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SYMPOSIUM 2012

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Book of Abstracts

November 14-15, 2012 | Mississippi Coast Coliseum and Convention Center | Biloxi, Mississippi

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SYMPOSIUM 2012

Climate and Hazard Resilience

Session

Architecture of defense

Climate and Hazard Resilience
Oral Presentation
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Allison leads research efforts focusing on resilience, coastal hazards and adaptation, and defensibility. Research informs every architectural project, including exploring precedents, material selections, establishing program goals and tracking performance of sustainability measures. Armouring structures against the risk of natural and manmade hazards is a key specialty, leading to storm-resistant community and first-responder shelters.

Architecture is designed to protect people from harm. Early threats came from people, and their weapons of war. New threats are still focused on our coastlines, but now include greater risks from nature, including climate change and sea-level rise. Whether the disasters are natural or man-made, the same forces affect buildings with negative consequences: wind, blast, earthquake, pollution, flood, fire and economic plagues of all kinds. The history of resilience has been written in survival, and the willingness to take on the challenges of protection, self-sufficiency and the ability to set limits so that capacity is not overextended.

Resilience against climate change requires a number of strategies, including distance, elevation, fortification and sustainability. To form the most adaptable architecture depends upon building structures that will be permanent, and the most efficient use of resources includes designing special buildings for extended service life. Case studies will illustrate designs for Emergency Structures, including Operations Centers and Community Shelters in the coastal regions, sited in both urban and rural environments.

In recovery after disaster, members of the community must suddenly meet their daily needs alone and establish self-sufficiency, including power generation on site from renewable sources; water collection, filtration, and use; wastewater treatment; food production; and the ability to commute without using fuel. Case studies will include strategies employed since 2005 on projects for cities and counties, including renewable energy solar arrays, ground-source heat exchange systems, rainwater harvest and grass roof installations.

Integrating hazard mitigation into local planning to support community resiliency on the Mississippi Gulf Coast

Climate and Hazard Resilience
Oral Presentation
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Integrating Hazard Mitigation into Local Planning to Support Community Resiliency on the Mississippi Gulf Coast is a research project currently being conducted by Southern Mississippi Planning and Development District with funding from Mississippi-Alabama Sea Grant Consortium. The project was conceived with the understanding that planning documents in most of the counties and cities in Coastal Mississippi are in two distinct categories: those that plan for future growth and those that address hazards and emergency management.

Investigators believe that the two plan groups likely have some linkages but seldom lack shared values or goals and objectives. Comprehensive planning is usually the responsibility of a planning or zoning department and hazard mitigation planning is conducted by emergency managers. If local governments are going to make sound planning decisions related to future growth, hazard impacts and coastal resiliency must be incorporated into the comprehensive planning process and the planning documents.

The first step in moving toward this integration is to identify the connections and the gaps between the two types of planning documents. Recommendations for improved linkages must then be made to local governments. Integrating hazard mitigation principles into comprehensive planning and land use strategies will reduce future damage to property and public facilities, avoid development in hazardous areas and provide adequate public shelters and reduce hurricane evacuation times.

The hypothesis for the study is that there are definitive ways to link the hazard mitigation plans to comprehensive plans. Objectives for the investigation are as follows:

- Identify existing connections between hazard mitigation plans and comprehensive plans
- Identify existing gaps or missing connections between hazard mitigation plans and comprehensive plans
- Develop recommendations on how to specifically link hazard mitigation principles to the comprehensive plans
- Develop policy recommendations related to mandates for hazard mitigation planning and comprehensive planning in Mississippi

The investigation is under way and results will be finalized and published after February 2013.

Determining localized risk perception and impacts of predicted sea-level rise (SLR) to engineered versus natural landscapes to enhance stakeholder SLR mitigation planning

Climate and Hazard Resilience
Oral Presentation

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Dr. Matthew Bethel is a Postdoc researcher/project manager at the University of New Orleans (UNO). He earned his Ph.D. in applied environmental science and engineering from UNO. His professional interest is in the application of geospatial technology in multi-disciplinary research that addresses information needs for ecological decision support systems.

Marshes are essential buffer zones between land and water in estuaries and coastal zones, they are disappearing rapidly, and those that remain are often in poor health. The most dramatic coastal marsh losses in the United States are in the northern Gulf of Mexico. These disappearing marshes serve as a vital habitat for a diverse and unique range of flora and fauna, a cushion between coastal waterfront-dependent communities and the open waters of the Gulf, and an integral resource for the economic and social viability of these communities. Therefore, coastal community leaders, government officials and natural resource managers must be able to accurately assess and predict a given coastal landscape's sustainability and/or vulnerability, especially as this coastal habitat continues to undergo rapid and dramatic changes associated with natural and anthropogenic activities, such as accelerated relative sea-level rise (SLR).

Currently, a multi-disciplinary research team is conducting a NOAA Sea Grant-funded project to use a regional approach to refine the NOAA SLR Visualization Tool for local implementation in areas experiencing two different driving mechanisms of coastal wetland habitat change (subsidence versus erosion). This collaborative research aims to determine the different ways in which two different stakeholder groups (traditional ecosystem users versus resource managers) evaluate risk and plan mitigation strategies associated with coastal habitat change due to predicted SLR resulting from climate change.

To achieve this goal, we are determining: (1) a method for producing localized vulnerability/sustainability maps based on predicted inundation and redistribution of coastal wetlands under accelerated SLR for two regionally representative systems; the first is an ecosystem-dependent coastal Louisiana indigenous Native American community, and the second is a Mississippi natural coastal preserve. Results from physical information derived from data and modeling of subsidence, erosion, engineered restoration and coastal protection features, historical land loss, and future land prediction under SLR that are complemented with traditional ecological knowledge (TEK) offered by the collaborating local ecosystem users will be integrated for these assessments; and (2) how and whether the results of such an approach can provide more useful information for assessing localized impacts of SLR and associated risk that may later be applied across the Gulf Coast by Sea Grant and the NOAA Coastal Services Center

among others. We are in the first year of this two-year research project, and intend to present the work to date in achieving the project objectives that includes: scientific field data collected related to marsh vegetation biomass characteristics, TEK data collection activities with the local experts, preliminary data analysis results, etc.

Resilient coastal construction: Successes, needs and opportunities

Climate and Hazard Resilience
Oral Presentation

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Alexandra Cary is the executive director of Smart Home America. Her skills include sustainable and resilient construction and training others in these practices. She is a licensed Home Builder with eight years experience in the field working with Habitat for Humanity, the US Green Building Council and Baldwin County Home Builders.

Hurricanes Ivan and Katrina made evident the vulnerability of our coastal communities and demonstrated the need for coastal resiliency, with the catastrophic losses of life and property in addition to the overall community economic losses. Since these disasters, partnerships were born from this need between organizations like Smart Home America, Habitat for Humanity, Disaster Smart Inspection Consulting, The Insurance Institute for Business and Home Safety (IBHS), State Farm Insurance, the Coastal Recovery Commission and many other local stakeholders. Smart Home America began addressing this issue through education, outreach, introduction and implementation of regulatory solutions and community demonstration projects. Mandated discounts on insurance premiums for homes built to IBHS's Fortified designation have encouraged homeowners to implement these changes and their research has instigated changes in local building codes as well. Demonstration projects with Habitat for Humanity have not only changed the way that the organization builds their homes, but has shown that these disaster resistant practices can be done affordably, with a three percent increase in construction costs, resulting in a 25 percent insurance premium savings. These results have convinced other home builders and residents to follow suit.

Due to the efforts of Smart Home American and their partners, Baldwin County and the municipalities throughout have adopted a Coastal Code supplement that mandates measures such as a Sealed Roof Deck and Roof Deck Attachment Requirements for all new homes and re-roofs. IBHS has estimate that the impact to loss reduction from this change alone could be as much as $11,600 per home. With and average of 1100 new and re-roofs per year, and an average of 50 percent of all structures damaged in a 50 year event, the loss reduction estimate for Baldwin County alone is $6 million per year. With an increase in roofing cost of less than $1500 per home, this means $8 to $10 loss reduction for every $1 spent. These figures do not include the impact of loss of use and the community economic impact that results from displaced residents.

The implementation of these codes and the increasing number of Fortified homes built and mitigated on the Gulf Coast is an encouraging start, but there are many more opportunities yet to be realized. The results from the Baldwin County Habitat demonstration project have prompted other Habitat demonstration projects across the coast, to be used as educational opportunities for those communities. The implementation of the Coastal Code Supplement has started conversations in other communities along the Gulf Coast that are still negotiating the implementation of stronger codes. All of these developments will ultimately result in safer, stronger, less vulnerable Gulf Coast communities when the next disaster strikes.

Habitat Family in front of their Fortified Home

Community Economic Preparedness: An Index Designed to Test the Economic Preparedness of Rural Communities

Climate and Hazard Resilience
Poster Presentation

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In 2010, the Mississippi State University, Center for Urban Rural Interface Studies (CURIS) conducted a research and outreach program on Community Economic Preparedness in the Gulf of Mexico Region. The goal of this project was to evaluate the overall community economic preparedness of rural counties and parishes. Community Economic Preparedness involves communities actively engaged in pursuing fundamental steps toward economic resilience and disaster management. Communities with local economies which are resilient to the effects of natural disaster will experience quick financial and physical recovery.

The Community Economic Preparedness Index (CEPI) measures a county's or parish's economic preparedness level based on fifteen different categories:

> economic development plan, effective zoning ordinances, industrial site capabilities, separate development organization, commercial development capabilities, small business development, community infrastructure, utilities capabilities, education access/quality, financial support available, strength of tourism boards, abilities/availability of labor force, natural disaster susceptibility, quality of life, and local government structure.

Each of these variables is then given a numeric value which is used to give each county or parish an overall economic preparedness score representing the current level of economic preparedness.

The CURIS Region includes 20 counties and parishes in four of the five coastal states bordering the Gulf of Mexico: Louisiana, Mississippi, Alabama, and Florida. These 20 counties were used as the basis for distribution of the CEPI Survey. A total of 60 survey forms were mailed to these 20 counties and parishes. Survey forms were mailed to the Chamber of Commerce, Board of Supervisors, and Economic Development Commission in each county or parish, along with instructions on how to complete it and a postage paid envelope to return the completed survey. A total of 2 mailings were sent out in May and June 2010. Of the 60 targeted CEPI survey participants, 17 completed surveys were returned, representing a response rate of 28.3%.

The data from the completed surveys have been analyzed, and each preparedness category, as well as, an overall average CEPI has been calculated. The Indices were assigned a value between zero and one, with one being the highest, or most prepared; and zero being the lowest or least prepared. The preliminary results indicate an overall average CEPI of 0.51 for the participating respondent counties. The highest average category score was found to be 0.83 in Industrial Site Capabilities, while the lowest average category score was listed at 0.12 in Effectiveness of County Zoning Ordinances. A more in-depth representation of these results will be represented in the poster.

Applying public participation GIS to identify hotspots of local landscape value that are vulnerable to sea level rise and pollution in the Mobile Bay region

Climate and Hazard Resilience
Oral Presentation
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Public Participation Geographic Information Systems (PPGIS) is a tool that has been developed to spatially capture the values and preferences of a local community. This provides local stakeholders with a voice in identifying hazards and threats to their region, which is useful for management decision-making.

This study used map-based surveys, which were sent to 2,750 residents, to identify which terrestrial and aquatic places stakeholders in the Mobile Bay, Alabama, region think are important for cultural reasons (such as economic, recreation, historic and aesthetic values), provide important watershed services (such as storm buffering, flood protection, water quality protection and fish nurseries), should be maintained as habitat for certain species (such as black bears, manatees, sea turtles and wading birds), and those that threaten the quality of the bay region through air and water pollution. The questionnaires were composed of five parts including: 1) knowledge and use of the bay region, 2) identification of threats to the region, 3) a mapping exercise to identify places that are important for cultural services, watershed services and wildlife habitat; pollution threats; and development preferences, 4) ranking the importance of the mapped values, and 5) a series of questions to ascertain the participants' occupational, demographic and socio-economic backgrounds.

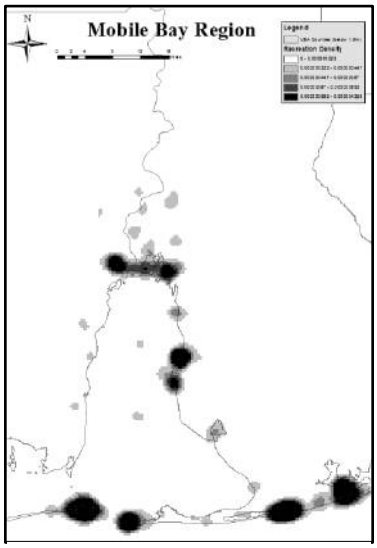

Figure 1. A map of Mobile Bay showing kernel densities for places of recreation value.

The survey results were digitized into a GIS database for spatial analysis. A kernel density analysis was used to identify places where particular values clustered significantly, which are considered to be hotspots for those values. Additionally, this analysis was used to determine locations where perceived pollution threats clustered. The mapped results were then overlaid with a map of sea-level-rise projections derived from the IPCC report (2007) to determine which value clusters are vulnerable to inundation from rising sea levels. These results provide important information for local land managers because they identify places that are considered to be important by the local community and spatially demonstrate which of these places are particularly vulnerable to the hazards of pollution and sea-level rise.

Simulation and prediction of storm surge in the Mississippi Gulf Coast using an integrated coastal/riverine/ocean process model

Climate and Hazard Resilience
Oral Presentation

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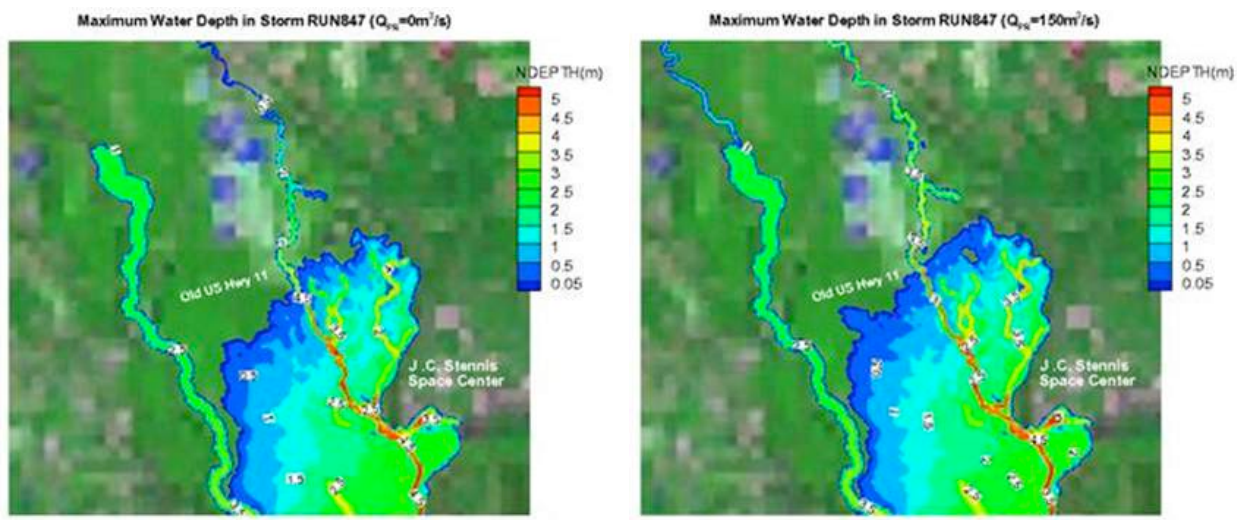
Dr. Yan Ding is a research associate professor of the National Center for Computational Hydroscience and Engineering (NCCHE) at the University of Mississippi, Oxford, Miss. His research interests include simulation and prediction of storm surge and wave due to tropical storms and hurricanes and applications of modeling technologies for coastal flood mitigation, erosion protection and environmental impact assessment.

The Mississippi Gulf Coast bears the brunt of attacks by ocean waves, tides and storm surges. This coast is specifically vulnerable during hurricane seasons. Hurricane Katrina in 2005 made a tremendous damage in properties and caused hundreds of human causalities. Hurricane Gustav in 2008 brought a lot of rainfall into the inland of the Gulf Coast. Together with river floods from the Pearl River due to increase of runoff in the Mississippi inland, storm surges of Gustav from ocean caused severe inundation in Hancock County, Miss. Recently, Hurricane Isaac (2012) was only a Category 1 hurricane. But due to the heavy rainfall, storm surges and inland flooding still can cause surprisingly dangerous flood and inundation in the three Mississippi coastal counties.

Existing numerical modeling studies of flooding along the Mississippi coastline during a hurricane event mostly focused on storm surge and wave effects, without the inclusion of river inflows from the Mississippi inland. Unfortunately, they generally did not resolve inland flooding resulting from river floods and backwater effects due to lack of sufficient resolution of a coastal watershed. To have a better assessment on the impact of storm surges and waves by hurricanes in the Mississippi coastal region, a large-scale simulation domain is needed to have the high-resolution bathymetry/topography to resolve the coastal watersheds of the Pearl River including the Mississippi and the Atchafalaya rivers. The integrated coastal/riverine/ocean process model must be applied to simulate coastal flooding and inundation driven by storm surges, waves, tides and river inflows over this large area during the whole duration of storm. In this study, by using an advanced numerical simulation model (CCHE2D-Coast), a special focus is to study storm surges over a large domain covering the Mississippi and Louisiana Gulf coasts and the watershed of the Pearl River by using a high-resolution DEM data. Simulation results indicate that the inclusion of the inland flood through the coastal watershed is important to predict correctly inundation and flooding in the coastal community (Figure 1). The obtained results of flood and inundation can be useful for better planning and management for flood/inundation protection in a wider area of the Mississippi Gulf Coast including the inland watershed.



(a) Case 1 (Q_{PR} =0.0m^3/s) (b) Case 2 (Q_{PR} =150.0m^3/s)

Figure 1. Close-up view of maximum water depth induced by Storm T19 (Q_{PR}: discharge from the Pearl River)

Working waterfront initiatives in Alabama: Protecting environmental, economic and cultural resources

Climate and Hazard Resilience
Poster Presentation
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Like many coastal states, Alabama has faced threats and disturbances to its ecological, economic, social and cultural structures. Natural and technological disasters, as well as the economic recession have impacted coastal communities that rely on access to the water for their livelihoods. In addition, coastal Alabama has experienced population growth and land use competition for waterfront access. Water-dependent businesses along the Alabama coast are wide-ranging and include international industrial shipping, commercial and recreational fishing, nature tourism and other maritime interests. Generations of families, based in traditional fishing towns like Bayou La Batre, Alabama, operate fishing boats, seafood processing facilities, marine vessel construction and repair, and other support industries. As diverse as they may be, these working waterfronts have one thing in common: their tremendous impact upon Alabama's economy and socio-cultural heritage.

In response to these concerns, the Auburn University Marine Extension and Research Center (AUMERC) and the Mississippi-Alabama Sea Grant Consortium (MASGC) are working with stakeholders to protect and preserve this economy and heritage. By providing educational opportunities and technical support, AUMERC and MASGC are working within waterfront communities to achieve results. Facilitation of the Alabama Waterfront Access Study Committee led to recommendations to the Alabama Legislature that include management-based tools, incentives and techniques to protect and preserve working waterfronts and waterfront access in the state. Municipal planners in Baldwin and Mobile counties learned about the issues facing working waterfront businesses and about possible actions from national leaders in working waterfront issues during an AUMERC/MASGC workshop. This workshop led to planning actions taken by a local community. AUMERC and MASGC are continuing to be leaders in addressing working waterfront issues, locally and nationally. Efforts by these organizations have been held up as examples of success in national publications and websites, putting Alabama at the forefront of a national movement to protect, preserve and promote working waterfronts. New initiatives are planned in Alabama and Mississippi, and AUMERC and MASGC are building new partnerships in Mississippi to increase working waterfront efforts in that state.

Delivering community decision support extension programming to local governments in budget planning under coastal risk

Climate and Hazard Resilience
Poster Presentation

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This presentation highlights how local communities may receive tropical natural disaster financial resiliency programming through the extension program (and its manual) titled "Community Decision Support to Local Governments in Budget Planning under Coastal Risk." The manual serves as a guide for extension agents and local practitioners, those working through the process of educating governmental entities or a community's leadership in attaining a desired level of financial resiliency for communities vulnerable to tropical natural disaster events. When assessing the financial health of a community, potential risks and assets to be appropriated during a disaster and recovery are the central topics aligning communities with resiliency planning. Examples of local governments' fiscal condition before and after hurricanes during the 2005-06 and 2008 seasons will be used to show difficulties encountered. The local government of Tangipahoa Parish Government, Louisiana, serves as the case study used in this manual to show how to execute a participatory-research driven advisory panel process with constituents of a local government to generate policy alternatives and their potential outcomes for elected community members to consider when desiring to improve their community's financial resiliency to future tropical natural disasters.

The extension program manual is broken into the following sections.
The Need for Local Government Financial Disaster Planning
Identifying and Preparing a Community for Financial Risk Resiliency Planning
- Module 1. Identifying the Community and Advisory Group
- Module 2. Establishing a Foundation for Advisory Group Decision Making
- Module 3. Representative Storm Analysis
- Module 4. Risk Profiling for Local Government Financial Disaster Planning
- Module 5. Identifying Financial Recovery Options from Natural Disasters

Post Meeting Deliverables and Action Steps

Measuring financial vulnerability of local governments to tropical natural disaster risk

Climate and Hazard Resilience

Oral Presentation

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Local governments share a burden in financing both emergency operations and cleanup and debris removal from tropical natural disasters. In recent studies conducted by project investigators, it was shown that while county (parish) governments did not find significant differences in financial health changes based on population of the county, case study analyses from these projects suggested that fiscal health of municipalities varies greatly by size and storm vulnerability. With the likely reduction in future federal government reimbursement levels, local governments will have to become more financially resilient. This research seeks to identify how vulnerable these municipal governments are to future tropical natural disasters and identify financial thresholds needed for them to be financially resilient to increased emergency and debris removal costs from future storms.

The research calculates existing financial health ratios of coastal municipal governments in Gulf Coast counties. These ratios are then adjusted based on projected out-of-pocket costs to local governments from a future tropical natural disaster scenario and compared to existing rules of thumb for fiscally healthy governments. Further, sensitivity analysis is performed to the financial ratios based on the level of "marketable assets" of the local government.

In the end, it is believed that results from this research will assist local governments in having tropical natural disaster, risk-adjusted "rules-of-thumb" for financial health.

The rapid damage assessment process: Putting together the numbers after a coastal storm

Climate and Hazard Resilience
Oral Presentation
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Dr. Kathleen Garland is a lecturer in environmental management at the University of Houston Clear Lake. Her research interests include coastal community resilience and identifying the natural and social processes which link human and natural systems on the coast. Dr. Garland holds a Ph.D. in geology from Penn State University.

In the 24 hours immediately following a storm, coastal communities conduct a rapid damage assessment (RDA). This semi-quantitative assessment describes the physical damages to the built environment, both public and private, within the community. These assessments are a prerequisite for Federal Emergency Management Agency (FEMA) disaster declarations and aid, as well as for reimbursement under the National Flood Insurance Program (NFIP), and are also required as part of many state and regional emergency response plans.

A comparison of the RDA process between coastal communities on the Upper Texas Coast and on the sound side of North Carolina's Outer Banks indicates a significant variation in how the RDA process is conducted and by whom. While the data itself is generally collated at the county level, individual communities collect the data using available human resources, and these resources vary depending on the size and capacity of local governments and the severity of the impacts. Storm severity also affects the timeliness of these assessments, as large quantities of debris and road obstructions may make accessing and viewing damaged areas extremely difficult in the immediate aftermath of a storm. The primary type of damage also affects the accuracy of these assessments. For example, damages from a storm that produces primarily flooding, such as Hurricane Irene in North Carolina, are more difficult to assess than damages from a storm like Ike, which produced high winds, because a structure that has experienced significant interior flooding may appear undamaged from the exterior, whereas a wind-affected structure is likely to have visible external damage.

Personnel conducting RDAs in the studied communities included community emergency managers themselves, county emergency management personnel, city and county building inspectors, county tax appraisers, city public works employees and personnel on loan from neighboring communities. The assessments themselves were conducted at various levels of rigor, ranging from windshield surveys to door-to-door visits. Damage data was consistently presented on a sliding scale, and reported on a standard form provided by the county in which each community resides. This apparent consistency in data presentation masks the variations in the quality and accuracy of the underlying data, and can lead to erroneous determinations of resource needs at the level of emergency management agencies. It is clear from this research that the most vulnerable communities and those hardest hit by a storm have the fewest resources available to complete accurate and timely RDAs and thus obtain aid.

This study of the RDA process illustrates two important points: first, a more consistent process would help emergency management agencies gain a more accurate assessment of damages across an affected region and thus provide resources more effectively and in a more timely fashion to the hardest hit and most vulnerable communities. Second, available community resources post-disaster depend to a large extent to the networks and relationships developed within and between city governments prior to the event. Strong reciprocal relationships augment a community's capacity to assess its damages rapidly and accurately, allowing them to obtain sufficient and timely assistance.

“Show me the money”
Economics: National Ocean Watch (ENOW) data for ocean management

Climate and Hazard Resilience
Poster Presentation

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Marian Hanisko joined the NOAA Coastal Services Center in 2010 as a coastal management specialist with I. M. Systems Group. In this position, she works with federal, state and local partners to address community resilience and climate change adaptation planning issues. Ms. Hanisko has over 10 years of experience in coastal management and policy.

The proper use of economic data is a vital part of making decisions about the management of our nation’s oceans and coasts. This presentation showcases a Web-based tool that makes it easy for users to explore data describing six economic sectors that depend on the oceans and Great Lakes. This collection of data, named Economics: National Ocean Watch or ENOW, provides indicators of the county, state and national significance of the ocean and Great Lakes economy. Four indicators are included: business establishments, jobs, wages and gross domestic product. ENOW is produced by the NOAA Coastal Services Center for 448 coastal counties, 30 coastal states and the nation using data from, and in partnership with, the U.S. Bureau of Labor Statistics, Census Bureau and Bureau of Economic Analysis. ENOW features the following six sectors: Living resources, marine construction, marine transportation, offshore mineral resources, ship and boat building, and tourism and recreation.

Visualizing the potential impacts of sea-level rise: A planning tool for Gulf Coast communities

Climate and Hazard Resilience
Oral Presentation
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Marian Hanisko joined the NOAA Coastal Services Center in 2010 as a coastal management specialist with I.M. Systems Group. In this position, she works with federal, state and local partners to address community resilience and climate change adaptation planning issues. Ms. Hanisko has over 10 years of experience in coastal management and policy.

One of the most challenging issues that coastal communities currently face is determining how to address the potential impacts of sea-level rise on a fragile landscape that is stressed by development pressures, coastal storms, erosion and subsidence, and a host of other factors. Adding sea-level rise to the realm of circumstances coastal managers consider when addressing issues, such as mitigation for coastal hazards, land-use planning or conservation strategies, is important because it helps create resilient communities that are better able to manage risk long term.

The NOAA Coastal Services Center (CSC) helps foster informed decisions about coastal issues by linking people with information, tools and technology. The goal of this presentation will be to provide a demonstration of one of CSC's newest tools, the Sea-Level Rise and Coastal Flooding Impacts Viewer. Features of the tool include simulations of sea-level rise, marsh migration scenarios, socioeconomic data overlays and trends in tidal flooding. Special emphasis will be placed on how the features of the viewer can be used to enhance local planning decisions.

This viewer was developed in response to an expressed need by Gulf Coast communities. It will be complete for all five Gulf states by the fall of 2012. For more information on this tool, please visit the following website: http://www.csc.noaa.gov/digitalcoast/tools/slrviewer.

Using post-disaster damage assessments to increase community resilience: A case-study of the Upper Texas Gulf Coast

Climate and Hazard Resilience
Poster Presentation

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Henry Hodde is a graduate research assistant and master's student of environmental management. His interests include coastal community resilience, sustainable development and hazards mitigation. He holds a bachelor's degree in residential sciences from Florida State University.

Coastal communities undergo record-breaking disasters year after year. The Upper Texas Gulf Coast recently experienced the third costliest storm event in U.S. history with Hurricane Ike in September of 2008. Resilience has emerged as a key concept to help communities cope with vulnerabilities and risk from disasters. A resilient community is one that can maintain and restore essential functions and structures in response to natural and manmade stressors. Local planning is an important tool for increasing resilience and reducing losses following natural disasters. To plan effectively, local data is needed; particularly data sets that reveal vulnerability.

Using GIS, the research team analyzed the following data for Hurricane Ike: community damage assessments, wind and flood claims, Small Business Administration (SBA) loans, surge data and FEMA floodplain data. First, this data was used to reveal the most vulnerable areas in the study area. Second, the data was analyzed spatially using GIS to the ZIP code and parcel levels. Finally, an evaluation was conducted on the policies regarding the damage assessment process, the effectiveness of communities adhering to such policies and land-use strategies to help mitigate inundation events. This analysis reveals weaknesses in the post-storm damage assessment process and shows that damage is often outside of the 100-year floodplain. Damage assessments do not represent the true cost of a disaster and are often ignored by community officials during the recovery phase of post-disaster management. When done properly, post-disaster damage assessments can be used as an effective tool for disaster response and recovery by informing land-use policies and helping planners mitigate future risks and guide their communities toward more sustainable development.

Climate resiliency on Dauphin Island, Ala.

Climate and Hazard Resilience
Poster Presentation

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The Southeast region of the United States is projected to experience many impacts of climate change, including higher temperatures, more droughts, rising sea levels, scarce water supplies and severe weather events. As a low-lying barrier island in Alabama approximately 15 miles long and at most one mile wide, Dauphin Island will be highly susceptible to these impacts, most particularly to sea level rise. As part of a two-year climate resiliency study for Dauphin Island funded by the National Sea Grant College Program, the Mississippi-Alabama Sea Grant Legal Program (MASGLP), as lead for the Mississippi-Alabama Sea Grant Consortium (MASGC), is looking at the anticipated regional changes in climate and how these changes can impact Dauphin Island's natural and built resources. The MASGLP is also helping Dauphin Island complete a climate change vulnerability and risk assessment process, through which Dauphin Island will prioritize its planning areas and climate change adaptation efforts. MASGLP will also review Dauphin Island's regulations, policies, practices, and procedures for each of its priority planning areas.

Through the project, MASGLP will address Dauphin Island's fragmented governance structure by working collectively with all three entities that govern the island's resources and can address climate change. By having all three governmental organizations work together, MASGLP is using a coordinated approach that will save time and money, ensure that all of the town's resources are included in the study, and provide the opportunity for the three branches to collaborate.

Finally, MASGLP will also engage in public education and outreach, including in-reach to officials in Dauphin Island, such as through presentations at regularly scheduled meetings of the Town Council and Planning Commission, and outreach efforts to the residents of Dauphin Island, including explaining the town's vulnerability to climate change, the needs for policy reform and how the reform will affect their lives on the island. The project will also work on bringing together other communities in the area working on similar climate issues to allow these communities to share their experiences and best practices.

This talk will discuss the approach that the project will take, how the approach can be shared with other communities in the region, and the results of the project so far, including difficulties in working and coordinating with the town, its different governmental entities and its residents.

Gulf Coast Study, Phase 2: Impacts of climate change and variability on transportation systems and infrastructure

Climate and Hazard Resilience
Oral presentation
Robert Kafalenos*[1], Robert Hyman[1], Bryan Beucler[1]
[1]Federal Highway Administration, U.S. Department of Transportation
(We also have consultants working on the project from ICF International, Parsons Brinkerhoff, South Coast Engineers, as well as assistance from the Virginia Burkett and K. Van Wilson of USGS and Kevin Harrison of the South Alabama Regional Planning Commission.)
Robert.Kafalenos@dot.gov

Robert Kafalenos is an environmental protection specialist in the Office of Natural Environment at the Federal Highway Administration. He works on climate change adaptation and currently co-manages Phase 2 of the *Gulf Coast Study*, which focuses on transportation's vulnerability to climate change in Mobile, Ala. He holds a master's in environmental management from Duke University.

Transportation agencies across the country are grappling with how to address the significant threats that climate change poses to transportation systems. To assist them, the federal government is investigating approaches and tools that can be used to assess the vulnerability of transportation infrastructure to climate changes and to help transportation agencies begin to evaluate the adaptation options at their disposal. This presentation will focus on one of those efforts, the Gulf Coast 2 study, which is assessing the vulnerability of transportation to climate change impacts in Mobile, Ala., over the coming decades. We will discuss the progress on the project to date and the lessons learned in developing a county-wide transportation vulnerability assessment in Mobile, Ala. We may also talk briefly about some related efforts happening outside the Gulf Coast area.

While the Phase 1 study (2008) took a broad look at the entire Central Gulf Coast region and provided a "big picture" view of the climate-related challenges facing transportation infrastructure, Phase 2 is focusing on the single Metropolitan Planning Organization (MPO) region of Mobile, Ala. The purpose of this more focused effort is to evaluate which transportation infrastructure components are most critical to economic and societal function, and assess the vulnerability of these components to weather events and long-term changes in climate. Phase 2 will also develop tools and approaches that the South Alabama Regional Planning Commission (which includes the MPO for the Mobile area) and other public and private system operators can use to determine which systems most need to be protected, and how best to adapt infrastructure to the potential impacts of climate change. Through this study, U.S. DOT plans to create a template for an assessment process that can be replicated in other regions of the country.

For more information on this study and related activities at FHWA, please see:

U.S. Department of Transportation, "Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: The Gulf Coast Study, Phase 2" (ongoing).

http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/gulf_coast_study/

Federal Highway Administration, "Climate Change Vulnerability Assessment Pilots," 2011. http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/vulnerability_assessment_pilots/index.cfm

Coastal changes in temperature and salinity observed during Hurricane Isaac recorded and downloaded by NASA DRIFTERs moored in Heron Bay and Half Moon Island, La.

Climate and Hazard Resilience
Poster Presentation

Maria Kalcic[1], Rodolfo Iturriaga[1], Philip Kuper[1], Stanford D. O'Neal[1], Lauren Underwood[1], Rose Fletcher[1], Russell Lambert[1], Shannon Ellis[1], Laura Pair[1], Ted Mason[2] and Duane A. Armstrong[2]
[1] CSC, NASA Stennis Space Center, [2]NASA Applied Science and Project Technology Office (ASTPO), NASA Stennis Space Center
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Major changes in salinity (~14 ppt.) and temperature (~4^0C) during Hurricane Isaac were continuously registered by two prototype NASA DRIFTERs, surface moored floaters, that NASA's Applied Science and Technology Project Office (ASTPO) has developed.

The DRIFTER floating sensor module is equipped with an Arduino open-source electronics prototyping platform and programming language (http://www.arduino.cc), a GPS (Global Positioning System) module with antenna, a cell phone SIM (Subscriber Identity Module) card and a cellular antenna which is used to transmit data, and a probe to measure temperature and conductivity (from which salinity can be derived). The DRIFTER is powered by a solar cell panel and all the electronic components are mounted and sealed in a waterproof encasement.

Position and measurement data are transmitted via short message service (SMS) messaging to a Twitter site (DRIFTER 002@NASADRIFTER_002 and DRIFTER 004@NASADRIFTER_004), which provides a Really Simple Syndication (RSS) feed. These data are then imported into a Google spreadsheet where conductivity is converted to salinity, and graphed in near real-time. The spreadsheet data will be imported into Google Fusion Tables on a webpage maintained by ASTPO, where it will be displayed and available for download.

Prior to Hurricane Isaac, these two prototype DRIFTER modules (Figure 1.) were deployed at Heron Bay (GPS 30^0 10.6467'N, -89^0 27.8955'W) and Half Moon Island (GPS 30^0 8.6362'N, -89^0 25.8337'W; Figures 2, and 3.) near the Louisiana/Mississippi border. The modules continued to transmit data prior to, during, and after August 28, 2012, as Hurricane Issac approached and hovered over the Louisiana/Mississippi coast. Data transmitted via the DRIFTER showed a rapid increase in salinity (~from 15 to 29 ppt.) and decrease in temperature (from 30 to 26^0C), which corresponded to the changing environmental conditions associated with Hurricane Isaac. The temperature and salinity values recorded correlated with those provided by US Geological Survey (USGS) moored instruments which are located at Northeast Bay Gardene near Point–A-LA-Hache, Louisiana. The salinity and temperature fluctuations observed by the DRIFTER modules corresponded to an 11-foot storm surge that was registered by the USGS moored instrument. After the hurricane storm surge subsided (by September 5 2012), lower salinity measurements were obtained. The lower salinity was consistent with the large amount of rainfall and subsequent storm water discharge originating from the Pearl River watershed and moving into coastal waters.

Figure 1. Two prototype DRIFTER modules

Figure 2. Deployed DRIFTER module near coastal marsh.

Figure 3. Close-up of DRIFTER module deployed near Half Moon Island.

Identifying Flood Generating Areas in 8-Mile Creek Watershed

Climate and Hazard Resilience

Oral Presentation

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Latif Kalin is an associate professor at School of Forestry and Wildlife Sciences, Auburn University. His research areas spans from watershed scale hydrologic and water quality modeling to modeling wetland nutrient cycling. He has a PhD from Purdue University School of Civil Engineering.

An index-based methodology coupled with a distributed hydrologic model (HEC-HMS) has been developed and utilized to identify flood generating areas in 8-Mile Creek watershed, which encompasses the city of Prichard (suburb of Mobile). Floods are the leading cause of natural disaster losses in the United States. In addition to property damages, floods kill on average 140 people each year in the United Sates alone. In coastal areas, floods are caused by two factors: large storms and storm surges resulting from hurricanes. Although climate is the major driver for both types of floods, land use and cover (LULC) change (especially urbanization) exacerbate the magnitude of floods resulting from the former cause (i.e., large storms). Development and urbanization change the vegetation and soil characteristics, and increase imperviousness. As a consequence of these changes, both frequency and magnitude of peak flows increase. Watersheds are heterogeneous systems. Not only runoff is generated disproportionately throughout a watershed, but also travel times of the generated runoffs to the watershed outlet show great variation. Therefore, certain areas have bigger contributions to downstream flooding. Identification of such areas can help minimize the adverse impacts of urbanization on hydrology. HEC-HMS model was first tested at 8-Mile Creek watershed using streamflow data collected by USGS from 1996 to 2000. With no calibration, HECM-HMS simulated streamflow volumes and peaks for selected large events compared well with observed data. Next, by working closely with the City of Prichard Economic Development Office future LULC map of the watershed was developed. For this purpose future development plan was overlaid onto the 2011 aerial photo in *eCognition* image analysis software. By utilizing the current and the future LULC within the index based method and using design storms of 1, 10, 25 and 100 year return periods, areas prone to generating high flows were located and ranked. Also, to explore the association of historic LULC conditions with peak flow and changes over time, the index method was also applied to 1966, 2001 and 2011 LULC. A noticeable development occurred over time in this watershed resulting in increase of peak flows. It was concluded that in addition to topography, soil type, roughness etc, the locations of the urbanization in a watershed plays a significant rule on its contribution to flooding. This study can help managers and decision makers of City of Prichard with their future development plan to decrease the risk of flooding under the impacts of urbanization.

Tides of change: The Plan For Opportunity and the Mississippi Gulf Coast

Climate and Hazard Resilience
Poster Presentation

Zachary E. Kenitzer*, Elaine G. Wilkinson*, Dr. Jennifer Evans-Cowley AICP PhD, Department of City and Regional Planning at The Ohio State University

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Elaine G. Wilkinson: Executive Director, Gulf Regional Planning Commission: egw@grpc.com

Zachary E. Kenitzer is a second year, Pre-Candidate PhD Student in City and Regional Planning at The Ohio State University. He holds a Masters in Urban Planning and a Bachelors of Science in Political Science, both from the University of Louisville.

Elaine G. Wilkinson is the Executive Director of the Gulf Regional Planning Commission in Gulfport, Mississippi.

Abstract:

The Plan for Opportunity, enabled through the unique Sustainable Communities Program, is a unique plan that brings together multiple partners throughout the Mississippi Gulf Coast to capitalize on the unprecedented opportunity that exists. While the coast has a powerful tie to the bountiful and beautiful Gulf of Mexico the Plan For Opportunity seeks to build, foster and promote the Gulf Coast as a resilient community.

While the whole community interacts with the water on a daily basis, and has a healthy respect for the Gulf, there are still many challenges that lie ahead, as well as a ripe set of opportunities. This presentation will cover multiple aspects of The Plan for Opportunity and how partners from Gulf Regional Planning Commission, Southern Mississippi Planning and Development District, Gulf Coast Housing Studio and The Ohio State University are working to create a new plan to guide the future of development and economic growth along the Gulf Coast.

Monitoring sea surface salinity changes near the Gulf Coast during Hurricane Isaac using microwave remote sensing

Climate and Hazard Resilience
Poster Presentation

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bumjun.kil@eagles.usm.edu

Bumjun Kil is a Ph.D. graduate student at the University of Southern Mississippi. His interest area is remote sensing of earth environment, including ocean color, sea surface salinity. He holds a master's degree in physical oceanography in School of Earth and Environmental Sciences from Seoul National University in South Korea.

Monitoring the sea surface during a hurricane is challenging job because severe weather conditions prevent shipboard measurements and clouds mask the sea surface for visible and near visible satellite sensors. However, L-band microwave can penetrate clouds and see the sea surface within a hurricane. In this research, monitoring sea surface salinity (SSS) near the Gulf Coast area during Category 1 Hurricane Isaac in August 2012 was conducted as a first trial using the European Space Agency Soil Moisture and Ocean Salinity (SMOS) sensor on the MIRAS satellite and the NASA AQUARIUS satellite. The NOAA Weather and Climate Toolkit was also used to map precipitation amounts for comparison with the SSS from the satellites. The SSS retrieved from SMOS in the heavy rainfall area in Gulf Coast is shown to be approximately 24.19 psu, a reduction of ~12 psu from values prior to the hurricane. Although the absolute value of these salinity changes may not be correct, because of the reliance on ECMWF sea surface temperature (SST) and wind speed for geophysical corrections, the pattern of low salinity matches those of the precipitation amounts. This down trend of SSS was also presented at the same date from the AQUARIUS satellite which uses the wind speed from a scatterometer. This low SSS zone was apparent after the storm moved away from the west coast of Florida and until the hurricane made landfall on the Louisiana coast shown eminent until landing into Louisiana coast. This zone might be caused by the combination of high precipitation region of the storm and slow to stationary movement off the Louisiana coast. These results indicate that SSS changes within a hurricane, monitored by satellite-born microwave sensors, could be a useful tool in hurricane monitoring.

Regional resilience training supports effective management in Gulf communities

Climate and Hazard Resilience
Oral Presentation

Chad Leister[1]*, Kristin Hicks[2], Avia Huisman[3], Rosalyn Kilcollins[4], Michael Shelton[5] and Tabitha Stadler[6]
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LeisterConsulting@gmail.com

Chad Leister is the president of Leister Consulting Company and specializes in environmental consulting and project management. He is currently on contract with the Weeks Bay Foundation in Fairhope, Ala., to manage a regional community resilience project with the Gulf of Mexico National Estuarine Research Reserve Coastal Training Programs. Funding for this work was provided by the NOAA Coastal Storms Program and prominently features the Community Resilience Index developed by Mississippi-Alabama Sea Grant. Chad holds a master's of environmental management degree from Duke University with focuses in coastal environmental management and economics and environmental policy and was formerly affiliated with the Mission-Aransas National Estuarine Research Reserve.

The National Estuarine Research Reserve (NERR) Coastal Training Program (CTP) acts as a bridge between coastal decision-makers including: scientists, policy-makers, planners and resource managers. The CTP promotes informed decision-making through science-based training and technical assistance. For four years, the five Gulf of Mexico NERR CTPs, with support from the Gulf of Mexico Alliance, NOAA Coastal Services Center and NOAA Coastal Storms Program, have collaborated to develop and implement a regional training initiative addressing priority coastal management issues, such as coastal community resilience. Resulting trainings and events featured the Community Resilience Index and other useful resources, tools and information decision-makers can use to increase community preparedness for future coastal disaster events. This regional training initiative is unique, serving as a model for increasing communication between local, state and federal decision-makers and resulting in informed decision-making and ultimately, improvements in the coastal management practices of communities on the Gulf of Mexico.

Sea-level rise, species survival and preservation of upland habitat

Climate and Hazard Resilience
Poster presentation
Jaclyn Lopez*[1] and Shaye Wolf[1]
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jlopez@biologicaldiversity.org

Jaclyn is a staff attorney with Center for Biological Diversity. She holds a law degree from the University of Denver and a master of science degree in urban planning from the University of Arizona. Jaclyn coordinates campaigns in the Southeast and Caribbean, with a focus on protecting imperiled species and ecosystems.

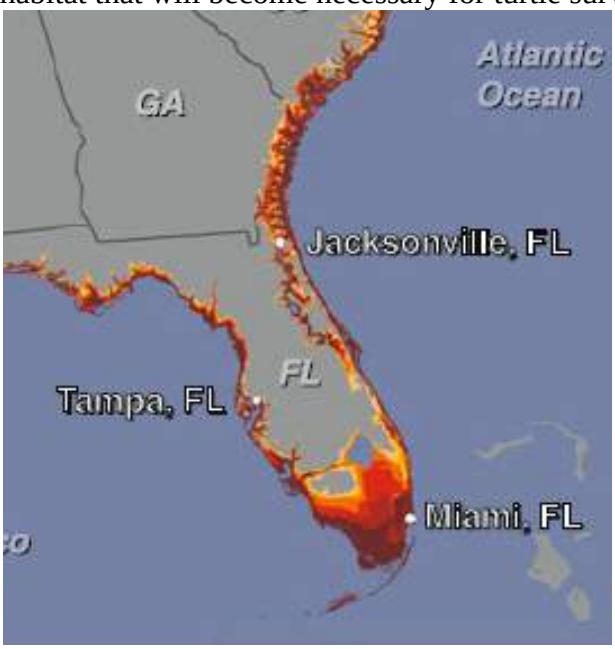
Overview: Florida's coastal ecosystems and species face rising sea levels and increasing storm surge. It is critical to proactively protect and manage upland habitats to enable adaptive habitat shifts by coastal species. Fortunately, the U.S. Endangered Species Act can help protect upland habitat for species to ensure they are able to move inland as their habitats are inundated.

Sea-level rise background: Mean global sea level is projected to rise by 1 to 2 meters on average within this century, while intensifying storms and storm surge will exacerbate the effects of sea-level rise. A 1- to 2-meter sea-level rise poses significant inundation risks for the Florida coast, and would cause many coastal species to suffer extensive habitat loss, forcing them upland. However, many coastal species are limited in their ability to move landward because so much coastal habitat has already been lost and degraded because of development and dense human populations along the coast. In Florida, population density along the coast is three times greater than in inland counties – thus coastal species are at risk of being trapped between rising sea levels and human developments. Sandy beaches that are narrow, lack extensive dune systems or are backed by armoring are vulnerable to disappearing entirely. Undeveloped areas that might be suitable for species' landward migration are likely to be claimed by development as human populations retreat landward.

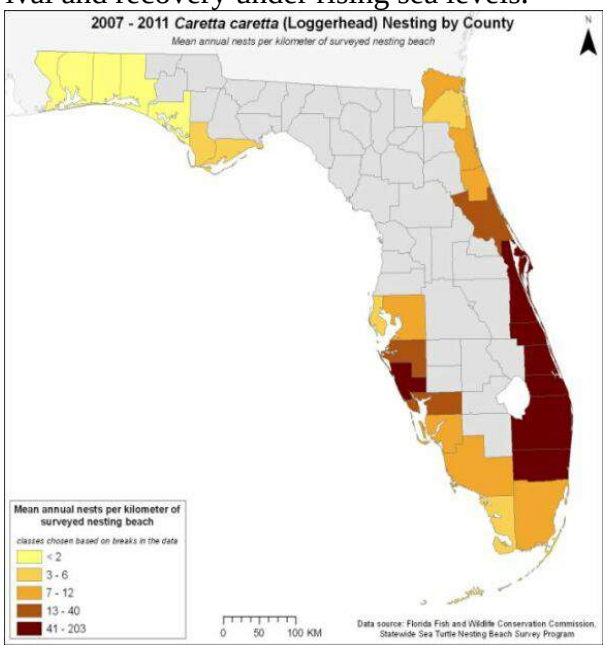
Endangered Species Act: Our nation's foremost biodiversity protection law, the Endangered Species Act, provides a powerful but under-utilized tool for proactively protecting habitat in response to climate change through the designation of "critical habitat." Under the Act, our federal wildlife agencies, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, must designate areas essential to the survival and recovery species as "critical habitat." These areas receive protection from all federal agency actions that are likely to "destroy or adversely modify" them and provides safeguards against development and other potentially destructive activities. In a climate change context, the Act allows the Services to designate critical habitat outside of a species' current range if those areas are needed for its conservation. Therefore, the Services can protect upland coastal habitat that will become essential to species' survival as the coasts are inundated.

Species spotlight: Loggerhead sea turtles: The loggerhead sea turtle is widely distributed within its range, and makes some of the longest journeys of any sea turtle species. Originally listed as threatened range-wide, the Services recently divided the species into nine District Population

Segments. The Services are now required to designate critical habitat. Loggerhead sea turtles nest on beaches from Texas to Virginia and face significant loss of nesting habitat because of sea-level rise. About 90 percent of U.S. loggerhead nesting occurs in Florida, mainly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, Broward and Sarasota counties. The critical habitat designation for the Northwest Atlantic Distinct Population Segment should include the upland habitat that will become necessary for turtle survival and recovery under rising sea levels.



Areas of the Florida coast at or below 1-3 m elevation. Weiss, J.L., J. Overpeck, and B. Strauss. 2011. Implications of recent sea level rise science for low-elevation areas in coastal cities of the conterminous U.S.A. Climatic Change 105:635-45.



Mean annual nests per kilometer of surveyed nesting beach. FWC Fish and Wildlife Research Institute. Feb. 8, 2012. Statewide Nesting Beach Survey Program, Loggerhead Nesting Data.

Coastal Resilience: A decision support tool for restoration and coastal hazards

Climate and Hazard Resilience
Oral Presentation

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Nicole Love is the coastal restoration and resilience project manager for the Louisiana Chapter of the Nature Conservancy based in Baton Rouge, La. Her primary role at TNC is to advance utilization of the Gulf of Mexico Coastal Resilience Decision Support Tool in the Gulf Region through stakeholder engagement and training. Before starting with TNC in September 2012, Nicole worked for the Florida Department of Environmental Protection on watershed issues in Northeast Florida.

In partnership with the University of Southern Mississippi, The Natural Capital Project and NOAA, The Nature Conservancy has developed a coastal resilience decision support tool for the Gulf of Mexico. This tool is a web-based mapping application designed to help inform coastal management decision making. This tool enables stakeholders to explore state-specific, Gulf-wide spatial data, and also at discrete site locations. With this tool you can conduct restoration scenario planning and examine potential future scenarios as sea levels rise and coastal hazards increase. An overview of the development, functionality and available coastal resilience and conservation planning tools will be presented. Additionally, the progress of new support functions and future development of the tool will be discussed.

The effects of storm track, intensity and sea level rise on storm surge

Climate and Hazard Resilience
Oral Presentation
Paul McKay[1*], Cheryl Ann Blain[1], William D. Graham[2]
[1] Oceanography Division, Naval Research Laboratory, [2]NASA Applied Science & Technology Program Office
Paul.McKay@rlssc.navy.mil

Paul McKay is an oceanographer at the Naval Research Lab at Stennis Space Center. He earned his Ph.D. in Marine Sciences in 2008 at The University of Georgia. His current research interests include monitoring and modeling circulation and processes on the coast, especially of channelized flows such as rivers or tidal creeks.

Relatively small changes in storm track and environmental conditions can have large effects on the magnitude and extent of storm surge in ways that are often non-intuitive. With Hurricane Katrina observations in the vicinity of Bay St. Louis and Stennis Space Center as a baseline, we use ADCIRC simulations to model storm surge for a range of Katrina-like storms accounting for the influence of winds and tides interacting with local topography and bathymetry. We examine the effects of variations in landfall location and approach angle, storm intensity and relative sea level on the maximum extent and location of storm surge. The extent and location of inundation are shown to be closely tied to storm track while surge velocity is more closely tied to sea level, indicating a new potential hazard as relative sea level continues to rise in this area.

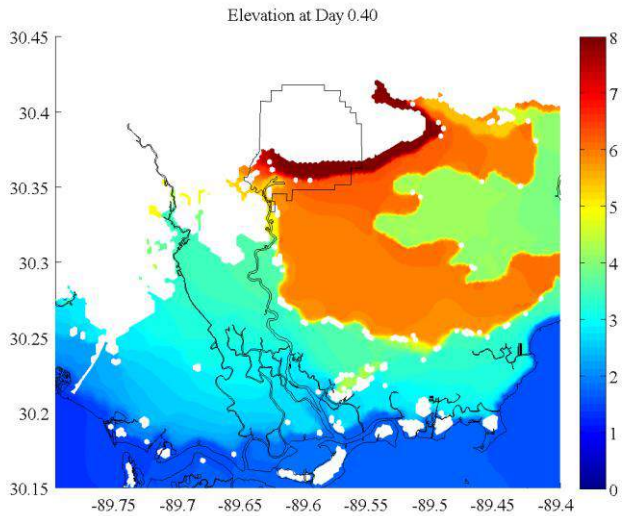

Figure 1 – Modeled inundation due to storm surge generated by a Katrina-like storm with 25 cm of sea level rise. The boundary of Stennis Space Center is indicated.

Does one rebuilt house bring back evacuees?

Climate and Hazard Resilience
Poster Presentation

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David T. Mitchell is an assistant professor of economics at the University of Central Arkansas. Previously he worked at the University of South Alabama. He holds a Ph.D. in economics from George Mason University.

Many nonprofits rebuilt houses throughout New Orleans after Hurricane Katrina. Using building permit data, we ask how government and nongovernmental organizations can best reseed a city after natural disaster. We analyze whether the rebuilding efforts of a nonprofit organization in the Mid-City district of New Orleans from 2005 to 2009 influenced the decisions of neighboring residents to return and rebuild. We use a spatial autocorrelation model to test whether houses rebuilt with local nonprofit assistance resulted in positive spatial spillover effects to neighboring houses. The results will be of interest to local governments, nongovernmental organizations and community residents in planning for rebuilding after future coastal storms.

Development and operational start of the Northern Gulf Operational Forecast System

Climate and Hazard Resilience
Oral Presentation
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[1]National Oceanographic and Atmospheric Administration (NOAA)

Tim Osborn is a member of the NOAA Office of Coast Survey, Eastern Gulf. Located in Lafayette, La., B.S. Marine Biology, Florida State University. Graduate Degrees at Louisiana State University. Experience and responsibility in coastal ports and navigation, tide and water levels and geodetic programs and projects. Has participated in the increase of coastal observation stations, the modernization of vertical and horizontal reference networks along the Gulf.

The development of a coastal forecast system for the northern Gulf of Mexico has been an effort seeing many years of work. The last two years has seen the increased number of coastal observation systems (meteorology, water levels, current) and the improvement of coastal models.

http://tidesandcurrents.noaa.gov/ofs/ngofs/ngofs.html

NOAA's Office of Coast Survey, Center for Operational and Oceanographic Products and Services, National Geodetic Survey, and National Weather Service- working with local stakeholders as the Mobile County Government, Port of Mobile and others, developed the Northern Gulf Operational Forecast System (NGOFS) that forecasts water levels, salinity, and other parameters along the coastal states of Alabama, Mississippi, Louisiana and Texas.

Made operational this year, the NGOFS is a move forward in supporting coastal states and communities to prepare and respond to coastal storms and to support the response of state, federal and local governments from spills and incidents in the northern Gulf.

Resilient Coastal Communities through Land Use Planning

Climate and Hazard Resilience
Oral Presentation

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Niki L. Pace is Senior Research Counsel for the Mississippi-Alabama Sea Grant Legal Program and an adjunct professor at the University of Mississippi School of Law, where she teaches land use law and other courses. She holds a LL.M. (Masters of Law) in environmental and natural resources law and a J.D. from Lewis & Clark Law School.

Resilient Coastal Communities through Land Use Planning is the result of a partnership between the Mississippi-Alabama Sea Grant Legal Program (MASGLP) and the Gulf of Mexico Alliance Coastal Community Resilience (CCR) Team. The CCR Team identified the need to research existing policies guiding coastal development and make recommendations to enhance resilience and funded the MASGLP to undertake this research. To achieve this goal, MASGLP first evaluated coastal development laws in the five Gulf states. That report was completed in May 2011. Now, the Legal Program is working to identify best management practices (BMPs) and ways these BMPs may be incorporated into land use decision-making for a final report. This presentation will discuss those research outcomes, specifically: identifying best management practices for achieving resilient coastal development, explain ways in which governments can incorporate BMPs into land-use decision-making, and discuss advantages of incorporating the BMPs into local planning.

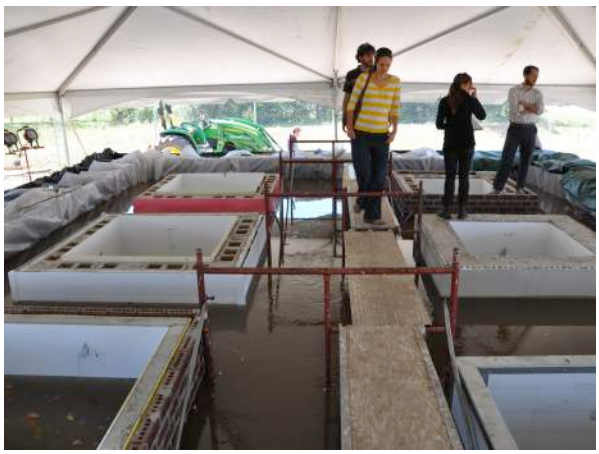
Flood-proof construction for neighborhood-scale commercial buildings
Climate and Hazard Resilience
Oral Presentation
David Perkes*, Mike Grote, Sam Carlsen
Mississippi State University Gulf Coast Community Design Studio
dperkes@gccds.msstate.edu

David Perkes is a licensed architect and professor for Mississippi State University. He is the founding director of the Gulf Coast Community Design Studio. David has a Master of Environmental Design degree from Yale School of Architecture, a Master of Architecture degree from the University of Utah and a Bachelor of Science degree in civil and environmental engineering from Utah State University. In 2004, David was awarded a Loeb Fellowship from the Harvard Graduate School of Design.

A community's economic resiliency and hazard resiliency intersect when its historic commercial streets are put into a flood zone. Many Gulf Coast communities have commercial streets that were twice impacted by Hurricane Katrina: first, their buildings were damaged by the storm; and second, the FEMA Base-Flood Elevation maps were drastically changed, thus putting their commercial streets, which had functioned for decades, into flood zones. The living space of buildings is always required to be above the base-flood elevation, and many houses and apartment buildings have been built in flood zones with raised foundations that lift the living space above street level. While raised houses are inconvenient and cost more than typical houses, raised commercial space is often not even feasible. There are two reasons raised commercial space doesn't work. First, commercial buildings need to be handicap accessible and second commercial buildings, especially retail spaces, survive economically by being on the street where they are visible to drivers and pedestrians. FEMA recognizes that commercial buildings operate differently and allow for commercial space to be built below the base-flood elevation as long as it is flood proof. However, the technical, legal, financial and regulatory aspects of flood-proof construction are largely unknown to a property owner whose property ends up in a flood zone.

The Gulf Coast Community Design Studio, a professional research center of Mississippi State University, received funds from the Department of Homeland Security to research flood-proof construction in commercial buildings. The goals of the research are to demonstrate with full-scale building that flood-proof construction is possible, to determine the technical requirements of flood-proof construction, and to explore its cost and regulatory implications. The proposed presentation will explain the completed research and summarize the key considerations for communities to build flood-proof commercial buildings.

The research tested full-sized building assemblies of a range of construction systems in a flood tank for 24 hours. Moisture sensing instruments were inserted in the wall assemblies and monitored for two weeks. The information from the flood tests was used to determine a recommended wall type and used in the design of a prototypical mixed-use building to explore the cost implications of flood-proof construction. The research has been part of discussions with FEMA officers, local and national flood-plain managers, insurance experts and code officials to better understand how flood-proof construction can become a viable option for communities.



Flood test

Coastal Resilience Gulf of Mexico – Methods, data and web-based mapping applications to inform coastal communities on the risks of sea-level rise

Climate and Hazard Resilience
Oral Presentation

George Raber*[1] Christine Shepard[2], Zach Ferdana[2], Ben Gilmer[2], Laura Geselbracht[3], Jorge Brenner[4] and Mike Beck[2]
[1]University of Southern Mississippi, [2]The Nature Conservancy- Global Marine Team, [3]The Nature Conservancy- Florida, [4]The Nature Conservancy-Texas
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George Raber is currently an associate professor of geography at the University of Southern Mississippi. George has been consultant to the Nature Conservancy for a number of geospatial applications including the GIS-based Protected Area Tools, the Climate Wizard and Coastal Resilience. George received his Ph.D. in geography from the University of South Carolina (2003). His research interests are primarily focused on land cover analysis and terrain modeling using Remote Sensing, as well as spatial modeling in GIS.

Coastal communities across the Gulf of Mexico are increasingly vulnerable to coastal hazards; sea-level rise (SLR) and coastal development add to these impacts. The gulf-wide loss of natural buffers, such as oyster reefs and wetlands furthers the risks. Despite a growing awareness of SLR and other coastal hazards, many local decision makers lack the tools to understand, assess and reduce their socio-economic and ecological vulnerability. This presentation discusses the development and implementation of the Gulf of Mexico Coastal Resilience decision support tool (gulfmex.coastalresilience.org) developed by The Nature Conservancy (TNC) and the University of Southern Mississippi (USM). In this presentation we share how TNC has used the tool to engage partners and communities in planning for coastal hazards and sea-level rise. Here we focus on two project sites, Galveston Bay, Texas, and Charlotte Harbor, Fla. In Galveston Bay, we are bringing together planners and practitioners throughout the estuary to share data and information that help communities identify and plan for coastal hazards and sea-level rise. Within the Gulf Coastal Resilience tool we will be highlighting the nearshore waves module which calculates the amount of wave attenuation (and therefore shoreline protection from erosion among other benefits) likely for proposed oyster reef restoration sites. In Charlotte Harbor, we are working with the City of Punta Gorda to identify natural areas (salt marsh, mangroves) of high hazard mitigation and sea level rise adaptation value. We are developing another web module that community members, planners and elected officials can use to explore which natural areas are most suitable for adaptation and hazard mitigation. We have planned several community engagement workshops to share the tool with both local planners and the public and the focus the public workshop will be an interactive session allowing citizens of Punta Gorda to use the module to provide feedback to the City regarding which natural areas should be retained for hazard mitigation and adaptation purposes. Partnering with local governments, organizations and universities has been critical to our success thus far in both Galveston and Charlotte Harbor and our presentation underscores the importance of these community connections for our Sea Grant-funded coastal resilience projects.

Information updating on storm forecasting model with climate changes

Climate and Hazard Resilience
Oral presentation
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Dr. Mohammad Rahman is an assistant professor at School of Construction in the University of Southern Mississippi. His research includes decision-making application under uncertainty where little information may be available and decision-making is risk-averse. His current works follow stochastic modeling, supply chain problems, intermittent forecasting and lean six-sigma models.

This paper introduces a stochastic forecasting model that is relevant to predict storm activities during a hurricane season to make the planning decisions regarding a normal or higher than normal storm season. The planning horizon begins during the initial stages of a hurricane season, and continues till the end of the hurricane season. In a two-phase stochastic model, the number of storm activities is uncertain; forecast is addressed for the highly active season based on the observation of tropical depression or disturbance at the initial stage for a shorter period. It is assumed that the storm pattern follows a distribution process with an unknown rate. The uncertainty of the demand rate is described by a prior probability distribution. The prediction of storm activities is challenging. Forecasting may obtain more accuracy if it is done at the later stage of the planning horizon relative to the earlier stage, and if the forecasting model is formulated with Bayesian updates where the updates are based on initial observation, past history and experts' opinion about the likelihoods. The figure shows the Bayesian updating method. A numerical example involving storm activities is presented to illustrate the methodology.

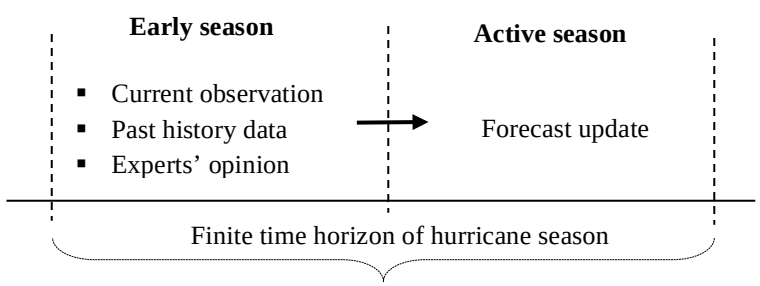

Figure: Forecast model with Bayesian update

In Bayesian model, the prior probability $f(\theta)$ is considered as known density function of parameter Θ. Define $f^n(u^n|\theta)$ as the likelihood function and $f^n(\theta|u^n)$ as the posterior density of Θ after observing random occurrences $U^n = (u_1, \ldots, u_n)$. Using the Bayes theorem, it yields

$$f^n(\theta|u^n) = \frac{f^n(u^n|\theta).f(\theta)}{\int_{\mathbb{R}} f^n(u^n|\theta).f(\theta)d\theta}$$

The model may be beneficial to many industries, private corporations, retail chains, government agencies and not-for-profit organizations that experience changes of schedule, logistics decisions and demand surge for services and products due to post-storm restoration. However, statistical technique facilitates correct planning, adequate preparation and ensure right supplies, equipment and personnel at the right places, at the right times and in the right quantities.

Coastal IQ - Hazards awareness, storm preparation and mental calculus of evacuation: A survey of Gulf of Mexico coastal counties

Climate and Hazard Resilience
Oral Presentation
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Jay Ritchie, the social sciences coordinator for the Northern Gulf Institute, is charged with enhancing social science research activities. He is a member of the Gulf of Mexico Research Initiative Administrative Unit and Ph.D. candidate (Exp. 2014) in the Human Capital Develop Program at University of Southern Mississippi.

Coastal areas are the most developed in the nation, home to more than 53 percent of the nation's population and increasing by 3,600 people per day (NOAA, 1998). This coastal population growth, climate change, and sea level rise all foretell increases in coastal hazards, climate-associated risks, socioeconomic impacts, and coastal resilience concerns. The Coastal IQ Survey is an attempt to contribute to the understanding of resiliency issues through the introduction of an institutional-based perspective that stresses not simply individual variations in behaviors and attitudes, but rather attempts to use cross-sectional survey data for the measurement of societal norms, practices, and beliefs surrounding resiliency issues.

The Coastal IQ survey was funded by the Gulf of Mexico Alliance (GOMA) Coastal Community Resilience Priority Team, with enhancement funds from the Coastal Storms Program. This program is composed of two surveys of coastal counties. The first is a five state, seven geographic region survey of householders over 18 years of age in the coastal counties of Florida, Alabama, Mississippi, Louisiana and Texas (N=2,829). The second survey focuses on the MS/AL Sea Grant region, covering the coastal counties of Alabama, Mississippi and portions of Louisiana (N=1,200).

This survey addresses public knowledge and attitudes toward coastal hazards, storm preparation, evacuation decisions, resilience, and community. The Coastal IQ survey will create a measure of knowledge and attitudes associated with the focus resilience issues. The construction of the measures present the results as a gradient, charting knowledge from low to high, and attitudes from non-acceptance to full acceptance. This allows for tracking of changes in knowledge and attitudes and provides an information source to interested agencies (e.g. emergency management, National Weather Service) to show areas that need educational focus and track the results of educational efforts.

The Working Waterfront Inventory 2012 update

Climate and Hazard Resilience
Oral Presentation

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Derrick Robinson is a graduate student studying for his Ph.D. in applied economics at Auburn University's Department of Agricultural Economics and Rural Sociology. His research area of interest is in examining policy issues in regional and urban socioeconomics.

The 2012 Working Waterfront Inventory of waterfront-dependent businesses in the coastal counties of Alabama and Mississippi is being conducted to examine the socioeconomics of water front dependent or related businesses. Due to population growth and subsequent land use competition among real estate and other traditional businesses and industries, land values have increased and altered land use patterns in the coastal areas. Understanding these changes and their influences is important to the coastal communities. This project seeks to address the resiliency of coastal economies by performing an integrated analysis of the social and economic impacts of Hurricanes Katrina and Ivan, the Deepwater Horizon oil spill, the recent Great Recession and other potential impacts affecting local waterfront economies.
The overarching goal is to establish baseline economic conditions for Alabama and Mississippi water-dependent businesses in 2012. The inventory establishes and tracks economic trends by developing GIS layers of business categories for use in planning and zoning efforts. Survey data is being collected using a combination of internet accessible surveys, mailings and fieldwork. Statistical, econometric and spatial analysis techniques will be used to analyze the impacts from these meteorological, technological, and economic shocks. The results will lead to better policy and land-use management decisions by public administrators. Further, the investigators conducted a similar study in Mobile County, Alabama, in 2008, which can be used with the new data to examine long run trends.

Preliminary results from surveys show that 40 percent of initial respondents identified being in business at the current location for 15 years or more, but most businesses were there for less than 10 years. This allows stakeholders to understand who are the current users of waterfront land and how long the land has been used in for a particular purpose. This same group had 50 percent of respondents who identified their business to have decreased profitability over the last 5 years, and 40 percent of those respondents experienced decreases greater than half of their profitability. Taking these few statistics and combine them with GIS analysis one can understand the characteristics of struggling businesses, including location, demographic information of surrounding census block group, and the size of the business. This specific information can be used to help policy makers improve efficiency of promotional and marketing programs by targeting specific industries/businesses, as well as which geographical areas the programs would be most effective.

Mapping social vulnerability to climate change hazards in Mississippi

Climate and Hazard Resilience
Oral Presentation
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Based in Jackson, Miss., Yumeka Rushing, Gulf Coast Policy Officer for Oxfam America, leads Oxfam's local and state policy advocacy efforts in the region. She focuses on engaging state legislators and governors, and works closely with state-wide organizations and coalitions. Previously, she served as the policy director for Mississippi Center for Justice.

Oxfam America worked with the Hazards and Vulnerability Research Institute at the University of South Carolina to produce a series of social vulnerability maps for 13 states in the US Southeast. In the report *Exposed: Social Vulnerability and Climate Change in the U.S. Southeast*, 75 percent of the variance for social vulnerability to four hazards associated with climate change--drought, flooding, hurricane force winds and sea-level rise--was explained by eight variables: wealth, age, race, ethnicity, rural, special needs populations, gender and employment. The overlay of social vulnerability, a static demographic assessment, with the dynamic potential for hazards associated with climate change is crucial information for emergency preparedness and regional planning.

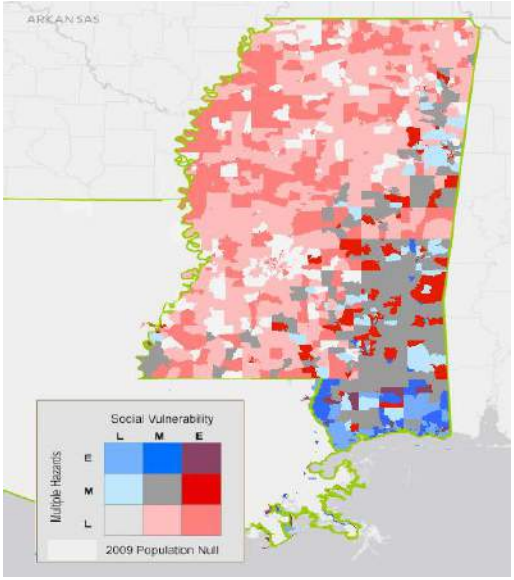

Figure 1.The Social Vulnerability map measures and illustrates the convergence of social vulnerability factors and environmental hazards. (Limited, Medium, Elevated)

In 2012, Oxfam-commissioned a more granular version of the maps for Mississippi and Louisiana to understand the vulnerability differences within a single parish. The presence of 'black spots' on the overlaid maps indicates that there is a high incidence of disasters historically, and that there is high social vulnerability as defined by the social vulnerability index, SoVI. The 'black spots,' concentrated on the southern coast and delta region of Mississippi, indicate both a high incidence of social vulnerability and climate change related hazards. In order to effectively manage the people resources in these areas, federal, state and local policies must be developed which respond to vulnerability in addition to resiliency.

The implications of this knowledge about social vulnerability to hazards are practical. The needs of a community with low social vulnerability are different than those for one with high social vulnerability; the systems developed by public money should reflect this. Since the information focuses on people, and not property value, the information can be used to develop systems for people-focused emergency management in the face of climate related disaster.

Facilitating disaster recovery and resilient communities: Recommendations for housing recovery in coastal communities

Climate and Hazard Resilience
Poster Presentation
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Dr. Deanna Schmidt is an assistant professor of geography. Her interests include community resilience, planning for disaster recovery and urban political ecology. She holds a Ph.D. in urban geography from the University of Wisconsin – Milwaukee.

Housing recovery is central to the recovery of our communities after a disaster and their future resilience. The ability to provide temporary shelter and the repair and replacement of damage housing stock determines the trajectory of recovery in a number of ways: 1) It allows individuals to return to their communities and begin the process of recovery and reconstruction; 2) It allows families and communities to reconstitute family and community bonds, and share vital information about recovery programs and resources; and 3) It allows family members to return to work and small businesses to reopen assuming their place of business can be made operational.

Through a comparative study of smaller, coastal communities located on Galveston Bay, Texas, and the sounds of North Carolina, we identify the policies, resources and capabilities that facilitate or constrain housing recovery after disasters. The research team developed two survey instruments; the first survey was mailed to over 150 local public officials in Texas and North Carolina; and the second survey sampled seven communities for more detailed data. Our key findings recommend that coastal communities can facilitate housing recovery by: 1) Developing and maintaining institutional knowledge and training; 2) Sustaining horizontal and vertical collaboration; 3) Planning for recovery; and 4) Utilizing local knowledge. The presentation will expand upon these key findings and provide specific recommendations to government agencies, nonprofits and other stakeholders in the disaster recovery network.

Adapting to climate change: Mississippi and Alabama communities are accepting the challenge

Climate and Hazard Resilience
Oral presentation
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Tracie Sempier is the Coastal Storms Outreach Coordinator for the Mississippi-Alabama Sea Grant Consortium. She works with local communities, state and federal agencies, non-profit organizations, port authorities, emergency and floodplain managers, residents and other audiences to try and decrease the negative impacts of coastal storms on families, communities, the environment, natural resources and property.

Many coastal management decisions about adapting to climate change are made at the local level. To increase local resilience to climate change, community planners and municipal leaders must understand how climate impacts are related to differences in vulnerability, how municipal actions can improve or exacerbate impacts, and how management decisions interact. The Coastal Storms Program and Mississippi-Alabama Sea Grant are working within three Mississippi communities (Waveland, Biloxi and Ocean Springs) and two Alabama communities (Orange Beach and Dauphin Island) to jointly identify vulnerabilities to climate change and subsequent management actions that can be taken at the local level to address future challenges (i.e. sea-level rise, flooding). The five coastal communities are taking a slightly different approach to adapting to climate stressors. This presentation will: (a) give an overview of the work being conducted in each of the five communities, (b) detail lessons learned from their experiences, (c) identify best management practices for local governments to consider, and (d) make recommendations for how communities can work together to tackle this complex issue of climate adaptation within their existing frameworks (i.e. hazard mitigation and comprehensive planning).

Community Disaster Preparedness: An index designed to measure the disaster preparedness of rural communities

Climate and Hazard Resilience
Poster Presentation

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Disaster preparedness can be defined as the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. The coastal communities of the Northern Gulf of Mexico region stretching from Louisiana to Florida are predominantly rural and, as such, have the potential to not only be impacted directly by a variety of hazards in the region, but also indirectly due to their geographical association to the more populated urban areas to which they border. A better understanding of how these communities prepare for and respond to disasters may offer insight into factors which could be used to increase the resiliency of these communities before, during and after a disaster.

In spring 2010, the Mississippi State University, Center for Urban Rural Interface Studies (CURIS) began an investigation into the development of a tool to measure how well prepared coastal communities were with regard to their ability to handle any type of natural hazard in the region. The goal of this project was to measure and compare the level of disaster preparedness of coastal communities along the CURIS region, which was defined as 20 counties and parishes in Louisiana, Mississippi, Alabama and Florida. Collection of disaster preparedness data was accomplished through the use of a mailed 52 question survey. Survey responses from sources which included emergency management, law enforcement, fire department and county/parish extension personnel were used to create a Community Disaster Preparedness Index (CDPI).

The CDPI measures disaster preparedness based on eight variables: disaster preparedness plan, communication, security, transportation, sheltering, volunteer collaboration, utilities and critical infrastructure. Based on responses is each community, these variables are scored with a numeric value and form a basis for the CDPI representing the current level of disaster preparedness of the county/parish. Surveys were mailed to 83 targeted participants with completion instructions and included a postage paid envelope to return the completed survey. Over the course of several weeks, two complete CDPI survey mailings were performed with a total response 24 surveys completed from 17 counties/parishes in the CURIS region.

The data from these completed surveys have been analyzed and preliminary results show an average CDPI score of 0.50 for the participating counties. The lowest average score was for the volunteer collaboration variable at 0.31 while the highest scoring variable was communication at

0.83. More results will be displayed on the poster. The scores are based on a ranking system of 0 to 1 where 0 is the lowest level of preparedness and 1 is the highest level of preparedness.

QUANTIFYING MODES OF SEDIMENTATION IN COASTAL MARSHES AROUND MOBILE-TENSAW RIVER DELTA AND MOBILE BAY REGION

Climate and Hazard Resilience
Poster Presentation

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Hurricanes, floods, and other natural hazards threaten human infrastructure and communities as well as natural landscapes around them. However, these natural processes may also transport sediment to coastal marshes that help abate pressures associated with sea-level rise (SLR). The Mobile-Tensaw River Delta (MTRD) and adjacent Mobile Bay contain a variety of non-tidal to tidal, hardwood and marsh wetlands. This area has also been subjected to a number of major storms, most of which occurred after 1950 (e.g., Hurricane Camile-1969, Hurricane Fredrick-1979, and Hurricane Ivan-2004). To quantify marsh response to storm-event deposition and the inclusion of inorganic sediment in marsh ecosystems, push cores were collected from marshes around MTRD and Mobile Bay. Marsh-accumulation rates and core geochronology were computed using a constant-flux model applied to excess lead-210 (^{210}Pb) measured in the sediments. Freshwater-marsh accumulation rates were highly variable (0.24 and 1.31 g cm^{-2} y^{-1}) with a general decrease over the last 100 y. The highest accumulation rates were observed in the 1950s and reflect large sediment influx during the 1955 flood event along the Mobile-Tensaw River. In comparison, salt marshes along the bay experienced a general increase in accumulation rates over the last 120 y (0.05 to 0.18 g cm^{-2} y^{-1} or 0.23 to 0.48 cm y^{-1}). Between 1880 and 1960 (a relatively quiescent period), organic accumulation remained fairly constant (~20%); however, intermittent pulses of higher inorganic-sediment supply were observed between 1960 and the present. Specific periods include the late 1960s, late 1970s to early 1980s, and early 2000s, which corresponds to times of several major hurricanes (e.g., Hurricanes Camilie, Fredrick, and Ivan). The nearly three-fold increase in sediment deposition in salt marshes during the last 120 y would thus appear to be partially dependent on inorganic-sediment supply from storm events. Based on this data set, marshes along the MTRD and Mobile Bay are accreting at rates sufficient to keep pace with local SLR (~0.4 cm y^{-1}).

Figure 1. Storm debris in a Juncus roemarianus marsh located on the western side of Mobile Bay, Alabama, USA.

Weathering the storm: Evidence-based outreach to encourage coastal hazard resilience

Climate and Hazard Resilience
Oral Presentation
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Chris Snyder is director of the Marine Education Center at University of Southern Mississippi's Gulf Coast Research Lab. Chris is responsible for the management and operation of the center. He has a bachelor's degree in biology and a master's degree in Workforce Training and Development, both from University of Southern Mississippi.

During MEC's long history of providing excellent teacher professional development, its educators have been asked to find a way teachers could return to GCRL and bring family and friends to participate in similar educational programs. Through the Educational Efforts grant sponsored by Mississippi-Alabama Sea Grant Consortium, educators are designing a series of family educational experiences that address the four Sea Grant focus areas. Currently, five different sessions in the Explore Seashore programs encourage interaction among researchers and participants in lab and field settings. Each program is offered twice a year; most include a short session Friday evening followed by a full day on Saturday.

The program Weathering the Storm is offered at the beginning and end of hurricane season to encourage coastal residents to make themselves and their homes as resilient as possible. This program begins with a short lecture providing an understanding of regional issues including seasonal storms, rising sea level and climate change. GCRL scientist Dr. Wei Wu describes how computer models allow environmental simulations and illustrates how storm surge will be affected by rising sea level. NOAA tools, including sea-level visualizations, help participants apply these lessons along the Mississippi Gulf Coast to consider risks to their neighborhoods. During the afternoon participants travel to GCRL's Cedar Point site to walk the trails where the Marine Education Center building (lost from Point Cadet Biloxi during Hurricane Katrina) will be relocated. Participants will learn the factors that are being considered and choices that have been made to build a new facility that will minimize its environmental footprint and become part of the educational program. The final stop is a trip to Bayou Auguste in Biloxi to explore the work of architects with the Mississippi State University's Gulf Coast Community Design Studio to redevelop this neighborhood for residents while restoring natural functions of the bayou.

"But it never flooded here before!" A generic prime-time television program on flooding with local application

Climate and Hazard Resilience
Oral presentation

Emily H. Sommer[1]*; George F. Crozier[2], Terry C. Plauche[3] and Kevin D. White[4]
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Emily Sommer holds a bachelor's degree from Tulane University and an MBA from University of South Alabama. She has had her Alabama Realtor's license since 1981, her broker's license since 1991 and is a certified instructor for the Alabama Real Estate Commission. She is the executive director of grassroots, inc., a 501C(3) organization and executive producer of "Gambling Against Mother Nature," three-part, prime-time TV program.

Greater rates of development and population growth on our coasts increase both the causes and the effects of flooding. Inland areas are also affected by climate change that heightens rainfall events and overwhelms creeks and rivers. Widespread impervious surfaces deflect the rain and cause ruinous results to lives and property. The average citizen is unaware of the causes and the possible solutions of flooding, as are many public officials.

This outreach project was a pilot program for a generic 28-minute television program on flooding, with 12 minutes of local issues/solutions. The initial site was in Houston, Texas, with KHOU (CBS affiliate). The program was produced by WKRG, Mobile, Ala. KHOU aired the program five times, with over 150,000 viewers. Over 600 DVDs of the program, including the Spanish-language version, have been distributed to libraries, classrooms, public works and parks/recreation departments. State/county/local officials are using it.

We have developed a one-hour teaching package for floodplain managers, planning officials and other professionals to take to their city/county governments, zoning agencies, planning commissions and other decision-making bodies. These important civilian boards greatly influence policies regarding storm water management, but few of their members have an environmental education background. This accessible and interesting package will help improve development practices and offer cost-efficient solutions.

The 16-minute generic portion is ready to be adapted to other communities, with Spanish or Vietnamese (for example) voiceovers. We have seen that these important environmental issues can be accessed by a wide public audience in terms that relate to the individual.

Implementing a hazard resilience tool: The Community Resilience Index

Climate and Hazard Resilience
Oral presentation

Jody Thompson[1*], Tracie Sempier[2] and LaDon Swann[3]
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Jody Thompson has worked in natural resources planning and extension in coastal Alabama since 1999. She provides extension and outreach on coastal resiliency and water quality issues to the communities along the Gulf Coast and is currently the Regional Outreach Coordinator for the implementation of the Coastal Community Resilience Index. Mrs. Thompson holds her Bachelor of Science degree from the University of Alabama, and her Master of Science from the University of South Alabama.

The Community Resilience Index (CRI) seeks to increase risk awareness among local communities of their susceptibility to natural hazard events. Developed in partnership with the Gulf of Mexico Alliance, the CRI is delivered through interactive sessions with community decision-makers and facilitated by trained facilitators from Sea Grant Extension, Cooperative Extension, National Estuarine Research Reserves and other partners. Now in the implementation phase, the CRI will be delivered to at least five communities in the five Gulf of Mexico states, with each community completing the CRI at one-year intervals. Tool effectiveness will be measured through qualitative and quantitative data in the initial three-year implementation and evaluation period. The CRI is a snapshot in time, assisting communities in assessing their natural hazard preparedness and planning. The recipient audience can include floodplain managers, land-use planners, local elected officials, natural resource managers and emergency managers, and is applicable at the city and county or parish level. The CRI can be coupled with existing training programs as an entrée to introduce other natural hazard planning topics, such as sea-level rise and climate change to coastal communities. The end outcome is for communities to take actions to address the weaknesses they identify utilizing the CRI, and community decision-makers that are more informed on their community's level of risk, ultimately increasing their capability of responding to disasters. The CRI development, delivery and adaptation model can be readily transferred to all U.S. coastal communities and is easily adapted for natural hazards more applicable to inland communities.

To date, 25 communities in five Gulf states have participated in a CRI meeting, facilitated by one of 75 trained volunteers. Quantitative and qualitative data are being gathered in order to evaluate the CRI tool. Partnerships have led to the CRI being facilitated in Bangladesh and Mexico, and introduced to other United States regions.

Sea-level rise and storm surge impacts in coastal habitats in the Gulf of Mexico

Climate and Hazard Resilience
Poster Presentation

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Michael received his B.S. from Willamette University. He received his master's in marine resource management from Oregon State University. He has worked in Oregon for Sea Grant, Fish and Wildlife, and as a consultant. He now works for the Nature Conservancy as a coastal and marine GIS analyst in Texas.

This presentation provides a series of final results of assessments and tools to inform from decision makers to the general public of the potential impacts caused by sea-level rise (SLR) and storm surge on coastal areas along the Gulf of Mexico. This project is being conducted for the Gulf of Mexico Alliance and their members to help provide technical aspects necessary in understanding the threats of SLR to habitats and coastal communities. This project used the Sea-Level Affecting Marshes model (SLAMM) and the Advance Circulation hydrodynamic model (ADCIRC) to assess the implications of storm surge caused by known storms in Galveston Bay, Texas, Jefferson County, Texas, Grand Bay NERR/NWR, Miss., and Choctawhatchee and St. Andrew Bays in Florida. The project accomplished three main objectives: 1) development of spatial models and future scenarios to assess the impacts of SLR and storm surge ((Figure 1), 2) develop a series of conservation and resilience analysis and synthesis products to assess the capacity of marshes to migrate due to these threats, and 3) encapsulate all GIS products, reports and final information synthesis in a GIS-based data platform for managers to use this information in their own assessments and adaptation plans (Figure 2). This presentations will provide results obtained in this project, inform participants of online access points for these freely available products, and present of next steps and subsequent projects that we are working on to help manages develop adaptation strategies for climate-related threats in the Gulf of Mexico.

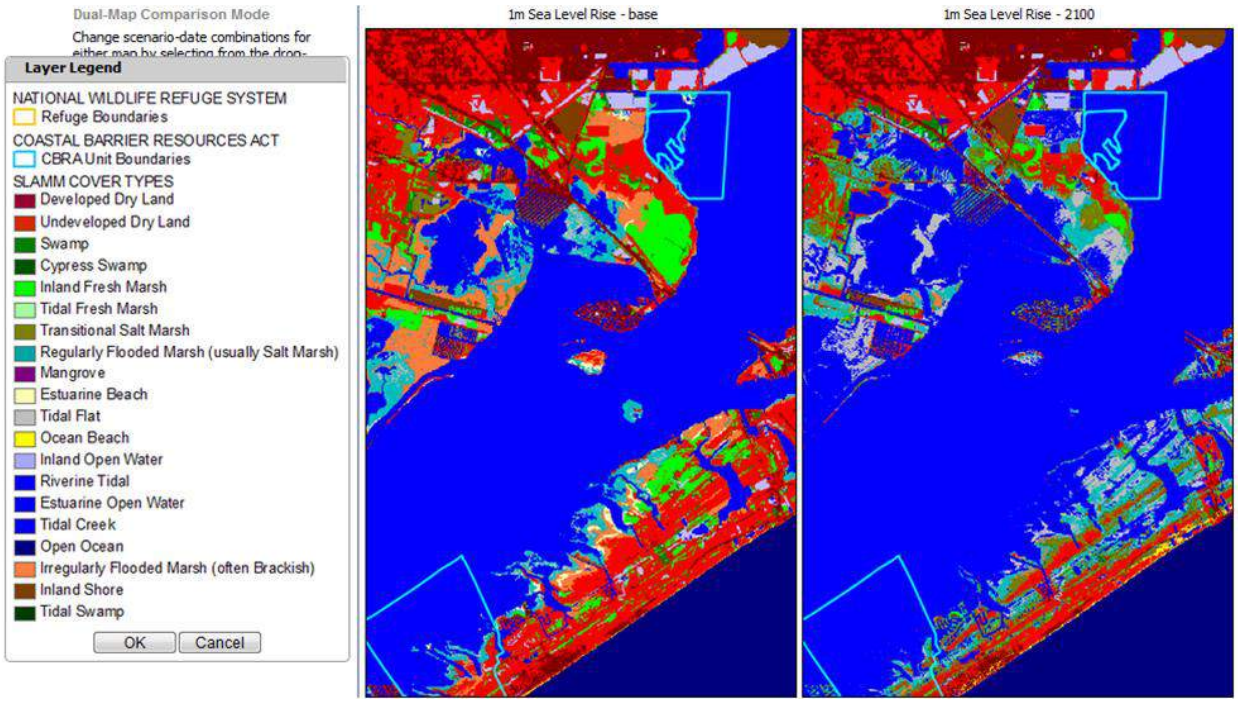

Figure 1. Sea-level rise scanarios for Galveston Bay area using the SLAMM model.

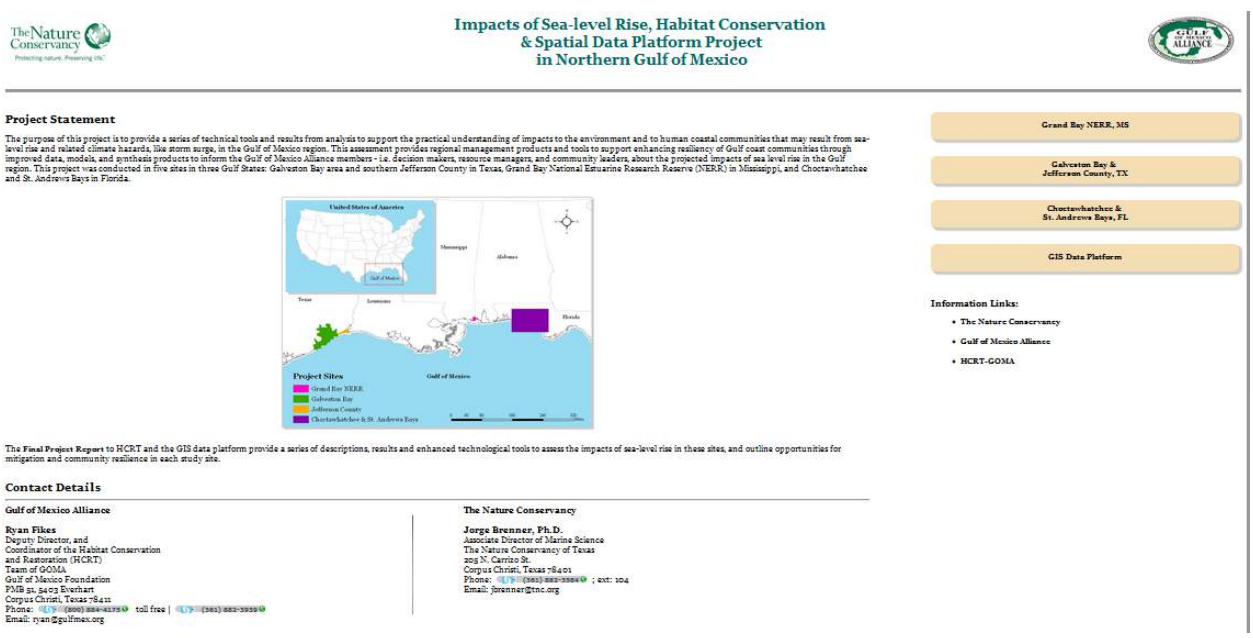

Figure 2. Sea-level rise data platform (source: http://stormsmart.org/goma/slr/interface/index.html)

Measurements of storm surge and waves on Dauphin Island during Hurricane Isaac

Climate and Hazard Resilience
Oral Presentation

Bret M. Webb[1]*, Spencer Rogers[2], Andrew Kennedy[3], Uriah Gravois[4] and Husam Omar[5]
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Bret Webb is an assistant professor of civil engineering at the University of South Alabama. His research focus is on coastal processes, including storm surge and waves, tidal circulation and transport, coastal water quality and living shorelines. Bret teaches undergraduate and graduate courses in hydraulic and coastal engineering.

The resilience and sustainability of the constructed coastal environment are constantly being tested. The expected impacts of global climate change, including rising sea levels, and the modification of land falling hurricane frequency and intensity will require adaptation and accommodation at many levels, including appropriate specification of structure elevations, structural connections, construction materials, and even foundation design. While full scale testing to quantify the impacts of storm water levels and waves on structures is possible, the costs are prohibitively high. A suitable alternative, then, is to instrument structures during storms to measure these processes at full scale under field conditions.

Figure 1. A storm surge and wave gauge deployed on Dauphin Island, Ala.

Instruments were recently deployed on Dauphin Island, Ala., during Hurricane Isaac to measure storm surge and wave characteristics at five locations across the barrier island. The instruments are simple pressure transducers sampling at a frequency of 2 Hz. When averaged over longer time intervals, the pressure measurements clearly show the time-dependent elevation of storm surge at each gauge location. These measurements can also be converted to wave characteristics, like height and period, at each location. Because of the dynamics of the storm, the limited storm surge and the geomorphology of the island in the study area, not all gauges recorded storm surge and waves.

The practical results of this ongoing storm surge and wave monitoring program are compelling: they may directly impact federal and state guidelines for construction methods and materials, building elevations, flood plain management and insurance costs in coastal municipalities. Improved predictions of wave heights above the storm surge elevation will improve guidance provided in base flood elevation maps. When the wave transformation process is evaluated in tandem with ground surveys of structural damage, an opportunity for improving specifications and codes for foundation-floor joist-wall connections, and appropriate elevations of the “lowest

structural member" will be realized. These results can lead to a reduction in repetitive losses, and more efficient construction.

Creating a resilient Gulf Coast through regional planning

Climate and Hazard Resilience
Oral Presentation
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The Plan for Opportunity is a collaborative planning project intended to guide the economic growth and development of the Mississippi Gulf Coast and to improve housing, employment and transportation opportunities throughout the region. The three year planning process is guided by the Constituency for a Sustainable Coast (CSC), a group of stakeholder committees that has been organized and expanded over the course of the plan to include city and county leadership, key community and public partners, and residents of the region.

It is necessary to honor the past but plan for the future if the coast is to be prepared to face the many challenges of its unique environmental landscape and vulnerability to natural disaster, while meeting the needs of a diverse economy and social needs.

It is appropriate that the plan is regional to examine issues that are not bound by jurisdiction and require multi-level and broad-based strategies to implement incentives, solutions or to make changes to conditions that impede positive, quality growth. Local plans and priorities are used to inform and guide the vision of the future. A regional analysis allows for the many, varied local plans to incorporate for a single purpose of economic competitiveness. The issues are broad and diverse, including economic development, transportation, housing; environmental resources and land use, but also they are inter-dependent.

There is increasing evidence that regional plans are considered by private investors as well as governmental divisions as a strategic and informed framework that lowers the risk of capital investment. The cities, counties and region will be in a better position to leverage funds with the *Plan for Opportunity* than with a region without a plan. The *Plan for Opportunity* is intended to provide information, data and recommendations with an on-going outreach program with the coast leaders and the public for input and consensus to guide and enhance the comprehensive plan.

As part of the planning process, the resiliency subcommittee is working with the current organization and work underway to create a framework for assessing resiliency across several systems; to develop the tools and methodology to work at a neighborhood level, creating the bottom-up approach for assessing vulnerabilities to climate and other major events, and to develop the skills and training for building local to regional scale resiliency plans. Ultimately, this process will expand the ideas of regional planning in addition to expanding upon the ideals of the resiliency index. The process will facilitate overarching ideas in an effort to define 'what a resilient gulf coast looks like in twenty years,' and lays the foundation for implementing the measures and policies to achieve this task.

Elaine G. Wilkinson,
Elaine G. Wilkinson is the Executive Director of the GRPC. She worked for many years as a professional planner at the New Orleans Regional Planning Commission and as a vice –president of a GIS Consulting firm before becoming director of the GRPC in 2002. She served on the federal advisory panel in 2005 to *The Impact of Climate Change and Variability on Transportation Infrastructure: The Gulf Coast Study*. She is currently the Chair for the Gulf Coast Ozone Action Group and a member of the Gulf Coast Business Council. She was project director for the Hancock County Comprehensive Plan, which included the cities of Bay St. Louis and Waveland. She is currently the project director for the updating of the long-range transportation plan for the Gulf Coast. She is the Executive Secretary to the GRPC Board of Commissioners and responsible for the operation of the agency and administration of agency funds in accordance with federal regulations and public policy.

Coupled methane and carbon dioxide fluxes in coastal marshes along a salinity gradient

Climate and Hazard Resilience
Poster presentation

Ben J. Wilson[1,2]*, Behzad Mortazavi [1,2], Ronald P. Kiene[2,3] and Gregory Starr[1]
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Ben Wilson is a second-year graduate student at the Dauphin Island Sea Lab. His interests include sediment biogeochemistry, plant physiology and biosphere-atmosphere interactions.

Carbon fluxes in tidal marshes vary spatially and temporally due to vegetation cover, subsurface biogeochemical processes and tidal inundation. Methane (CH_4) emissions, in particular, have been shown to vary widely with changing salinity and vegetative species composition. The objective of this study is to use measured carbon dioxide (CO_2) and CH_4 fluxes at various light levels to model net ecosystem exchange, the balance between gross ecosystem CO_2 fixation and ecosystem respiration, over an annual time scale and across a salinity gradient. Three marsh sites in the Mobile Bay estuary were selected that varied in salinity (0-27 ppt) and vegetative species composition (*Cladium jamaicense* and *Spartina alterniflora*). CO_2 and CH_4 fluxes were measured monthly in triplicate plots in the field at several different light levels to generate light response curves. Sediment nutrient profiles and hydrogen sulfide concentrations were measured using porewater wells at 10 and 25 cm depth. Porewater CH_4 concentrations were also measured from sediment cores every 8 cm down to 25 cm. Short term CO_2 and CH_4 fluxes measured in the field will be used to generate gross ecosystem exchange vs. PAR and ecosystem respiration vs. air temperature relationships at each site.

Mean ecosystem respiration rates of CO_2 ranged from 1.1 μmol m^{-2} sec^{-1} at the high salinity site to 11.4 μmol m^{-2} sec^{-1} at the fresh site. Depth integrated porewater CH_4 inventories did not vary significantly between sites; however, the higher salinity site generally had higher concentrations of porewater CH_4 in the sediments compared to the fresh site. For example, porewater CH_4 inventory for the high salinity site during May was 10.1 ±2.7 mol m^{-2} compared to 5.1 ±3.9 mol m^{-2} for the fresh site. Diffusive CH_4 fluxes from the fresh site were highly variable by month and by plot, with the largest flux of 65.0 ±41.4 mg CH_4 m^{-2} d^{-1} measured in June. Diffusive CH_4 fluxes in the brackish and salty sites were higher in May compared to March, when soil temperatures were higher. Combined flux data coupled with sediment nutrient profiles and environmental data will allow us to specify ecosystem controls on C fluxes in coastal marshes. This ongoing study will continue to examine C exchange in Alabama's coastal marshes for a total of 13 months.

Determining the performance of breakwaters during high energy events: A case study of a Gulf of Mexico breakwater system

Climate and Hazard Resilience
Oral Presentation

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Andrew Woodroof is a professional engineer at Digital Engineering and a graduate student at Louisiana State University. His interests include civil, environmental and coastal engineering, with emphasis in coastal protection, restoration and pollution prevention. He is a licensed civil engineer and a master's degree candidate in coastal and ecological engineering at LSU.

A variety of empirical models for predicting the shoreline response to breakwaters are available to coastal engineers, including the commonly referenced Dally and Pope, Suh and Dalrymple, and Pope and Dean methods. The primary input parameters for these empirical models are geometric properties of breakwater systems such as breakwater length, breakwater distance from shore, and gap distance between breakwaters. These empirical methods are useful for predicting long-term response, but they do not account for short term events that can cause hydrodynamic variations between systems. Recent studies show that the type of shoreline response to a detached breakwater system may vary depending on the level of emergence or submergence of the breakwater in relation to the mean water level. The variance in emergence of a breakwater can strongly affect the nearshore hydrodynamic circulation patterns near the breakwater and the shoreline response to the structure. While emergent breakwaters typically induce sediment accretion along the shoreline, recent studies using laboratory and numerical models indicate that overtopped or submerged breakwaters may increase erosion of the shoreline. This variation of the hydrodynamic patterns and shoreline response is of particular interest for breakwaters along shorelines that can be impacted by hurricanes and other events that trigger large variances in water level, as the breakwaters may periodically shift between emergent, and submerged states.

The Holly Beach Breakwater System is one such feature that has been constructed to protect a vital stretch of Louisiana State Highway 82, which serves as a hurricane evacuation route in the southwestern portion of Louisiana. Typically, these breakwaters are fully emergent and can be characterized using traditional empirical methods. However, these breakwaters can frequently be impacted by surge events and become overtopped or submerged and may not always perform as intended. This study uses survey data, aerial photography, storm data and 3D surface modeling to assess the performance of the breakwater system during different surge conditions and differentiate the response of the shoreline to the breakwater system during emergent and submerged states.

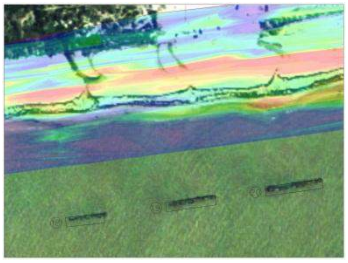

Figure 1 - Sediment transport patterns after storm surge

Detached breakwaters similar to Holly Beach have been constructed in many areas along the Gulf Coast to protect shorelines from wave energy and erosion. The Gulf Coast is under constant threat from tropical storms and hurricanes, and breakwaters can frequently become overtopped

or submerged during such high energy events. Therefore, breakwaters along the Gulf Coast may not be suitable for typical analysis methods, and analysis should consider emergent, overtopped and submerged states to fully assess their impacts. This project aims to improve the methods used to analyze and monitor shoreline protection systems and serve as a tool for hydrodynamic modeling of breakwater structures.

The evolving coastal economy in Alabama: The role of waterfront

Climate and Hazard Resilience
Poster Presentation

Yaoqi Zhang[1]*, Larry Teeter[1], Sheng Li[1] and Anwar Hussain[1]
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This article describes the evolution of the Alabama coastal economy and examines the driving forces in historical context. The role of waterfront is particularly investigated and the coastal economy of Alabama is compared with other regions and the broader economy. The impact of three events (pre-Katrina, post-Katrina but prior to Deepwater Oil spill) on the coastal economy and working waterfronts is investigated. Working waterfronts in the Baldwin and Mobile counties of Alabama face similar challenges as faced by working waterfronts in other regions, but also have some unique problems (e.g., Hurricane Katrina and Deepwater Oil Spill) because of their location. While fishing is still important, water-related tourism, natural-based tourism, birding, and real estate are among the emerging important economic activities in the Gulf Coast economy.

Integrating climate change education into K-12 science standards

Climate and Hazard Resilience
Oral Presentation

Miller-Way, Tina[1]*, Hazel Wilson[1], Jenny Cook[1], Carrie Riley[1] and John DiPlacido[2]
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Tina Miller-Way is chair of Discovery Hall Programs, the education and outreach group at the Dauphin Island Sea Lab. She has taught biology, aquatic biology, environmental and marine science in academia (12 yrs) and as an informal educator in K-12 (5 yrs). She is currently completing NOAA's Climate Stewards certification.

Climate change is not explicitly included in the K-12 science standards for Alabama or Mississippi. However, the topic embodies many basic scientific concepts that are in the standards and can be used as entry points for exploring many aspects of climate change through both content coverage and experiential activities in the lab, field or classroom. With funding from the Mississippi-Alabama Sea Grant Consortium, Discovery Hall Programs has offered a multi-day workshop on climate change for in-service, pre-service and informal educators. In this workshop, we present content and conduct hands-on activities on historical patterns of CO_2 concentration, sea-level rise, ocean acidification, the greenhouse effect, changes in the distribution of species, extreme weather events including hurricanes, and climate models. For example, a discussion of ocean acidification begins with an introduction to pH, covers the carbonate buffering system, shows a short video on 'champagne seas,' discusses the current and potential ramifications of ocean acidification and includes an experiment on the acidification of carbonate shells. Workshop participants are also provided an annotated, relatively comprehensive list of climate change resources for K-12 students. Pre- and post-testing results indicate that workshop participants significantly increase their knowledge of these aspects of climate change ($n=34$, $p<0.05$). Evaluations indicate that participants consider most lectures and activities valuable or very valuable. Participants indicated that the most valuable components of the workshop were the list of websites and resources, the coverage of basic information on climate change, including the explanation of data used to draw conclusions, the opportunity to talk to research scientists and the lessons to take back to class. Interestingly, when asked "was there another topic that you think is important for climate change, but was not included" (in the workshop), participating educators have asked for information and examples of what individuals can do to reduce impacts of climate change. This suggests that teachers and informal educators are receptive to suggestions of behavior change and that, if supplied, they would convey this information to their students or audiences. We are addressing this need with our current outreach efforts. Through this workshop, we have successfully started the integration of an important and current environmental issue into the K-12 curriculum.

BAYS & BAYOUS

SYMPOSIUM 2012

Deepwater Horizon

Oil Spill Science

Session

Social effects of offshore oil and the Deepwater Horizon: Phase one study findings

Deepwater Horizon Oil Spill Science
Oral Presentation

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Dr. Diane Austin is an associate research professor in the University of Arizona's Bureau of Applied Research in Anthropology. Her work focuses on community dynamics amid large-scale industrial activity, impact assessment, and community-based, collaborative research and outreach programs. She has studied the effects of the offshore petroleum industry since the mid-1990s.

The social effects of the *Deepwater Horizon* disaster in the U.S. Gulf of Mexico have been extensive, and they are ongoing. Shortly after the rig exploded, social scientists at the Bureau of Ocean Energy Management (BOEM, at that time the Minerals Management Service) began working with researchers at the Bureau of Applied Research in Anthropology to design and implement a multi-phase study to measure, document, and describe the social effects of this event and its aftermath on coastal communities of southeast Louisiana, Mississippi, and Alabama. This presentation summarizes the results of phase one of the study, which focused on the period from April 2010 through December 2011. Those results are being published in two volumes. The first volume describes the study approach and methodology, establishes the context within which this disaster occurred, includes a timeline of key events in this unfolding disaster that have triggered local effects, and describes the communities that were the focus of the study. For each community, the report highlights some of the locally-specific and synergistic effects of the disaster. The second volume describes five key economic sectors in the region (offshore petroleum, commercial fishing, tourism, fabrication and shipbuilding, and retail) and summarizes how the disaster has impacted the people, businesses, and communities involved in each of those sectors. It also describes the effects of the disaster on non-governmental organizations, the claims processes and how they have affected residents and communities, and the influence of ethnicity on the nature and distribution of impacts.

The effects of oil from the Macondo blowout on infaunal foraminifera of Louisiana and Mississippi marshes

Deepwater Horizon Oil Spill Science
Oral Presentation

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Charlotte Brunner is a geological oceanographer and a professor at the Southern Miss Department of Marine Science. Her interests include coastal and deepwater paleo-environments, Foraminifera, biostratigraphy and taphonomy. She has a Ph.D. in oceanography from the University of Rhode Island.

Heavy contamination by BP oil apparently affected infaunal marsh foraminifera by reducing both their standing stock and depth of habitation, but moderate to light oiling seemed to have little effect. Nine cores from marshes of Barataria Bay (La.) and the Mississippi Sound were examined before and after oiling by the Macondo well blowout of 2010. The sites were sampled at different seasons of the year by necessity. Cores were taken from the lower marsh in the *Spartina alterniflora* zone and sliced at 1-cm intervals to 10 cm depth in core. Samples stained with rose Bengal were washed on a screen with 45-µm openings to capture juvenile and small adult specimens, and were then split using a settling-type splitter. Slices were counted downcore until 95% of stained specimens were accumulated (defined as the depth of habitation). Specimens were kept wet throughout processing. The degree of oiling was assigned from the shoreline cleanup assessment technique (SCAT) data published by the environmental response management application (ERMA), and subsequently verified by measurement of polycyclic aromatic hydrocarbons [PAH] in the cores.

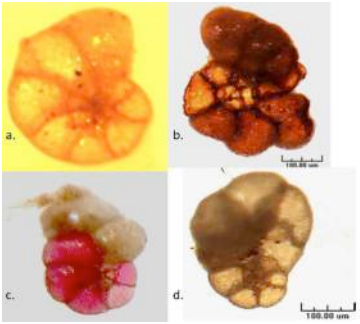

Figure 1. Tests of the foraminifer *Balticammina pseudomacrescens* from Bay Jimmy, La.: a. normal test; b-c. deformed specimens.

Uncontaminated sites and sites lightly or moderately contaminated by Macondo oil had a depth of habitation deeper than 7 cm with most exceeding 10 cm. The standing stock of live specimens exceeded 1,000 specimens, ranging from 1,200 to 6,700, often with a subsurface maximum. In contrast, at heavily oiled Bay Jimmy, the depth of habitation was only 2-3 cm, and the standing stock was 400-800 live specimens with most living in the top centimeter. The Bay Jimmy cores contained deformed specimens (Fig. 1), which were not observed elsewhere in our study. The shallow depth of habitation of live specimens at Bay Jimmy has implications for marsh functioning.

Effects of dispersant and cometabolite addition on hydrocarbon degradation gene diversity and abundance in coastal Alabama sediment microcosms

Deepwater Horizon Oil Spill Science
Poster Presentation
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While changes in the microbial community at a taxonomic level in response to oil spills have been well studied, the functioning of these new communities has not been as well studied. We examined the effects of various dispersant and nutrient amendments on the microbial hydrocarbon degrading community in sediment microcosms established using sediments from Point aux Pins, Ala. These sediments contained less than 40ppm total petroleum hydrocarbon (TPH). The oil used was a Louisiana sweet crude (LSC) obtained from BP that is similar in characteristics to the MC252 oil released during the DWH oil spill. Corexit 9500 was also obtained through BP. Oil was weathered in a fume hood for 48h prior to use to mimic the condition of oil that would reach shorelines during an oil spill. Oil was added to an initial concentration of 40,000ppm. Oil concentration was monitored and the presence of various oil degradation genes was assayed over an 8-week incubation period. Oil concentrations decreased over time in all oiled microcosms, with the added dispersant and added cometabolite treatments exhibiting the fastest oil removal rates. The samples were screened by end-point PCR with degenerate primers targeting the initial genes in aerobic hydrocarbon degradation pathways: alkane hydroxylase *alkB* and *cyp153A* (alkane degradation), *nmr*, *Ac*, and *cyc* PAH dioxygenase (polyaromatic hydrocarbons), *tol*, *todC1*, *tmoA*, *tbmD* (BTEX compounds) and *pmoA* (methane). Alkane degradation genes were evident early in the incubation but disappeared later, suggesting that bacteria attack the more easily degraded fraction of the oil first. Interestingly, Cyp153A alkane hydroxylases were detected earlier than *alkB*-alkane hydroxylases suggesting that the two enzymes may be attacking different alkane fractions. We assayed for three different suites of PAH dioxygenase genes. One or more of these genes were detected in the majority of oiled microcosms throughout the incubation period. BTEX degradation genes were rarely detected, possibly because the BTEX compounds were removed during weathering. Quantitative PCR was also conducted to assess degradation gene abundance during periods of rapid oil removal and used to identify samples for deep sequencing of alkane and PAH degradation genes. Our results indicate that the microbial community in Point aux Pins sediments contain a wide diversity of hydrocarbon degradation genes and are primed to respond to oil exposure.

Just the facts? Stakeholders' opinions on media coverage of the Deepwater Horizon oil spill's impact on seafood safety

Deepwater Horizon Oil Spill Science
Oral Presentation

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Stefanie Christensen is a graduate research assistant in Auburn University's Department of Agricultural Economics and Rural Sociology. After completing her bachelor's degree in political science at the College of Charleston in Charleston, S.C., Christensen produced news for the PBS NewsHour, CNN and Politico. She is originally from Fairhope, Ala.

This research was produced thanks to a grant from the Mississippi-Alabama Sea Grant Consortium to assess the social and economic impacts of the Deepwater Horizon oil spill on coastal communities. The presentation focuses on the opinions held by stakeholders of the news media coverage of the spill's effects on the safety of seafood harvested in the Gulf of Mexico. These opinions were obtained through in-depth, one-on-one interviews with 20 harvesters, processors, wholesalers, retailers and restaurateurs who live and work in the coastal communities of Alabama and Mississippi. Findings illustrate frustration, resignation and anger toward the media's portrayal of Gulf seafood safety. When this research is completed, recommendations will be made as to the best way to capitalize on positive media coverage or minimize negative coverage to allow stakeholders to continue their recovery with limited barriers and constraints.

The impact of the Deepwater Horizon Oil Spill on the composition of marine megafauna in the Gulf of Mexico

Deepwater Horizon Oil Spill Science
Oral Presentation
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Chris Free is an intern at the Fisheries Ecology Lab at the Dauphin Island Sea Lab. His interests include quantitative stock assessment, marine spatial planning, and population modeling. He holds a bachelor's degree in conservation biology from Middlebury College.

The 2010 BP Deepwater Horizon oil spill has damaged marine ecosystems and species on every scale from marine meiofauna to marine megafauna. The recovery of these populations depends on understanding population trends and the demographic processes driving them; however, many populations have not been adequately assessed and the extent of recovery remains uncertain. We conducted aerial surveys for marine megafauna in the northern Gulf of Mexico between July 2008 and July 2012. In 34 surveys totaling 16,774 km of effort, observations of fish, sharks, rays, turtles, marine mammals and jellyfish were systematically recorded. Using this data, we calculated a standardized index of abundance for each species group and for marine megafauna collectively using year and season as covariates. The species composition and diversity of marine megafauna before and after the oil spill were compared using both multivariate and univariate methods in the PRIMER and R software packages. The total abundance of marine megafauna increased before the spill but experienced a precipitous decline in the month following. Total megafauna abundance is recovering towards pre-spill levels but the post-spill species composition is significantly different from the pre-spill species composition. Rays, fish and marine mammals have been slow to recover while sharks and turtles have rebounded relatively quickly. As oil spill recovery and remediation continue, those species recovering most slowly should be the focus of protection and restoration efforts.

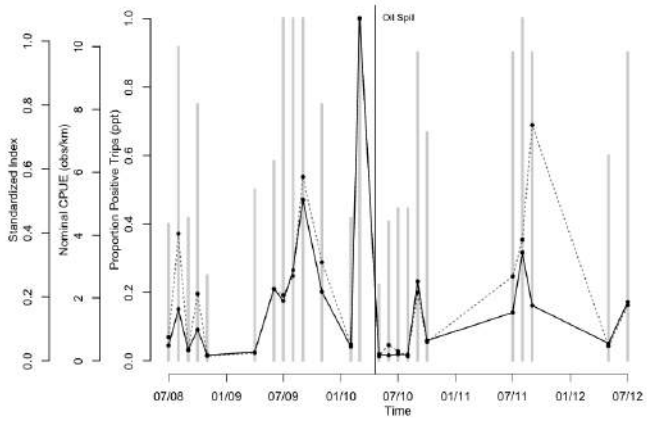

Figure 1. Monthly trends in the proportion of positive trips (gray bars), nominal observation rate (dotted), and standardized index of abundance (black line) for total marine megafauna.

Key nearshore findings from the Northern Gulf Institute monitoring and research program undertaken in the immediate aftermath of the Deepwater Horizon incident

Deepwater Horizon Oil Spill Science
Oral Presentation
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John Harding serves as chief scientist for the Northern Gulf Institute. His research interests include coastal ocean prediction especially as applied to integrated ecosystem assessments. He holds a master's degree from Scripps Institution of Oceanography and a Ph.D. from Louisiana State University, both in marine science.

The Northern Gulf Institute (NGI), a National Oceanic and Atmospheric Administration (NOAA) Cooperative Institute, addresses important national strategic research and education goals as a partnership of five complementary Gulf academic institutions and NOAA. Mississippi State University leads this collaboration, partnering with the University of Southern Mississippi, Louisiana State University, Florida State University, Alabama's Dauphin Island Sea Lab and NOAA scientists at various laboratories and operational centers having interests in the northern Gulf of Mexico region.

NGI contributes to NOAA's strategic interests within the four research themes of ecosystem management, geospatial data integration and visualization, coastal hazards and climate effects on regional ecosystems. The established NGI institutional and management structure and its recognized Gulf of Mexico science leadership in these theme areas positioned NGI as a key participant in the necessarily rapid monitoring and research response required in the immediate wake of the April 20, 2010, Deepwater Horizon incident.

This situation called for a rapid action including the continuation of existing, as well as the initiation of new, environmental monitoring and research prior to the influx of oil into northern Gulf ecosystems. Within the first months NGI provided both NGI and non-NGI affiliated researchers from the Gulf states and beyond with about $4M rapid, phase 1, initial funding from the the BP-funded Gulf of Mexico Research Initiative (GoMRI). Forty individual projects within nine overarching research efforts focused on the five original GoMRI themes: (1) physical distribution, dispersion and dilution of contaminants under the action of ocean currents and tropical storms, (2) chemical evolution and biological degradation of the oil/dispersant systems and subsequent interaction with the marine and coastal ecosystems, (3) environmental effects of the oil/dispersant system on the sea floor, water column, coastal waters, shallow water habitats, wetlands, and beach sediments, and the science of ecosystem recovery, (4) technology developments for improved mitigation, detection, characterization and remediation of oil spills, and (5) fundamental scientific research integrating results from the other four themes in the context of public health.

Subsequent to the phase 1 rapid response, NGI conducted a call for proposals for the remaining $6M, again focused on the GoMRI themes. NGI solicited proposals from investigators from the five NGI institutions with all proposals subject to an independent peer-review process. The peer review was conducted and award decisions for 25 projects were completed by January 2011.

This presentation will summarize key findings from both phases of this NGI-managed research with particular focus on those projects relevant to beaches, estuaries and nearshore waters.

Anthropogenic impacts on the movement of a small coastal shark

Deepwater Horizon Oil Spill Science
Oral presentation

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Andrea Kroetz is a graduate student at the University of South Alabama and Dauphin Island Sea Lab. Her interests include the ecology of bonnethead sharks and the predator-prey interactions between bonnetheads and red drum. She holds a bachelor's degree in integrative biology from the University of Illinois Urbana-Champaign.

Bonnetheads (*Sphyrna tiburo*) are highly mobile fish that occupy dynamic coastal environments. Identifying the factors influencing the distribution of these fish is essential for understanding potential impacts induced from anthropogenic alterations to coastal ecosystems. Dauphin Island is a barrier island that was split into two halves in 2005 by Hurricane Katrina. This opening, known as Katrina Cut, allowed for water flow between the Gulf of Mexico and Mississippi Sound and also served as a potential passageway for mobile consumers to move freely between the two water bodies. Following the Deepwater Horizon oil spill in 2010, Katrina Cut was closed off by a solid rock wall in an attempt to prevent oil from reaching the shoreline (Figure 1). Acoustic telemetry was used to asses if altering Dauphin Island's natural coastline hindered ingress/egress of bonnetheads into Mississippi Sound. There were changes in bonnethead movement from 2010-2011. Prior to the closure of Katrina Cut, bonnethead detections were concentrated in a small area proximal to the cut during 2010. Following the closure of Katrina Cut, telemetered sharks relocated to the west tip of Dauphin Island and Petit Bois Island, Miss., during 2011. A shift in abiotic parameters may be a possible explanation for the shift in distribution of this small coastal shark. Here, we present acoustic telemetry as a means by which to identify a rapid shift in habitat use by a mobile consumer in response to an anthropogenic impact.

Figure 1. Katrina Cut closed off by rock wall.

Subsistence seafood use and the BP oil spill

Deepwater Horizon Oil Spill Science
Oral presentation
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Dr. Brian Marks was a post-doctoral researcher in the Bureau of Applied Research in Anthropology for a study on the social effects of offshore oil and the Deepwater Horizon in 2011 and 2012. His prior work addressed the livelihoods of shrimp fishermen and aquaculturalists in the Mississippi and Mekong Deltas.

Subsistence seafood use, meaning its non-monetary use for personal consumption, community gifts, and barter, is a long-standing and widespread practice in Gulf coast communities. Ethnographic data collected in 2010-12 indicates that subsistence use practices were disrupted, and in some cases remain disrupted, following the Deepwater Horizon spill. Fisheries closures and concerns about seafood safety led to several direct consequences for subsistence, such as reduced or stopped consumption, declining transfers of subsistence seafood, and greater concern among subsistence users about food safety. Two indirect consequences of the spill for subsistence use are differing interpretations of seafood safety guidelines and the almost entirely ineffective response of claims processes to compensate for loss of subsistence use. Seafood safety guidelines, intended to reassure consumers, were based on consumption levels and species composition at variance with the subsistence use patterns in some Gulf coast communities. Some study respondants criticized seafood safety assurances, citing general distrust of the process and underestimation of their actual seafood consumption. At the same time, other respondants were uncertain or defended their continued consumption of Gulf seafood, citing the survival of seafood after prior oil spills in the Gulf and questioning the motives of seafood safety skeptics. Another indirect effect of the spill on subsistence use is the inability of subsistence seafood users to be compensated for their losses through the claims process. While more than 36,000 loss of subsistence use of natural resources claims were filed with the Gulf Coast Claims Facility (GCCF), just 127 claims, worth some $250,000, were paid by 3/14/12. Resolution of subsistence claims, representing the second-largest number of claims to the GCCF after loss of income or profits claims, faced several hurdles. One issue was the lack of documentation for subsistence use, an activity generating no paperwork and substantiated, in the Gulf of Mexico, by very limited scientific data. In a process driven by the documentation-based paradigm of insurance adjustment and open skepticism by the GCCF's leadership, who declared in a 9/23/10 press release thousands of poorly-documented subsistence claims were "bogus" and were being summarily denied, the overwhelming majority of subsistence claims filed with GCCF were never paid. The furor over subsistence use claims, and the claims process generally, among commercial fishermen (who are also the primary subsistence seafood producers on the Gulf coast) led to new forms of social interaction and organizing in and among fishing communities. Initiated by NGOs from the Vietnamese community in New Orleans, advocacy for loss of subsistence use built through 2011, resulting in stronger social connections among fishermen across ethnic, community, and sectoral lines. These efforts resulted in some progress in establishing a methodology to resolve subsistence claims but still very little compensation.

NOAA's management of subsurface monitoring data from the Deepwater Horizon event

Deepwater Horizon Oil Spill Science
Oral Presentation

Sharon Mesick[1]*, Julie Bosch[1], Scott Cross[1], Andy Allegra[2], Bryan Stephenson[2], Benjamin Shorr[3]
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Sharon Mesick is a regional scientist and program manager with the National Coastal Data Development Center. She led the post-response data recovery and documentation efforts for the Deepwater Horizon collection. She holds a bachelor's degree in computer science and a master's of science in geography from the University of Southern Mississippi.

The response to the Deepwater Horizon oil spill produced an oceanographic dataset that is remarkable in its size and diversity. Early in the response, the National Incident Commander formed a Subsurface Monitoring Unit (SMU) to facilitate the collection and rapid analysis of data to help characterize the location and movement of subsurface hydrocarbon. The resulting dataset includes roughly 2000 CTD casts and 1500 Niskin-bottle samples, as well as data from aircraft-deployed profilers, drifters, gliders, acoustic profilers, and a number of other sensors. An SMU data-management team was formed and co-led by the NOAA Office of Response and Restoration and the National Coastal Data Development Center.

During the response the team established standard data-management procedures to enable rapid decision support in the field.

Post-response, the focus turned toward ensuring broad public access to the complete collection over the long term. The field team was retained to complete the data inventory, provide quality control and data reprocessing as needed, develop metadata documentation, and to work collaboratively with the NOAA Data Centers to provide access to information and long-term data preservation.

Figure 1. A dedicated NOAA website provides centralized access to the DWH data collection.

This broad collection includes direct access to archived data in a variety of formats, Ocean *In Situ* data, Regional Products, Fisheries Information, a Selected Bibliography, and Special Collections. NOAA seeks to inform users about the status and availability of this large collection, and seeks feedback from users on future needs.

Addition of dispersant or dispersed oil results in bacterial communities significantly different from those exposed to crude oil alone

Deepwater Horizon Oil Spill Science
Oral Presentation

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Alice Ortmann is an assistant professor in the Marine Sciences Department at the University of South Alabama and a Senior Marine Scientist I at the Dauphin Island Sea Lab. Her research focuses on the role of microbes in marine environments and how microbial diversity affects the function of microbes in coastal habitats.

The effects of dispersants on microbial communities in the Gulf of Mexico remain unknown, even though large volumes of these chemicals were applied at depth and on the surface during the Deepwater Horizon oil spill in 2010. Using a mesocosm approach, we have demonstrated that the addition of dispersant (Corexit 9500A), either alone or with crude oil, results in a significant decrease in the abundance of eukaryotes, including diatoms, dinoflagellates and ciliates. With the reduction of grazers, the abundance of prokaryotes increased significantly with addition of dispersant and dispersed oil. In the incubations receiving no addition (control), glucose or crude oil, the abundance of prokaryotes was reduced, even though growth rates were either higher or not significantly different from the initial conditions. This pattern was detected in two independent experiments carried out in June and August 2011.

Because oil and dispersant can represent a carbon source for some prokaryotes, we were interested in determining how the addition of the glucose, oil, dispersant and dispersed oil affected the bacterial community. Samples collected at 0, 24 and 72 hours were analyzed by sequencing the V6 region of the bacterial 16S rRNA gene. In both experiments, the alpha diversity of the glucose treatments decreased over time, suggesting a smaller number of OTUs were able to exploit the simple sugar compared to the carbon available in the other treatments. Comparisons of the diversity of the communities using different estimates of beta diversity suggest that the communities where dispersant or dispersed oil were added are more similar to each other than to the other treatments. In June, the community exposed to oil is not significantly different from the control community; however differences are observed in August. In both experiments the addition of dispersants, with or without crude oil, selected for bacterial communities that were significantly different from the naturally occurring community. Shifts in the diversity of the bacterial community could translate to shifts in the metabolic ability and efficiency of this trophic level, resulting in changes to carbon cycling in the pelagic coastal waters.

Enhancement of weathered oil biodegradation in coastal wetlands

Deepwater Horizon Oil Spill Science
Oral Presentation

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Irvin Pickett is from Mobile, Ala., and was in the U.S. Navy for four years, after which he attended the University of South Alabama (USA) and graduated with a bachelor's degree in chemical engineering. He worked with International Paper in Mobile for 19 years and is presently working on his master's degree in environmental toxicology at USA.

Oil spill bioremediation is based on the premise that some of the components of oil are degradable by bacteria. There are two main approaches to bioremediation: bioaugmentation and biostimulation. Bioaugmentation is accomplished by adding oil-degrading bacteria to supplement the existing bacterial population, whereas biostimulation is accomplished by stimulating the growth of indigenous bacteria with the addition of nutrients.

This study investigated biostimulation to evaluate the effectiveness of nutrient, dispersant and cometabolite addition on the biodegradation of oil-contaminated coastal wetland soil. Weathered Louisiana light sweet crude (LSC) oil was applied to native wetland soil taken from an Alabama coastal marsh in 50 mL glass microcosms. Nutrients in the form of commercially available organic and inorganic fertilizers, a cometabolite (sucrose) and the dispersant (Corexit® 9500A) were added to the oil contaminated soil in various combinations to stimulate bacterial growth, increase oil bioavailability, and as such, accelerate the removal of crude oil from our oil contaminated soil samples.

While several treatments did enhanced oil biodegradation when compared to non-treated controls, statistical analysis did not confirm significant differences between treatments.

Advanced Petroleum Hydrocarbon Testing of the tissue and organs of the inshore fish of Pensacola Bay and offshore in the Gulf of Mexico

Deepwater Horizon Oil Spill Science
Oral Presentation
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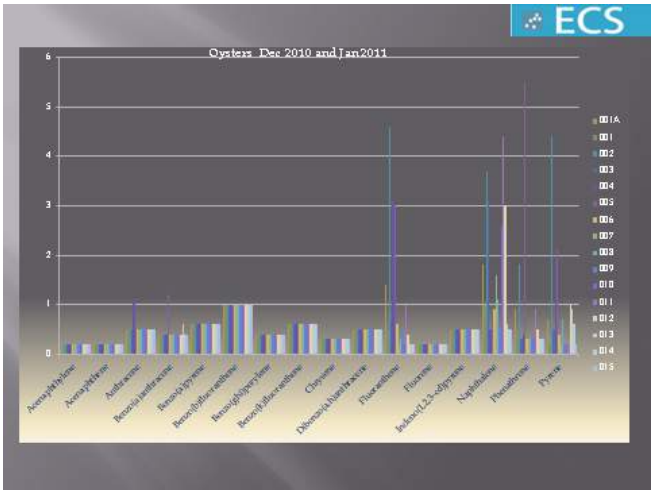
Heather Reed has been in the environmental/marine research field for 19 years in various locations around the U.S. Her field of study includes marine mammals, fish, coral reefs, jellyfish, plankton, Gulf sturgeon, seagrass, oysters and small- and large-scale restoration projects. Her education is AAS in marine technology and engineering, a bachelor's in marine biology and a master's in environmental science. She currently owns Ecological Consulting Services Inc. in Pensacola, Fla.

Figure 1- A mullet caught in the vicinity of Deadman's island, Gulf Breeze, Florida post DWH oil spill (left) A Snapper caught offshore of Pensacola, Fla.

Biological observations during each oil incident in the Pensacola Bay and Santa Rosa Sound showed irregular behavior in sharks and birds. Mortalities of horseshoe crabs, turtles and dolphins were also reported. Observations of sick and dying fish were found around the oyster reef at Deadman's Island. These observations included oysters. Standard state tests were performed on the fish and oyster tissue and no detection of normal PAH was found. Further looking into the forensics of crude oil, it was found State testing criteria, was for basic PAH of 13-16 chemical compounds and was not designed to find crude oil compounds. The State is not allowed to test outside of their water quality criteria, which is compliant with the Clean Water Act. A pilot test of tissue analysis of the inshore and offshore fish was conducted to evaluate the possible cause of mortalities using the 60 chemical compound tissue tests. The tests showed the 60 chemical compound showed better results and possible links to the BP oil spill than the standard 13 chemical compound tests.

Table 2- Dec 2010 and Jan 2011 Oyster tissue test results



Microbial growth inferred from nutrient depletion in Deepwater Horizon submerged oil/gas plumes

Deepwater Horizon Oil Spill Science
Oral presentation

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Alan Shiller is a professor of marine science at USM. He specializes in processes affecting trace element distributions in natural waters, but also deals with nutrients, carbon dioxide and methane. He obtained his bachelor's degree in chemistry from Caltech and Ph.D. in oceanography from the Scripps Institution of Oceanography.

The Deepwater Horizon accident resulted in a substantial uncontrolled hydrocarbon release to the northern Gulf of Mexico, much of which was entrained in deep submerged plumes. While bio-degradation of the hydrocarbons has been inferred from microbial biomass and genetics, the amount of conversion of oil and gas carbon to biomass remains uncertain. Here we examine correlated depletions of nitrate, phosphate and oxygen in the submerged plumes during May 2010. Combining these correlations with published estimates of overall oxygen consumption, we estimate that the substantial portion of hydrocarbons in these plumes was initially converted to biomass. This contrasts with nutrient-limited surface waters where other work has suggested respiration to carbon dioxide to be the dominant fate of the hydrocarbons. Our results suggest the need for better monitoring of changes in nutrients as well as study of nutrient recycling in similar future hydrocarbon releases.

Response to stranded marine mammals and turtles in Mississippi and Alabama after the BP Deepwater Horizon oil spill

Deepwater Horizon Oil Spill Science
Oral Presentation

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Moby Solangi is the president and executive director of the Institute for Marine Mammal Studies. He founded the organization in 1984 to promote marine research, conservation and education. Dr. Solangi received his Ph.D. in marine biology from the University of Southern Mississippi in 1980.

A dramatic increase in the number of stranded dolphins and sea turtles was observed in the northern Gulf of Mexico during 2010 and 2011. This led to an investigation and enhanced monitoring by the National Marine Fisheries Service (NMFS). After the BP Deepwater Horizon oil spill occurred in April 2010, the Institute for Marine Mammal Studies (IMMS) in Gulfport, Miss., was designated as a stranding response center for dolphins, sea turtles and manatees. This allowed IMMS to devote critical resources to collect dolphin and turtle carcasses for NMFS assessment and provide care for live stranded dolphins and turtles. Logistics for the facility preparation and response to live and dead animals, as well as the cleaning of oiled sea turtles, rehabilitation, satellite tagging and release of sea turtles will be discussed.

In 2010 and 2011, IMMS collected over 234 dead dolphins and 550 dead turtles in Mississippi; additionally, approximately 90 live turtles from both Mississippi and Alabama were admitted for rehabilitation at IMMS facilities. In the spring of 2011, 50 percent of the dead stranded dolphins were newborn calves and aborted fetuses, which represented a significant and disproportionate number of the carcasses. The vast majority of dead and live stranded sea turtles in this region have been the Kemp's ridley, the most endangered sea turtle species. Almost all of the sea turtles that were admitted to IMMS for rehabilitation were released back into the ocean after their health was restored. Satellite transmitters have been utilized to track movements of a subset of released turtles and these data will offer crucial insight about the ecology of Kemp's ridley sea turtles in historically under-studied geographical areas. IMMS is working with the Mississippi Department of Marine Resources to address the various issues of sea turtles in Mississippi waters.

The Gulf of Mexico Research Initiative: Investigating the impacts of oil, dispersed oil and dispersants on the ecosystems of the Gulf of Mexico

Deepwater Horizon Oil Spill Science
Oral Presentation
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Charles (Chuck) Wilson is chief scientific officer of the Gulf of Mexico Research Initiative. His interests include impacts of oil and gas platforms on fish communities and marine fish life history. He holds a Ph.D. in fishery biology from University of South Carolina.

The Gulf of Mexico Research Initiative (GoMRI) was formed to administer the $500 million fund committed by BP for research to understand the fate and effects of the 2010 Deepwater Horizon oil spill. After an initial year of block funding through research entities in each of the Gulf states directly impacted by the oil spill to ensure rapid response capability, awards have been made by a peer-review process led by an independent research board. Chaired by Dr. Rita Colwell, the board comprises 20 distinguished researchers with 10 members from around the world appointed by BP and 10 members from research universities in the Gulf region appointed by the Gulf of Mexico Alliance.

The two main goals of GoMRI are: 1) to study the Deepwater Horizon incident and its associated impacts (and similar incidents), on the environment and public health, and 2) to develop improvements for spill mitigation, oil detection and new remediation technologies. Through public input, GoMRI identified five research themes: 1) physical distribution of contaminants, 2) chemical evolution and biological degradation of contaminants, 3) environmental effects and ecosystem recovery, 4) technological developments and 5) public health impacts.

The largest pool of funds made available by the GoMRI was through RFP-I, released in April 2011, for consortia composed of at least four institutions to conduct interdisciplinary work on one or more of the research themes over three years. GoMRI awarded $112.5 million to eight consortia for this three-year period. These awardees included experts from across the country, though most principal investigators were from Gulf States. Funds ($18.5 million) from a second RFP were awarded to 19 research teams at 18 different institutions with 15 sub-awardees; contracted amounts range from $100,000 to $1 million per year for up to three years.

GoMRI has established extensive data management and outreach programs. It set up policies for timely submissions of data to existing national databases so data collected or generated will be available to all interested. A portal will be placed on GoMRI's website in 2013 to guide users to

the data. Outreach efforts include consortia specific programs, an active central web portal for access and exchange of information and a centralized annual outreach plan. Investigators will have the opportunity to discuss and share their findings at January, 2013 the Gulf of Mexico Oil Spill and Ecosystem Science meeting in New Orleans.

BAYS & BAYOUS

SYMPOSIUM 2012

Education Facilities

Poster Session

Mississippi Gulf Coast Community College – Estuarine Education Center: Merging outdoor recreation with environmental education

Educational Facilities
Poster Presentation

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Todd Adams is director of the Estuarine Education Center at Mississippi Gulf Coast Community College. He has experience in Tribal environmental protection, state and local emergency management, and broadcast meteorology for radio and television. He holds a master's degree in geosciences from Mississippi State and a bachelor's in geography from Southern Miss.

Mississippi Gulf Coast Community College opened the Estuarine Education Center (EEC) in January 2008. The EEC is a 33-acre site, on Mary Walker Bayou, located on the north end of the Jackson County Campus in Gautier, Mississippi. The center offers a ropes/challenge course, indoor climbing wall, kayaking, boat tours, trails, a 2,000-square-foot greenhouse, classroom and laboratory space, and meeting space. The college recently acquired a 7-acre island in Mary Walker Bayou. Progress is underway to build a pier to allow access over the marsh grasses and have trails for students to explore. The purpose of the EEC is to offer natural resources programs and outdoor recreational opportunities for college students, K-12 teachers and students, community members and business/industry. Programs and courses are offered in environmental science, marine science, biology, geography and outdoor recreation.

Figure 1. An environmental tour of Mary Walker Bayou is provided aboard the Bayou Bulldog.

Figure 2. Kids learning to kayak during a summer camp offering.

In fall 2012, the leadership of Mississippi Gulf Coast Community College set forth a goal for the Estuarine Education Center to become a "center of excellence" for eco-tourism. A plan will be developed to merge outdoor recreation with environmental education to provide additional public access and exploration of the Pascagoula River Delta.

Grand Bay Coastal Resources Center: Living on the Edge—The Nature of Change

Environmental Education Facility (EDF)
Poster Presentation
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Jennifer Buchanan is a coastal ecologist working as the Education Coordinator for the Grand Bay NERR in Moss Point, Miss. She received both her undergraduate and graduate degrees in Biology from the University of Southern Mississippi and has worked almost exclusively for the MDMR since 1984.

Figure 1. The Grand Bay Coastal Resources Center

The Grand Bay Coastal Resources Center serves as the headquarters for the Grand Bay National Estuarine Research Reserve and the Grand Bay National Wildlife Refuge. This Gold LEED certified center was completed in 2009. Located in extreme southeastern Mississippi on the Mississippi-Alabama border, the facility consists of office space, an interpretive area, classrooms, laboratories and a dormitory for visiting researchers and educators.

The exhibit theme, ”Living on the Edge: The Nature of Change”, reflects the many challenges and the precarious nature of our coastal resources. Our natural coastal environment is dynamic and in a constant state of change as are our coastal human communities. The exhibits reflect coastal resource management, cultural heritage, coastal ecology and sustainable or green development and construction practices. Recently, in order to reduce its carbon footprint, the Reserve installed solar panels as a demonstration for the public. The Reserve promotes research on coastal issues, translates research findings for a variety of audiences including coastal decision-makers and community members and provides experiential learning opportunities for students and community members of all ages.

The interpretive center is open to the public weekdays, Monday through Friday, from 9:00 a.m.-3:00p.m. The center is closed on all official Mississippi State Holidays. Check the Reserve’s website for upcoming events at www.grandbaynerr.org .

Dauphin Island Sea Lab's Discovery Hall Programs: An education and outreach facility for the state of Alabama

EDF
Poster presentation

Tina Miller-Way*[1], Jenny Cook[1], John Dindo[1], Greg Graeber[1], Mendel Graeber[1], JoAnn Moody[1], Carrie Riley[1], Joan Turner[1], Stephanie Serra[1] and Hazel Wilson[1]
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Tina Miller-Way is chair of Discovery Hall Programs, the education and outreach group at the Dauphin Island Sea Lab. She has taught biology, aquatic biology, environmental science and marine science in academia (12 yrs) and has worked as an informal educator in K-12 (5 yrs).

Chartered by the Alabama's legislature in 1972, the Dauphin Island Sea Lab (DISL) is the marine research and education facility for the state of Alabama. DISL is incorporated as a non-profit organization under the name of the Marine Environmental Sciences Consortium (MESC) and serves 22 institutions of higher education in the state. DISL's education and outreach group, Discovery Hall Programs (DHP), offers K-12 experiential environmental science classes during the school year, professional development throughout the year for in-service, pre-service and informal educators, overnight and one-day marine-themed camps for school-age children during the summer and an intensive month-long class in marine science for high school students. Additionally, DHP offers summer internship opportunities in marine science education and student mentoring throughout the year. DISL also offers graduate and summer undergraduate education through University Programs.

Figure 1: An aerial image of the Dauphin Island Sea Lab campus.

DHP school-year classes include content that is age-appropriate and tied to Alabama Course of Study Standards (and Ocean Literacy Principles) and hands-on activities that engage students and promote STEM learning and environmental stewardship. DHP's teacher workshops offer field activities, classroom explorations and interactions with research scientists and are typically supported by grants allowing teachers to attend without cost.

DHP hosts the BayMobile, a mobile marine science classroom that travels to K-12 schools throughout the state and to a number of regional events. Supported by donations,

the BayMobile brings marine science information and hands-on activities directly to students and schools that do not have the time or financial resources to visit DISL. Additionally, the BayMobile allows us to reach the public at environmentally-themed festivals and educational events throughout the year.

DISL is home to the *Estuarium*, a 10,000-square-foot public aquarium that focuses on the Mobile Bay watershed and coastal ocean. The DHP *Estuarium* educator interacts with visitors to the facility and offers programs for the public including the successful Boardwalk Talks, an informal conversation series between scientists, researchers or students and the public, as well as Summer Excursions, a set of field trips designed for the public. Additionally, the *Estuarium* has an active docent (volunteer) program.

These varied programs are supported by DISL infrastructure that includes dormitory housing (capacity for150), a cafeteria (3 hot meals daily), school buses for transporting large groups, a computer lab dedicated to K-12 activities, 10 classrooms, campus-wide wi-fi and a state-of-the-art distance learning auditorium. DISL also offers running seawater tanks, a mesocosm facility for experimental work and the 65' RV *Discovery Alabama* designed for educational use, as well as a fleet of smaller vessels and vehicles. Lastly, DISL is moving towards environmental sustainability with a LEEDS Gold certification for our newest building, a geothermally-regulated ray exhibit at the *Estuarium*, and the largest capacity for solar power generation in Alabama.

Creating stewards of the Sound: The education and outreach programs at the Gulf Coast Research Laboratory's Marine Education Center

Education Facilities
Poster presentation

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Chris Snyder is director of the Marine Education Center at University of Southern Mississippi's Gulf Coast Research Lab. Chris is responsible for the management and operation of the center. He has a bachelor's degree in biology and a master's degree in workforce training and development, both from University of Southern Mississippi.

The Marine Education Center (MEC) is the education and outreach arm of the University of Southern Mississippi's Gulf Coast Research Laboratory (GCRL). The MEC has established a long and rich history of providing quality marine education to students, visitors and coastal residents of all ages. Building upon these traditions, a proposed new marine education and outreach center is planned for GCRL's Cedar Point site in Jackson County. The proposed educational facility will be the model for connecting people to the Gulf of Mexico, its resources and attributes while providing an understanding of how they impact our daily lives. The new center will include 34,000 square feet of environmental education exhibits, hands-on activities, classrooms and laboratories.

Programs and educational opportunities presently offered include Sea Camp, a marine science day camp for ages 6-13 and Shark Fest, a week long day camp where students ages 12 to 18 enjoy hands-on work with elasmobranchs including dissection, identification and long lining. Aboard a GCRL research vessel, they visit the top shark fishing hotspots around the barrier islands, catching and tagging sharks to contribute to ongoing scientific research. The MEC is now conducting a new series of workshops, Explore a Seashore, which allow adult participants to explore the rich diversity and dynamic landscape of the northern Gulf of Mexico coastline. Some examples of workshops topics are, Art, Science and Horn Island, Human Diseases from the Coastal Ocean, Insights into Parasites of the Sound and Weathering the Storm. This series of family educational experiences is designed to address the four focus areas of Mississippi-Alabama Sea Grant Consortium: Safe and Sustainable Seafood Supply, Hazard Resilience in Coastal Communities, Healthy Coastal Ecosystems and Sustainable Coastal Development.

BAYS & BAYOUS

SYMPOSIUM 2012

Habitat Management
and Restoration

Session

Wave attenuation devices: A comprehensive evaluation of wave transmission through physical modeling

Habitat Management and Restoration
Poster Presentation
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Richard Allen is a civil engineering master's student at the University of South Alabama. His research is focused on living shorelines, more specifically, the engineering design of wave attenuation devices associated with them. Richard plans to graduate in May 2012 and continue working on living shorelines in his future career.

Wave Attenuation Devices (WADs) are used to modify wave characteristics along shorelines in such a way as to promote ecological and biological enhancement, with stabilization of the shoreline often an express goal. WADs are defined in this study as a structure composed of formed concrete units or any structure used to manipulate the geometry of a substrate for the purpose of attenuating wave energy. Studies have shown WADs are a successful alternative to tradition rubble mound breakwaters in the environmental aspect; however, the true success of these structures has not been quantified in terms of the hydrodynamic loading due to wave energy dissipation. By physically modeling WADs using the University of South Alabama's wave basin, much of the engineering design related to wave energy will be determined. WAD designs will be obtained through their respective proprietor as scale models. The testing will include multiple configurations and orientations with respect to the wave energy propagation. Additionally, the properties of the wave form will be altered to address any variations in wave transmission. Results from the testing will be used to compare the WAD designs to each other and traditional structures such as rubble mound breakwaters in terms of effectiveness in wave attenuation. Currently, two types of substrate have been tested in the wave basin: concrete armor units and bagged oyster shell. Future testing conducted in late 2012 and early 2013 will also include coir fiber logs and a scaled equivalent of ReefBLK™. Presentation material will include the results from testing completed to date and descriptions of WAD designs with respective testing configurations of those received.

Figure 1. Laboratory testing of wave transmission through concrete wave attenuation devices in the USA Coastal Transportation Engineering Research and Education Center wave basin.

Developing monitoring guidelines and criteria for judging the success of oyster restoration projects

Habitat Management and Restoration
Oral Presentation

Lesley P. Baggett[1]*, Sean P. Powers[1], Robert Brumbaugh[2], Loren Coen[3], Bryan DeAngelis[4], Boze Hancock[2] and Summer Morlock[4]

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Lesley Baggett is a marine ecologist whose research focuses on the ecology, conservation and restoration of nearshore benthic marine habitats, such as seagrass beds and oyster reefs, as well as anthropogenic effects on these habitats. She holds a Ph.D. from the University of South Alabama and master's and bachelor's degrees from the University of Alabama.

A recent assessment of oyster habitats estimated an 85-percent global loss of these ecosystems, with the majority of remaining oyster populations being in poor condition. In the past, restoration of oyster habitats often focused on recovering oyster harvests and mitigating losses from natural and man-made disasters; however, increasing recognition of the valuable ecosystem services provided by oysters (e.g. water quality maintenance, nutrient cycling, provisioning of habitat for fish and invertebrates and stabilization and/or creation of adjacent shoreline and other habitats) has focused attention on restoring the ecological functions of oyster habitats. Unfortunately, restored reefs have often not been monitored post-construction to an extent that will allow the determination of whether or not ecosystem-based restoration goals have been successfully achieved or allow for adaptive management during the initial monitoring efforts of restored reefs. To address this problem, a coalition of restoration practitioners from the Atlantic, Pacific and Gulf coasts, led by members of the NOAA Restoration Center, The Nature Conservancy, the University of South Alabama and Florida Atlantic University embarked upon a cooperative project to develop performance criteria and recommend monitoring guidelines for universal metrics to be monitored for all oyster restoration projects as well as monitoring guidelines that are specific to the various restoration goals and ecosystem services associated with oyster reefs. Monitoring of an additional set of universal environmental variables will aid in the interpretation of universal metric data collected through pre- and post-construction monitoring. The purpose of these guidelines is to allow the success of restored oyster reefs to be compared within and across regions, tidal location and construction type, and to provide practitioners with valuable information towards adaptive management of restored reefs.

Universal metrics that are to be monitored for every oyster restoration project include: (1) reef areal dimension; (2) reef height (for *Crassostrea virginica* only) or emergent shell volume (for *Ostrea lurida* only); (3) oyster density; and, (4) oyster size-frequency distributions. The following universal environmental variables should also be monitored for every oyster restoration project to help with interpretation of universal metrics data: (1) water temperature; (2) salinity; (3) dissolved oxygen (for subtidal reefs); (4) disease prevalence and intensity (if applicable); and, (5) presence of predatory and competitive species (optional). Performance

criteria for the universal metrics are based on emergent structure and oyster density present at short- and mid-term time frames post-construction.

Along with the universal metrics, an additional set of monitoring guidelines (including metrics, suggested methodologies and performance criteria) are provided to enable project managers to assess the following ecosystem service-based restoration goals: (1) brood stock and oyster population enhancement; (2) habitat enhancement for resident and transient species; (3) enhancement of adjacent habitats; (4) water quality improvement; and (5) improvement of oyster stock disease resistance.

Qualifying and quantifying oyster habitat: A comparison of unsupervised bottom classification techniques of sonar data collected from Cedar Point and White House Reefs, Ala.

Habitat Management and Restoration
Oral Presentation

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George S. Bosarge is the Fisheries Ecology Lab manager at the Dauphin Island Sea Lab. His interests include remote sensing and GIS. He is currently pursuing a master's degree in Geographic Information Technology from Northeastern University.

The benthic habitat assessment program developed to support the University of South Alabama Oyster Reef and Fisheries Habitat Enhancement Program was initiated in spring of 2008. One of its stated purposes is to accurately assess oyster resource within Mobile Bay and Mississippi Sound utilizing acoustic survey techniques (side-scan and single beam sonar). While the data generated from these techniques in their very basic form provide useful visual cues for discerning potential oyster habitat, more refined methods of divination are necessary to fully qualify and quantify oyster habitat in relation to surrounding sediments of similar acoustic properties. A case study is presented here of two locations within Mobile Bay: Cedar Point Reef, which is an actively harvested reef area, and White House Reef, which is now considered to be inactive relic reef. Three software packages that employ unsupervised classification methods are compared: Biosonics Visual Bottom Typer 2™ (VBT2) for single beam sonar data and SonarWiz 5 (Chesapeake Technology Inc.) and ERDAS Imagine 2011 (Intergraph Corporation) for side-scan data.

All three software packages were employed to analyze data from the two areas of interest to determine the one best suited for the program objectives. VBT2 was used to process the single beam data. While adept at classifying sediment types with few data anomalies, temporally disparate data sets created unique challenges and the subsequent analysis output lacked the spatial coverage that would otherwise be derived from analyzing the side-scan data. SonarWiz 5 also had temporal issues as well and appeared to have memory limitations that restricted the amount of data which could be analyzed within a single process step. Of the three software packages, ERDAS Imagine 2011 showed the most promise, having the ability to process a full side-scan mosaic in its entirety, taking full advantage of the entire spatial extent of successive survey events within a coverage area. To add, the program provided the ability to isolate data anomalies from the mosaic to help refine search areas needing further investigation and ground truthing.

Community Grass Gardens: A community restoration, outreach and education initiative

Habitat Restoration and Management
Poster Presentation

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Chris Boyd is an associate extension professor of coastal ecology for Mississippi State University and is an outreach coordinator for the Healthy Coastal Ecosystems Program for the Mississippi-Alabama Sea Grant Consortium. He holds a doctorate from Auburn University's Department of Fisheries and Allied Aquacultures.

The Community Grass Garden Project was created as a way to educate the public about the importance of natural resource protection through environmental education and hands-on experience. The overall goal of the project was to have the community physically involved in a habitat restoration project. The restoration site chosen was a recently dredged section of Deer Island, Miss. The island is managed by the Mississippi Department of Marine Resources Coastal Preserves Program (MS DMR). The project team worked with MS DMR staff to plan and coordinate the project. Volunteers targeted for the project were Mississippi State University Master Naturalists and Master Gardeners. These groups were targeted because of their knowledge of the local environment and their desire to assist in projects that benefit their community.

Figure 1. Deer Island Restoration Site on July 30, 2011, after 16.3 inches of rain occurred in 14 days.

Twenty volunteers from Jackson, Harrison and Hancock Counties, Mississippi attended the Coastal Ecology and Restoration Workshop and received training on successful planting techniques. The volunteers and project team planted over 2,100 dune plants to restore a 0.2 acre section of western Deer Island. The overall survival rate is 49.7%. The survival for individual species was: *Uniola paniculata* or sea oats, 4%; *Panicum amarum* or panic grass, 97%; *Ipomoea pes-caprae* or red morning glory, 85%; *Ipomoea stolonifera* or white morning glory, 86%; *Sesuvium portulacastrum* or sea purslane, 96%; *Iva imbricate* or beach elder, 16%. The lower than expected overall plant survival rate was most likely the results of abnormally high precipitation in July (17.4 in) and September (14.9 in) coupled with the slow drainage properties at the site. The restoration project is thought to be a very successful one by having over 1,000 plants surviving and accretion of greater than one foot occurring within many portions of the project site.

This project was supported wholly or in part by the Dauphin Island Sea Lab and the NOAA Coastal Services Center in support of the Gulf of Mexico Alliance.

Cost estimates for shoreline erosion products in the Northern Gulf of Mexico
Habitat Management and Restoration
Oral Presentation

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With the high cost of coastal real estate, shorefront property owners must defend their properties against the continuous process of erosion. The coastal property owner has become accustomed to the straight line approach where they can simply walk onto their dock to access the water. To accommodate this desire, contractors traditionally have recommended hard structures such as bulkheads, rip-rap, groins and seawalls to control shoreline erosion. As of 2012, over 23 percent of coastal Alabama shorelines are armored by hard structures, and this practice also is common in other Gulf states. Hard armoring often leads to erosion of adjacent unprotected property, habitat loss and loss of public water access. The sloped natural shoreline in some regions of the coast is being lost. In selected portions of coastal Alabama the mean shoreline change rate ranges from -1.4 to -6.1feet per year, and it has been estimated that Louisiana has lost 1,800 square miles of land over the last 80 years.

Figure 1. Nature Conservancy emplacement of Oysterbreak™ rings in Vermilion Bay, La., added habitat and reduced erosion.

Homeowners and marine contractors need to understand that other erosion control options are available that might be more economical, aesthetically pleasing and environmentally sound. Bulkheads might be the best choice in areas with medium to high erosion rates, but in areas with lower rates of erosion, planting vegetation, installation of offshore breakwaters, or a combination of vegetative plantings, sand fill and an offshore breakwater might provide the necessary erosion protection needed while maintaining natural coastal processes.

There are many erosion control devices on the market. These products include wetland plants, coconut fiber logs, geotubes, rock or wood sills, oyster shell bags, wave attenuation devices, headland breakwaters and vinyl, concrete or wooden bulkheads. In this presentation the authors will present the costs, benefits, maintenance and site selection criteria for many erosion-control options that are being used in the northern Gulf of Mexico.

Recovery of vegetation and land area on the Mississippi-Alabama barrier islands in the initial five years following Hurricane Katrina

Habitat Management and Restoration
Poster Presentation

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Gregory A. Carter is an associate professor in the Department of Geography and Geology and chief scientist of the Gulf Coast Geospatial Center, University of Southern Mississippi. His research includes extensive use of remote sensing in studying vegetation and geomorphic features in coastal systems.

The Mississippi-Alabama barrier islands, including, from west-to-east, Cat, West Ship, East Ship, Horn, Petit Bois and Dauphin islands, were impacted dramatically by Hurricane Katrina in August, 2005. Image data acquired from satellites and aircraft before (2004-2005) and after Katrina (2005-2010) were compared to determine immediate storm impacts and assess the recovery of island total vegetative cover and land area. These variables were quantified using isodata classifications of spectral imagery and field observations. Immediate loss of vegetation cover was caused primarily by scouring and burial under sand sheets and washover lobes. Physical impacts and saltwater flooding combined with a subsequent 8-month drought resulted in slash pine mortality rates of 80 percent on Horn and virtually 100 percent on East Ship and Petit Bois. By 2008, total land area of Cat, West Ship, East Ship, Horn, Petit Bois and West Dauphin had recovered to 92, 90, 33, 99, 93 and 91 percent, and total vegetative cover to 85, 101, 85, 94, 83 and 102 percent of pre-Katrina values, respectively. Habitat-type maps developed from 2010-2011 field surveys and remotely-sensed image data indicate general increases in areal coverage of near-shore dune habitats and declines in marsh habitat as a result of sand overwash. Although slash pine reproduction is apparent, woodland habitat on East Ship, Horn and Petit Bois islands is now replaced with more extensive coverage by shrub species. The increased tropical storm frequency and intensity and accelerated sea level rise anticipated under the present climate-warming scenario will likely inhibit the reformation of late-successional habitat-types, such as woodlands and stable dunes, in the 21st century.

Deer Island restoration: Coastal fringe tree species survival and condition

Habitat Management and Restoration
Oral Presentation

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Tom Cathcart is a professor at Mississippi State University. He received his Ph.D. from the University of Maryland in 1987 and has spent much of his career working on problems concerned with wetlands, water quality, coastal habitats, erosion control, stormwater runoff management and sustainable environmental design.

Erosion on Deer Island has resulted in removal of much of the population of fringe tree species that protected the forested interior of the island. During the period November, 2010, through May, 2011, 300 coastal fringe trees were planted at 12 sites on the north and south sides of the island. Approximately 25 trees were planted at each site, comprised of roughly equal numbers of *Ilex cassine* (Dahoon Holly), *Magnolia grandiflora* Claudia Wannamaker, Pinus *clausa* (sand pine) and *Quercus geminate* (sand live oak). Trees were purchased from a nursery that specializes in stock that is genetically adapted to the region. Their heights at the time of planting were 0.9-1.8 m (excluding root ball). At three sites, the trees were planted at conventional depth (i.e., the depth of the root ball, approximately 27 cm). At nine sites, the trees were deep planted at a depth of 80 cm (i.e., approximately three three times the depth of the average root ball). The period February-July, 2011, was a severe drought. This provided a rigorous test of the efficacy of the deep-planting approach. The sites were revisited during mid-June, July and September (following the end of the drought), and trees were examined for survival and evaluated using a three point condition scale (3 = excellent condition, 2 = stressed, 1 = severely stressed, 0 = dead). Survival and condition were significantly ($P < 0.05$) related to time of planting and depth of planting. Planting prior to the beginning of the drought, not surprisingly, resulted in greater survival and better condition. Depth of planting was clearly a significant factor in both condition and survival. It is assumed that the porosity of sandy soil allowed adequate oxygen to reach the root zone and that deep planting increased root ball access to available moisture.

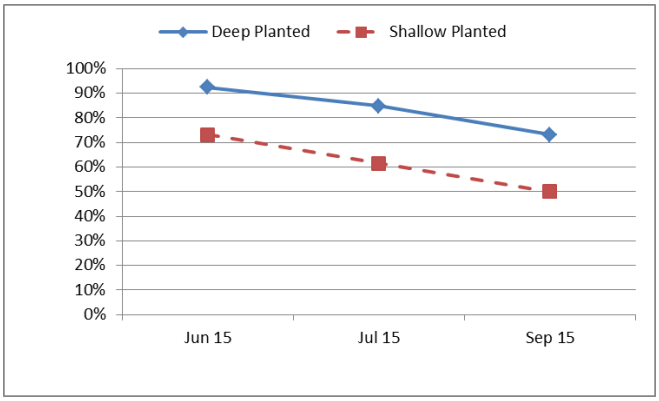

Figure 1. Survival of trees planted in 4 sites on the north side of Deer Island.

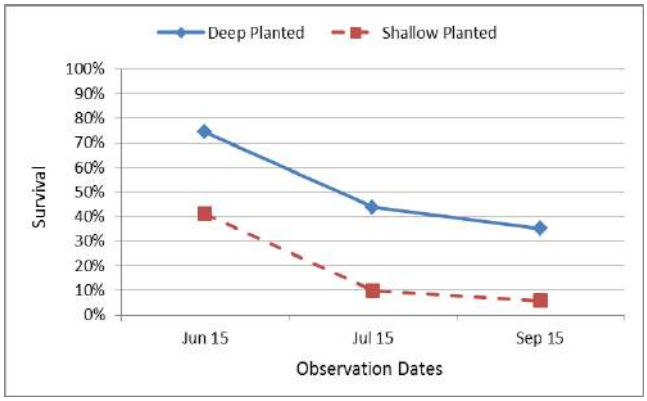

Figure 2. Survival of trees planted in 8 sites on the south side of Deer Island.

The intersection of habitat restoration and the community: How one strengthens the other

Habitat Management and Restoration
Oral Presentation

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Jeff DeQuattro is the coastal projects manager for The Nature Conservancy's office in Mobile, Ala. He joined the TNC team to manage a $2.9 million Recovery Act Project to construct 1.5 miles of oyster reefs, and now manages all of TNC's oyster restoration/living shorelines projects in Alabama.

Mobile Bay, Alabama, the fourth-largest estuary in the United States, plays an important role in nurturing the finfish, shrimp, crabs and oysters that are vital to Gulf of Mexico communities. It has experienced significant loss of critical coastal habitats that shelter these species through dredge-and-fill activities, seawalls, erosion, storm events and other causes. In 2010, TNC-Alabama received funding from the U.S. Fish and Wildlife Service's Coastal Program, the National Wildlife Federation, the Alabama Wildlife Federation, the American Recovery and Reinvestment Act and many others to construct a living shoreline located at Helen Wood Park in Mobile, Ala.

Figure 1. Over 500 volunteers converge upon Helen Wood Park to build a 1/4-mile long living shoreline.

As the kick-off project for the 100-1000: Restore Coastal Alabama, this project used two marsh buggies, 343 Reef Balls, 23,000 bags of oyster shell and over 500 volunteers to create a 1,000-foot living shoreline that now protects over 1,200 feet of eroding shoreline. In addition to the creation of habitat for fish and invertebrates, this restoration project fostered significant socio-economic benefits.

This presentation will focus on the partnerships and the community cohesion that was created by this restoration project. This project provided immediate jobs for members of the communities that suffered from the effects of the economic downturn and the Deepwater Horizon oil spill. Additionally, citizens that could not help during the oil spill because of the hazards, joined together to steward a community investment in the recovery of the natural resources on which their quality of life depends.

Site suitability modeling for Mobile Bay & Mississippi Sound: A GIS & remote sensing based approach

Habitat Management and Restoration
Poster Presentation
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Saranee Dutta is a PhD student at Mississippi State University. Her research interest includes using Geospatial technology to study wetlands, coastal shoreline erosion, and habitat restoration. She holds a MS degree in Geosciences from Mississippi State University and a BS degree in Urban Planning from the University of Calcutta, India.

Shoreline recession is a natural process which usually occurs in a geologic time scale, but often human activity such as high speed boating and shoreline armoring increases the natural rate of erosion. In Mobile Bay, it has been determined that greater than 38% of the bay has been armored using hard erosion control techniques as of 2012 (Figure 1). Living shorelines are considered a more natural approach to protecting properties from erosion instead of bulkheads and rip-rap. Living Shorelines is a shoreline stabilization technique which uses living plant material, oyster shells, earthen material or a combination of natural structures with offshore breakwaters to protect the shore from erosion while maintaining natural coastal processes.

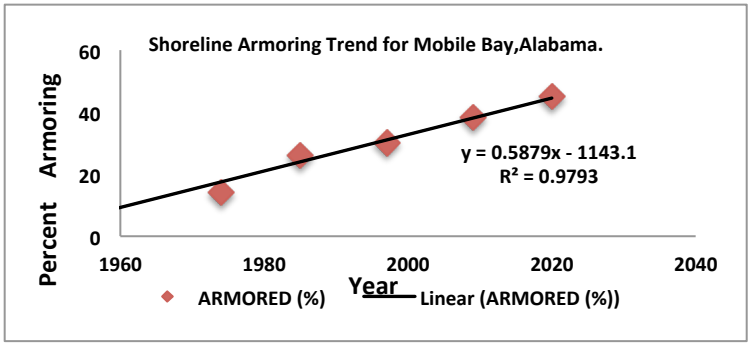

Figure 1: Shoreline armoring trend in Mobile Bay, AL. Data modified from the 2012 Comprehensive Shoreline Mapping, Baldwin and Mobile Counties, Alabama Phase III report by S. C. Jones and Tidwell.

The goal of this research is to create a living shoreline site suitability model by using GIS & Remote Sensing technology for sections of Mobile Bay & Mississippi Sound. There are several different types of suitability models. A Weighted suitability model found in the spatial analysis toolbox in Arc Gis will be used for this study. Several bio-physical parameters such as soil and vegetation type, wave energy, wind velocity, and fetch length will be used and scaled from 0-3; with 0 being not suitable, 1 suitable, 2 good, and 3 optimum. The final product will show a suitability surface that will identify the most preferred and least preferred locations for installing living shoreline structures using the above conditions. The United States Geological Survey Digital Shoreline Analysis System extension for Arc map will be used to quantify the rate of shoreline movements on a temporal scale within the study area. In addition, the suitability model will be validated by creating an error matrix using ground truth data. Ground truth data will be collected by using Mobile Mapper 100L1 GPS units with real time SBAS of less than 50cm and a DGPS less than30cm accuracy.

Alabama State Lands Division Coastal Habitat Restoration Projects Update
Habitat Management and Restoration
Oral Presentation
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Carl Ferraro is a Natural Resource Planner for the Alabama Department of Conservation and Natural Resources, State Lands Divisions. He is involved in coastal habitat restoration efforts, represents the ADCNR on the Gulf of Mexico Alliance Habitat Restoration and Conservation team and also serves on a number of Natural Resource Damage Assessment Technical Working Groups in association with the BP Deepwater Horizon NRDA. He holds a Bachelors of Science in Wildlife Sciences from Auburn University.

Approximately 2 years ago, the ADCNR-State Land Division (SLD) completed the Little Bay Finfish and Shellfish Restoration Project. At that time, this was the largest salt marsh restoration project conducted in coastal Alabama. The SLD is now preparing to conduct the engineering, design and permitting phase of the Marsh Island (Portersville Bay) Restoration project. The Marsh Island project, which is being conducted as part of the BP-Deepwater Horizon Natural Resource Damage Assessment-Early Restoration Program (ERP), will be larger in scope and complexity when compared to the Little Bay Project. This presentation will provide a 2-year update of the Little Bay Project as well as providing details on the status of the current Marsh Island project.

Multi-scaled investigation of landbird stopover during spring migration across the northern Gulf of Mexico coast

Habitat Management and Restoration
Poster Presentation

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Jill Gautreaux earned a bachelor's degree in conservation biology/wildlife and fisheries from Louisiana State University in 2007 and is currently pursuing a master's degree in biological sciences at the University of Southern Mississippi. Jill intends to continue her career in conservation science, focusing on Gulf coastal monitoring, restoration and education/outreach.

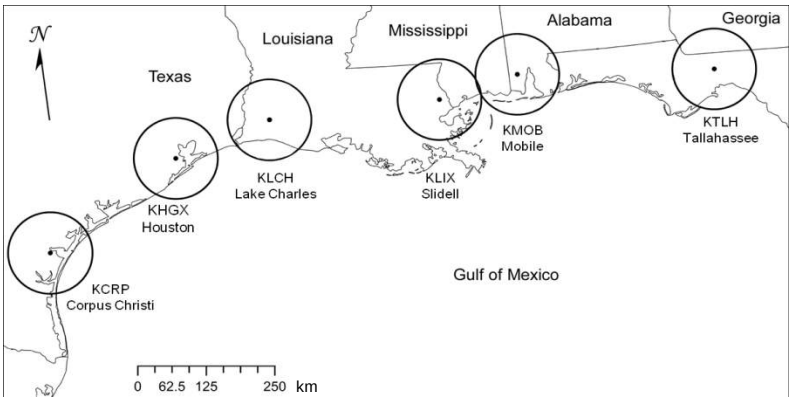

Figure 1. Locations of coastal weather surveillance radar stations with 80 km range rings indicating sampling areas.

Two-thirds of bird species breeding in eastern N. America annually migrate from temperate breeding grounds to tropical wintering locations, engaging in non-stop movement directly across the Gulf of Mexico (GOM). Consequently, millions of migrants concentrate in woodlands along the northern Gulf coast during spring and fall passage. These narrow coastal landscapes are important links in the chain of stopover areas for many eastern migrants as they are the first refueling locations after arrival in spring and the last staging sites prior to departure for trans-Gulf flight in autumn. In fact, forested habitats within 10 km of the coast are sometimes characterized as "fire escapes" in that birds are forced by extrinsic factors to use these areas for rest and refueling before continuing the migratory journey. These same coastal landscapes are some of the most rapidly developing areas in the United States with population growth rates five times higher than that of inland areas. The mosaic of isolated remnant forested patches within these heavily urbanized landscapes has been characterized as urban forest with 20 percent canopy loss from this already depleted landcover type since 1990 along the Mississippi coast, making vast regions of the coastline virtually unusable as resting and refueling sites for migrants during passage. Anthropogenic pressures, along with other human-created (e.g., oil spills) and natural disturbances (e.g., hurricanes), result in rapid loss and fragmentation of sensitive coastal ecosystems, creating tension between the importance of coastal landscapes for economic development and their value for energetically constrained migratory birds. Thus, there is urgency in conserving coastal habitats and identifying important stopover areas across the entire Gulf coast to create a framework for understanding and monitoring critical habitats, designing management and restoration strategies, and informing conservation goals.

A network of weather surveillance radar stations exists along the northern coast of the GOM, and their sampling ranges encompass a significant portion of coastal habitats critical to migratory birds (Figure 1). We analyzed archived Level II weather surveillance radar data for spring migratory periods for four years at four of these stations. Reflectivity, a measure of returned radio energy from objects in a sampled volume of airspace and an index of relative bird density, was used to determine distributions of migrants across the landscape, effectively highlighting important stopover habitats. Reflectivity was averaged across all years for each sampling volume and laid over the 2006 USGS National Land Cover Dataset (NLCD) for assessing habitat relationships within each radar range.

Additionally, using ground-based techniques to examine influences of anthropogenic coastal alteration on stopover behavior, we measured bird behavior and physiology at stopover sites from Ocean Springs to Pascagoula, Miss., during the most energetically constrained time of the annual cycle. Specifically, we investigated impact of habitat patch size on migrant-habitat associations during spring stopover within an urban coastal landscape by quantifying fat deposition and refueling rates within forested patches of varying sizes. Factors affecting site-specific refueling performance and indicating habitat quality that were analyzed include plasma metabolite profiles, foraging behavior and resource competition.

Hydraulic impact on fish migration in a Sariakandhi fish pass of Bangladesh

Habitat Management and Restoration
Poster Presentation

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Bijoy Kumar Ghosh is the deputy director of administration for the Educational Engineering Department of the Ministry of Education in Bangladesh. He holds a master's degree in water resources development from Bangladesh University of Engineering and Technology and a master's degree in zoology (fisheries) from University of Rajshanhi.

The importance of open water fish in our socio-economic regime has recently drawn the attention of the policy makers of the country. FCD/FCDI projects mainly serve the agricultural interests, but it interferes fish migration. This inevitably affects the open water fisheries sector as migratory routes. Nursing grounds of many species of fish are hampered and disturbed for these projects also. In order to permit fish migration in rivers, it is necessary to maintain conditions that help migrants reach their spawning grounds. To overcome obstacles, such as hydraulic structures, placed in the path of migrating fish, structures must be designed to assist the fish to pass them. The periodic and directed travel of fish mainly for feeding, breeding and overcoming adverse climatic conditions is called migration. Fish passes are constructed to allow normal breeding migration and to ensure natural route of fish movement.
The concept of a fish pass is relatively new in Bangladesh. At present, two fish passes and two fish-friendly structures are constructed. These are Fish Pass in Jamuna to Bangali River at Sariakandi in Bogra, fish Pass in Kawadighi Haor of Monu river in Moulovibazar, fish-friendly structure in Lohajong river of Tangail and fish-friendly structure at Morichardanra in Chapainawabganj. Fish fry, spawning and hatchling movement from Jamuna to Bangali River was the main objective of Sariakandi Fish Pass Project. The Fish Pass Project of Sariakandi is necessary for the development of the dominant fishes like catfish and small fishes. The structures will also aid in efficient development of the carp fishes. Spawning migration, mainly in carp fish, in the study area was found to begin at the second week of May and continue up to the third week of July. Catfish migrations began the last week of March and continue up to the second week of June.
Fish fry and hatching movement from Jamuna to Bangali river was the main objective of Sariakandi fish pass project. The study also found that there were seven major category migratory species in the project area and the fish pass is contributing positively for growth of fishery resources in the study area. During the monsoon, carp fish is the dominating migratory species. Carp fish migrates in a higher velocity, whereas, catfish migrates in a lower velocity. Some problems were found in the operation and management of fish pass.

Keywords: FCD/FCDI projects, Nursing grounds, Hydraulic structures, Natural route, Dominant Fishes, Peak migration.

The economics of restoration: Linking science, communities and dollars

Habitat Management and Restoration
Oral Presentation
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Judy Haner is the Marine and Freshwater Programs Director for The Nature Conservancy in Alabama, where she oversees marine, estuarine and freshwater restoration, coastal ecology, regional conservation efforts and links communities with resources.

Globally, an estimated 85 percent of oyster reefs have been lost, more than any other marine habitat. In Mobile Bay, where research has shown only a 9-percent decline in reef area, there has been an 80-percent loss in reef biomass. Recent projects across the Gulf of Mexico show that large scale restoration can create man-made oyster reefs that duplicate many of the benefits of natural reefs. In addition to the oyster fishery itself, oysters and the reefs they form are the foundation of a healthy and resilient coastal ecosystem, providing valuable services to both people and nature. Reefs increase catches of fish and crabs that rely on them for food or shelter. They protect shorelines from waves, minimizing coastal erosion and flooding. Reefs also remove nitrogen from coastal waters which causes algal blooms and dead zones, negatively impacting fisheries and tourism.

While the people of the Gulf Coast know that the environment and the economy are connected, scientists have struggled with measuring the natural environment's influence on human wellbeing, specifically the economic values of coastal restoration efforts, until recently. Environmental Economist Timm Kroeger, Ph.D., with The Nature Conservancy recently completed the most comprehensive study to date that measures the economic and social benefits that reef restoration provides, using two planned restoration projects in Alabama. This analysis draws on findings from research on restored and natural reefs in Mobile Bay and other parts of the Gulf and estimates that an investment in oyster reef restoration will have a several-fold return on investment in terms of recreational and commercial fisheries and protection of property and public infrastructure.

Protecting and restoring these important habitats strengthens Gulf Coast communities and economies and makes them more resilient in the face of struggling economies, dwindling fisheries and coastal hazards such as storms and flooding. In combination, these factors create social and economic flexibility in local communities, sustain tourism and other coastal businesses, provide critical nursery areas for Gulf fisheries and reduce damages from storms. An investment in reef restoration makes good economic sense.

Adaptive management to reduce infestation of common reed (*Phragmites australis*) in a restored wetland area at Helen Wood Park, Mobile, Ala.

Habitat Management and Restoration
Poster Presentation
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Tom Herder holds a bachelor's degree and a master's degree in marine biology from UNC-Wilmington and pursued doctoral work at the University of Florida. He lives in midtown Mobile with his wife, dogs and birds and surfs whenever the Gulf of Mexico cooperates.

Helen Wood Park (HWP) is a 7.4-acre City of Mobile park that provides public access to the western shore of Mobile Bay. Park land was donated by Ms. Helen Wood of Daphne and developed through a partnership of the Mobile Bay National Estuary Program (MBNEP), the Alabama Department of Conservation and Natural Resources (ADCNR) and the City. Phase One included installation of pervious parking, landscaping, bulkhead repair and construction of a waterfront boardwalk and a gazebo. Phase Two involved restoration of a 1.4-acre wetland area infested by the nuisance common reed, *Phragmites australis*, to enhance ecological services and improve visibility and park security for law enforcement officers. In 2009, after unsuccessful control efforts using combinations of herbicide application and burning, we implemented recommendations by consultant Fred Nation to reduce elevation and restore hydrology, before planting native vegetation. The distribution of *Phragmites* in the marsh interior was dramatically reduced, but fairly uniform infestation along the margins of the restored marsh remained.

In late 2011, concerns over remaining or increasing *Phragmites* infestation stimulated us to seek an assessment and recommendations by Mr. Nation. He expressed pleasure and surprise over the degree to which the slight elevation reduction decreased the density of the *Phragmites*. In his assessment, he noted that "*Phragmites* is nearly absent from the restored area…replaced by native species." His recommendations: "Several times during the growing season, hand cut the *Phrag* to near ground level and immediately spray the cut stems with 50 percent glyphosate formulation. Continue to cut and spray the regrowth, which will decline over time. It is crucial that control activities not be halted or suspended."

In March 2012, 16 volunteers from Holcim, Inc. met at HWP to implement Mr. Nation's recommendations. Volunteers used loppers and machetes around the margins of the restored marsh to cut reeds to knee-high length. Subsequently, a backpack sprayer was used to apply 5 percent glyphosate solution to the cut stems, using care to avoid neighboring native plants. Volunteers with hand spray bottles applied 50 percent herbicide formulations to the cut stems in particularly close proximity to native plants. *Phragmites* growing in the marsh interior was hand-sponged with a 5 percent herbicide solution to avoid impacting native plants.

Despite efforts to avoid application of herbicide to native vegetation, troubling post-treatment mortality was noted in patches of *Schoenoplectus* spp. in the marsh interior. Mr. Nation assessed the by-kill as "acceptable," but he will provide recommendations for reducing it in future

treatments. Re-sprouting at marsh margins will be addressed with fall 2012 glyphosate application.

The provenance of *Phragmites australis* and its service provision in coastal ecosystems continue to be the focus of contentious debate, but an inverse relationship clearly exists between *Phragmites* infestation and biodiversity. This site will be monitored and compared to a neighboring, non-restored, control site to investigate enhancement of biodiversity and ecological services as the subject of a post-graduate thesis as we continue efforts to eliminate *Phragmites* infestation.

The value of ecosystem services provided by oyster reefs, mangroves and salt marshes along the Gulf of Mexico

Habitat Management and Restoration
Oral Presentation
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Matthew Interis is an environmental economist who specializes in stated preference approaches to value estimation of environmental goods and services. His recent applied work includes estimating the value of wetland and barrier island restoration in coastal Louisiana. He holds a doctorate in environmental economics from The Ohio State University.

Oyster reefs, mangroves and salt marshes are important coastal ecosystems that provide a wide range of services, including water quality improvement, hazard mitigation, fisheries support and wildlife habitat. Each of these habitats has suffered along the Gulf of Mexico coast, and some people have proposed active restoration of these habitats. However, while the costs of restoration are relatively straightforward to estimate, the benefits of restoration are less clear. In this study, we attempt to estimate the benefits of restoring these habitats in two key coastal areas: the Barataria-Terrebonne National Estuary in Louisiana and the Mobile Bay National Estuary in Alabama. In economics, these benefits are considered "non-market benefits" because ecosystem services, while valuable, are not traded in markets. Estimation of non-market benefits can be difficult, and, in our study, we use a specific type of survey known as a "stated preference" survey, in which survey respondents state whether they are in favor of or opposed to various hypothetical coastal restoration projects, which might be implemented at a cost to them. Economists use these choices to statistically estimate the dollar value of the ecosystem services. Our primary objective is to estimate the value of the ecosystem services provided by each habitat, but we also seek to answer the following questions:

1. Do people care which of the habitats provides a given ecosystem service? Several ecosystem services are provided by more than one of the specified habitats. Traditionally in economics, it is assumed that people care only about the services provided, not how they are provided. We specifically examine whether this assumption holds in the context of coastal ecosystem services.

2. Does the value of the ecosystem services provided differ across the two estuaries? One difficulty in ecosystem services valuation is that values can vary widely across geographical location.

3. How do values differ between people who are more directly affected by the ecosystem services and those more remote? Many people who may not live close to the estuaries may yet value the services they provide. Our sample includes both residents who live in and near the estuaries and those who live farther away.

Louisiana asserts extended fisheries management boundaries: Legal issues and potential impacts to Gulf resources

Habitat Management and Restoration
Oral Presentation

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Catherine M. Janasie is an Ocean and Coastal Law Fellow at the Mississippi-Alabama Sea Grant Legal Program. She received her LL.M. in environmental and natural resources law from Lewis & Clark Law School and her J.D. from Rutgers School of Law-Newark.

The Gulf of Mexico is home to a number of natural resources that provide a tremendous amount of revenue for the five states along the Gulf coast: Texas, Louisiana, Mississippi, Alabama and Florida. With offshore natural gas production royalties and recreational and commercial fishing revenues in the billions, it is no wonder all five states have previously made efforts to increase their jurisdictional limit and control of the submerged lands lying off their respective coasts. Most recently, the Louisiana Wildlife and Fisheries Commission extended its jurisdiction over state fishing waters from three miles offshore to just over 10 miles, enforcing Louisiana fishing regulations in waters that are traditionally governed by federal law. Officials based their decision on a 2011 state law that recognized Louisiana's historical authority to manage the waters and natural resources up to that distance. However, until Congress or the courts approve the action, federal law will continue to be enforced, creating confusion among enforcement officials and citizens, alike.

This presentation will explore the legal implications of these changes to state jurisdictions as well as the impacts to natural resource regulation. The presenter will also include a brief discussion of the historical basis for the existing jurisdictional boundaries, including the Submerged Lands Act and prior litigation on behalf of the Gulf states that led to Texas and Florida having a 10-mile boundary but left Louisiana, Mississippi and Alabama with a 3-mile limit.

Shrimp biofloc solids as an alternative to commercial fertilizer in coastal salt marsh plant nursery production

Habitat Management and Restoration
Poster presentation

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Dr. Heather Joesting is a post-doctoral researcher in the marine botany section of the University of Southern Mississippi's Gulf Coast Research Laboratory. Her research interests include leaf physiological adaptations to abiotic stress and the potential role of salt marsh plants in the management of effluent from marine aquaculture facilities.

The large nutrient inputs required to support high stocking densities in intensive, minimal-exchange shrimp culture contributes to accumulation of biofloc particles. Although these particles are beneficial to shrimp and nutrient cycling, management of biofloc concentration using settling chambers has been shown to significantly enhance shrimp production. To increase sustainability and investigate the potential for supporting an alternative cash crop, a means of nutrient reclamation from removed biofloc should be considered. This study examines the use of biofloc solids as fertilizer for production of salt marsh plant species used in coastal restoration.

Settling chambers were used to filter biofloc particles from minimal-exchange *Litopenaeus vannamei* culture systems. Solids were aerated and dewatered in drying beds, collected and stored at -20°C. *Spartina alterniflora* and *Juncus roemerianus* individuals were maintained in a greenhouse and assigned to one of three weekly dosing treatments, for a six-week dosing period: (1) control, with the addition of 30-mL water, (2) addition of 30-mL Miracle-Gro® (200-g dissolved in 5-L water, ~5 times normal concentration to mirror nutrients in biofloc), and (3) addition of 7-g dried, ground biofloc solids and 30-mL water. Plants were measured three times during the dosing period (initial, midpoint and final) and approximately ~3 months post-dosing (response period) for plant biomass, chlorophyll, nitrogen, and phosphorous content, and growth rate.

During the response period, total aboveground biomass and growth rate of *J. roemerianus* plants dosed with biofloc solids were not significantly different from those treated with Miracle-Gro, but biofloc treated plants had significantly greater belowground biomass than control and Miracle-Gro treatments (Table 1). Belowground biomass and growth rate of *S. alterniflora* individuals dosed with biofloc solids were not significantly different from those receiving Miracle-Gro. Based on similar plant responses of biofloc and Miracle-Gro treatment, these results suggest that biofloc solids are an effective fertilizer for production of salt marsh species.

Table 1. Total aboveground (AG) and belowground (BG) biomass (g) and growth rate (cm/week) for *Juncus roemerianus* and *Spartina alterniflora* grown under three dosing treatments. F-statistics and *P*-values from one-way ANOVA with two degrees of freedom.

	Control	**Miracle-Gro®**	**Biofloc solids**	**F-ratio**	**P-value**
Juncus roemerianus					
Total AG	17.24[a]	23.97[b]	22.10[ab]	4.7977	0.0192
Total BG	13.53[a]	10.89[a]	18.89[b]	12.5831	0.0003
Growth rate	2.35[a]	3.75[b]	3.43[ab]	3.373	0.0405
Spartina alterniflora					
Total AG	10.41	16.75	11.66	3.3037	0.0576
Total BG	5.32[a]	11.18[b]	8.18[ab]	4.7470	0.0206
Growth rate	4.80[a]	7.39[b]	6.34[ab]	3.2223	0.0464

Bayou Auguste restoration project: A community-based effort to protect our natural resources

Habitat Management and Restoration
Oral Presentation
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Britton Jones is a landscape architect with the Gulf Coast Community Design Studio. Britton has been project manager over the restoration activities over the last three years and continues seek out opportunities to expand restoration efforts along the Gulf Coast.


Figure 1: View of Bayou Auguste post restoration.

Through a collaborative process with local organizations and multiple funders, The Bayou Auguste Restoration Project addresses habitat health, sustainable development practices, public access and environmental education. Bayou Auguste is located in East Biloxi and has a half-mile course that runs through neighborhoods with varied land uses, which have negatively impacted the bayou's health. While the adjacent land uses vary they have mostly resulted in the filling of tidal marshes and channelization of the bayou course. Like many of the tidal bayou/marsh habitats of the Gulf Coast that have been impacted, they no longer fully support the plant and animal species that are key components to maintaining good water quality, providing a local food source and supporting the seafood industries, acting as stormwater buffers and creating recreational opportunities.

The Gulf Coast Community Design Studio (GCCDS) formed a partnership with the City of Biloxi, Biloxi Public Schools, Biloxi Housing Authority, The Land Trust for the Mississippi Coastal Plain and Cypress Environmental Sciences & Management to create a restoration master plan for Bayou Auguste. The master plan included the restoration and creation of tidal marsh and upland habitats along Bayou Auguste as well as designing a trail system with overlooks and boardwalks that can provide access for recreational and educational opportunities. This partnership has also fostered educational activities with over 200 students from the Biloxi Public Schools. Students ranging from 2nd to 12th grade have learned about tidal marsh/bayou ecology, conducted water quality tests and experiments on erosion and pollution, created works of public art to increase awareness and stewardship toward the environment, and have even collected seeds and propagated native plant species.

To date, approximately 7.5 acres of tidal marsh habitat has be created, restored or improved and 2,000 feet of streambank has been enhanced and realigned. These restoration activities have been made possible by funding received through grants from The National Fish and Wildlife Foundation, FishAmerica Foundation and the Gulf of Mexico Foundation. Through this process there has been an increased interest of community members and city officials in the restoration of other coastal habitats in Biloxi. The community is recognizing the benefits of conserving and restoring coastal habitats and understanding their important role in maintaining resilient and sustainable coastal communities.

Sea turtles, climate change and beach renourishment on Horn Island, Miss.: "Finding the ties that bind" to ensure availability of critical sea turtle nesting habitat

Habitat Management and Restoration
Poster Presentation

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Andrew Maurer is an Eckerd College graduate (May 2012) with degrees in environmental studies and Spanish. After graduation he accepted an internship at Gulf Islands National Seashore under Dr. Matthew W. Johnson. Maurer's research has focused on sea turtle nesting site selection. Future plans include more work experience and graduate school.

Barrier islands play an essential role in the Mississippi coastal ecosystem by buffering the coastline against wave energy and by providing critical habitat for many organisms. A primary function of these islands it to provide habitats suitable for nesting by many endangered and threatened species of birds and turtles. However, extreme weather events and sand starvation can destroy these habitats resulting in the need for occasional beach renourishment and/or reconstruction. The objective of this study was to describe the characteristics of sea turtle nesting locations to identify critical elements consistent among nest sites to ensure that beach renourishment is done in a manner that facilitates nesting. During July 2012, 14 locations (11 nests and three false crawls) were identified with sea turtle crawls on Horn Island, Miss. At each site a 30 meter wide, three-dimensional profile of beach surrounding the site was created that incorporated the sea turtle beach entrance and exit points. Two-point slopes were also calculated and analyzed for three beach measurements: waterline to body pit or vertex of the false crawl, waterline to the first berm, and berm to pit/vertex. Three-dimensional graphing and curve fitting analysis showed no significant difference between false crawl profiles and nest profiles. Although not significantly different, results for slope comparisons showed that false crawls had a steeper mean slope for all three beach measurements. Nest sites were located on flatter sections of beach compared to false crawls. Results suggest that creating beaches with an overall slope of less than 0.1 could be beneficial to sea turtle nesting on Horn Island.

Artificial reefs in the Mississippi Sound: The attraction versus production debate

Habitat Management and Restoration
Oral Presentation
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Viviana Mazzei is a graduate student in the Marine Botany Lab at the University of Southern Mississippi's Gulf Coast Research Laboratory. Her interests are in marine botany and ecology, with emphasis on the use of algae as a bio-indicator of environmental change in estuarine and coral reef systems.

The use of artificial reefs as a coastal management tool has become increasing popular worldwide. The most common reasons for artificial reef deployment in coastal areas include enhancement of commercial fish stocks and harvests, maintenance and restoration of habitat and biodiversity, and the establishment of recreational diving and fishing hotspots. Although these benefits are attractive motives for the use of artificial reefs, there has been considerable controversy over whether these submerged structures are doing more harm than good. The "attraction versus production" debate argues that artificial reefs do not actually increase the fish standing stock but rather concentrate the existing fish biomass at reef sites, leaving them vulnerable to overfishing and predation. In order for artificial reefs to help create new fish biomass, they should provide ample primary production to support the development of a reef-based food web.

The Mississippi Sound in the northern Gulf of Mexico has 67 artificial reefs sites, the main goal of which is to increase the production of economically and recreationally important fish, such as speckled trout, white trout, redfish and black drum. Our study aimed to quantify primary production on the reefs in order to model assumptions about the fish biomass these reefs could potentially sustain. We estimated benthic primary production at four representative artificial reefs in the Sound using artificial installations deployed seasonally on or surrounding the reefs. These consisted of an array of plexiglass settlement plates fixed at different levels in the water column. Ten arrays were deployed at each reef during each sampling season (quarterly from July 2011 to June 2012) and allowed to soak for 4 weeks before being collected. Primary productivity, biomass and chlorophyll a concentrations were measured, and the results were compared seasonally among depth zones and across reefs. Primary productivity and chl a levels were also measured for water samples collected during the array soaking period to assess the contribution of phytoplankton to local primary production.

Our results indicate that local primary production, in the form of attached algae, is negligible. It is possible that external sources of fixed carbon, such as phytoplankton or detritus from nearby salt marshes, may contribute significantly to reef trophodynamics. Secondary production by filter- or deposit-feeding invertebrates on the reefs is a potentially important mechanism by which phytoplankton primary production and plant detritus, respectively, are incorporated into benthic biomass and made available to higher trophic level consumers, including fish. However, stable isotope studies are needed to determine the sources of external carbon to the reefs (phytoplankton vs. salt marsh detritus), and how important a contributor they are to the overall reef food web.

Numerical modeling of Mobile Bay

Habitat Management and Restoration
Oral Presentation

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Tate McAlpin is a research physicist with the U.S. Army Corps of Engineers in Vicksburg, Miss. His primary interest is in numerical modeling of estuarine systems. He has bachelor degrees in mathematics and physics and is completing the requirements for a master's degree in civil engineering from Mississippi State University.

In 2007, the U.S. Army Corp of Engineers (USACE), Mississippi State University (MSU) and the Northern Gulf Institute (NGI) entered into a partnership to advance the understanding of the impacts of the Mobile Bay Causeway on the hydrodynamics and sediment transport of the system. A numerical model was developed to include the entire Mobile Bay system in order to investigate the impacts associated with removal of the causeway. The Adaptive Hydraulics (AdH) Code was used to validate the numerical model for hydrodynamics and transport.

Due to the physics based nature of the AdH numerical model, the validated model could be altered to represent the plan conditions (removal of the Mobile Bay Causeway). Comparisons of the base and plan model results indicate the impacts of removing the causeway are not widespread and are primarily limited to Chocolatta Bay and the areas adjacent to the causeway. The model results suggest an increased exchange of water between Chocolatta Bay (north of the causeway) and Mobile Bay for the removed causeway configuration. Chocolatta Bay also experiences an increased inflow from the river systems which result in increased suspended sediment concentrations and sediment deposition.

Figure 1. Mobile Bay Causeway

Integrated Ecosystem Assessment: Comparison of four northern Gulf of Mexico systems

Habitat Management and Restoration
Oral Presentation

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William H. McAnally, Ph.D., P.E., is a research professor at Mississippi State University. He is engaged in research on inland and coastal hydraulics, sedimentation and ecosystem assessment. He and his wife, Carol, have four children and six grandchildren and live in Columbus, Miss.

Integrated Ecosystem Assessment (IEA) of four northern Gulf of Mexico ecosystems contributes to an overall Ecosystem Approach to Management (EAM). Objectives of this work include defining comparative ecosystem drivers, pressures, impacts, states and responses for Perdido Bay, Fla.; Mississippi Sound, Miss.; Barataria Basin, La.; and Galveston Bay, Texas, and examining effects of scale.

IEA is "a syntheses and quantitative analysis of information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives" and begins with the identification of a critical management or policy question. IEA employs a Drivers-Pressures-States-Impacts-Responses (DPSIR) framework for scoping the ecosystem assessment process and setting management goals. This study employs conceptual and numerical models of physical and ecosystem processes and establishes a risk framework for interpreting findings. It also employs Sulis, a natural resource assessment system, as an architecture and a software framework.

Three Driver categories – Hydrologic Modification, Climate and Human-Related Processes – and 13 Pressures have been identified that are pertinent to at least one of our four systems. Salient commonalities are that (1) Human-Related Processes dominate Drivers for the region, with Local Population Size and Tourism/Recreation cited for all systems and (2) five Pressures manifest those drivers: increased fishing effort, increased urban/coastal development, increased boat traffic, increased nutrients and increased pollution. Nearly equal distributions of Pressures were identified at different scales, ranging from individual lagoons to entire estuaries, but substantial dissimilarities in at least some physical processes suggests that while management measures may be similar at multiple scales, evaluation of the system's behavior in response to those measures may not be. For example, total dissolved nitrogen (TDN) concentrations were always higher within each of the individual Perdido Bay lagoons than in the surrounding Bay. These results suggest that the assessment step should include both the smaller scale features and the overall system.

The work was performed by the Northern Gulf Institute with support from NOAA.

Successful restoration of shoalgrass (*Halodule wrightii*) to an Alabama coastal lagoon

Habitat Management and Restoration
Oral Presentation
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Ashley McDonald is a Ph.D. candidate at the Dauphin Island Sea Lab. Her studies focus on the ecology and restoration of shoreline vegetation, including both marshes and seagrasses. Her primary interests are in determining how the changing coastal environment affects these ecosystems and to accurately detect the plant communities' responses to these stressors.

Seagrass restoration is a controversial subject for both researchers and coastal managers alike. Successful restorations are rare for seagrasses in the Gulf of Mexico because these species nearly always must be transplanted from donor sites. These types of restorations are typically unsuccessful due to the fact that in many areas where seagrasses have disappeared there are multiple environmental stressors leading to declines in the health of the water column and/or benthic environment. This has led to many attempts at restoring the seagrasses to these decimated locations, without any alleviation of the stressors that caused the declines in the first place. Without proper funding to support restoration of the surrounding environment, which typically entails proper nutrient pollution diversion or prevention and restoration of the shoreline's emergent vegetation, and also without public support of such endeavors, these projects are largely unsuccessful. These factors were examined in preparation for a restoration of shoalgrass in an area historically known to harbor it. The primary focus for this project was to provide evidence that a successful restoration can be implemented cheaply and efficiently. Little Lagoon in Gulf Shores, Ala., was a prime candidate for this project for multiple reasons including: accessibility to a shoreline located in a nature preserve, proper nutrient pollution management that has led to a high-quality light environment for the benthos, and strong community support for the project.

The first restoration attempt took place in May of 2009 with approximately 300 15cm planting units (PUs) that were harvested from two disparate donor sites that differed mainly in sediment type and benthic light quality. This attempt resulted in 100 percent mortality, primarily due to a summer drought along with high bioturbation. Interestingly, results from the first restoration gave evidence that PUs from the high light region survived longer under stressful conditions in the Little Lagoon due to healthier, stronger individuals within the PUs than the individuals from the low light quality site. This information was used when conducting our second restoration attempt in May 2011, except this time only PUs from the high light quality site were transplanted and bioturbation was alleviated with a large gauge mesh screen anchored into the sediment. Currently, survival for these PUs is at 100 percent with high rates of horizontal rhizome growth and shoot propagation. This success gives further evidence of the extent to which restoration planners must know not only the environment for the area of restoration, but also the ecology and physiology of the donor seagrasses being used.

New *Spartina alterniflora* wetland establishment technology

Habitat Management and Restoration
Oral Presentation

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Professor Pete Melby created the Center for Sustainable Design at Mississippi State University in 1994, helped established the Experimental Natural Beach Landscape in Biloxi in 1995, developed a master planting plan for Harrison County beaches in 2009 and is currently working on a restoration plan for Deer Island.

Since 1997, experiments have been conducted to create a methodology for reestablishing smooth cordgrass salt marshes in areas where they once existed. It is estimated there have been greater than 8,500 acres of salt marsh in Mississippi lost since 1952. This is 13 percent of the salt marshes along the Mississippi Gulf Coast. The ecosystem services these lost marshes provided is immense, and the ecological capital they represented was huge. Reestablishment of emergent wetland marshes is now hindered primarily by interruption of natural sediment flow by ship channels, the occurrence of increased boat generated waves and landscape management practices that do not work with naturally occurring cycles.

Through recent work on the Experimental Natural Beach Landscape in Biloxi, a process has been created, which is successful in establishing emergent smooth cordgrasses (*Spartina alterniflora*). Established grasses are now expanding and creating emerging marsh wetland habitat that is attracting a host of aquatic life including juvenile fish, shrimp, crabs and shore birds. The wave energy reduction system used to establish the salt marsh plantings is lightweight and easily installed with only hand labor. The system reduces destructive wave forces to the extent that mechanical damage to plants is prevented, thereby allowing wetland grasses to establish and grow. Once emergent plants are established, the new wave energy reduction system can be removed by hand and moved to another location for reuse. It takes approximately 8-10 months for the wetland establishment technology to allow for emergent smooth cordgrass to establish.

Figure 1. Smooth cordgrass planted August 2011 with wave energy reduction rolls.

The emergent salt marsh wetland is the final component of Biloxi's Experimental Natural Beach Landscape, which was first begun in 1995. That landscape is now composed of maritime forest trees and shrubs, a substantial sea oat and dune system with more than 50 additional naturalized native dune plants, and now an emerging smooth cordgrass wetland. The wetland is the final component of creating a methodology for natural beach restoration and management along the Gulf Coast.

The Experimental Beach Landscape site was established by the Harrison County Board of Supervisors in 1995 at the request of the Biloxi Bay Chamber of Commerce. The 3-acre beach site was changed from traditional, intense beach management into a natural beach landscape complete with restoration of the beach environs into a natural beach habitat. All traditional beach grooming activities have been eliminated and the model beach restoration site has been managed since 1995 with only hand collection of litter. While emphasis in the presentation will be given to the new wetland establishment technology, techniques for creating the upper beach landscape including the success of deep planting trees, shrubs and grasses will be shared as well.

Figure 2. Established and spreading grasses in April 2012

An Integrated Ecosystem Assessment of the Mississippi Sound & Bight

Habitat Management and Restoration
Oral Presentation

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Scott Milroy is an assistant professor of marine science. His research interests include ecological modeling, functional ecology and marine science education/curriculum development. He holds a doctoral degree in marine science (biological oceanography) from the University of South Florida in St. Petersburg, Fla.

The Integrated Ecosystem Assessment (IEA) process is rooted in NOAA's objective to "Protect, Restore, and Manage the use of Coastal, Ocean, and Great Lakes resources through an Ecosystem Approach to Management." Inherent to the IEA process, the DPSIR framework is employed in order to define the salient ***Drivers*** of change within an ecosystem, which introduce specific ***Pressures*** on the ecosystem. As the ecosystem responds to these pressures, these changes can be quantified by monitoring the appropriate ***State Variables*** which themselves serve as indicators of ecosystem dynamism. The ***Impacts*** of these changes can also be quantified and are then considered within the context of resource management and the risks associated with ameliorative action. Such actions are of course a part of the management ***Reponse*** and are designed to change the fundamental Drivers and/or Pressures affecting the system and therefore affect positive change within the managed system.

Our IEA conducted within the MS Sound/Bight indicates that the most important drivers at work within this system include: 1) *Hydrologic Modifications*; 2) *Climate*; and 3) *Anthropogenic Processes*. The hierarchical relationship between the variable ***Pressures*** (▻) induced by each of the three main ***Drivers*** (•) at work within MS Sound/Bight ecosystems can be summarized as:

- Hydrologic Modifications
  - ▻ Exploration and Navigation Canals
  - ▻ Flood Levee and Dam Construction
  - ▻ Freshwater Diversions
- Climate
  - ▻ Sea Level Rise/Subsidence
  - ▻ Extreme Weather Events
  - ▻ Climate Variability
- Anthropogenic Processes
  - ▻ Local Population Size
  - ▻ Trade/Industry
  - ▻ Socio-Political-Educational Perceptions
  - ▻ Tourism/Recreation

Unique combinations of these ***Drivers*** and ***Pressures*** give rise to a multitude of "states" within MS Sound/Bight ecosystems, which can be quantified by choosing the correct ***State Variables*** to serve as an indicator of measureable changes within the affected ecosystem(s). For each of these states, we provide a list of suggested state variables to serve as the most appropriate metric(s) for use in the

planning, execution and analysis of ameliorative strategies employed by resource managers and environmental professionals.

Monitoring North America's migratory birds along the northern coast of the Gulf of Mexico

Habitat Management and Restoration
Oral Presentation
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Frank Moore has established an internationally recognized research program focused on the biology of migratory birds. He and his students have conducted research across North America as well as in Italy and Sweden, but most notably for over 30 years along the northern coast of the Gulf of Mexico.

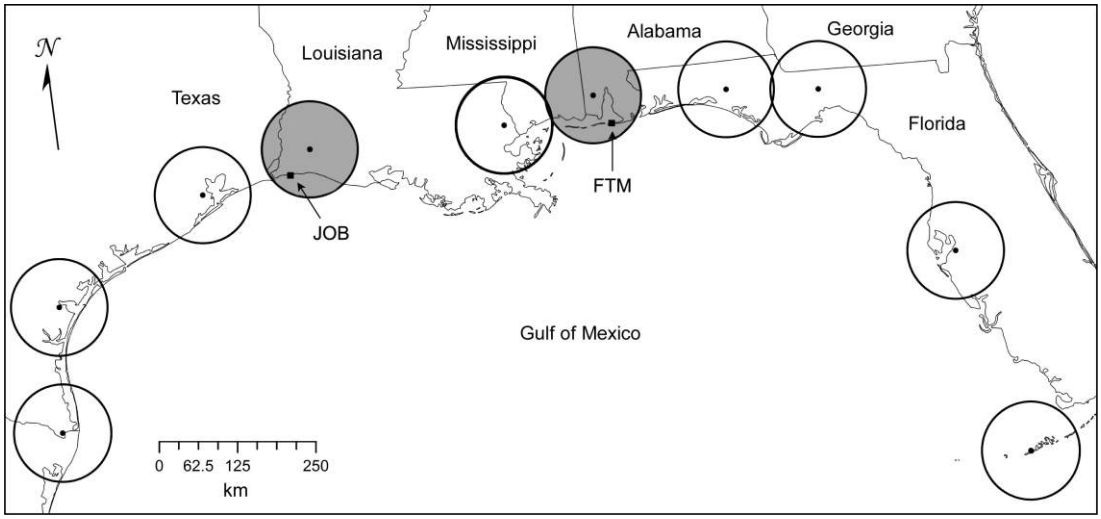
Birds are a conspicuous and remarkable natural resource of the Gulf of Mexico. Hundreds of species and millions of individual birds are supported by barrier islands, beaches, marshes, and coastal forests. Colonial waterbirds, essential components of coastal ecosystems, feed near the top of the food chain, while overwintering shorebirds forage in the mud and sands closer to the bottom of the coastal food chain. Twice yearly, the coastal habitats of the Gulf of Mexico also provide essential stopover sites for millions of migrating songbirds where they assimilate resources accumulated from the entire ecosystem. Collectively, these species provide excellent and unparalleled indicators of ecosystem health.

Today, the availability of coastal habitats for birds is often at odds with rapid human population growth in coastal landscapes. Anthropogenic pressures, along with human-created (e.g., oil spills) and natural disturbances (e.g., hurricanes), result in loss and fragmentation of sensitive coastal ecosystems, creating tension between the importance of coastal areas for economic development and their value for birdlife. Conservation and management of important coastal bird areas should be informed by data that (1) explain how birds use the marine-land interface, (2) document temporal and spatial population trends across a wide range of species and sites, and (3) offer capacity to explain those trends and the major stressors driving avian abundance and distribution.

Our comprehensive plan includes the establishment of a network of regional hubs (see Figure) to monitor coastal bird populations, conduct research, and present educational/outreach programs to the public. Each hub will bring together scientific and educational tools, including a banding station, observational approaches to study local populations, and archived NEXRAD weather surveillance radar data to better understand the density, distribution and movement of coastal birds. In addition, a string of receiving towers stretching from Texas to Florida would link the hubs; each tower equipped with an automated receiving unit for detecting individually marked birds, an acoustic monitoring device, and a meteorological unit. Shorebird and waterbird monitoring schemes would be conducted systematically from each hub using both professional as well as citizen scientists. Finally, we will institute regular tissue sampling of all focal bird groups to monitor for contaminants across the network.

The proposed network will integrate multiple data sets operating across widely different spatial and temporal scales that allow us to intercept many migratory species that occupy broad geographic wintering ranges. This network will allow biologists to gather critical data on the health of the Gulf of Mexico and associated coastal habitats as well as the bird populations that might be vulnerable to natural and anthropogenic disturbance. Finally, birds captivate the public and represent an excellent vehicle for educating the public on issues important to species and habitat conservation along the coast of the Gulf of Mexico. Each monitoring hub provides a venue to engage and educate the public about our natural resources, including the extraordinary phenomenon of migration, the species that exhibit it, and the essential role the Gulf of Mexico and associated habitats plays in this spectacle.

GULF OF MEXICO AVIAN MONITORING NETWORK FIGURE



Circles represent hubs for network activity centered on 80 km radius sampling ranges for weather surveillance radar facilities along the northern coast of the Gulf of Mexico. The network will use archived radar data to monitor movement, density, and habitat association patterns as a compliment and supplement to ground-based research and monitoring activity. Radars east to west: Key West, FL, Tampa Bay, FL, Tallahassee, FL, Eglin AFB, Mobile, AL, Slidell, LA, Lake Charles, LA, Houston, TX, Corpus Christi, TX, and Brownsville, TX. Shaded ranges represent long term sites where radar and ground based work have been successfully integrated.

Sub tidal oyster reef restoration in Mississippi's coastal bays

Habitat Restoration and Management
Oral Presentation
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Mike Murphy works in coastal restoration for the Nature Conservancy in Mississippi.He has a master's and bachelor's degrees in fisheries from Colorado State University, and he has extensive experience with state and federal agencies, private industry and academia. Expertise and experience includes aquaculture, wilderness lands, aquatic endangered species and coastal restoration.

The Nature Conservancy is working to restore sub tidal oyster reefs on suitable water bottoms in Bay St. Louis and Biloxi Bay, Miss. Working in cooperation with the Mississippi Department of Marine Resources and the University of Southern Mississippi, TNC has completed four reef restoration projects totaling 31 acres, since 2004, and has funding on hand to complete an additional 30 acres, planned for 2013. Reefs are constructed on suitable water bottom areas, by deploying natural oyster shell from a barge, with high pressure water. Restored reefs are constructed in areas not open for harvest, to maximize ecological benefits, including water quality, fish habitat and substrate stabilization. Extensive monitoring has been conducted by the University of Southern Mississippi, the Department of Marine resources and the Nature Conservancy, both pre and post deployment. Monitoring methods have included side scan sonar imaging, gillnet and trap net sampling, water quality measurements, tonging, and rod and reel samples from community volunteers. Oyster spat settlement and growth on the new reefs has occurred, as has as use of reef habitat by reef affiliated fishes. Sampling has confirmed that these reefs were not adversely affected by either the Deepwater Horizon oil spill or by the opening of the Bonne Carre spillway. TNC will continue monitoring on constructed reefs for several years, to determine their persistence and natural function. Funding for past and planned projects has been provided by the EPA, NOAA, the National Fish and Wildlife Foundation, along with support from DuPont, Chevron and BP.

Fisheries enhancement by "Living Shorelines" — Does this concept work in coastal Alabama waters?

Habitat Management and Restoration
Oral Presentation

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Claire M. Pabody is a research assistant in Dr. Sean Powers' Fisheries Ecology Lab at the Dauphin Island Sea Lab. Her interests include shoreline restoration, oyster reproduction, and marine mammal population dynamics. She holds a master's degree in marine science from the University of Alabama.

Nearshore environments provide crucial habitat for finfish and invertebrates but are often degraded or threatened by both natural and anthropogenic stressors; efforts to protect valuable coastal property have included armoring shorelines with seawalls and bulkheads. More recently, techniques employing various materials designed to become "Living Shorelines" have been developed and widely promoted. Living shorelines are designed to provide a suite of ecosystem services including a structurally complex habitat that could enhance populations of commercially and recreationally important species of both juvenile and adult finfish and invertebrates. Four experiments were conducted in Alabama coastal waters at Alabama Port and southeast Point aux Pins in 2007, Helen Wood Park in 2008, northeast Point aux Pins in 2009, and Coffee Island and Alabama Port in 2010 to test the effects of multiple shoreline construction techniques on finfish and invertebrate populations. Construction techniques included loose shell reef complexes paired with unaltered control sites, bagged shell and reef ball complexes paired with unaltered control sites, fenced shell reef complexes paired with unaltered control sites, and a complex made up of individual stretches of ReefBLK, Reef Balls, bagged oyster shell, and unaltered substrate as a control. Gillnet and seine sampling methods were used to quantify populations of finfish and invertebrate communities before and after reef construction. With the exception of the Helen Wood Park reefs where little benefit to adult fish communities was evident, reef presence enhanced abundance, biomass, and diversity of juvenile and adult fish species including some commercially and recreationally important species, which is consistent with findings of earlier studies from coastal Alabama and elsewhere. Strong positive responses to all construction techniques were observed for juvenile blue crab and juvenile and adult spotted seatrout, while penaeid shrimp and other Sciaenids, including red drum and sand seatrout were also enhanced. At the loose shell complexes, reefs flattened from wave action over time, likely limiting long-term enhancement potential. In other studies, interannual variability in the fenced shell data set and a short winter season of pre-restoration monitoring at the ReefBLK, Reef Ball, and bagged shell sites may have masked stronger community responses to the constructed reefs. Collectively, these studies demonstrate that durable living shorelines, informed by long-term monitoring of fish and invertebrate communities, can enhance populations of commercially and recreationally important fisheries in coastal waters.

Plugging the leak: Barrier island restoration following Hurricane Katrina enhances habitat quality for oysters in Mobile Bay, Ala.

Habitat Management and Restoration
Oral Presentation

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Kyeong Park is professor of marine sciences at the University of South Alabama and senior marine scientist at the Dauphin Island Sea Lab. He has been conducting observational and modeling studies related to physical transport processes, water quality conditions and living resources.

Changes in geomorphology of estuaries are common following major perpetuations such as hurricanes and may have profound effects on biological systems. Hurricane Katrina in 2005 created a new pass, called Katrina Cut, halving Dauphin Island in Mobile Bay, Ala. Significant decline in oyster population at Cedar Point Reef, which had supported more than 90 percent of oyster harvest in Alabama, had persisted since then until the Cut was artificially closed in 2010. A bio-physical oyster larval transport model was used to evaluate two potential mechanisms for oyster decline: increased salinity in the context of oyster predation and loss of oyster larvae out of the system.

The model results revealed that the presence of the Katrina Cut increases the salinity at Cedar Point Reef, regardless of forcing conditions of tidal, river discharge or wind conditions, only during the tropic tides but no changes during the equatorial tides. The Cut increases maximum salinity by 5-9 psu by enhancing maximum surface salinity and prolonging the duration of the maximum bottom salinity. The presence of the Cut reduces larval retention in the spawning area regardless of tidal or river discharge conditions. It is likely due to more dynamic transport conditions owing to the enhanced tidal energy coming in through the Cut, which then results in increased westward transport of larvae from the spawning area. Decreases in larval retention are particularly large for near median river discharge conditions (450-537 $m^3 s^{-1}$) which are most frequently occurring conditions in Mobile Bay. Trends in oyster densities at Cedar Point Reef reflected the poorer conditions for oysters during the time period of the Cut: declines in both juvenile and adult abundances until 2010 were evident. The tidal Mobile Bay system is a typical Gulf of Mexico estuary protected by barrier islands, and we believe our results demonstrate how large-scale changes in the marine landscape can alter habitat quality for a key biological component of the ecosystem.

Utilizing NASA Earth Observing Systems (EOS) data to determine ideal planting locations for wetland tree species in St. Bernard Parish, La.

Habitat Management and Restoration
Poster Presentation

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Ross Reahard is a graduate student at the University of New Orleans and studies coastal geomorphology through the use of remote sensing and GIS. He will be graduating in the fall of 2012. Ross is passionate about the Gulf Coast and spends much of his spare time on the water.

St. Bernard Parish, in southeast Louisiana, is rapidly losing coastal forests and wetlands due to a combination of natural and anthropogenic disturbances (e.g. subsidence, saltwater intrusion, low sedimentation, nutrient deficiency, herbivory, canal dredging, levee construction, spread of invasive species, etc.). After Hurricane Katrina severely impacted the area in 2005, multiple non-governmental organizations (NGOs) have worked not only on rebuilding destroyed dwellings, but on rebuilding the ecosystems that once protected the citizens of St. Bernard Parish. Volunteer groups, NGOs and government entities often work separately and independently of each other and use different sets of information to choose the best planting sites for coastal forest restoration. Using NASA Earth Observing Systems (EOS), Natural Resources Conservation Service (NRCS) soil surveys, and ancillary road and canal data in conjunction with ground truthing, the team created maps of optimal planting sites for several species of wetland trees to aid in unifying these organizations, who share a common goal, under one plan. The methodology for this project created a comprehensive Geographic Information System (GIS) to help identify suitable planting sites in St. Bernard Parish. This included supplementing existing elevation data using LIDAR data and classifying existing land cover in the study area from ASTER multispectral satellite data. Low altitude AVIRIS hyperspectral imagery was used to assess the health of vegetation over an area near the intersection of the Mississippi River Gulf Outlet Canal (MRGO) and Bayou la Loutre. Historic extent of coastal forests was mapped using aerial photos from USGS collected between 1952 and 1956. The final products demonstrated the utility of combining NASA EOS with other geospatial data in assessing, monitoring and restoring of coastal ecosystems in Louisiana. This methodology also provides a useful template for other ecological forecasting and coastal restoration applications.

A comparison of breakwater effectiveness in various types of designs in relation to the high wave impact area of Deadman's Island

Habitat Management and Restoration
Oral Presentation
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Heather Reed has been in the environmental/marine research field for 19 years in various locations around the U.S. Her field of study includes marine mammals, fish, coral reefs, jellyfish, plankton, Gulf sturgeon, seagrass, oysters, small and large scale restoration projects. Her education is an AAS in marine technology and engineering, a bachelor's degree in marine biology and a master's degree in environmental science. She currently owns Ecological Consulting Services Inc. in Pensacola, Fla.

Figure 1- A 2011 aerial photos showing the two types of breakwaters protecting Deadman's Island, Gulf Breeze, Fla.

In Pensacola Bay, extensive development, shoreline alteration, dredging, sediment deficient to prevent renourishment and increases in sediment loads have caused a decrease of the historical oyster populations. Deadman's Island is a unique ecosystem that has fallen victim to erosion by past permitted activities. To protect the historical resources and reduce erosion, two types of offshore oyster reef breakwater was built to protect the declining habitat/ecosystems of Deadman's Island. These breakwaters are the first step for the completion of the five task restoration project. Comparisons of these breakwaters were conducted to determine the sustainability, transferability and an alternative to riprap or seawalls. Other comparisons included accretion, offshore wave attenuation, oyster and fish recruitment and shoreline protection.

Figure 2- Two designs of breakwaters. A modified version of the Ecosystem by Reefmaker, David Walters -Orange Beach, Ala., (left) Reefblk by Coastal Environments Inc., Mark Gagliano- Baton Rouge, La. (right)

The NOAA Gulf of Mexico Data Atlas: Digital discovery and access to Gulf data

Habitat Management and Restoration
Poster Presentation

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Kate Rose is a habitat specialist with NOAA's National Coastal Data Development Center where she works with GIS data, mapping coastal habitats to support restoration and monitoring projects. She holds a master's degree in earth and environmental sciences from the University of New Orleans.

Based on the format of traditional atlases, the Gulf of Mexico Data Atlas is a data discovery and access tool that allows users to browse through a growing collection of datasets visualized as map plates. Thematically, the Atlas provides updated long-term assessments of physical, biological, environmental, economic and living marine resource characteristics in the Gulf of Mexico that indicate baseline conditions to inform restoration and monitoring efforts in the Gulf.

To date, the Gulf Atlas holds 95 map plates in 31 subject areas resulting from collaborations between over 30 federal, state, non-governmental and academic partners. Subject matter experts review each map plate for accuracy; these experts also provide descriptive text of the map plates explaining the methodology and relevance of the datasets. All data presented is accompanied by FGDC standard metadata. Download links to the original data in a range of formats are also provided, enabling users to either replicate the atlas maps or create their own products and analyses.

The goals of the Gulf Atlas align with those of NOAA's Next Generation Strategic Plan, the U.S. Department of Interior and Federal Geographic Data Committee "Geospatial Platform Modernization Roadmap v4- March 2011," the Gulf of Mexico Alliance Action Plan II and the Gulf Coast Ecosystem Restoration Task Force's Regional Restoration Strategy.

Coastal ecology educational experiences at Mobile County's Environmental Studies Center: Supported by Mississippi-Alabama Sea Grant Consortium, NOAA and Legacy Inc.

Habitat Management and Restoration
Poster Presentation

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Anita Salinas is a resource teacher at the Environmental Studies Center. She is the lead teacher for the SEA ICE (Student Enrichment Activities in Coastal Ecology) program. She holds a bachelor's degree in wildlife science and a master's degree in secondary science education, both from Auburn University.

The SEA ICE program funded by Mississippi-Alabama Sea Grant began at the Environmental Studies Center in 2003. Each year the program has continued to reach as many as 1,000 high school students providing a unique learning experience as students utilize a 500-acre nature center with trails through Alabama's native forest and native animal exhibits. Sea Grant funds this educational experience by covering the expense of the students' field trip; including the bus, student admission and the substitute teacher for the participating teacher. Students complete a pre- and post-test, which allows the success of the program to be evaluated.

Figure1. A SEA ICE group on their discovery hike.

Topics covered during the all day program include habitat needs, habitat destruction, invasive species, watershed ecology, chemical contamination in the environment and environmental recovery following natural or man made disasters.

A new program for middle school students began in 2011 with funding from NOAA through the University of Southern Mississippi. Teachers and students have participated in a B-WET (Bay Watershed Education and Training) program. This program may potentially reach as many as 500 middle school students each year. Students explore topics such as watershed ecology, navigation using GPS and watershed mapping using aerial photos and topographic maps. This program instills an understanding of one's place in and affect on their watershed environment.

With funding through Legacy- Partners in Environmental Education, the Environmental Studies Center has been able to purchase curriculum materials from the Leopold Education Project (LEP). During the 2011/2012 school year, 60 teachers across the state of Alabama received training to use the LEP curriculum materials. Aldo Leopold is known as the father of habitat conservation. His book *A Sand County Almanac* shares his love and knowledge of the natural environment and teaches its reader to see the deeper aspects of interrelatedness in the ecological landscape. These partnerships have given thousands of students the opportunity to examine their ecological surroundings and to grow up as citizens who place value on habitat protection.

Conservation legacy: A conservation strategy for the Mississippi Gulf Coast

Habitat Management and Restoration
Oral Presentation
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Oliver Sellers-Garcia is a planner with CDM Smith focusing on sustainable land use. He has worked across the United States, Asia and the Middle East. He will be joined by David Spector of CDM Smith and Judy Steckler of the Land Trust for the Mississippi Coastal Plain in Biloxi.

In the Mississippi Gulf Coast region, the opportunities for conservation are great, as is the need for environmental protection. Since its founding in 2000, the Land Trust for the Mississippi Coastal Plain (LTMCP), headquartered in Biloxi, Miss., has acquired and managed property in order to safeguard water quality, habitats and species, and cultural resources. With funding from the Coastal Impact Assistance Program (CIAP), the LTMCP and its consultant CDM Smith carried out the innovative Conservation Legacy program from 2010-2011. The program was designed to combine stakeholder input and technical analysis to develop planning and technical tools for conserving land in a coordinated, strategic manner in the six coastal area counties of Mississippi. Among the program's results is a conservation suitability mapping tool that ranks potential lands for conservation.

The objective of the conservation mapping tool is to provide a common baseline for regional conservation efforts, which can be used by local landowners, land-use planners, local and state agencies, and conservation practitioners to visualize individual projects as part of a larger whole. The conservation mapping data are housed in an easy-to-use geographic information system (GIS) that can be used for a broad range of purposes, from carrying out parcel-level analysis to creating regional-level visual aids.

The GIS database consists of a variety of data layers that were selected with input from regional conservation stakeholders, representing more than 20 organizations with a range expertise in conservation, development and natural resources. Throughout the project, CDM sought input from stakeholders, including two committees that it assembled specifically for this project: a strategic advisory committee for general guidance and a technical advisory subcommittee for technical input and review. Collaborators included the LTMCP Board of Directors, Mississippi Department of Marine Resources, the Gulf of Mexico Alliance and the U.S. Army Corps of Engineers, among others.

Stakeholder input was combined with technical and scientific analysis to determine the suitability of land for conservation in the six-county region. Analysis focused on assessing a variety of natural resources factors, such as habitats and wetlands, as well as man-made factors, such as proximity to development and currently protected land. Results were combined in an analytical model that ranked all of the land in the six-county area according to its potential for conservation, as defined by conservation priorities of the LTMCP and its strategic partners. The database is structured to allow for the addition of new data layers as they become available in the

Potential effects of black mangroves (*Avicennia germinans*) on structural and functional attributes of local saltmarsh grasses

Habitat Management and Restoration
Oral Presentation

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Shailesh Sharma is pursuing a Ph.D. in the ecosystems lab of the Dauphin Island Sea Lab. His research interests are restoration ecology, seagrass ecology, marsh ecology and invasive species. His dissertation work includes oyster reef restoration specifically looking at the impacts on seagrass habitat.

Recent appearance of black mangrove (*Avicennia germinans)* on Horn Island in Mississippi Sound has arisen some curiosity among the ecosystem ecologists. Many climate scientists have attributed global warming for the northward expansion of black mangroves from their previously documented proximal habitat at Chandeleur Islands, La. Although, black mangroves are ecologically important ecosystem in the tropics, their effects on local marsh grasses of the northern Gulf of Mexico are yet to be investigated. Our study aims to investigate the potential structural and functional changes brought about by *A. germinans* on local marsh grasses namely *Juncus* and *Spartina.* To fulfill this aim, we have been measuring a suite of variables that best describe the structural and functional attributes of local marsh grasses. As the structural attributes, we have been measuring (i) the density of *Spartina* and *Juncus* culms monthly in the vicinity of mangrove trees and (ii) the morphometrics of *Spartina* stems. Similarly, as the functional attributes we have been measuring (i) the grazed leaf area of mangrove and *Spartina* (ii) decomposition rate of *Spartina* and mangrove leaf. These two functional attributes are major trophic routes of primary production of mangrove and *Spartina*. With these functional attributes we would be able to explain the preference of already exiting local herbivores and detritivores on newly added choice of mangrove. Our preliminary results suggest that there have been some significant negative changes on *Juncus* and *Spartina* density in the vicinity of some mangrove trees. However, these changes cannot be attributed to mangrove trees alone. No significant changes on morphology of local grasses have been observed yet. No difference on grazed leaf area between mangrove and *Spartina* has been observed yet. However, the mangrove leaves seem to decompose faster than *Spartina* leaves.

future. The database is available to stakeholders in the region, and several agencies have already begun to incorporate the suitability ranking into their own conservation efforts and analysis. In addition, a simplified version of the mapping tool has been placed online for public access (http://gisdemo2.cdm.com/ltmcp/index.html).

This session will present key findings of the Conservation Legacy program and will introduce participants to the conservation suitability mapping tool. Attendees will learn how they can benefit from the analysis and tools produced in this project.

Addressing Gulf-wide tidal hydrology restoration needs through a federal-university partnership

Habitat Management and Restoration
Oral Presentation

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Steve Sempier is deputy director of the Mississippi-Alabama Sea Grant Consortium and also works closely with the three other Gulf Sea Grant college programs on regional issues. Steve is the Sea Grant coordinator of the NOAA Restoration Center partnership that focuses on coastal hydrology in the Gulf of Mexico.

For decades, the natural hydrology and tidal flows of the Gulf Coast have been altered because of coastal development. These alterations can take various forms such as installation of dikes, causeways, levees and other barriers, and inadequate culverts. These modifications result in reduced or restricted tidal or freshwater exchanges and change the structure and function of coastal habitats, which can eliminate viable nursery grounds for important marine and coastal species. By investing in the removal or alteration of a barrier, large-scale ecosystem benefits can be observed as tidal flow is resumed upstream of the barrier and freshwater exchange is resumed or enhanced.

Figure 1. Poorly functioning culverts such as this prevent adequate water exchange. Photo credit: Meg Goecker

The NOAA Restoration Center has partnered with the Gulf of Mexico Sea Grant college programs to address hydrological restoration along the Gulf Coast. The partnership is using a three-pronged approach, which includes supporting an inventory of hydrological restoration projects that remove barriers to natural flow, funding on-the-ground restoration projects and developing a monitoring plan to accurately evaluate the effectiveness of the restoration project. This partnership was designed to support restoration projects from the conception of project idea phase through implementation and assessment phases. The partnership also emphasizes collaboration with restoration practitioners and scientists. The presentation will focus on the current status and use of the inventory and the method for adding projects to the inventory. In addition, there will be an overview of the funded restoration projects to date and the monitoring criteria, which was developed by a panel of experts.

Cost-effectiveness of two small-scale salt marsh restoration designs

Habitat Management and Restoration
Oral Presentation

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Eric Sparks is a Ph.D. student in the Ecosystems Lab at the Dauphin Island Sea Lab. His interests include salt marsh ecology, restoration ecology, ecosystem services and anthropogenic impacts on coastal systems. He holds a bachelor's degree in marine biology from Troy University.

Marshes play important roles in coastal systems that are not only ecologically important, but also beneficial to humans, thus economically valued. Marshes are being destroyed in many parts of the world due to human coastal development, and restoration is a common practice to palliate this loss. Many restorations are conducted on large scales and governmental owned property. However, the majority of coastal property is broken into small privately owned tracts, therefore, the most potential for restorations are on private property owner scales. Few studies have compared the success and cost-efficiency of different restoration designs on these smaller scales. This is a pressing need for environmental managers and private property owners, who often need to balance the target goals with the cost and effort required. Two small-scale black needlerush (*Juncus roemerianus*) marsh restoration designs were examined for cost-effectiveness by analyzing a suite of morphological and physiological metrics, along with vegetated area over time. Transplantation was used to restore the marsh by harvesting 25 cm x 25 cm sods from an adjacent natural marsh and planting in the restoration site. Both restoration designs are on suitable scales for private property owners to conduct, but differed in initially planted coverage area. One design was fully planted (100 percent coverage of planted marsh sods; termed full-density design), and the other design was planted at half the density of the fully planted design (50 percent coverage of planted marsh sods; termed half-density design). We found no consistent differences in the measured metrics between the two restoration designs and few differences between restored sites and reference natural marsh stands. These findings suggest potentially similar functionality across all treatments. The only metrics with consistent differences among treatments were increased leaf nutrient and chlorophyll content in the restored plots when compared to natural stands. These differences are potentially attributable to nutrient-rich runoff from an adjacent parking lot to the restoration site. Total vegetated coverage area for half-density plots was similar to full-density plots at 2.1 years after planting. Cost-effectiveness analysis of both designs across eight differing restoration scenarios (based on hiring or donation of cost categories) resulted in half-density plots having higher or equal cost-effectiveness in seven of the eight scenarios. Half-density plots were approximately twice as cost-effective in scenarios with donated pre-planting site construction. Based on the similar vegetated area between the two designs and lower cost and restoration effort, we suggest the half-density design as a more cost-effective restoration strategy than the full-density design and should be considered for small-scale black needlerush restoration projects.

Emergent wetlands status and trends in the northern Gulf of Mexico: 1950-2010

Habitat Management and Restoration
Poster Presentation

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Kathryn Spear is an ecologist with USGS at the National Wetlands Research Center where she works on issues related to coastal land loss, status and trends syntheses, avian ecology and science communication and outreach. She graduated from the University of Georgia with a master's degree in wildlife ecology and management.

Throughout the past century, emergent wetlands have been declining across the Gulf of Mexico. Emergent wetland ecosystems provide many resources, including plant and wildlife habitat, commercial and recreational economic activity, water quality and natural barriers against storms. As emergent wetland losses increase, so does the need for information on the causes and effects of this loss; emergent wetland mapping, monitoring and restoration efforts; and education. The U.S. Geological Survey and the U.S. Environmental Protection Agency's Gulf of Mexico Program are committed to providing the best science possible to restore, enhance, and protect these important ecosystems. The purpose of the Emergent Wetlands Status and Trends in the Northern Gulf of Mexico: 1950-2010 report is to provide scientists, managers and citizens with valuable baseline information on the status and trends of emergent wetlands along the coast of the Gulf of Mexico. This study will examine the emergent wetlands of eight individual estuarine areas within the northern Gulf of Mexico region, including Corpus Christi/Nueces/Aransas Bays and Galveston Bay in Texas; Barataria/Terrebonne Bay and the Mississippi Delta in Louisiana; Mississippi Sound in Mississippi; Mobile Bay in Alabama; and the Florida Panhandle and Tampa Bay in Florida, as well as present statewide summaries for Texas, Louisiana, Mississippi, Alabama and Florida. Each study area will be detailed in vignettes that address current status and historical trends of estuarine and palustrine emergent wetlands, emergent wetlands mapping and monitoring, causes of status change, restoration and enhancement activities, background information for the study areas and the methodology employed to analyze and document the historical trends and current status of emergent wetlands. The report is being made available incrementally at gom.usgs.gov/gomeco.aspx as individual chapters are completed. This presentation will discuss the completed Statewide Summaries for Alabama and Mississippi and the Mobile Bay and Mississippi Sound vignettes.

Planning for large-scale restoration: How to get ahead of the permitting curve

Habitat Management and Restoration
Poster Presentation
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Mary Kate Stubljar is the Coastal Conservation Specialist for The Nature Conservancy in Alabama. Her primary responsibilities involve securing permits, collecting field monitoring data, and utilizing GIS in planning decisions of restoration activities for TNC, including the 100-1000: Restore Coastal Alabama project.

Mobile Bay, Alabama is the fourth-largest estuary in the US, and it plays an important role in sheltering and nurturing the finfish, shrimp and oysters that are vital to Gulf of Mexico communities. Over the last several decades, Mobile Bay has experienced significant loss of oyster reefs, seagrass beds and coastal marsh habitats through dredge-and-fill activities, seawalls and jetties, erosion, storm events and other causes. Despite these challenges, coastal Alabama represents one of the largest potential areas for outright restoration, replacement and enhancement of these lost habitats on the northern Gulf Coast due to the size of the estuary, historic distribution of oysters, high natural oyster spat sets and warm water for fast growth.

The Nature Conservancy in Alabama (TNC) has been working diligently with partners and agencies in selecting sites for the 100-1000: Restore Coastal Alabama project, which aims to build 100 miles of oyster reef and plant or promote the growth of 1,000 acres of marsh. To implement 100-1000, TNC was required to obtain a joint permit from the U.S. Army Corps of Engineers – Mobile District (USACE) and state agencies (Alabama Department of Environmental Management and Alabama Department of Conservation and Natural Resources). The initial phase of the permitting process involved working with the permitting agencies to select and gather information on shorelines for potential restoration projects. TNC conducted meetings with natural resource professionals and members of the commercial and recreational fishing industries, completed in-office research of selected sites, conducted rapid shoreline field assessments consisting of shoreline position, depth profiles, fish and shellfish surveys and seagrass presence/absence surveys to fulfill the requests of the permit applications. Field data was analyzed and compiled into GIS-based maps, Excel worksheets and reef designs for review and comment by the agencies. Preparation and research of site specific data and information into user-friendly formats contributed significantly to the complete permit application and met the needs of the permit reviewers. In addition, continuous communication and feedback between TNC and the permitting agencies with regards to the details of the proposed sites, necessary requirements and public notice comments proved to be essential in ensuring a smooth process with successful results.

With restoration under way and more on the horizon, The Nature Conservancy in Alabama continues its work in coordinating with USACE and state agencies, selecting sites, gathering field data, preparing permit applications for large-scale restoration and implementing

construction of permitted sites within the coastal waters ranging east to west from Florida to Mississippi as part of the 100-1000: Restore Coastal Alabama project.

Integrated ecosystem assessment for Barataria Basin, La.

Habitat Management and Restoration
Oral Presentation

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Erick M. Swenson is a research associate at Louisiana State University. His interests include analysis of long-term climate, water level and salinity in the Louisiana coastal ecological systems with emphasis on wetland restoration and management. He holds a master's degree in earth science from the University of New Hampshire.

An integrated ecosystem assessment for the Barataria Basin in Louisiana was using the NOAA Integrated Ecosystem Assessment Driver-Pressure-State-Impact-Response (DPSIR) Framework. The first phase involved an assessment of the Barataria system as a whole. This was followed by a second phase in which the system was assessed on a sub-basin level to look at potential scale effects. The work was performed in conjunction with assessments of several systems around the Northern Gulf of Mexico with the Northern Gulf Institute Ecosystem Team.

Barataria Basin is an irregularly shaped bar-built estuary, approximately 120 km in length and about 50 km in width, located west of the Mississippi River in southeastern Louisiana. The basin is divided into 5 major habitats based on vegetation type: freshwater swamp forest, fresh marsh, intermediate marsh, brackish marsh and salt marsh. These habitats were used to define the sub-basins for the assessment.

Broad, big picture, terms for the drivers and pressures were used so as to be applicable to the multiple systems in the Northern Gulf of Mexico. The three primary drivers and their associated "sub-drivers" are hydrologic modification (exploration and navigation canals, flood levee and dam construction, freshwater diversion), climate (sea level rise/subsidence, extreme weather events, climate variability), and human-related processes (local population size, trade/industry, socio-political-educational perceptions, tourism/recreation). The drivers (and sub-drivers) and pressures were determined and tabulated for each of the sub-basins in the Barataria basin. A total of 194 pressures were identified for the entire Barataria Basin distributed among the sub-basins: Swamp 34, Fresh Marsh 34, Intermediate Marsh 38, Brackish Marsh 45, and Salt Marsh 42. Climate drivers were responsible for 15 percent of the pressures with the remainder (85 percent) resulting from human activities.

The actions from the Barataria-Terrebonne National Estuary Program (BTNEP) Compact and the Governors Action Plan were used in defining the state variables, indicators, and response for each of the pressures for each of the sub-basins. Indicator variables included on the ground sampling, remote sensing, and public opinion surveys. Many of the indicators are already being monitored under existing programs. A logical "next step" would be an accurate inventory of existing monitoring programs to identify data gaps. The responses identified range from public outreach and education to larger scale construction type projects. Another "next step" would be to further refine the pressures in each of the sub-basins in order to rank them in to "high," "medium" and "low" classes. The responses should be further refined to account for costs as well as risk/uncertainty. This would allow for the development of a priority matrix to guide response implementation.

Monitoring for ecological impacts of sea level rise: Establishing vertical control and sentinel site status at the Grand Bay National Estuarine Research Reserve in Mississippi

Habitat Management and Restoration
Oral Presentation

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Will Underwood is the Stewardship Coordinator at the Grand Bay National Estuarine Research Reserve. His interests include studying the natural history of the southeast, canoeing, photographing nature, and restoring and using antique woodworking machinery. He holds a master's degree in wildlife biology from Auburn University.

Obtaining and applying accurate elevations tied to a national datum (vertical control) is critical to achieving a better understanding of the potential and realized impacts of changes in sea level on marsh habitats around the country. Ties to a common vertical datum allow for direct comparison of elevation both within a site and across a region. Having accurate measurements of marsh elevations increases the power to detect shifts in vegetation communities related to sea level change and allows for more precise tracking of rates of accretion and subsidence on both local and regional scales. Additionally, accurate elevation measurements improve the utility of models to predict marsh survival and movement based on increases in sea level. Staff and collaborators at the Grand Bay National Estuarine Research Reserve (GBNERR) have been working for several years to design and implement a robust system of vertical control on the Reserve that will strengthen our ability to monitor for changes in the marsh environment.

The backbone of the vertical control network at the GBNERR consists of fifteen surface elevation table (SET) installed along the elevation and plant community gradient from open water to the upland interface. These SETs, placed in groups of three to increase statistical power, consist of deep-driven stainless steel rods capped with a receiver head designed to accept the SET measuring unit. Measured on a quarterly basis and validated with feldspar marker horizons, the SETs allow for fine scale measurement of accretion and subsidence processes in the marsh. Emergent marsh monitoring will be initiated in the spring of 2013 on plots tied to the SET installations. Digital elevation models will be created for emergent marsh monitoring plots using Real Time Kinematic GPS techniques. In addition, ground water wells and water level loggers, along with readings from area tide gauges, will strengthen the ability to model tidal inundation along the elevation gradient of the marsh. This network of monitoring stations will be tied together using digital leveling techniques to transfer NAVD88 elevations from benchmarks on U.S. Highway 90 down into the marshes at the GBNERR. GPS surveying techniques will be used to apply elevations to sites too remote to be accessed using traditional surveying techniques. When fully implemented in the spring of 2013, the vertical control network at GBNERR will be recognized as a National Estuarine Research Reserve Sentinel Site and will serve to provide valuable data and support for sea level change modeling and research efforts for years to come.

Oyster gardening on Mobile Bay

Habitat Management and Restoration
Poster presentation
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PJ Waters is an extension specialist with ACES/MASGC focusing on oyster reef restoration through the Mobile Bay Oyster Gardening Program. He has coordinated MBOGP since 2009.

The Mobile Bay Oyster Gardening Program is a volunteer based project which focuses on education, restoration/enhancement and research by bringing the reef to the people. Now in its eleventh year of operation, oyster gardeners have produced nearly 500,000 oysters for restoration and enhancement efforts within Mobile Bay. Currently, the oysters produced by gardeners located around Mobile Bay are slated to be planted on a newly leased 10-acre oyster reserve made possible with funding from the National Fish and Wildlife Foundation. Students from local high schools will take part in the 2012 MBOGP season and work to plant oysters along cultched sections of the reserve.

Table 1. Oyster production, by year, by volunteer Gardeners involved in the Mobile Bay Oyster Gardening Program.

Year	Oysters Grown	Total Oysters
2001	50,000	50,000
2002	25,000	75,000
2003	74,000	149,000
2004*	27,000	176,000
2005**	11,000	187,000
2006	60,000	247,000
2007	60,000	307,000
2008	59,000	366,000
2009	45,000	411,000
2010***	17,500	428,500
2011	57,000	485,500
2012	In Field	

* Hurricane Ivan

** Hurricane Katrina

*** Deepwater Horizon Oil Spill

Maximizing the ecological and engineering benefits of living shorelines through the effective design of breakwaters

Habitat Management and Restoration
Oral Presentation

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Bret Webb is an assistant professor of civil engineering at the University of South Alabama. His research focus is on coastal processes, including storm surge and waves, tidal circulation and transport, coastal water quality and living shorelines. Bret teaches undergraduate and graduate courses in hydraulic and coastal engineering.

A key component of many living shoreline projects is a wave attenuating structure, or breakwater. While energy dissipation is the primary goal of a breakwater, research has shown that they provide ecological habitat and generally tend to enhance ecosystem services when integrated properly into the design of living shorelines. And while there are numerous references to the design and performance of breakwaters in the published literature, the functional design of breakwaters for living shorelines projects has not received detailed treatment. Existing resources do not specifically address the implementation of structures in living shorelines where specific requirements on wave attenuation for vegetation and habitat viability may exist.

Figure 1. A representative example of a constructed living shoreline using rock, vegetation and clean sand fill.

A two-year project currently underway is addressing these shortcomings through the development of a decision support toolkit. The toolkit will improve the function and efficiency of living shorelines through a refined treatment of the role of structures in attenuating wave energy when wetland protection and habitat creation are express goals. The toolkit will allow end-users to identify and describe impacts of the structures on the study area; the viability of coastal wetland habitat in the lee of structures; expected ecological benefits of the structures; and the socioeconomic impacts of the living shoreline project. Anticipated benefits to society include functional, more resilient, and more impactful living shorelines, with an ultimate goal of providing the framework for an alternative to bulkheads, seawalls and revetments which eliminate or impair intertidal habitat.

BAYS & BAYOUS

SYMPOSIUM 2012

Living Estuarine Resources

Session

Outreach, extension and research activities related to derelict blue crab traps in Louisiana

Living Estuarine Resources
Oral Presentation
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The blue crab (*Callinectes sapidus*) is an economically important species in south Louisiana where landings surpass 20 thousand metric tons annually. Whereas commercial fishermen have benefited from recent advances in harvest technology, the bays and bayous of the Gulf of Mexico ecosystem have experienced increases in crab trap-associated debris (Figure 1). Crab traps become derelict due to vandalism, severing of buoy lines, inclement weather and improper disposal of retired traps. Derelict crab traps and other lost fishing gears have the potential to negatively impact the ecosystem because they continue to recruit crabs, fish, and other wildlife. Subsequently, the traps contribute to increased fishing mortality and by-catch through a process known as ghost fishing. Another challenge is that derelict traps can only be removed by the owner or during state approved fishery closures; periodic, voluntary removal is infrequent and increases resident times of derelict traps in the ecosystem.

Figure 1. A derelict trap removed during a rodeo.

In partnership with the Louisiana Department of Wildlife and Fisheries, we organized the first annual Derelict Crab Trap Rodeo that was held on three weekends in late winter 2012. Although annual crab trap removal events have occurred in the past, the model for the rodeo included a festival-like atmosphere that included free food, door prizes and citizen scientist activities that engaged volunteers in data collection. During the rodeos that were held in Plaquemines, St. Bernard and Terrebonne Parishes, we removed 2,708 derelict traps and enlisted the help of 304 volunteers and 65 watercraft. Our citizen scientists sampled a portion of these traps and found that 75 percent of derelict traps were still fishable, and 30 percent contained live crab. In addition to the rodeos, we created a lost trap reporting website that allowed fishermen to easily report lost traps anonymously. After Hurricane Isaac in August 2012, nearly 1,500 traps were reported lost to the database. Educational materials were created and displayed at regional environmental fairs and festivals to encouraging children to explore the effects of litter and debris on marine life. We are currently developing promotional material to educate recreational fishermen and other resource users on the prevention of crab trap loss. As a research component, we began a field study in September 2012 that will evaluate blue crab mortality associated with ghost fishing using a combination of monthly visits to experimental derelict traps and mark-recapture techniques. Our goal is to reduce the effects of ghost fishing in the Gulf of Mexico by engaging the public with science-based evidence.

Estuaries 101: An online resource for all your estuary education needs!

Water Quality and Quantity, Living Estuarine Resources, or Climate and Hazard Resilience
Oral Presentation

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Jennifer Buchanan is a coastal ecologist working as the Education Coordinator for the Grand Bay NERR in Moss Point, Miss. She received both her undergraduate and graduate degrees in Biology from the University of Southern Mississippi and has worked almost exclusively for the MDMR since 1984.

Margaret Sedlecky has served as the Education Coordinator at Weeks Bay NERR in Fairhope, Ala for the past 17 years. She is an employee of Baldwin County Board of Education and has 27 years of teaching experience in environmental science.

How many times have you wished you had ready-to-use, estuary educational resources to help you translate research on estuarine issues to your audiences? NOAA's National Estuarine Research Reserve System has been developing Estuary Education, www.estuaries.noaa.gov , for just such a purpose over the last few years. The most recent addition to this website is a curriculum for middle school teachers from around the world to use with their students that the State of Alabama recently funded. In addition to the new middle school curriculum, a high school curriculum, informational videos, visualizations and archived estuary field trips can also be found on the site.

Although originally designed for educators, an unexpected benefit of this project has been the development of selected videos and visualizations relating to estuaries that are useful by all speakers for all audiences from K through gray! There are many short videos and animations that can be easily placed in a PowerPoint presentation to reinforce your message.

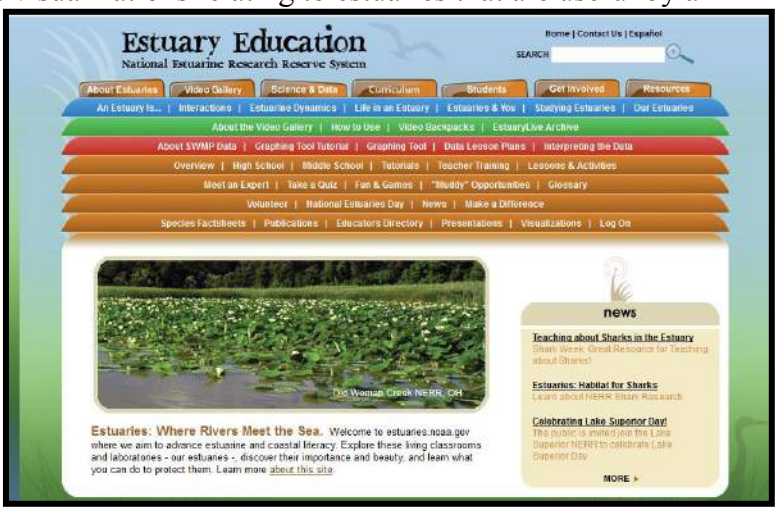

Figure 1. A screen shot of Estuary Education website

An especially useful component of this website is the educational portal to our near real-time weather and water quality data that is collected from all the NERRs around the country. The health of every reserve is continuously monitored by the NERRS System-wide

Monitoring Program or SWMP (pronounced “swamp”). SWMP measures changes in estuarine waters to record how human activities and natural events affect coastal habitats. Scientific instruments that are located at over 100 reserve data stations collect information in different estuaries across the country. Each monitoring station collects data on a variety of factors. Educators and researchers can access a tutorial to learn how to create and interpret graphs with their audiences.

Linking hypoxia and organic enrichment to macrobenthic process indicators using the Peters Mass Balance Model: Calibration via laboratory experiments

Living Estuarine Resources
Oral Presentation
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Miss Burns is currently a Ph.D. student at the USM Gulf Coast Research Laboratory, where she is studying with Dr. Chet Rakocinski. She received her undergraduate degree in marine biology at James Cook University in Australia and went on to intern in Bonaire, Netherland Antilles, for the Council of International Educational Exchange Laboratory.

Body size is a fundamental ecological trait that underpins critical vital rates, including oxygen consumption and feeding rates. Body-size dependent processes provide one means to link environmental stress to changes in metabolic activity on the individual level, which may in turn scale up to changes in the distribution of biomass among discrete size classes. Thus, size-based macrobenthic indicators can be linked to ecosystem function and health. Formerly, Rakocinski adapted the Peters Mass Balance Model (PMBM) to simulate effects of oxygen limitation on macrobenthic biomass-size distributions through inferred effects on ingestion rates. However, this adaptation of the PMBM was predicated on several provisional assumptions gleaned from the literature or derived from apparent mechanistic links that still require experimental confirmation:

1. Oxygen consumption rate (OCR) increases hyperbolically with ambient dissolved oxygen (DO) concentration as $OCR = (a+b/DO)^{-1}$, where $OCR_{max} = 1/a$;
2. Given unlimited food availability, the ingestion rate will be constrained by oxygen limitation through a direct proportional relationship between OCR and metabolic capacity, wherein realized ingestion rate $\approx OCR/OCR_{max}$;
3. Given that small organisms attain higher mass-specific rates of oxygen consumption than large organisms, large organisms should regulate oxygen intake better than small individuals as ambient DO declines;
4. Given that the ratio of the OCR curve parameters (b/a) conveys the capacity for metabolic regulation, an allometric scaling rule was adopted wherein the slope of the log body mass vs. b/a relationship was -0.285 (i.e., intermediate between 3⁄4 and 2/3 scaling rules).

The need to confirm or revise the nature of these premises, as well as to parameterize and extend them, provides much of the justification for this study. Calibration experiments will test the overarching hypothesis that gradients in food and oxygen supply drive macrobenthic community structure and function through opposing effects of oxygen versus food limitation as mediated by body size related constraints. Experimentation will be broken down into five parts: 1) oxygen consumption, 2) DO tolerance, 3) starvation effects, 4) feeding and 5) growth. Calibration of a fully developed Hypoxia Mass Balance Model (HMBM) will need to incorporate findings from laboratory experiments as well as from the literature, followed by sensitivity analyses to evaluate

the effects of uncertain parameters. The development of a realistic HMBM should incorporate effects of DO as well as effects of other mediating factors, such as food quality, food quantity and water temperature. In order to eventually serve as a management tool for understanding changes in macrobenthic condition and implications relative to the benthic subsystem, a complete HMBM should include various metabolic and behavioral costs and benefits in energetic terms.

Summer of the Kemp's ridley: The IMMS' response to the high number of incidental captures at Mississippi fishing piers

Living Estuarine Resources
Oral Presentation

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Andrew T. Coleman is the senior research scientist leading the Marine Turtle Research Program at the Institute for Marine Mammal Studies. He received his Ph.D. research in biology from the University of Alabama at Birmingham and the National Sea Grant College Program Dean John A. Knauss Marine Policy Fellowship.

Abnormally high numbers of sea turtles, particularly immature Kemp's ridley (*Lepidochelys kempii*) sea turtles, were incidentally captured by recreational fishermen at fishing piers in the three coastal counties of Mississippi. Almost 200 captures were reported in 2012, whereas approximately 30-40 captures were reported in both 2010 and 2011. The turtles were transported to the Institute for Marine Mammal Studies where they received care and rehabilitation. Straight-line carapace lengths ranged from approximately 21 cm to 48 cm. Turtles were grouped by capture date and pier to examine temporal and location trends. Additionally, hook sizes and types were measured and analyzed for any potential influences on incidental captures. Feces were passively collected from rehabbed turtles for the first 10 days to examine local dietary preferences. Several of the turtles were fitted with satellite transmitters, and the observed movements will be discussed. The north central Gulf of Mexico has been previously identified as an important developmental habitat for the Kemp's ridley sea turtle; however, this region has been historically understudied. The need for better understanding this critically endangered species' abundance is further underscored because it has been recently experiencing a population recovery due to conservation efforts on nesting beaches, foraging grounds, and migratory corridors. The substantial increase in incidental captures in 2012 could be due to a number of factors including increased awareness and population recovery. However, the possibility of degraded natural habitat driving the turtles into close proximity to the fishing piers cannot be discounted and needs to be further explored.

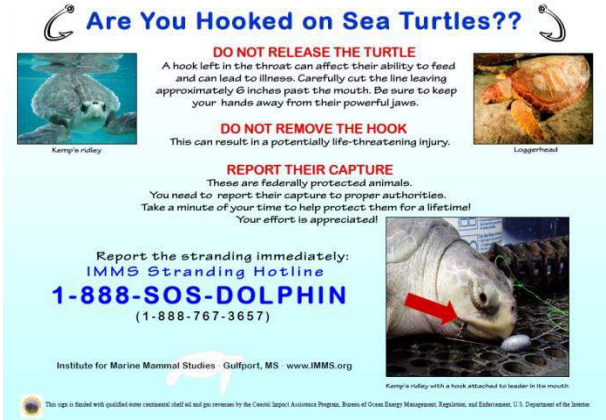

Figure 1. Sign placed at local fishing piers to inform fishermen about what to do with hooked turtles.

Calibrating a Biological Condition Gradient model to the Mobile Bay Estuary

Living Estuarine Resources
Oral Presentation

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A marine scientist at Dauphin Island Sea Lab, Mike Dardeau is the author of several characterizations of the living resources of coastal Alabama. He is co-chair of the Mobile Bay National Estuary Program Science Advisory Committee and a member of the Weeks Bay National Estuarine Research Reserve Advisory Committee.

The Mobile Bay National Estuary Program (MBNEP) is identifying environmental indicators to gauge progress toward the objectives established in the MBNEP Comprehensive Conservation and Management Plan. The MBNEP will calibrate a Biological Condition Gradient (BCG) model to the Mobile estuary to provide a means of measurement of the status and trends of environmental quality, and inform restoration and protection goals. The BCG is a tiered system of aquatic life use designation along a gradient that describes how biological attributes change in response to increasing levels of human disturbance. The ecological state of BCG attributes is divided into tiers or levels of condition, ranging from a natural condition to severe changes in the structure of the biotic community and major loss of ecosystem function. For estuarine BCG, attributes such as ecosystem function and habitat connectivity have potential to be applied at watershed and whole estuary scales. The BCG framework is being calibrated to measure the sufficiency of ecosystem services to ensure ecological sustainability and resiliency in coastal Alabama. MBNEP science committee members and other experts individually evaluated the vulnerability of various ecosystem services to a suite of anthropogenic stressors in the study area. The evaluation matrix included 12 ecosystem services, 12 priority habitats, and 13 stressors. The scientists rated on a scale of 0 (no impact) through 3 (high impact) the present-day level of impact in the study area that each stressor has on each ecosystem service. Evaluators were asked to leave blank any combination of stressor, ecosystem service, or habitat that was outside of their expertise. Based on the aggregate scores, the ecosystem services under most stress are biodiversity, wildlife habitat, water quality, and primary production. **The habitats with the greatest amount of stress on ecosystem services are freshwater wetlands, intertidal marshes and flats, streams and rivers, and riparian buffers.** Stressors having the most impact are land use change, habitat fragmentation, dredging and filling, and sedimentation. Existing biological and physical environmental data for ecosystem services, habitats, and stressors are being examined to determine their adequacy for application to the BCG. A range of biological values will be identified for each ecosystem service or habitat metric to correspond to BCG condition tiers. Biological potential will be expressed by both quantitative and qualitative measures. A five-year environmental monitoring program will be conducted to measure spatial and temporal change in the BCG attributes for the identified metrics, and to empirically validate the BCG framework. Long-term monitoring will be used to identify problem areas and formulate restoration approaches to enhance ecosystem function and habitat quality.

Off-bottom oyster farming: Creating entrepreneurial opportunities in rural Gulf communities

Living Estuarine Resources
Poster Presentation

Julie E. Davis*[1], William C. Walton[1], Glen Chaplin[1], F. Scott Rikard[1], D. LaDon Swann[2] and Terry Hanson[3]
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Julie Davis is a master's student at the Auburn University Shellfish Laboratory on Dauphin Island, AL. Her research focuses on optimizing production and product quality using the adjustable long-line system for oyster grow-out.

Off bottom oyster farming provides an opportunity for rural Gulf of Mexico citizens to earn a sustainable income from an activity which is both culturally in tune with the community and environmentally friendly. The northern Gulf of Mexico is one of the nation's largest producers of oysters. The majority of oysters are harvested from on-bottom leases that are susceptible to natural, and sometimes unpredictable, environmental changes. Off-bottom oyster farming (growing single set oysters in containers raised off of the substrate) allows the farmer greater control over what their lease will yield at the end of the day. This allows the farmer to rely on the income from the farm and build a business plan based on its output. This in turn helps build resilient communities that are better equipped to respond to natural or man-made fluctuations. In addition to the economic benefits of oyster farming, oysters provide several ecological services such as improving water clarity and providing nursery habitat for estuarine species.

Oyster research at the Point-aux-Pins Oyster Farm, Grand Bay, AL

Off bottom oyster farming will allow the Gulf oyster industry to diversify. Currently, the majority of oysters harvested in the Gulf are processed for the shucked meat market. An off bottom farmed oyster is destined for the premium half-shell market, a market where the Gulf is not represented at the same caliber as other oyster farming areas in the nation. Based on initial sales from Alabama, farmed Gulf oysters can fetch up to $0.50/pc and cost approximately $0.20/pc to produce, excluding permit and management costs. Market research indicates there are strong regional and national markets for a premium half shell Gulf oyster.

We will present a synopsis of research and extension efforts to develop off-bottom oyster farming in the Gulf and how the results of these studies can be used to create an oyster industry that is environmentally, culturally and economically sustainable.

Colonial nesting birds of Mobile Bay and Mississippi Sound area

Living Estuarine Resources
Oral Presentation
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Dr. John Dindo is the associate director of the Dauphin Island Sea lab and has been studying colonial nesting birds in coastal Alabama and Mississippi Sound for over 30 years. Roger Clay is a coastal biologist and has worked along the coast for 20 years.

Mobile Bay and coastal Alabama has a rich diversity of birds throughout the year. Colonial nesting birds can be found from the Mobile delta to Isle aux Herb (Coffee Island) in Mississippi Sound. Cat Island, located 2.5 miles off the mouth of West Fowl river support the oldest recorded nesting colony of herons and egrets in coastal Alabama. These birds have been utilizing this island for almost a hundred years. Following hurricane Ivan in 2004, the Cat Island colony expanded west to Coffee Island establishing a few nests but have expanded to over 60 nesting pairs of herons and egrets. Cat Island has been reduced to a third the size it was in the 1980s due to hurricanes and is a prime location for restoration in the future. In March of 2012, Brown pelicans were identified establishing nests on Cat Island, and this may pose a threat to the herons and egrets that nest currently nest there. Although very difficult to find, there are numerous heron and egret colonies in the Mobile Tensaw Delta.

Figure 1. Cat Island, Alabama

Brown pelicans, seen rarely along the Alabama coast in the 1970s and early 80s, established four nests on Gaillard Island in 1983. Gaillard Island is a Corps of Engineers, spoil island and the 2012 nesting census of Brown pelicans was estimated to be over 11,000 breeding adults. The first ever pelican tracking research project for birds on Gaillard Island was initiated during the 2012 nesting season. In addition to pelicans, this island supports a large colony of Laughing gulls, Royal terns, Caspian terns, Sandwich terns and a mixed heron and egret colony.

It is theorized that the majority of all food resources that support these colonial nesters comes from Mobile Bay and Mississippi Sound. Colonial nesting colonies have long been sentinels for water quality within an ecosystem, and it is believed this holds true for this area. The Gaillard Island Brown pelican population and the Cat Island colony of heron, egrets and now pelicans support this hypothesis of healthy ecosystem. Future restoration of Cat Island and Isle aux Herbs (Coffee Island) will enhance the return of large breeding populations of herons and egrets to these islands.

Are tiger sharks a seasonal conduit of terrestrial energy into marine foodwebs?

Living Estuarine Resources
Oral Presentation

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J. Marcus Drymon is a post-doctoral researcher at the Dauphin Island Sea Lab. His interests are in the trophic ecology and foodweb dynamics of upper trophic level predators, particularly coastal sharks. He holds a Ph.D. in marine science from the University of South Alabama.

As apex predators, some shark species have the potential to couple energy pathways from disparate foodwebs. This is particularly true of tiger sharks, highly migratory fish known for the breadth of items they consume. In addition to foraging on invertebrates, bony and cartilaginous fishes, sea snakes, marine mammals and seabirds, tiger sharks are known to consume terrestrial birds. While accounts of this predator-prey interaction date back over half a century, we know little about the pervasiveness of this phenomenon within a population, or of the potential contribution terrestrial birds make to the diet of tiger sharks. We investigated the extent to which individual tiger sharks are dietary generalists or specialists using a combination of stomach content and stable isotope analyses. Tiger sharks were sampled during routine, standardized bottom longline surveys of the coast of Alabama from 2009-2011. From fall 2010 to fall 2011, stomachs (n=48) and muscle tissue (n=52) were collected. Gut contents were identified to the lowest possible taxon, and avian remains (primarily feathers, Figure 1) were genetically identified. Indices of specialization were calculated using IndSpec. Using this combination of techniques, in concert with time series data from a standardized coastal bird survey, we combine datasets across marine and terrestrial ecosystems to evaluate the frequency of specialized feeding behavior in a known generalist shark. While tiger shark populations consume a notoriously wide range of items, identifying the extent that trophic strategy varies among individuals is increasingly important in the face of management measures that may impact only portions of the population (e.g. the recent harvest ban in Florida).

Figure 1: Feathers taken from the stomach of a tiger shark.

Impacts of seagrass cover in shallow coastal embayments on the abundance and biomass of macroinvertebrate and finfish populations

Living Estuarine Resources
Oral Presentation
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Rachel is a master's student at the Dauphin Island Sea Lab working in the Ecosystems Lab. She is originally from Bolivar, Mo., and received her undergraduate degree from Samford University in marine biology. Her interests and work to date have focused in ecosystem conservation in coastal embayments.

Shallow coastal embayments with seagrass beds provide a rich, complex habitat for resident, transient and juvenile macroinvertebrates, smaller epifauna and infauna, and finfish. Many juveniles of economically important fishery species preferentially recruit to seagrass beds. However, a recent estimate showed that nearly 50 percent of the Gulf of Mexico (GOM) estuaries are chemically impaired, and that major losses have occurred in most seagrass meadows. To quantify the impact of seagrass decline on coastal fisheries production in the GOM, we are studying six coastal embayments in northwest Florida that range widely in seagrass cover (0-80 percent). We are quantifying macroinvertebrate and finfish abundance, diversity and biomass seasonally through seine and suction samples in all six lagoons.

Results to date suggest that overall fish and macroinvertebrate abundance were not correlated with seagrass cover, suggesting that the effects of seagrass loss on macroinvertebrate and finfish in shallow coastal lagoons may be disparate, with some species showing reduced abundance but not others. Biomass results, which use AFDW as a proxy for secondary production, follow similar trends to finfish and macroinvertebrate abundance data and are not directly correlated to seagrass cover. Further analysis of abundance and secondary production estimates will investigate the importance of habitat heterogeneity within an embayment as well as species-specific habitat recruitment.

Trawling for answers and reeling in classroom teachers: The essentials of fisheries management in a K-12 classroom

Living Estuarine Resources
Oral presentation

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With concerns of fisheries stocks declining in many areas, apex ocean predators all but gone, the Magnuson-Stevens Act coming under fire at the local level, and governments around the world looking to expand seafood harvests, the time to bring knowledge of fisheries and fisheries management into the K-12 classroom is now. The Dauphin Island Sea Lab's Education and Outreach group, Discovery Hall Programs, has developed an educational and rigorous week-long funded professional development opportunity for teachers, Fins, Fishes & Fisheries (FFF). This workshop, funded by Mississippi Alabama Sea Grant Consortium (MASGC) and offered free of charge, directly addresses the National Sea Grant Focus Area of *Safe and Sustainable Seafood*. It includes an intense field component and delivers fisheries content while in the classroom relevant to K-12 Science Standards and Ocean Literacy Principles. The workshop immerses the teachers in various fishing methods and aquaculture while in the field. Back in the classroom, topics such as fish stocks, sustainability, life history and age/growth studies are covered in lectures and hand-on activities.

The main objectives of the FFF workshop are to 1) immerse the teachers in a variety of commercial fishing techniques including controversial ones such as rod and reel, longlining, gillnetting, trawling, and various by-catch reduction devices; 2) introduce alternatives to wild harvest including aquaculture focusing on current efforts in Mississippi and Alabama; 3) discuss rules and regulations of fisheries management at the state and federal level; 4) deliver current research in the field of fisheries science including age and growth, larval fish life history, and telemetry; and 5) explore numerous related classroom activities that can be adapted to specific teaching situations.

Figure 1: Teachers pulling in a gillnet

Highlights in the field have included catching several large great hammerhead sharks and implanting an acoustic monitoring tag in an adult bonnethead shark. In-service teachers also enjoy taking back a specimen collection of important Gulf of Mexico organisms. The class has visited and toured Claude Peteet Mariculture Center (Gulf Shores, Ala.), the Auburn Shellfish Lab (Dauphin Island, Ala.), R.A. Lesso Seafood (Biloxi, Miss.) and the Thad Cochran Marine Aquaculture Center (Ocean Springs, Miss.).

More than 50 participants have attended the FFF workshop over three summers. The teachers come primarily from Alabama and Mississippi, but also Florida, Georgia, Tennessee and Virginia. Attendees include online community college instructors, pre-service teachers, and experienced K-12 teachers at all grade levels. Assessments have indicated a significant content knowledge gain in all three years ($n=54$, $p<0.05$), and evaluations indicate that all attendees feel the workshop was valuable or very valuable.

Short-term movements and habitat use of phase II hatchery released striped bass, *Morone saxatilis,* in the Biloxi River, Miss.

Living Estuarine Resources
Oral presentation

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Striped bass, *Morone saxatilis*, were once abundant in northern Gulf of Mexico (nGoM) coastal drainages from Lake Pontchartrain, La., to the Suwannee River, Fla. However, during the 1950s and 1960s, extensive habitat alterations depleted populations so severely that by the 1970s striped bass were considered to be extirpated from all Gulf drainages except for a remnant population in the Apalachicola Drainage in Florida. As a result, stock enhancement activities began during the late 1960s in an effort to restore and maintain self-sustaining striped bass populations in coastal rivers along their native nGoM range. With such a significant investment, understanding the life history and movements of hatchery released fish is crucial for establishing self-sustaining populations and reducing stocking costs. A telemetry experiment was undertaken to describe initial acclimation behavior of hatchery reared phase II striped bass (120 – 225 mm TL) upon release into a riverine environment with relation to river physiochemical conditions. Ten phase II striped bass were acoustically tagged, released into the Biloxi River and manually tracked with acoustic hydrophones at one, four and 32 days after release. Up and downstream movements from the release site were detected with no trends favoring tide or flow. Physiochemical characteristics compared within Principal Components Analysis (PCA), along with Akaike's Information Criterion (AICc), suggested depth and bottom salinity were the most influential physiochemical components driving presence of striped bass. These findings suggest that release locations in areas adjacent or near deep habitats (2.1 – 7.3 m) with higher than mean salinity values (10.8 – 13.9 psu) may favor survival during acclimation to natural coastal systems. Understanding the habitat and physiochemical requirements of released striped bass can increase acclimation survival and provide more successful hatchery inputs within nGoM coastal rivers.

Evaluating the performance of vertical longlines to survey reef fish populations in the northern Gulf of Mexico

Living Estuarine Resources
Oral Presentation

Kevan Gregalis[1]*, Lela Schlenker[1,2], J. Marcus Drymon[1], John Mareska[3] and Sean Powers[1,4]
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Kevan Gregalis is a research assistant for the Dauphin Island Sea Lab. His research interests include fisheries management and conservation. He has a master's degree in fisheries ecology from the University of South Alabama.

A common critique of many stock assessments is the lack of fishery-independent abundance indices and age composition data. Such data streams are essential in evaluating population trajectories that are derived largely from harvest and age composition of landings. For example, high scientific uncertainty in the most recent stock assessment of Gulf of Mexico red snapper *Lutjanus campechanus* resulted from a conflict between trends in fishery-dependent and fishery-independent data. Because sample sizes for the latter data were an order of magnitude lower, resolution of the conflicting trends was even more problematic. Recognizing the need for cost-effective expansion of fishery-independent data in the region, we evaluated the performance of vertical longline surveys for sampling reef fish within a large artificial reef zone in the northern Gulf of Mexico. Specifically, we (1) determined species composition and the length frequency of red snapper (the dominant species captured) as a function of hook size and bait type within our survey area during 2010; (2) evaluated the effect of different soak times on catch for various hook types (a combination of hook size and bait type); and (3) utilized our results to test the effect of artificial reef type on red snapper CPUE and mean size. During March-November 2010, we conducted 532 vertical longline sets, capturing 1,217 red snapper that ranged from 184 to 827 mm FL. Mean FL of red snapper differed among hook sizes, with 3/0 and 8/0 hooks sampling smaller fish than 11/0 hooks. Soak time trials revealed a significant effect of soak time on CPUE, with peak catch rates observed at 5 min. As habitat area increased, the mean size and CPUE of red snapper increased. We conclude that our vertical longline is an effective gear for sampling red snapper, and we recommend protocols to maximize its utility and standardize its use.

Coastal bioengineering with eastern oyster *Crassostrea virginica* for shoreline protection and habitat enhancement

Living Estuarine Resources
Oral Presentation

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Steven G. Hall, Ph.D., P.E., is associate professor and graduate coordinator in Biological and Agricultural Engineering at the LSU AgCenter, Baton Rouge, La. He focuses on efficient use of resources including coastal bioengineering and ecological approaches to environmental and aquacultural challenges. He is past president of the Aquacultural Engineering Society.

The Gulf of Mexico provides excellent habitat for many species including the eastern oyster, *Crassostrea virginica*. However, Louisiana, like many coastal areas, is losing land, with an estimated 1,800 square miles of land loss in the last 80 years. This extensive land loss can be attributed to three main causes: subsidence (slow compaction of soil particles), erosion and sea-level rise. This project aimed at maximizing biological growth to protect the shoreline and continue to grow to the new relative surface level, providing habitat for juvenile fish and other species.

Coastal engineering has traditionally focused largely on hard structures such as groins, jetties and seawalls. Biological engineers aim to integrate biology into engineering design to enhance function and maximize sustainability. This coastal bioengineering team has designed these reefs which are currently being used as breakwater devices in some locations on Louisiana coast. As oysters (*Crassostrea virginica*) begin to grow on these reefs, their strength can increase by a factor of 10, providing a long lasting and biologically dominated artificial reef structure. The engineered reefs are made of porous cement with biological additives, which allows water to flow through, causing more energy dissipation and sediment deposition. As sediment continues to deposit, growth of coastal plants, such as *Spartina alterniflora* can help to maintain the structure of this new land. In a working coast, growing structures that serve economic and

Figure 1. Coastal bioengineering enhances growth of eastern oysters *Crassostrea virginica*, and plants such as *Spartina alterniflora* and others.

pragmatic functions can also provide critical habitat and coastal protection. Enhancing living resources including shellfish, plants and fish, as well as enhancing sustainability of the ecology can improve long-term sustainability of the coastal environment.

Estimating release mortality in the Gulf of Mexico greater amberjack (*Seriola dumerili*) stock with acoustic telemetry

Living Estuarine Resources
Poster Presentation

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Jay Jackson is a research technician in the Fisheries Ecology Lab at the Dauphin Island Sea Lab. His interests include ecology of reef fishes and large pelagic fishes. He holds a bachelor's degree in biology from the University of South Alabama.

Release mortality estimates are vital to the assessment of marine fish stocks. However, due to a lack of latent release mortality data, this information is not available to management officials for a number of recreationally and commercially important fish stocks. The Gulf of Mexico greater amberjack (*Seriola dumerili*) stock, which has been designated as being overfished and undergoing overfishing, is one such stock that is missing an estimate of release mortality; therefore, fishery specific release mortality information is required for future assessment as outlined in SEDAR09. Currently, a release mortality rate of 20 percent is assumed for the assessment of this stock. We used acoustic telemetry to assess release mortality of greater amberjack in the northern Gulf of Mexico and to determine if the rate assumed by management officials is accurate. We deployed 26 ultrasonic tags across two size classes of fish, legal (>30 in. FL, n=16) and sublegal (<30 in. FL, n=10). These tags were distributed evenly across two tagging sites. At each site, we deployed a temporary acoustic array consisting of four LOTEK WHS 3050 acoustic hydrophones. The hydrophone arrays were deployed for datalogging in 48 hour intervals during three tagging cruises. Our detection data suggests similar release mortality rates between the two size classes of fish and across site depths. Our estimation for release mortality ranged from 20 percent to 50 percent between the three tagging trips in this preliminary study. In year two of this study, we will deploy permanent acoustic arrays for continuous datalogging, and we will collect data under warm and cool water conditions for a comparison of release mortality rates between seasons.

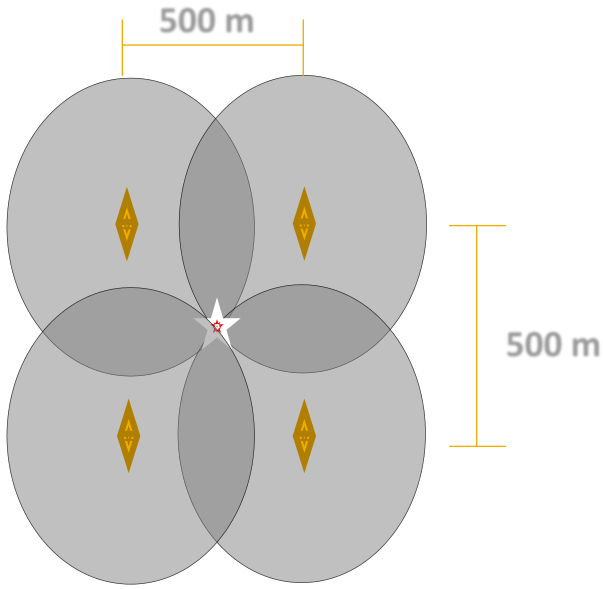

Figure 1. A diagram illustrating our acoustic array design.

The use of charismatic megafauna to engage citizen scientists: A successful integration of outreach into research

Living Estuarine Resources
Oral Presentation

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Elizabeth Jones is the educational programs manager at the University of Southern Mississippi's Marine Education Center. Her interests are marine education and public outreach, with a particular emphasis on secondary students. She holds a master's degree in marine biology from the College of Charleston and a Mississippi teaching certificate with endorsements in biology and elementary education.

The Marine Education Center (MEC) is the outreach and education arm of the University of Southern Mississippi's Gulf Coast Research Laboratory (GCRL). As such, we endeavor to partner with GCRL scientists to highlight the research conducted on campus, and utilize this information to connect the local citizenry to coastal sciences.

The MEC offers three public outreach programs that employ a partnership with the GCRL Shark Biology Lab to educate citizens about sustainable fisheries, habitat conservation, local biodiversity and coastal ecology. Each program is staffed by personnel from both entities, and includes an interactive background presentation followed by the immersion of participants into activities such as trawling, rod and reel fishing, water quality sampling, coastline exploring and specimen dissecting. Participants have the opportunity to aid the researchers in measuring, weighing, and tagging all shark specimens encountered prior to release. The data collected on these trips is then incorporated into the GCRL Shark Biology Lab's existing dataset.

Fig. 1: Jill Hendon assists in tag and release of specimen

This use of charismatic megafauna (sharks) as a vehicle for capturing citizen interest in coastal sciences has proven successful. In 2011 and 2012 all shark programs offered to the public filled to capacity. Additionally, data from pre and post assessments indicate that participants have mastered the identified learning objectives, and ultimately have a better understanding of the importance and implications of the research they assisted in. The MEC plans to use the approach developed in these programs as a general model for collaborating with researchers. It is hoped that the incorporation of similar outreach components into future funding proposals will broaden the overall impacts of the project and increase the competitiveness of the proposals.

Landscape factors affecting density of Clapper Rails and Seaside Sparrows in the Grand Bay National Estuarine Research Reserve

Living Estuarine Resources
Poster Presentation

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Ali Leggett is a coastal resource manager with the Mississippi Department of Marine Resources Coastal Preserves Program and a master's student at the University of Georgia College of Forestry and Natural Resources. Ali's research interests include coastal and estuarine ecology and the application of research to guide ecosystem management and decision making.

Tidal salt marshes are highly productive ecosystems and are important both ecologically and economically. Since it is often difficult to monitor the overall health of an entire ecosystem, managers and researchers may rely on one or a suite of indicator species as proxies for ecosystem health. Protecting and restoring appropriate habitat for these species is contingent upon understanding the habitat features they utilize. The objective of this analysis was to create a density model for each of two species, Clapper Rails (*Rallus longirostris*) and Seaside Sparrows (*Ammodramus maritimus*) that have been proposed as "indicator species" in the tidal marsh system of the Grand Bay National Estuarine Research Reserve, Jackson County, Mississippi. During 2010-2012, we conducted point count surveys to assess the influence of various landscape metrics on densities of Clapper Rails and Seaside Sparrows at random sampling locations within the estuarine boundary. Candidate models were based on a priori hypotheses determined by observed species distribution and known life history requirements. The results for Seaside Sparrows suggest an influence of predator abundance and elevation, both of which may be related to the chance of nest success. Clapper Rail results indicate that there is no clear driver behind Clapper Rail density, suggesting that they may have more general habitat requirements than Seaside Sparrows. Future analyses may want to consider variables that vary annually or consider patterns of density at a larger scale.

Examining current mercury concentrations in northern Gulf of Mexico red drum

Living Estuarine Resources
Oral Presentation

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Crystal LouAllen Hightower is a M.S. graduate student at the University of South Alabama in Dr. Sean Powers' Fisheries Ecology Lab at the Dauphin Island Sea Lab. Her interests include fish population ecology, age and growth of fishes using otoliths, marine ecotoxicology and conservation and management of marine resources. She holds a bachelor's degree in marine biology from the University of North Alabama.

Mercury (Hg) is a toxic metal that bioaccumulates in tissues of long-lived fishes and can pose health risks to humans when consumed in large quantities. While the accumulation of Hg in marine fishes in the Gulf of Mexico (GOM) has been established, Hg levels above the United States Food and Drug Administration (FDA) action limit (1.0 ppm) have only recently been reported for red drum (*Sciaenops ocellatus*). Red drum are likely candidates for bioaccumulation of Hg since they spend their early years in estuaries, forage in the benthos, are long-lived, and grow to large sizes. Recent studies of Hg concentrations were conducted in Florida and Texas and showed that larger size classes of red drum accumulated Hg to levels above that of the acceptable limits; however, Hg levels for large red drum are lacking from the central region of the GOM. Currently, four out of the five Gulf States allow anglers to keep oversized red drum. The allowable catch limits for all Gulf States except Florida present the possibility of human consumption of high total Hg concentrated red drum. Understanding concentrations of Hg in GOM red drum is essential in order to reduce the possibility of Hg contamination due to consumption of contaminated fish. This ongoing study will also bring to light the importance of consistent management of this species across the Gulf States.

Figure 1. Large red drum sampled for Hg concentration at the Alabama Deep Sea Fishing Rodeo

Assemblage-level metrics of trophic structure in fragmented salt marsh habitats based on stable isotope analyses

Living Estuarine Resources
Oral Presentation

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Michael Low is a doctoral candidate in the Department of Coastal Sciences at the University of Southern Mississippi. He received his master's degree in fisheries from Auburn University and his bachelor's in marine fisheries from Texas A & M University. His research interests are broadly focused on aquatic ecosystem function with specific emphasis on the ecology of freshwater and marine fish and invertebrates.

The northern Gulf of Mexico, particularly coastal Mississippi, is undergoing rapid urbanization that may impact the habitat value of salt marsh ecosystems for many fish and decapod crustaceans (i.e., nekton). As coastal landscape become increasingly urbanized, salt marsh patches become progressively smaller and inter-patch distance increases (i.e., fragmentation) to the point that they may be less suitable for the maintenance and regulation of nekton populations, thus potentially reducing ecosystem services. Using a landscape ecology approach to quantify the impacts of human induced changes on salt marsh habitat composition and configuration in both the Pascagoula River and Biloxi Bay estuaries, previous work on this project documented differences in 1) nekton assemblages driven by greater catch-per-unit-effort of ecologically (grass shrimp and Gulf killifish) and economically (brown shrimp and Gulf menhaden) important nekton in unaltered salt marsh patches, 2) macroinfaunal assemblages driven by the density of stress-tolerant and stress-sensitive species in altered salt marsh patches, and 3) differences in diet composition and reduced growth for both Gulf killifish and spot. In this presentation, we explore the results of isotopic analyses (carbon, nitrogen and sulfur) of benthic microalgae (BMA), particulate organic matter (POM), emergent plants (C3 and C4), macroinfaunal feeding guilds (surface deposit feeding annelid worms, suspension feeding amphipods and surface deposit feeding chironomids) and nekton (Gulf killifish, juvenile spot, juvenile southern flounder, grass shrimp, juvenile brown shrimp and blue crab). A Bayesian stable isotope mixing model is used to quantify the contribution of primary producers and potential prey items to the isotopic signatures of upper level consumers and examine differences in energetic pathways in salt marsh patches with different levels of fragmentation and landscape alteration. Initial examination suggests that trophic pathways are altered in completely fragmented salt marshes relative to partially fragmented and intact natural salt marsh patches.

Recovery of barrier island plant communities and associated changes in habitat on Horn Island, Miss., following Hurricane Katrina

Living Estuarine Resources
Oral Presentation

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Kelly Lucas is deputy director of the Gulf Coast Geospatial Center, The University of Southern Mississippi. Her research utilizes passive and active remote sensing science and technology in conjunction with in situ data to address topics of importance to the ecology and economy of the Northern Gulf of Mexico.

Over temporal scales ranging from hours to decades, barrier islands are shaped and maintained by their response to wind, waves, current, sediment supply, coastal subsidence, sea-level rise and tropical storms. In the northern Gulf of Mexico, the most sudden geomorphological, hydrological, and biological alterations to barrier islands occur in response to hurricanes. Extreme storm winds and tidal surge can significantly redistribute sediments resulting in erosion, deposition and compaction. Vegetation is not only affected by storm impacts such as burial under sand and direct removal by erosion, but also by wind-driven salt spray and flooding by saltwater tidal surge. The recovery of the island environment is facilitated by the available sediment, wind and vegetation. This study utilized field surveys in conjunction with remotely-sensed data to evaluate changes in plant species composition and sediment distribution on Horn Island, Miss., USA, in the initial 5 years after Hurricane Katrina. Horn Island is under the jurisdiction of the Gulf Islands National Seashore, U.S. National Park Service and is designated as a Wilderness Area in the National Wilderness Preservation System. The policies associated with the Wilderness Preservation System allow natural processes to proceed without human intervention. This hands-off approach affords a great opportunity to study island recovery following storms and potentially provide information for successful restoration procedures on developed barrier islands.

Changes in vegetation composition were ongoing after one full growing season (2007), and the majority of alterations in vegetation composition were observed between the 2007 and 2010 field surveys. Habitat change was most often associated with an adjustment to higher-elevation plant communities at the expense of wetlands. In addition, substantial tree and shrub mortality as a result of wind, storm surge, salt-spray and saltwater flooding reduced maritime forest and stable dune habitat thus decreasing ecosystem maturity. Recovery of maritime forest will depend on the protection afforded by dune ridges as they continue to build and recover from the storm. Interior island habitats where washover deposits were evident and foredunes were flattened continued to gain sediment up until at least 2 years following Hurricane Katrina. Therefore, postponing restoration efforts such as dune plantings or fencing on barrier islands may provide back-barrier habitats with the sediment supply needed to promote island elevation and potentially offset sea-level rise and subsidence.

Effect of salinity on the ontogeny of osmoregulation in Gulf killifish *Fundulus grandis*

Living Estuarine Resources
Oral presentation

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Yanling Meng is a Ph.D. candidate in the laboratory of Fernando Galvez in the Department of Biological Sciences at Louisiana State University. Her interests include fish physiology and environmental adaptation.

The Gulf killifish (*Fundulus grandis)* is a euryhaline species inhabiting the coastal marshes of the Gulf of Mexico, where they may be exposed to large, episodic salinity changes. Although mechanisms of osmoregulation are well studied in juvenile and adult killifish, little is known of how exposure to varying salinities during early development will influence the ontogeny of osmotic tolerance. This study investigated the ontogeny of osmoregulation in *F. grandis* reared from hatch in salinities ranging from fresh water to sea water. More specifically, the study aimed to investigate the cellular distribution and protein abundance of the ion transporting proteins, Na^+/K^+ ATPase (NKA), $Na^+/K^+/Cl^-$ cotransporter (NKCC), and chloride channel cystic fibrosis transmembrane conductance regulator (CFTR). Results showed that the protein levels of NKA, NKCC, and CFTR significantly increased during the 28 days of larval development. Comparing protein levels from fish that were at the same developmental stage but reared at different salinities showed that NKA and NKCC protein levels showed significant difference only at 28 days post hatch (dph), while CFTR showed significant difference only at 3 dph. Differences in protein localization were also seen in fish that were reared at the same salinity during development. At 6 hours post hatch, fish reared at 32 ppt had NKA expressed on portions of the skin, as well as in the gill, kidney and intestine. Meanwhile, at 28 dph, fish reared at 32 ppt had only negligible NKA expression on the skin, which indicate that the skin of seawater-acclimated fish may function as an osmoregulatory tissue during early life but not later in development. There were also differences in CFTR localization in the posterior intestine between fish reared at 0.1 and 32 ppt at 8 dph indicating different roles of this tissue during development.

Engineered oyster reefs for achieving multiple design objectives

Living Estuarine Resources
Oral Presentation

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Tyler Ortego, MS, PE, founded ORA Estuaries in 2009 with the mission to build and maintain the ecological infrastructure that allows our estuaries to remain abundant and productive in conjunction with ever increasing human presence.

Oysters aren't just for eating. A common and often threatened inhabitant of estuaries, oysters have been described as "ecosystem engineers" for their ability to modify their habitat. The ecological functions provided by oyster reefs have been studied extensively. Oyster reefs have been shown to enhance fisheries, modify hydrodynamics, protect shorelines, remove nutrients from the water column and provide larvae for oyster fisheries. Often, project implementation requires proof that quantifiable objectives can be met in order to justify funding. This may exclude creative, but relatively untested, approaches from being used. Here we explore conceptually how created oyster reefs can be implemented using a design approach to achieve specific quantifiable engineering objectives. We use simple models and empirical studies borrowed from other areas of engineering practice to show how reefs can be designed to achieve those specific engineering objectives. Where applicable, results of real-world examples are used.

Thaumarchaeota contribute significantly to the total prokaryote community in bottom waters from two distinct seasonally hypoxic zones in the Northern Gulf of Mexico

Living Estuarine Resources
Oral Presentation

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Natalie Ortell is pursuing a Ph.D. at the University of South Alabama in the Marine Microbial Ecology Laboratory. Her research focuses on determining the presence/absence, diversity and distribution of marine Archaea around Mobile Bay, as well as, archaeal community response to hypoxic events using multiple molecular techniques such as PCR, DGGE, QPCR and sequencing.

Anthropogenic disturbances are believed to increase the severity of hypoxic events. As microbes can contribute to and survive in these low-oxygen habitats, it is important to understand how microbial communities might respond or contribute to the formation and maintenance of coastal hypoxia. Thaumarchaeota are a group of Archaea implicated in nitrogen cycling in marine environments and have been investigated in oxygen minimum zones and upwelling systems; however, there is a lack of data from seasonally occurring coastal hypoxic systems. The objective of this study was to characterize the thaumarchaeal community before, during and after hypoxia in two distinct hypoxic zones in the northern Gulf of Mexico. Due to the differences in hypoxia formation and maintenance between the Mississippi Bight and Mobile Bay, it might also follow that the contribution of Thaumarchaeota to the total prokaryotic community will differ during normoxic and hypoxic conditions. To test this hypothesis, surface and bottom samples were collected during two summers from Mobile Bay, Ala., and the Mississippi Bight. Thaumarchaeota 16S rRNA genes were quantified using qPCR to characterize the community dynamics. Different patterns were observed between the Mississippi Bight and Mobile Bay hypoxic zones. Thaumarchaeota contributed more to the total prokaryote community in bottom waters than surface waters in both systems. Shallow bottom waters had greater abundances than deep waters in Mobile Bay, however, in coastal Mississippi, the abundance of Thaumarchaeota increased as stations moved to deeper water reaching a maximum 6.0×10^4 copies ml^{-1} in June 2011. In Mississippi surface samples, late spring to summer stations were characterized by much lower abundances than fall stations. Preliminary qPCR results illustrate the variability in bottom and surface water Thaumarchaeota abundance suggesting that the interactions between hypoxia and Thaumarchaeota might differ between depths.

A national survey of consumer preferences for branded Gulf oysters and risk perceptions of Gulf seafood

Living Estuarine Resources
Oral Presentation
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Dan Petrolia is associate professor of environmental economics at Mississippi State University. His research focuses on using survey methods to value natural resources, with a focus on coastal restoration. He is also researching market potential for branded Gulf oysters, coastal residents' participation in the national flood insurance program and evacuation behavior.

A multi-state, multi-institution, multi-disciplinary effort is underway to address research priorities for Mississippi-Alabama Sea Grant Consortium's (MASGC) Safe and Sustainable Seafood Supply Focus Area. The overall goal of the project is to evaluate branded, farm-raised oysters in the context of a choice experiment accounting for potential effects of consumers' real and perceived risks associated with Gulf seafood. Key tasks include development and implementation of an online survey instrument and three in-person taste panels. The survey will be conducted via Knowledge Networks, the premiere online survey panel, and targeted to residents in key metropolitan regions both nationally and along the Gulf Coast. The survey will be used to evaluate consumer preferences toward branded, farm-raised Gulf of Mexico oysters. Key attributes under study are the effect of brand name, production method, post-harvest treatment, appearance and price. Branded Gulf oysters will be paired with various combinations of East and West Coast oysters as well as un-branded (generic) Gulf oysters to determine if consumers are willing to pay a premium for branded Gulf oysters relative to un-branded ones, and if there exists market potential for them in markets currently dominated by un-branded oysters and those from the other coasts. Three taste panels will be conducted at a local restaurant, at a high-end restaurant in either Houston or New Orleans, and at the 2013 International Boston Seafood Show. The taste panels add a dimension not feasible for testing in the online survey: taste.

Key hypotheses to be tested are: oyster consumers are willing to pay a price premium for 1) geographically-branded Gulf oysters, 2) oysters with a specific suite of improved attributes, 3) farm-raised Gulf oysters and 4) that consumer risk perceptions regarding the effect of the Deepwater Horizon oil spill and/or *Vibrio vulnificus* have a significant effect on WTP for Gulf oysters. The results of this work should provide Gulf oyster producers with useful information regarding market potential for alternative oyster products. Results indicating weak potential would make evident the risk associated with pursuing alternative production methods and/or marketing schemes. However, results indicating strong potential would provide useful information both on what gains are possible, but also identify specifically those product attributes that have the most potential. These results could be utilized immediately by MASGC, oyster producers, wholesalers, restaurateurs and others concerned with the sustainability of the Gulf oyster sector. We emphasize that the intent of the proposed work is to identify and measure

consumers' current perceptions, not to alter them. Such information will substantially improve the industry's understanding of the market situation for Gulf oysters.

Seagrass assessment on Northern Chandeleur Island, La.

Living Estuarine Resources
Poster Presentation

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Linh Thuy Pham is Ph.D. student at the Department of Coastal Scienes, The University of Southern Mississippi. Her current study focuses on mapping seagrasses in Mississippi Sound and Chandeleur Islands, analyzing historical trend of this resource and interpreting major factors that affect seagrass distribution in the Sound.

A mapping effort based on field data collected from Northern Chandeleur Island in May and June 2012 was performed to provide more insights into the current status as well as into changes of the areal extent and species composition of seagrasses. Transects were run in an East-West (inshore – offshore) direction with stations at every 100 meters; some of stations in 1998/1999 study were also revisited. Fieldwork included assessing seagrass species composition, percent cover and canopy height using quadrat method, and measuring patch dimension. There were 167 stations visited and used for geostatistical analysis, together with 26 other points that served as reference data. Seagrasses were found at 119 stations (71.3 percent) out of those visited. Four seagrass species were recorded, including *Thalassia testudinum, Halodule wrightii*, *Syringodium filiforme*, and *Ruppia maritima* (and floating *Halophila engelmannii*). A map of total seagrass percent cover on the Northern Chandeleur Island in summer 2012 was created using ordinary kriging with six categories of Braun – Blanquet scale. The offshore limit of seagrass coverage in 2012 shows similarity to October 2005 data. Indicator kriging was employed to create distribution maps of *Thalassia testudinum, Halodule wrightii* and *Ruppia maritima*, which show probabilities of finding each species in the study area. All three distributions show a gradient in the East – West (inshore to offshore) direction; *H. wrightii* occurrences also indicate a North – South gradient to a lesser strength. A map of seagrass species composition was created by integrating information from the three maps of individual species distribution and the map of total seagrass percent cover. The data show that in 2012 seagrasses on the Northern Chandeleur Island mainly exist as large continuous beds stretching over the area and comprising of one or more species co-occuring. *H. wrightii* dominates offshore areas where water depth is over 1.5 meters; this species occurs more in the northern and center portions of the study area than in the south. As water depth reduces, *T. testudinum* is found and becomes the dominant species at 1 – 1.3 meter depth zone. *R. maritima* dominates inshore areas, starting its occurrence around a depth of 0.7 meters in a mixed bed with *T. testudinum* or *H. wrightii,* or both. There are chances of finding *S. filiforme* in the Northwestern area. The results indicate that appropriate field sampling can provide data for mapping not only seagrass occurrence but also species composition. Further study will be combining these maps with the 1998-1999 field assessment and the 1999 – 2005 maps for comparison and studying seagrass changes on Northern Chandeleur Island from 1998 to 2012 to understand more about recovery of this resource from oil spill impacts and hurricane damages.

MarketMaker: A direct marketing tool for the seafood industry

Living Estuarine Resources
Poster Presentation

Benedict Posadas[1*], Bethany Starr Walton[2*], Amanda Seymour[1], Randy Coker[1], Deacue Fields[3] and LaDon Swann[2]
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Benedict Posadas is an associate extension/research professor of economics at Mississippi State University Coastal Research and Extension Center and a marine economist with the Mississippi-Alabama Sea Grant Extension Program.

Bethany Starr Walton is the outreach coordinator for Alabama MarketMaker and works along the coast of the Gulf of Mexico from the Auburn University Marine Extension and Research Center in Mobile, Ala. She works with local food producers, particularly the seafood and charter boat industries, to promote their products on a regional and national scale.

MarketMaker is a free online resource that connects all aspects of the food supply chain. This includes farmers, ranchers, fishermen, retail markets, wholesale markets, processors, agritourism, charter boat captains, wineries, farmers markets, restaurants, buyers and consumers. Recently, the Gulf States Marine Fisheries Commission (GSMFC) provided funding to Mississippi-Alabama Sea Grant Consortium to increase awareness of MarketMaker within the fisheries sector. The goal is to assist the seafood and charter boat industries with marketing their products and services to a broader audience. Businesses can create profiles that include detailed information about their products, as well as contact information. MarketMaker helps consumers and businesses connect with one another using market research, detailed census data and a geocoded searchable database.

Mississippi MarketMaker partners include NOAA, the Gulf States Marine Fisheries Commission, Mississippi State University Extension Service, Mississippi State University Department of Agricultural Economics, U.S. Department of Agriculture, Agricultural Marketing Resource Center, Farm Credit, Farm Bureau and the Mississippi Department of Agriculture and Commerce.

Alabama MarketMaker sponsors and partners include NOAA, the Gulf States Marine Fisheries Commission, Mississippi-Alabama Sea Grant Consortium, Auburn University, Alabama Cooperative Extension System, Alabama Department of Agriculture and Industries, and the Alabama Department of Conservation and Natural Resources - Marine Resources Division.

Mississippi efforts include generating weekly newsletters that are distributed to the MSU Extension Service and through social media outlets (Facebook and Twitter). Extension specialists have mailed information cards to seafood businesses and have made personal visits to help them become registered on MarketMaker. We have worked with the Mississippi

Department of Marine Resources to help pass along information about MarketMaker to their clientele. At the start of the program, Mississippi conducted several training workshops for seafood regulators, extension and research faculty and staff, vegetables growers and seafood dealers and processors.

Alabama outreach initiatives include creation of social media outlets (Facebook and Twitter) to help promote individual businesses, and distribution of monthly e-newsletters. We have visited seafood businesses to talk with them about registering their businesses on MarketMaker and also attended seafood industry trade association meetings. We have worked closely with the Alabama Cooperative Extension System to help cross-promote seafood along with other seasonal Alabama products. We have also worked with the Orange Beach Fishing Association to create business profiles for their members, who are charter boat captains.

Coastal pelagic fish resources in the Gulf of Mexico: A population genetics analysis

Living Estuarine Resources
Oral Presentation

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Meagan Schrandt, a Ph.D. student at the University of South Alabama, works at the Dauphin Island Sea Lab in the Fisheries Ecology Lab. Her master's thesis focused on coral reef fish behavior and stress endocrinology and her dissertation work involves population ecology of coastal pelagic fishes.

All species have geographical limits to their distributions based on physiological tolerances, but these limits may be less evident in marine systems because of relatively few topographical boundaries. However, few populations are truly continuous; most exist as spatially separated populations and the degree of connectivity or exchange among habitats determines whether the populations behave as one metapopulation or as distinct populations. When local populations have predominantly independent population dynamics but receive some influence from other, neighboring populations, the collection of populations may be termed a metapopulation. Extremely limited connection among subpopulations, however, leads to some degree of reproductive isolation in space and/or time, which can ultimately be reflected in genetic differences, morphological variations, and exposure to different chemical regimes.

Two coastal pelagic fish species found in the Gulf of Mexico (Gulf), Spanish mackerel (*Scomberomorus maculatus*) and Florida pompano (*Trachinotus carolinus*), have geographic distributions encompassing the entire Gulf (and beyond) but abundances can vary widely and areas of local depletion can occur, creating potentially separate local populations. The ecology of Spanish mackerel and Florida pompano is such that these two species have the potential to possess multiple populations as a result of their spawning and migration timing. Like many other Gulf species, Spanish mackerel and Florida pompano are also exploited commercially and recreationally, and they are managed by individual states even though the fish migrate throughout coastal waters, regardless of state lines. Defining how exploited resources are partitioned spatially and temporally is a prerequisite for management, and although there are many ways to determine population structure, population genetics has become an increasingly common method. Analyzing genetic variation within a species provides information on the long term structure of the population, encompassing multiple generations, and can be used to elucidate population structure and estimate the degree of connectivity. In this study, fish were collected from multiple locations throughout the Gulf, as well as the east coast of the United States, and DNA was extracted for sequence analysis of a mitochondrial (cytochrome oxidase subunit I) and nuclear gene (actin intron). The DNA sequence information was used to detect signs of population differentiation or isolation by distance for fish in the Gulf and western Atlantic. Ultimately, the genetic results will be used in concert with demographic information and otolith microchemistry to elucidate the population structure of these two species, which in turn may be used to help inform management decisions for these coastal pelagic fish resources.

Expanding fisheries independent surveys into Alabama's artificial reef permit zones: Traditional gear meets the unconventional

Living Estuarine Resources
Poster Presentation

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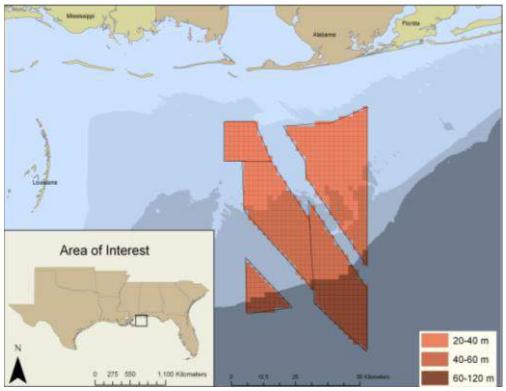

Figure 1. Alabama's reef permit zone

Fisheries independent data are useful for assessing local reef fish populations, including spatial distributions, age compositions, and abundances. In 2010, a fisheries independent, multi-gear survey was implemented by the Fisheries Ecology Lab at the Dauphin Island Sea Laboratory to explore Alabama's artificial reef permit zone. The reef permit zone was organized into 2 km by 2 km grids. Each grid was assigned a depth stratum; 20-40 meters, 40-60 meters, or 60-120 meters. Grids were randomly selected, then swept with side-scan and single-beam sonar to quantify all vertical structure. Grids were then sampled using bottom longline, vertical longline, trawl, and a remotely operated vehicle (ROV). Trawl and ROV surveys both sample small benthic fishes; the objective of this analysis is to compare the fish assemblage with trawl versus the assemblage sampled with ROV, as well as document how both assemblages change as a function of season and depth. The trawl was a 12.2-meter semi-balloon otter trawl pulled for thirty minutes per site. The ROV used was a Seabotix LBV300-5 rated to a depth of 300 meters, equipped with two cameras: a high definition, 1080 line color camera coupled with a 520 line color camera. In 2011, 110 species of finfish and elasmobranchs were collected in the trawl nets. Analyses of the trawl data show no significant difference in species abundance or species biomass with season or depth. ROV video analysis show significant differences in abundance between shallow-to-mid and shallow-to-deep strata with tomtate (*Haemulon aurolineatum*) and grey triggerfish (*Balistes capriscus*) driving the difference. While no significant difference with season is expected due to little abiotic change on the sea floor, no significant difference with depth could be due to low replication within deep strata. The use of traditional gear, such as trawl, in conjunction with ROV surveys provides us with a unique assessment of Alabama's reef fish populations within one of the world's largest reef permit zones.

The influence of depth on the distribution and composition of apex predators in the Northern Gulf of Mexico

Living Resources
Poster Presentation

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A fundamental measure of an organism's ecology is their distribution. Identifying the factors that influence a species' distribution is imperative for population dynamics and conservation biology. Fisheries-independent surveys are a valuable tool for investigating these factors in nearshore and offshore habitats. Previous studies suggest that changes in the distribution of apex predators may be a function of depth across the northern Gulf of Mexico continental shelf (Drymon et al. 2010). However, these findings were extracted from various survey methods over different time periods. Given the rising concern over upper trophic level predatory fish declines, research on composition and distribution apex predators in both nearshore and offshore habitats is a priority. In order to develop these findings further, the Fisheries Ecology Laboratory at the Dauphin Island Sea Lab (DISL) designed a fisheries-independent bottom longline survey that was conducted throughout the seasons (Spring-Winter) in 2011. A transect line was randomly selected with fishing occurring from inshore to offshore across four depth strata (0-10m, 10-30m, 30-50m, >50m) (Figure 2). Multivariate analysis indicated both depth and seasonality as significant factors in determining community composition. Pairwise comparisons revealed a high degree of dissimilarity among depth strata with the highest dissimilarity between 0-10m and 10-20m which was driven by red drum *Sciaenops ocellatus* and blacknose shark *Carcharhinus acronotus*. Similarily, there was a high degree of dissimilarity among seasons with spring and fall being the most disparate. This difference in community structure was driven by red snapper *Lutjanus campechanus* and Atlantic sharpnose shark *Rhizoprionodon terraenovae.* Our results demonstrate the importance of surveys that encompass the entirety of an ecosystem in order to accurately characterize distributions of important higher trophic level predators. In addition, our study may help supplement data for current and future stock assessments on these important apex predators.

Figure 1. Photograph of Atantic sharpnose shark *Rhizoprionodon terraenovae*

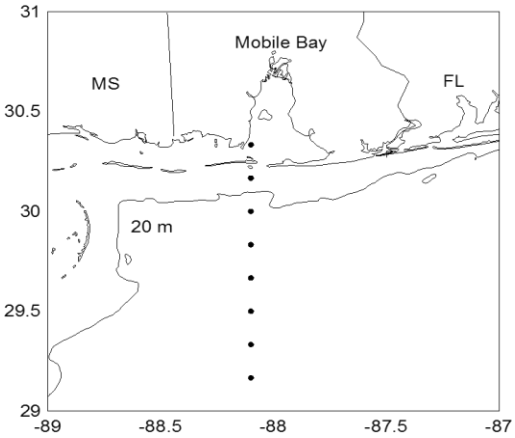

Figure 2. Fall 2011 transect survey stations.

Shellfish farming in the Gulf of Mexico: Effects of ploidy and gear on the performance of farmed oysters

Living Estuarine Resources
Oral Presentation

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Bill Walton works along the coast of the Gulf of Mexico at Auburn University's Shellfish Lab (Dauphin Island, Ala.) and the Auburn University Marine Extension & Research Center (Mobile, Ala.). He conducts applied research with local shellfish farmers, shellfishermen (commercial and recreational), and national and local organizations.

Oyster farming presents an environmentally friendly opportunity for coastal communities in the northern Gulf of Mexico to create jobs, maintain working waterfronts, enhance the environment and increase community resilience. Maximizing the performance of farmed oysters increases the odds of success for regional oyster farmers. In 2011 at a commercial oyster farm in Grand Bay, Ala., we conducted an experimental field test of ploidy (triploids and half-sibling diploids) and gear type (LowPro bottom cages [Chesapeake Bay Oyster Company, or CBOC], adjustable long-line baskets [BST, Ltd.], OysterGro floating cages [Ketcham Supply] and floating bags [CBOC]) as two potentially interacting means of improving performance. Eastern oysters, *Crassostrea virginica*, were deployed in the four gear types from May 5 to October 11 (166 days), with replicate bags of each ploidy assigned to each gear type ($n \geq 3$). Survival, growth and oyster shape ("fan" and "cup" ratios) were quantified at the conclusion of the experiment. Condition indices were determined in both August and October, while abundances of the bacteria, *Vibrio vulnificus* and *V. parahaemolyticus*, were quantified in August and September. Survival was equivalent between ploidies, but differed significantly among gear types with poor survival in the bottom cages (affected by the oyster drill, *Stramonita haemastoma*). In terms of growth, triploids grew better than diploids for almost all metrics. Among gear types, growth was poorest in the bottom cages. For dry tissue weight, there was a significant ploidy by gear interaction; within floating bags, there was no difference between triploids and diploids, but triploids had higher dry tissue weight than the diploids in all other gear types. No differences were observed in fan ratios among treatments, but triploids had significantly higher cup ratios than diploids. For condition index, unexpectedly there was no clear pattern explained by ploidy in the August sample. In October, however, triploid condition index exceeded the diploid condition index. Finally, there was no significant effect of gear or ploidy on the abundances of the two *Vibrio* spp. assessed, but there was a tendency for these abundances to be lower in triploids than diploids. This study adds to the growing body of evidence of the benefits of genetic triploidy to the Eastern oyster aquaculture industry. We suggest that oyster farmers could expect to benefit from raising triploid oysters, but that the magnitude of these benefits will depend on the type of gear selected.

Development of marine mammal stranding and identification/viewing smartphone apps for the Southeast Region

Living Estuarine Resources
Oral presentation

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Amy Whitt is a marine scientist with over nine years of experience in marine mammal research, management and education. Her interests include studies on the distribution/abundance of protected species and human interactions (tourism and development). She has been actively involved marine mammal conservation and outreach efforts throughout the Southeast United States.

All marine mammal species are federally protected under the Marine Mammal Protection Act (MMPA), and several of these species are afforded protection under Endangered Species Act (ESA). As such, NOAA and other federal agencies are faced with numerous challenges to enhance the protection, conservation, and management of these protected species. One of the main challenges is the lack of public awareness about how and where to report stranded marine mammals. When the public is unaware of how to contact the stranding network, response can be delayed, compromising the animal's chance of survival and/or limiting the amount of valuable data collected from dead animals. Data on mortality rates and causes of death of marine mammals are critical to understanding the health of populations and for informing management decisions. In addition, quick responses to live stranded animals increase their chances of survival.

Another challenge is the lack of understanding among the public and commercial tour operators about the impacts of harassment and feeding on marine mammals and what best practices prevent or minimize disturbance. Many people who encounter wild marine mammals do not abide by, or are unaware of, the MMPA feeding and harassment regulations or NOAA's viewing guidelines to minimize harassment. Harassment and feeding violations are particularly evident in the Southeast United States where food provisioning is common, and recreational boaters and tour operators do not always follow the viewing guidelines to minimize harassment.

Geo-Marine and the NOAA Fisheries Service, with the technical expertise from Applied Research Associates, are working collaboratively to develop two smartphone apps that will result in accurate and timely reporting of strandings in the Southeast to the Stranding Network and promote responsible viewing of marine mammals in the Southeast United States. The use of smartphone apps to assist in the reporting of stranded marine mammals is an innovative and potentially extremely effective method for increasing the overall number of reports as well as the awareness of the general public. In addition to the stranding app, the viewing/identification app will inform the public on appropriate ways to enjoy viewing wild marine mammals without harming or harassing them. These user-friendly apps will be developed for both iPhone and Android platforms, will be designed specifically for use by the general public, and will be free. The apps will be disseminated through an extensive outreach plan consisting of nine components including tried-and-true methods and innovative web advertising. The popularity of smartphone apps and the ease with which these can store, provide, and report information make them an ideal avenue for promoting responsible viewing and stranding reporting. Although apps cannot solely stop illegal activity or lead to reports of all stranded animals, the apps will appeal to a wide audience and give NOAA Fisheries Service's Southeast Region personnel and other stakeholders an innovative avenue for promoting the conservation of marine mammals in the Southeast United States.

BAYS & BAYOUS

SYMPOSIUM 2012

Water Quality
and Quantity

Session

Land conversion in coastal Alabama and its effect on headwater wetland and stream functions

Water Quality and Quantity
Poster Presentation

Christopher J. Anderson[1], Diane Alix[1], Flynt Barksdale[1], Brad Schneid[2], Latif Kalin[1] and Charlene Lebleu[3]
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Growth of coastal communities in Alabama is expected to continue leading to expanded urbanization and land use change. Drainage from these areas has the potential to alter important functions related to adjacent and downstream aquatic resources (e.g., habitat, biogeochemical cycling, hydrology). Headwater wetlands and low-order streams may be most susceptible to changes by land conversion (forest to either urban or agriculture) because of their immediate proximity to these lands and their runoff. Functional changes to headwater wetlands and streams have shown to occur as they become increasingly influenced by surface-flow drainage (instead of being groundwater driven in unaltered settings). The results of our current and recently completed research have focused on headwater wetlands and streams in Baldwin County, Alabama. Using 15 headwater wetlands, the dominant land use/land cover (LULC) (i.e., % agriculture, % forest, % impervious surface) were determined in the catchment and used to calculate runoff curves for each wetland. Across a range of LULC conditions, increased runoff was closely related to wetland water level variability and leaf litter storage. Results showed that wetlands surrounded by converted lands tend to have flashier hydroperiods with increased export of coarse organic carbon. Hydrologic alterations may also reduce habitat suitability for certain wetland-dependent species. Results of amphibian surveys from headwater wetlands using constrained searches and voice recordings suggested that species sensitive to hydrologic alterations (e.g., salamanders) may be displaced by land conversion while more tolerant species (e.g., ranid frogs) may become more prevalent. Other results examining LULC effects on first and second-order streams in the region also showed increased flashiness and reduced water quality associated with increased impervious surface related to urban lands. Current work related to headwater wetlands will examine the potential for these wetlands to lose their capacity for maintaining water quality as they become hydrologically altered. Four headwater wetlands in Baldwin County were selected to determine water quality loads (nitrite-nitrate, ammonium, phosphorus, and TSS) coming into and out of each wetland during stormflow and baseflow conditions. Wetlands were selected to represent a range of surrounding LULC conditions typical of the region (forest, agriculture, urban). We predict the capacity for wetlands to retain nutrients and sediment will be closely tied to its hydroperiod and the increased influence of surface-flow drainage. Results from this study will be incorporated into a regional watershed model and used to develop model ordinances designed to maintain and enhance water-quality functions associated with these wetlands.

After the golden goose dies: Investing in multi-purpose projects for a sustainable Gulf Coast

Water Quality and Quantity
Oral Presentation

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Jeff Ballweber has a bachelor's degree in political science from Oregon State University and a J.D. with an Ocean and Coastal Law Certificate of Completion from the University of Oregon School of Law. From 1993-2007, he worked with the Mississippi Water Resources Research Institute at Mississippi State University on water resources issues. In 2007, he joined the Pickering Firm to work on economic development and water development and management projects.

Water is the life blood of the Northern Gulf Coast's economy, culture and environmental health in coastal Alabama, Louisiana and Mississippi. Historically, the coast has been extremely resilient to occasional dramatic fluctuations in water quantity from hurricanes or droughts. Likewise, the coast has quickly recovered from periodic water quality impacts that may have resulted in short term beach or oyster bed closures. However, since August 2005, two epic disasters dramatically changed the ebb and flow of water quality and quantity discussions.

First, relating to water quantity, after making landfall on Aug. 29, 2005, Hurricane Katrina cut a wide swath of absolute destruction from storm surges and flooding along the coast. Then relating to water quality, in the spring and summer of 2010, just as the Gulf Coast region was recovering from Katrina, the Deepwater Horizon Oil Spill took place and raised serious and well publicized concerns about coastal water quality and potential public health and environmental impacts. In between, in the summer of 2011 the Gulf coast suffered through an "exceptional" drought. While the drought did not impact groundwater that provides most of the coastal drinking water supplies; it threatened withdrawals of surface water from the Pascagoula River that are vital to many major industries in Jackson County.

The two major catastrophes each had a silver lining—significant funding. Following Hurricane Katrina, the federal government appropriated billions of dollars for recovery efforts. Mississippi alone received almost $5.5 billion of Community Development Block Grant funding for various recovery efforts including the Gulf Region Water and Wastewater Plan. Likewise, after the Oil Spill, initial funding for research and Natural Resources Damage Assessments may soon grow into billions of dollars for various activities. Given current and projected national, state and local fiscal conditions it is unlikely that the Gulf Coast will see these funding levels continue. Accordingly, this presentation discusses opportunities to pursue multi-purpose projects with multiple long-term water quality, quantity and habitat benefits under the RESTORE Act of 2012. With proper planning and foresight, investments in well designed multi-purpose projects will pay broad economic and environmental dividends long after the "Golden Goose" dies.

Polycyclic aromatic hydrocarbons degradation in emerged and submerged sediment

Water Quality and Quantity
Oral Presentation
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Doorce S. Batubara is a graduate student working on her Ph.D. program in civil and environmental engineering at Louisiana State University.

Polycyclic aromatic hydrocarbons (PAHs) which are abundant in crude oil can be toxic to many marine species in coastal environments; the impact depends on a number of factors such as: amount of oil; degree of weathering before it reaches the coast; inundation rate onto the coastal area; frequency of inundation; and rate of degradation or cleanup of the oil within these habitats. Crude oil spilled in the U.S. Gulf of Mexico will accumulate over time as well as undergo some weathering before reaching Louisiana coastal areas. The PAHs of concern that reach marsh coastal wetland after being weathered are phenanthrene, pyrene and benzo(e)pyrene. Knowing the level of these PAHs concentration in marsh wetland over a long time helps predict how much the aquatic species are exposed to PAHs contaminant.

The long-term impact of PAHs in crude oil to some aquatic species is relatively difficult to evaluate since exposure rates of the oil are largely unknown. Gulf Coast habitats have experienced a wide range of inundation and exposure rates of the released oil making it difficult to assess the overall impacts to the coast and its fauna. Wave and tidal actions in coastal marsh wetland is believed to play roles in degrading some contaminants, including polycyclic aromatic hydrocarbons (PAHs), in coastal water and sediment. Due to physical and topographical conditions some wetland sediment may be submerged all the time or may be emerged periodically. It is expected PAHs degradation rates will be different between emerged and submerged sediments.

Mesocosms will allow replicated looks at different scenarios of long-term exposure and study of the biodegradation of contaminants of concern in crude oil (phenanthrene, pyrene and benzo(e)pyrene), especially by mimicking the important feature related to their degradation in a marsh wetland sediment system, i.e., tidal movement. The designed recirculating mesocosm for the marsh wetland in this study consists of two mud modules (MMs) with different elevation to enable evaluation of sediment that is intermittently emerged by tidal movement or constantly submerged. The top or the emerged MM is facultative since it is intermittently exposed to the air and the submerged MM is anaerobic. The MMs are put in a tank above an air chamber filled with water. The water level (tidal movement) is controlled by filling the air chamber with air (the water level goes up) and letting the water back to the air chamber (the water level goes down) periodically. The results of PAHs degradation show that the degradation is higher in the intermittently emerged sediment than that in the submerged sediments, as expected. It is subject to facultative degradation reactions and physical exchange processes.

Biogeochemical controls on denitrification in a shallow lagoon

Water Quality and Quantity
Oral Presentation

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Rebecca Bernard is a second-year Ph.D. student at the University of Alabama. Her research focuses on nitrogen cycle pathways in estuarine sediments. She holds a master's degree in biology from Florida International University, where her thesis focused on stable isotope composition and fractionation in nitrogen-limited seagrass beds.

Nitrogen is often a limiting nutrient in estuarine ecosystems and its availability can influence community structure and food web dynamics. The bottom-up controls on nitrogen (N) availability are often poorly categorized, and often nitrogen flux rates are lacking in studies that do investigate the availability of N. The main purpose of this study was to quantify the dissolved inorganic nitrogen (DIN) fluxes in a shallow lagoon and investigate seasonal patterns of denitrification. Little Lagoon, Ala., is a groundwater-influenced, shallow lagoon with a narrow inlet connecting it to the Gulf of Mexico. Three sites in the lagoon were chosen to represent the end-points and middle gradients of salinity and nutrient content and sampled on a near monthly basis for one year. In contrast to many estuarine studies where benthic denitrification is a net sink for N, Little Lagoon is a source of N (i.e. net N uptake) for the majority of the year at the Mouth and East sites. At the West site, net N_2 flux was positive for 5 out of 9 months sampled (but not significant for 3 of the 5 months). Porewater nutrient profiles, benthic nutrient flux and denitrification activity in Little Lagoon seem to indicate the predominance of dissimilatory nitrate reduction to ammonium (DNRA) over removal of fixed nitrogen via denitrification. The presence of hydrogen sulfide (HS^-) in the sediments supports findings of low denitrification activity (50 to 80 µmol m^{-2} hr^{-1}) at the three sites (Figure 1). As HS^- is known to inhibit the nitrification and denitrification pathways, high concentrations in the top centimeters of sediment indicate potential inhibition of the nitrifying and denitrifying bacteria communities. High concentrations of HS^- (>1000 µM) were observed in the summer of 2010 but were undetectable at the Pass and East sites in January 2011, and moderate concentrations at all sites were observed in April 2011. Thus, the bioavailabilty of N as NH_4^+ in Little Lagoon seems to be governed by the influence of HS^- interference on the nitrification and denitrification pathways. The DNRA pathway may then be enhanced and the NH_4^+ produced may lead to a positive feedback in the system, further enhancing episodic algae blooms in the lagoon.

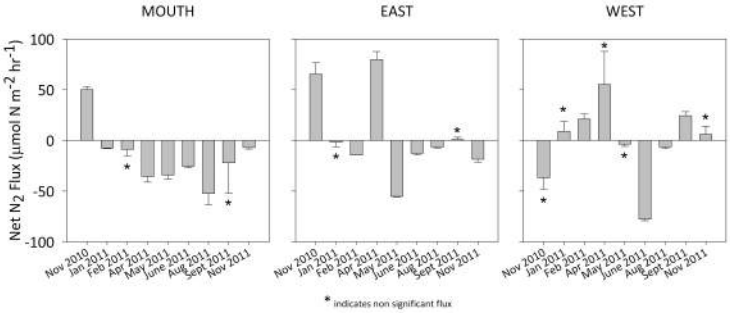

Figure 1. Net N_2 flux for three sites in Little Lagoon, AL

Supply and use of global freshwater resources: Present and future

Water Quality and Quantity
Oral Presentation
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Claude E. Boyd is the Butler/Cunningham Eminent Scholar in Agriculture and Environment and a professor in the Department of Fisheries and Allied Aquacultures at Auburn University. He has been involved in research on water-related issues for over 40 years.

Although water quantity shortages ultimately become a local or regional issue, much effort to encourage water conservation relies upon national and international concerns about increasing water usage and shortages. The world's exploitable, renewable freshwater is estimated at about 13,129 km^3/yr. The volume is not expected to increase in the future, because of environmental restrictions on building new dams and requirements for minimum flows. The world's water footprint – the total amount of freshwater used to produce the goods and services used by its inhabitants – was calculated in 2005 as 9,087 km^3/yr. Assuming no changes in water use per capita, extrapolation to the projected world population of about 9 billion in 2050 gives a global water footprint of 12,643 km^3/yr – roughly the amount available. This scenario poses questions about future sustainability of the human population.

Agriculture uses a tremendous amount of water – 92% of the global water footprint. However, the "green virtual water" fraction – defined as rainwater that evaporates from agricultural areas – accounted for 6,684 km^3/yr of the total agricultural water footprint of 8,363 km^3/yr in 2005. "Green virtual water" has a minor if not negligible effect on the volume of exploitable, renewable freshwater. Omitting "green virtual water" reduces the agricultural water footprint to 1,678 km^3/yr and the total water footprint to 2,402 km^3/yr. Extrapolated to 2050, the global water footprint would be only 3,435 km^3/yr – only about one-fourth of the exploitable, available freshwater.

Many countries, nevertheless, have serious water shortages simply because they are "water poor," or have "water poor" regions, and water infrastructure and management also may be inferior. Water shortages will increase as population increases – especially during droughts. Moreover, the global, middle class is expected to increase by about 2 billion by 2050, and affluency increases water use. In France and the United States, water use (including "green virtual water") is 1,875 and 2,483 m^3/capita/yr, respectively, while in China and Bangladesh it is 702 and 896 m^3/capita/yr.

Better water management and conservation is critical, because most countries cannot increase their water supply. Using less water also will lessen environmental impacts associated with extracting, storing, and conveying water. However, conserving water in a "water rich" area is of little benefit to a "water poor" or drought stricken one. Water shortages seem to result mainly from a natural scarcity of water or from the useful water being at the wrong place or at the right place but at the wrong time.

Temporal and spatial variability of phytoplankton production along the shoreline of the Bay of Saint Louis, Mississippi, estuary

Water Quality
Oral Presentation

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Adam Boyette is a graduate student at The University of Southern Mississippi Department of Marine Science. He has participated in several estuarine water quality studies in the Northern Gulf of Mexico and was heavily involved in R&D studies examining natural populations of marine algae for their potential as biofuels.

Potential primary production was measured for six consecutive months (July 2010 to December 2010) at selected stations along the shoreline of the Bay of St. Louis (BSL) estuary. Monthly surface and a series of subsurface samples were taken to observe the temporal (monthly and short-term) and spatial variability in production relative to environmental variables that potentially could influence phytoplankton photosynthesis. Volumetric production, $P_{t,n}$ ranged from 0.14 to 3.80 g C m^{-3} d^{-1} and was observed to vary seasonally for all stations. Between-day and within-day variability in daily areal primary production, P was observed also at two selected stations on the western margin of the estuary. Production ranged from 0.25 to 0.84 g C m^{-2} d^{-1}over the course of a week and within-day values ranged from 0.36 to 0.72 g C m^{-2} d^{-1} with peak production occurring at midday. Because the waters along the BSL shoreline are shallow and often turbid, results suggest that temperature and underwater photosynthetically available radiation (PAR) may be the principle factors regulating phytoplankton production for this study. These results will provide the first estimates of primary production within the BSL system and will facilitate ecological research and monitoring efforts within regional estuaries.

Effects of low-grade weirs on hydraulic patterns of agricultural run-off in the Mississippi Delta

Water Quality and Quantity
Poster Presentation

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Angela Brison is a field/laboratory technician for the water quality laboratory at Mississippi State University. Her interests include fisheries and watershed management, water quality and hydrology. She holds an undergraduate degree in fisheries and watershed management from Mansfield University of Pennsylvania.

Agricultural best management practices, in the form of low-grade weirs, have demonstrated the ability to mitigate nutrient and sediment loads to downstream aquatic systems. In a recent study, investigations of impacts in artificial low-grade weirs implemented in drainage ditches reported increased hydraulic residence times, which is an essential component to enhance nutrient reduction. However, research on the success of weirs is currently limited to controlled experiments of single weir systems rather than naturally occurring storm event conditions. This research investigates the effect of low-grade weirs on natural hydraulic residence time in multiple agricultural drainage ditches in the Mississippi Delta. Effects of low-grade weirs will be assessed by comparing storm event hydrographs in drainage ditches between pre- and post-weir implementation, as well as between weirs within a single drainage ditch. Preliminary results suggest time to peak significantly increased between storm events pre- and post-weir implementation ($K=13.478$; $p<0.001$; Kruskal-Wallis). The post-weir time to peak maximum value was found to be two orders of magnitude greater than the minimum value, indicating the future analysis should be weighted by precipitation amounts. No significant differences were found between pre- and post-weir time to base (K0.118; $p=0.732$; Kruskal-Wallis), although a large amount of variance about mean values also suggests data should be weighted by precipitation. Further research should account for variable physical dimensions and drainage area of drainage ditches, precipitation patterns, and the number and spatial arrangement of weirs implemented to understand how weirs impact hydraulic patterns of drainage.

Coastal Alabama Stormwater Team (CAST)

Water Quality and Quantity
Oral Presentation
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Mobile, Alabama native, Casi Callaway graduated from Emory University with degrees in philosophy and ecology. As executive director of Mobile Baykeeper, Casi coordinates public education, community organizing, research and fundraising. She holds four gubernatorial appointments and serves on the boards of several local, state and regional environmental organizations.

The Coastal Alabama Stormwater Team (CAST) is a coalition of over 10 local organizations within Mobile and Baldwin counties who have come together to address one of the biggest challenges to the coastal way of life – polluted stormwater runoff. The streams, creeks, wetlands, beaches, bays and bayous of coastal Alabama have borne the brunt of the cumulative impacts of our growth by receiving an increasing volume and velocity of stormwater runoff. Largely a consequence of residential and commercial development, stormwater runoff has begun to significantly degrade public infrastructure, personal property, and our waters. Local governments have been limited in their ability to fully adopt effective stormwater management programs, in part due to compounding costs related to previous inaction, but also due to the low priority given to stormwater management programs by the public.

CAST seeks to educate the public on the importance of this issue by creating a media campaign and resources to promote and develop an ethic of stewardship and responsibility among residents of coastal Alabama. CAST programs will encourage individual actions that result in the reduction of stormwater pollution at boy the an individual and community scale. The long-term goals of this project are to improve public understanding of stormwater and its impact; increase demand for improved stormwater management programs; and expand individual actions to reduce stormwater runoff.

Specifically, working together, the members of CAST are creating a Stormwater Awareness Campaign that includes a developed message, brand and logo as well as public service announcements, outreach materials, website, social media tools and media training for all CAST members. The group will also establish a process (such as awards program) for recognizing best practices and establish materials for empowering public involvement in stormwater management decision-making. A "Stormwater Awareness Outreach Campaign Kit" comprised of all materials will enable every organization for CAST to individualize campaign materials to meet their unique, place-based interest and will fully integrate the campaign and message into each organization's outreach plans.

The members of CAST see this process of integration, resource sharing and collaboration as an excellent tool to effectively educate the community on a complicated and often misunderstood issue.

Export of organic matter from bayous and lagoons with different levels of anthropogenic disturbance

Water Quality and Quantity
Oral Presentation

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Bart Christiaen is a Ph.D. student at the Dauphin Island Sea Lab. He is advised by Dr. Just Cebrian and Dr. Alice Ortmann, and works on plant-microbe interactions and carbon cycling in bayous and shallow coastal lagoons.

Bayous and coastal lagoons are often fringed by wetlands and may contain significant amounts of submerged aquatic vegetation. These plants have the potential to produce more organic matter than can be consumed locally. This excess production is either buried or exported to adjacent habitats. There is ample evidence that the export of excess production from seagrass beds and marsh plants fuels secondary production in the coastal marine environment, but the magnitude of these fluxes remains unclear. We calculated the exchange of organic matter through the mouths of three bayous and lagoons with different shoreline characteristics and varying amounts of submerged aquatic vegetation, located in Lower Perdido Bay (FL). We test the hypothesis that bayous and lagoons with different degrees of anthropogenic disturbance vary in their potential for export of organic matter, and relate the import/export of organic matter to environmental parameters, nutrient loading and ecosystem metabolism. Our results show that the majority of carbon exchanged trough the mouths of bayous and lagoons is in the form of small particulate matter and DOC. All our study sites exported carbon in the form of DOC, despite their differences in nutrient load, shoreline modification and submerged aquatic vegetation.

Expanding real-time hydrographic and meteorological monitoring in Mobile Bay

Water Quality and Quantity
Oral Presentation

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Renee is a recent graduate of the University of South Alabama, receiving her master's degree in marine sciences. She is currently working for the Dauphin Island Sea Lab in marine technical support.

Comprehensive understanding of the complex changes in estuarine ecosystems is crucial to properly managing valuable ecological and economical resources. Long-term coastal monitoring of both meteorological and hydrographic data provides (1) continuous characterization of spatial and temporal patterns of changes in water quality, (2) development of a permanent record of significant and human-caused changes in environmental indicators over time and (3) support for research activities through the availability of consistent, scientifically valid data. The Dauphin Island Sea Lab in coordination with the Mobile Bay National Estuary Program has worked to expand on the already existing real-time hydrographic and meteorological monitoring system in Mobile Bay, Alabama. A member of the Gulf of Mexico Coastal Ocean Observing System, this coastal monitoring program has recently added four more sites in an east-west transect, as well as a wave and current profiler at the center of the bay. While supporting research/management purposes, publicly available data also serves as an outreach tool for the general public, informing and educating about local environmental conditions and complexities.

The Dauphin Island Sea Lab and the Mobile Bay National Estuary Program have partnered with the University of South Alabama, local National Estuarine Research Reserves, the Alabama Department of Conservation State Land Division Coastal Program, the Alabama Lighthouse Association, the U.S. Coast Guard and the Alabama Marine Police Department to provide real-time wind speed, wind direction, air temperature, barometric pressure, photosythetically active radiation, quantum radiation, precipitation, water temperature, dissolved oxygen, water height and salinity for seven sites throughout coastal Alabama. Additionally, current speed and direction in stepwise depth bins and wave height, period and direction are displayed from a centrally located weather station. The addition of the current and wave profiler contributes to better understanding of transport patterns and processes in the bay. Updated every half-hour, real-time data is available at www.mymobilebay.com in the form of user-friendly graphs accompanied by pop-up windows describing each parameter. Archived data is also available for download in spreadsheet form.

Spatial and temporal variation in water quality at Grand Bay National Estuarine Research Reserve

Water Quality and Quantity
Poster Presentation

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Kim Cressman is the System-Wide Monitoring Program Coordinator at Grand Bay National Estuarine Research Reserve. She has a master's degree in marine biology from the University of North Carolina-Wilmington. She has worked on water quality, wetland and coastal ecology, and environmental education throughout the Southeast.

The Grand Bay National Estuarine Research Reserve (NERR), like each of the 28 NERRs in the reserve system, monitors water quality at four estuarine sites as part of the System-Wide Monitoring Program (SWMP, pronounced "swamp"). SWMP also includes a single weather station within NERR boundaries. Water quality and meteorological data are collected every 15 minutes, 24 hours/day, 365 days/year. These data are transmitted in near real-time to the Centralized Data Management Office (CDMO) and can be accessed anytime through the CDMO website, http://cdmo.baruch.sc.edu/.

The Grand Bay NERR's SWMP program has been in place since 2004 and uses standard operating procedures developed specifically for the NERR system. The primary mission of SWMP is to inform effective coastal zone management by quantifying short-term variability and long-term changes in the water quality, biological systems and land-use/land-cover characteristics of estuaries and their watersheds. For the purposes of this presentation, we will only be discussing the water quality portion of the Grand Bay NERR SWMP program.

Water quality parameters we collect include salinity, water temperature, dissolved oxygen, pH, and turbidity. Exploratory analysis of this data from 2005-2011 shows significant spatial and temporal variability in conditions at our four sites. Because no rivers feed into the NERR, the bayous tend to be marine-dominated, with runoff and rain events being the major sources of freshwater. Bayou Heron and Bayou Cumbest tend to have lower salinity and lower pH than the more marine sites of Point aux Chenes Bay and Bangs Lake, and are also much more strongly impacted by rain events. Salinity varies throughout the year at all sites. Dissolved oxygen is consistently lowest at Bayou Heron. This difference is even more pronounced in mid- to late-summer, when dissolved oxygen is generally lower at all sites and Bayou Heron becomes hypoxic due to stratification. Water temperatures are similar at all sites and show the expected seasonal pattern. Turbidity is generally similar between sites, although Point aux Chenes Bay shows substantially more variability in turbidity values than the other sites.

The long-term abiotic data set we are collecting throughout the NERR system is important for monitoring trends in environmental conditions at both local and national scales. Abiotic data help interpret results of biological monitoring, and have also been used at the Grand Bay NERR to

guide the design of research projects aimed at the data needs of coastal resource managers. Long-term data can also provide context for seasonal patterns, acute pollution events like the 2005 chemical spill in Bangs Lake, and natural events such as hurricanes. The data summaries presented here are intended to broadly characterize the waters of the Grand Bay NERR and facilitate further research efforts on the Reserve.

Quantification of Harmful Algal Blooms (HABs) in the Grand Bay in Jackson County, Miss.

Water Quality and Quantity
Poster Presentation

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Jeanna M. Dampier is currently enrolled in the Environmental Science Ph.D. program at Jackson State University. Her research interests include harmful algal blooms and coastal water quality in the northern Gulf of Mexico. She received her bachelor's degree chemistry/biology from Xavier University in New Orleans, La.

Harmful Algal Blooms (HABs) are caused by species of tiny plants, phytoplankton. HABs may cause harm through the production of potent chemical toxins or by their accumulated biomass. Impacts include massive fish kills, loss of sales revenue primarily from fisheries and tourism, loss of commercially valuable and culturally vital shellfish resources, illness and death in populations of protected marine species, and threats to human health. Among the many HAB impacts in the northern Gulf of Mexico, those due to coastal blooms of the diatoms genus *Pseudo-nitzschia* with its associated toxin domoic acid, and the dinoflagellates of the genus *Karenia* with its associated toxin brevetoxin are of particular concern. This work is a field, laboratory and satellite remote sensing research focused on quantifying HABs in the Grand Bay.

This encompasses the collection of field data which is analyzed in the laboratory for pigments, suspended sediments, dissolved materials and toxins, as well as a satellite remote sensing component focused on developing techniques for mapping HABs from space. Recently, a procedure was developed to estimate cyanobacterial concentrations by quantifying chlorophyll a and the primary cyanobacterial pigment phycocyanin using OCM satellite data. This required the development of an atmospheric correction and vicarious calibration methodology for satellite data in inland and coastal waters. It has been tested to work for data from several satellite sensors such as OCM, SeaWiFS, MODIS, MERIS and QuickBird. This research is focused on use of satellite sensors, NPP VIIRS and MODIS AQUA, and the developed techniques to quantify HABs in the Grand Bay. In addition to algal toxins, the toxicity of environmental pollutants (i.e., heavy metals such as Pb, Cd, etc.) in the water will be investigated and the mutual relationships between the heavy metals and HABs will be examined. This research will enhance the current state of knowledge on detection and mapping of the HABs in the Grand Bay and thus support state and coastal community efforts to manage fisheries in the region. Preliminary results from this project will be presented.

Detection and mapping of cyanobacterial harmful algal blooms using satellite data in one Louisiana lake and four Mississippi lakes

Water Quality and Quantity
Poster Presentation

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Padmanava Dash is a professor of biology and environmental science with a Ph.D. from LSU. His research interests include remote sensing of harmful algal blooms, limnology and biological oceanography. His current research focuses on quantifying harmful algal blooms in the northern Gulf of Mexico and the bays and inland lakes.

Cyanobacteria represent the major harmful algal group in fresh to brackish water environments. Cyanobacterial blooms are aesthetically undesirable since they discolor the water, cause turbidity in recreational facilities and synthesize a large number of low molecular weight compounds which cause taste and odor problems. Of particular concern are a diverse range of toxins produced by cyanobacteria, termed cyanotoxins, which are hazardous to human, animal and aquatic ecosystem health. Due to the human health threats and their negative impact on aquatic life, recreation and tourism, cyanobacterial blooms have significant economic and sociocultural impacts worldwide. Recently, a procedure was developed to estimate cyanobacterial concentrations by quantifying chlorophyll *a* (Chl *a*) and the primary cyanobacterial pigment phycocyanin (PC) using OCM satellite data over a small lake (49 km^2 surface area) Lac des Allemands in Louisiana, USA. This required the development of an atmospheric correction and vicarious calibration methodology for satellite data over inland and coastal waters. Empirical inversion algorithms were developed to convert the OCM *Rrs* at bands centered at 510.6 and 556.4 nm to concentrations of PC. For the algorithms to be uniformly valid over all areas (or all bio-optical regimes) of the lake, a holistic approach was developed to minimize the influence of the other optically active constituents. Similarly, empirical algorithms to estimate Chl *a* concentrations were developed using OCM bands centered at 556.4 and 669 nm. The best PC algorithm (R^2=0.7450, $p<0.0001$, n=72) yielded a root mean square error (RMSE) of 36.92 µg/L and a mean absolute error (MAE) of 21.79 µg/L (PC from 2.75 to 363.50 µg/L, n=48). The best algorithm for Chl *a* (R^2=0.7510, $p<0.0001$) produced an RMSE of 31.19 µg/L and a MAE of 16.56 µg/L (Chl *a* from 9.46 to 212.76 µg/L, n=48). The results demonstrated the preliminary success of using OCM satellite data to map cyanobacterial blooms in a small lake in Louisiana. In the summer of 2012, five field campaigns were undertaken to four large Mississippi lakes, Lake Sardis, Lake Enid, Lake Grenada, and the Ross Barnett reservoir in order to obtain a database of photosynthetic pigment concentrations and phytoplankton composition. The objective of this project is to combine multiple satellite data from several sensors such as VIIRS, MODIS AQUA and OCM-2, and developed techniques to quantify cyanobacteria in these four large Mississippi lakes and make the mapped images available through a website for use by water quality managers and general public to rapidly obtain synoptic information on cyanobacterial blooms. Time-series of true color satellite images clearly show the presence of algal blooms. Preliminary analyses of the field data analyzed thus far demonstrate the presence of numerous toxic species of cyanobacteria in these lakes. Preliminary results from this project will be presented.

National and international collaboration to enhance participation of underrepresented groups in engineering and sciences by developing green infrastructure research studies at Mississippi State University

Water Quality and Quantity
Poster Presentation

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Dr. Diaz-Ramirez is an assistant research professor in the MSU Civil and Environmental Engineering Department. His research interests involve computational modeling of hydrological transport for numerical forecasting of water quality, evaluation of nutrient concentrations in freshwater systems and trends in water quality related to changes in land use.

Management and reduction of sediments and nutrients from point and non-point sources reaching water bodies are priorities of several agencies and universities in the United States. Since 2004, faculty and personnel from the Mississippi State University (MSU) Departments of Civil & Environmental Engineering (CEE) and Landscape Architecture (LA) have been working together in developing strategies to improve environmental conditions in rural and urban drainage systems. They are developing decision support systems and demonstration sites; offering courses related to environmental issues; educating students and the general public; and enhancing participation of underrepresented groups in green infrastructure design and evaluation. The LIDIA software is a Microsoft Excel spreadsheet hydrological model, which can be used in assessing rainfall-runoff impacts by land cover change. In addition, LIDIA is useful to design water retention facilities like ponds and vegetated swales. Two demonstration sites (green roof and vegetative swale) are located on the MSU South Farm. These demonstrations sites are generating water quantity and quality data to evaluate their performance and design guidelines for Mississippi environmental conditions. Both sites are used to show the general public (school teachers & students and others) environmental awareness (Figure 1). Undergraduate and graduate students have been trained in evaluating and using green technology with emphasis on engaging underrepresented groups in science and engineering (female and Hispanic). Students from different majors in science and engineering from MSU, Puerto Rico and Colombia have been learning about state-of-the-art green infrastructure (Figure 2). So far, two female students from CEE have completed their master research thesis in low-impact development studies, and one Hispanic female student has worked with the Landscape Architecture team as an international collaborator at the site. In addition, more than 12 undergraduate students trained from this collaborative

Figure 1. Dr. Schauwecker showing green roof experiments to school teachers.

Figure 2. Gabriel Roman, University of Puerto Rico, retrieving rainfall data at the vegetative swale site in MSU South Farm.

program have presented at local, state and national meetings their findings. Students in the program face the challenge of work in multidisciplinary teams by developing field experiments, laboratory analysis, data analysis, computer software, presentations, posters and reports. This program has received funding from the Mississippi Agricultural and Forestry Experiment Station, National Science Foundation, Mississippi Department of Marine Resources and Northern Gulf Institute.

Particularly, this poster will show preliminary data from a set of 24 green roof and flow-through planter experiments, designed to compare hydrographs from conventional roofs with green roofs, and to determine the effects of flow-through planters on green and conventional roof runoff.

Characterization of rain and stormwater nitrogen inputs to Mississippi Sound using a landscape approach

Water Quality and Quantity
Oral Presentation

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Kevin Dillon is an associate professor in the Department of Coastal Sciences at the University of Southern Mississippi. Trained as a chemical oceanographer, he examines carbon and nutrient dynamics in coastal and offshore ecosystems that are due to physical and biological processes using natural and artificial biogeochemical tracers.

Different nitrogen species are being examined in rainwater and subsequent stormwater (SW) in three landscape types along the Mississippi Gulf Coast: pristine, residential and hardened. Integrated SW from drainage pipes that drain to Mississippi Sound are also being sampled. Rainwater ammonium (NH_4) concentrations collected in 2011 ranged from below detection to 39 μM and had nitrogen stable isotope (^{15}N) values that were isotopically light (-5 to -1 per mil) while nitrate (NO_3) concentrations in rain ranged from 1 to 30 μM with ^{15}N values ranging from -5 to +6 per mil. The range of rainwater dissolved organic nitrogen (DON) concentrations was similar to NH_4 and NO_3 concentrations (DON = 7 to 31 μM). The Grand Bay NERR serves as the pristine site where NH_4 concentrations in SW were the lowest (0 to 13 μM) among the sampled sites and had ^{15}N signatures that were isoptically heavier than rainwater (-1.7 to +7.5 per mil). Pristine SW NO_3 concentrations were much greater (0 to 71 μM) than NH_4 and had ^{15}N values that were unusually light (-23.8 to -2.8 per mil). DON concentrations at the pristine sites were also higher than rainwater (17 to 51 μM). SW samples from residential and hardened sites were similar in terms of NH_4 and NO_3 concentrations (0 to 68 μM). ^{15}N values for NH_4 from these sites ranged from -7.5 to +17.3 per mil while ^{15}N-NO_3 values were much lighter isotopically (-19.1 to +1.4 per mil). The range of observed DON concentrations in SW from residential and hardened areas (0 to 85 μM) were higher than that of NH_4 or NO_3. Integrated SW samples had a range of NH_4 and NO_3 concentrations that were slightly lower than the residential and hardened areas (0 to 54 μM NH_4, 0 to 45 μM NO_3) while ^{15}N values of NH_4 and NO_3 were similar to the developed sites (^{15}N-NH_4 = +2.3 to +14.5 per mil, ^{15}N-NO_3 = -20 to +1.4 per mil). The range of DON concentrations in integrated SW (0 to 34 μM) was lower than that at other SW sites and was similar to rainwater concentrations. Results show that there are spatially and temporally variable sources of both NH_4 and NO_3 to SW as it flows over different landscape types along the Mississippi Gulf Coast unlike a previous study that showed a loss of NH_4 in SW due to volatilization (Dillon and Chanton, 2005).

Updating the Harmful Algal Bloom Observing System to meet the needs of scientists and the public

Water Quality and Quantity
Oral Presentation

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Matt Dornback graduated with his bachelor's degree in marine biology from the University of North Carolina Wilmington in 2005 and a master's in biological oceanography from the University of Southern Mississippi in 2011. He has worked on the Harmful Algal Bloom Observing System (HABSOS) project at the NOAA National Coastal Data Development Center (NCDDC) since October of 2011.

Harmful algal blooms (HABs) are a historical and current threat to people and ecosystems across the Gulf of Mexico. Public and private labs, universities and non-profits all take part in monitoring their regions for the toxic phytoplankton. This regional approach is efficient for sampling, but data exchange falters at regional boarders. Since the Gulf of Mexico is one system, it is important to facilitate this exchange. Mitigating HAB effects through information exchange will allow us to create a safer, healthier Gulf. Florida Institute of Oceanography and NOAA's NCDDC have collaborated to create an updated version of the Harmful Algal Bloom Observing System (HABSOS). HABSOS consolidates and standardizes HAB data from across the Gulf Coast into a single database and mapping service. Data access is designed to be intuitive and robust. This allows the public to understand the core concepts of harmful algal blooms and it provides scientists with enough features and data to be useful to research efforts. Recent HAB and environmental samples will be shown on the interactive map and older data will be available through an automated request to NOAA's National Oceanographic Data Center.

Net primary productivity (netPP) and respiration (RESP) measured using an automated optical dissolved oxygen (DO) sensor

Water Quality and Quantity
Poster Presentation

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Kjell Gundersen is a biological oceanographer with focus on primary productivity, respiration and its impact on the cycling of carbon, nitrogen and phosphorus in the Northern Gulf of Mexico. His interests also include automated time-series applications, underwater automation and nanotechnology.

Ecosystem metabolism, driven by available organic and inorganic nutrients, is an important end-point indicator for water quality and health of estuarine systems. Generally, the main producers of oxygen and primary users of inorganic nutrients (photosynthetic microplankton) are counterbalanced by the main consumers of oxygen and primary users of organic nutrients (heterotrophic plankton). When consumption of oxygen exceeds the rate of DO production, hypoxia (<2 mg DO/L) or even anoxic (no oxygen) conditions may develop.

Traditionally, netPP and RESP have been determined by time-course incubations of DO using the Winkler method or an automated DO sensor. While diurnal (daytime) netPP can easily be determined by DO time-course incubations, only nocturnal (night-time) RESP (or long-term dark RESP) has been determined with these methods.

In this study, diatom cultures and *in-situ* incubations of natural seawater were used to demonstrate how netPP and RESP (diurnal and nocturnal) can be determined separately by the DO sensor incubator method. Rates of diurnal RESP are frequently higher than the nocturnal ones and, the rate of nocturnal respiration is not always linear as a function of time. From this new and improved method of determining netPP and RESP we can calculate a daytime netPP:RESP-ratio that helps us assess the biology driving regional hypoxia and anoxia in coastal waters of Mississippi.

Distribution of trace elements in Louisiana Shelf waters

Water Quality and Quantity
Poster Presentation

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DongJoo Joung is a Ph.D. student of the Department of Marine Science in USM. His research focuses on trace element, stable and radio isotope distributions in natural waters and sediments.

Trace elements (Fe, Ba, Mn and Co) were studied in Louisiana Shelf waters during May and November 2008, and June 2009. Samples were collected from shelf waters at different depths and also included Mississippi (MR) and Atchafalaya (AR) River samples. The elements were determined in samples filtered for total (< 0.45 μm) and truly (< 0.02 μm) dissolved concentrations. River water-seawater mixing experiments were conducted and compared with the field data. Seasonal variations in metals were observed in low salinity regions, reflecting seasonal changes in the river water endmembers. Metals were mostly in the truly dissolved fraction, except Fe, for which colloids were the dominant fraction. Removal of Fe occurred at low salinity during all sampling campaigns, and colloidal Fe was the major fraction in these regions, suggesting that the removal is due to colloidal flocculation. A maximum in Ba was found at low salinity, indicating desorption of Ba from riverine particles. Similarly, Co showed its maximum concentration at mid-salinity (15-20), and this is likely due to desorption and/or benthic remobilization. Mn showed removal in low salinity regions. However, in November 2008, there was also a Mn maximum at a salinity of ~20. Based on the lower Mn concentration in the bottom compared to the surface, desorption was the most likely source at that time. Some elements showed different distributions between the distributary mixing zones of the MR and AR plumes. For example, Mn was much higher in the MR plume than in the AR plume. The AR waters enter the relatively shallow and wide (> 100 km) shelf leading to rapid settling of its suspended load, reducing Mn desorption, whereas the MR waters discharge near the shelf break through a highly channelized pathway. These physiographic differences of the two distributary zones may account for the relatively lower Mn concentration in the AR mixing zone. In addition, higher biological productivity in the AR than in the MR regions may increase biologically mediated Mn oxidation, lowering Mn concentration in the AR region.

Watershed connections to landscape change: B-WET students become coastal stewards

Water Quality and Quantity
Oral Presentation

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Jessie Kastler is the coordinator of program development at the Marine Education Center at University of Southern Mississippi's Gulf Coast Research Lab. She helps people achieve a better understanding of their environment and the process of science. She holds a Ph.D. in Oceanography and Coastal Sciences from Louisiana State University.

The Bay Watershed Education Training program (B-WET) was developed by the National Oceanic and Atmospheric Administration to teach K-12 students standard course content using meaningful watershed educational experiences (MWEE). Gulf Coast Research Laboratory and Mississippi-Alabama Sea Grant Consortium collaborated during the first year of the Gulf of Mexico B-WET program to develop the Shifting Baselines Learning Community. This project engages K-12 teachers and their students in a variety of landscape explorations to learn about watersheds.

Figure. B-WET students navigate an obstacle course while keeping the Earth ball from falling to the ground during the Stewardship Summit.

Teachers learn Shifting Baselines MWEE activities during summer professional development institutes at GCRL. The MWEE includes school-based activities in both the classroom and field settings. Classroom activities compare coastal and inland watersheds and examine change over time using maps, aerial photographs, change detection analysis and oral history. Field activities include ground-truthing of maps, elevation profiling, detailed descriptions at both landscape and fine scales. Teachers bring a class of students to GCRL for a field experience and return with a subset of students in spring to report on their progress becoming environmental stewards.

Teachers who have been involved in this project have taken different approaches to implementing the MWEE. At one school a gifted teacher and math teacher worked together to develop a multidisciplinary unit around specific project activities and followed that with a group stewardship effort in which teams developed educational materials about water quality and shared them throughout their community of Jackson, Miss. Another pair of teachers (science and reading) implemented various activities throughout the academic year. During the last months students worked on individual or team projects they developed themselves to become active stewards. Projects included litter quantification and removal, mapping of shorebird nesting sites, recycling initiatives and pharmaceutical collections.

The status and long-term trends of trace metals in oysters from Mississippi Gulf Coast

Water Quality and Quantity
Poster Presentation

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Dr. Yungkul Kim is an assistant professor/Marine Science Program Director in the Department of Biology at Jackson State University. He received his Ph.D. in Oceanography from Rutgers University in 2003 and has been involved with the biological component of NOAA National Status and Trends Mussel Watch Program since 1992.

The NOAA's National Status and Trends Mussel Watch Program has been measuring chemical contaminants of environmental concern in bivalves, as indicator organisms of coastal environmental quality, sampled from the entirety of United States coastline, and is the longest continuous nationwide contaminant monitoring program in coastal waters. As part of the program, oysters were collected during winter months at three sites along the Mississippi Gulf Coast (Pascagoula Bay, Biloxi Bay and Pass Christian) from 1995 to 2008. To examine the interannual variation and to assess temporal trends, oysters were analyzed for 11 trace metals (Ag, As, Cd, Cr, Cu, Fe, Hg, Ni, Pb, Se and Zn). Data from this Program will be analyzed to document the status and distribution of trace metals in oysters from the three coastal sites in the Mississippi Sound, to examine the interannual variation, and to assess temporal trends. The long-term data will be compared among the three sites and also among the sampled years. Analysis on temporal variability of environmental variables (water temperature and salinity) will be also conducted and results will be presented.

Evolution of the nitrogen cycle over saltwater marsh ecosystem formation

Water Quality and Quantity
Poster Presentation

Alice Kleinhuizen[1,3]*, Matthew Logsdon[2] and Behzad Mortazavi[1,3]
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Alice Kleinhuizen is the lab manager in Dr. Behzad Mortazavi's biogeochemistry lab at the Dauphin Island Sea Lab. She holds a bachelor's degree in earth system science from the University of California in Irvine.

Marsh vegetation plays an important role in the nitrogen cycle through the removal of nitrogen by assimilation into plants, sediment burial and denitrification. With increasing anthropogenic nitrogen inputs into marsh ecosystems there is a vital need to understand the changes in the nitrogen cycle as shifts in these ecosystems occur. This study focuses on changes in nitrogen cycling in ecosystems that share similar characteristics but differ in stages of development. This will help to build a picture of how the processes change over time during the development of a habitat. Study sites included a fully established marsh bank that was predominantly inhabited by *S. spartina* (MB), a second marsh bank that was dominated by *S. spartina* but differed in sediment characteristics (MC) and a newly colonized marsh bank that was sparsely inhabited by *S. spartina* (CB). These sites were located on Dauphin Island, Ala. At each site samples were taken in vegetated plots as well as plots that lacked vegetation in order to assess the impact of vegetation on nitrogen cycling.

All three sites had negligible net nitrification rates. Nitrogen fixation rates at the CB (0.09±0.16 umol N g^{-1} hr^{-1}) were significantly higher than rates at the MB (0.60±0.07 umol N g^{-1} hr^{-1}) and MC (0.29±0.06 umol N g^{-1} hr^{-1}) sites ($p < 0.01$). At both the MB and MC sites potential denitrification rates were significantly greater in vegetated sediment when compared to non-vegetated sediment ($P<0.001$). Potential denitrification at the CB was much lower than the MB and MC sites with little variance in the vegetated and bare plots. Net N_2 fluxes were measured with a membrane inlet mass spectrometer in water samples collected from flow through cores incubations. Rates of denitrification in the vegetated sediment at the CB site were extremely high (11.7± 1.1 umol N m^{-2} hr^{-1}) when compared with the non-vegetated cores from the same site (0.9 ± 0.7 umol N m^{-2} hr^{-1}). Cores from the MB displayed less variation between vegetated (50.8 ± 11.6 umol N m^{-2} hr^{-1}) and bare cores (74.2 ± 15.1 umol N m^{-2} hr^{-1}). This indicates that in the CB site the presence of vegetation increases denitrification rates whereas in the MB the dominant rate-determining factor is no longer the vegetation. Using the measurements of nutrient fluxes at these two sites a nitrogen budget was constructed as shown (Table 1). The CB site had low fluxes of NH_4, NO_2, NO_3, and PO_4 in plots with and without vegetation, most likely because of lower organic matter availability. The MB site acted as a sink for NO_3 and a source of NH_4 to the water column. Our results suggest that immediately following the establishment of a marsh, denitrification becomes an important N sink, and that rates of denitrification continue to increase as the marsh develops.

Table 1: Nitrogen budget for CB and MB sites for vegetated and non-vegetated cores with values given in umol N m^{-2} hr^{-1}

Site	DON	NO3	NH4	N2 (DNF)	Total N uptake	% N Loss from DNF	Increase in N uptake	Increase in DNF
Colonized Bank	343 ± 11	63 ± 23	-35 ± 17	12 ± 2	406 ± 33	2.7 ± 0.3	6 x	12 x
Non Veg	-79 ± 10	39 ± 5	27 ± 3	1 ± 1	66 ± 15	1 ± 0.5	N/A	N/A
Marsh Bank	1174 ± 130	573 ± 125	-107 ± 21	51 ± 11	1747 ± 130	2.8 ± 0.6	26.5 x	51 x
No Veg	1080 ± 60	912 ± 110	309 ± 82	74 ± 14	1932 ± 170	3.8 ± 0.7	2.9 x	74 x

REACH: A Mississippi program towards grassroots water resource conservation

Water Quality and Quantity
Poster Presentation

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Robbie Kröger is an assistant professor in the Department of Wildlife, Fisheries and Aquaculture. He has a master's degree in botany from the University of Witwatersrand, Johannesburg, South Africa, and a Ph.D. from the University of Mississippi.

REACH (Research and Education to Advance Conservation and Habitat) is a state-wide, producer driven, "hands-on" delivery vehicle, that will provide coordination and support for documenting the benefits of conservation efforts to natural resources and agriculture on specific farms. REACH will provide scientifically defensible information to support efforts that meet the resource needs of landowners and producers while increasing awareness of sustainable conservation in production agriculture. The REACH program goal is create a network of cooperative farms in Mississippi with variable agricultural practices to illustrate the success of conservation practice implementation on landscape stewardship while encouraging profitable and sustainable production systems. Objectives of the REACH program include: 1) quantifying and documenting resource benefits through science, to provide sound justification for federal investments in conservation; 2) will further efforts in Mississippi that support the health of Mississippi's water resources, both inland and downstream to the Gulf of Mexico; and 3) assist in implementing from a research, education and outreach standpoint, existing efforts of nutrient reduction at both regional and state levels. REACH currently has 29 farmers enrolled that encompass over 90,000 acres that cover most commodity production systems in Mississippi.

Promoting riparian buffer protection in coastal Alabama

Water Quality and Quantity
Oral Presentation

Charlene LeBleu[1]*, Latif Kalin[2], Puneet Srivastava[3], Maria Hines[1] and Navideh Noori[2]
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Charlene LeBleu is an associate professor of landscape architecture at Auburn University in Alabama. Her interest and research are green building and water quality issues including low-impact development. She is a member of the American Planning Association, the American Institute of Certified Planners and the American Society of Landscape Architects.

Riparian buffers are permanently vegetated transition zones. These vegetated lands adjacent to streams intercept runoff to filter pollutants and encourage infiltration of water before it enters the stream. The primary function of the vegetative buffer is to intercept and slow runoff, but it also serves to capture nutrients, stabilize stream banks and to provide food and shelter to wildlife. Restoring riparian buffers is considered a low-impact development (LID) practice. An impaired riparian buffer might be overtaken with nonnative invasive species or it may receive agricultural runoff causing the stream to fall short of water quality standards. In an urban setting, riparian buffers work well with other LID stormwater control measures that slow down stormwater runoff and help reduce flashy urban flows. Riparian buffers are often recommended as a part of a holistic watershed management plan aimed at reducing non-point source pollution.

This presentation addresses restoration of a riparian buffer in the 8-Mile Creek Watershed in Prichard, Ala. Collaborating with partners from Auburn University School of Forestry & Wildlife Science and Department of Biosystems Engineering, a future land use and cover (LULC) map of the watershed was developed. Reading Creek in Prichard a tributary of 8-MileCreek, was selected as a case study for restoration due to stream scouring, evidence of erosion and high-number of invasive plant species resulting from LULC change. Planning and design interventions, including collaboration with the Mobile Bay National Estuary Program and the Auburn University Water Quality Program, result in outcomes that include energy dissipation of stream flow and reestablishment of the riparian buffer. Model policy research advocates for the adoption of a Riparian Buffer Ordinance in Prichard to help protect and maintain this tributary corridor and other riparian corridors in this coastal area.

Greywater irrigation of six diverse southeastern U.S. landscape plant species

Water Quality and Quantity
Poster Presentation

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Charlene LeBleu is an associate professor of landscape architecture at Auburn University, Alabama. Her interest and research are green building and water quality issues including low-impact development. She is a member of the American Planning Association, the American Institute of Certified Planners and the American Society of Landscape Architects.

Greywater is wastewater produced from bathtubs, showers, hand basins, laundry machines and kitchen sinks. Use of greywater for irrigation is limited by two primary contaminants, sodium chloride (NaCl) and surfactants. Research was conducted to establish the potential for greywater as a substitute for potable water for landscape irrigation and to characterize chemical properties of greywater samples collected from on-campus buildings. Landscape plant species evaluated for NaCl tolerance included *Illicium parviflorum*, *Itea virginica* 'Henry's Garnet,' *Muhlenbergia capillaris*, *Portulaca oleracea* 'Big Bloom Red,' and *Begonia* x *semperflorens-cultorum* 'Cocktail Whiskey.' Plants were irrigated with one of six concentrations of NaCl: 0, 2000, 4000, 6000, 8000, or 10000 $mg \cdot L^{-1}$. Root dry weight (RDW) and shoot dry weight (SDW) and survival was determined at experiment termination. Greywater was collected from a hand washing station on Auburn University campus and analyzed for surfactant, sodium, and chloride concentrations. Five concentrations (0%, 25%, 50%, 75%, and 100%) of collected greywater were used to irrigate *Portulaca oleracea*. *Echinacea purpurea* was irrigated with one of five surfactant concentrations: 0, 50, 100, 150, 200, and 250 $mg \cdot L^{-1}$. Final RDW and SDW were determined at experiment termination for *P. oleracea* and *E. purpurea*.

RDW and SDW of *Illicium parviflorum*, *Itea virginica*, *Portulaca oleracea*, and *Begonia* x *semperflorens-cultorum* decreased linearly with increasing NaCl concentration. There was no effect of NaCl concentration on SDW of *Muhlenbergia capillaris*. *Itea virginica* exhibited foliar damage at the lowest NaCl concentration. *B.* x *semperflorens-cultorum* and *I. virginica* had mortality at the highest NaCl concentrations. All five landscape species evaluated, except *I. virginica*, were tolerant of NaCl concentrations four times higher than what would be expected from greywater, with *I. virginica* being the least tolerant.

In collected greywater, surfactant concentration in ranged from 25-90 $mg \cdot L^{-1}$, Na concentration ranged from 22-24 $mg \cdot L^{-1}$, and Cl concentration ranged from 12-25 $mg \cdot L^{-1}$. The concentration of collected greywater used for irrigation did not affect RDW or SDW of *Portulaca oleracea*. RDW and SDW of *Echinacea purpurea* were not affected by surfactant concentration. Thus, both *P. oleracea* and *E. purpurea* would be tolerant of surfactant concentrations similar to or higher than expected in greywater.

Results indicate that greywater has the potential to replace potable water for landscape irrigation for the six plant species evaluated here. Additionally, tolerance to high salinity has application for plants in arid, saline environments as well as landscapes along the coast.

Alabama Department of Environmental Management Water Quality Monitoring: Current status

Water Quality and Quantity
Oral Presentation
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Fred Leslie is chief of the Montgomery branch in the Field Operations Division of ADEM and serves as the water quality monitoring coordinator. Since 1989, Mr. Leslie has served in a variety of water quality roles for the department, including the initiation and development of several monitoring programs.

During 2012, the water quality monitoring strategy developed for the state of Alabama in 2005 was revised and updated according to EPA program specifications. As in 2005, EPA program specifications included:

- EPA's *Elements of a State Water Monitoring and Assessment Program* that provided a basic framework that states were required to use to monitor and assess their aquatic resources. The elements include the development of a strategy that outlined quality assurance plans, data management, data analysis, reporting, program review and overall resource needs.

- EPA's linkage of Clean Water Act (CWA) §319 nonpoint source funding to the CWA §303(d)/TMDL process. Combining these programs was needed to begin implementing nonpoint source control activities more effectively.

- EPA's *Integrated Water Quality Monitoring and Assessment Report Guidance* that required placement of all state waters into one of five categories that describe the extent to which state water quality criteria/designated uses are met.

Changes in ADEM water quality monitoring programs that were included in the strategy are as follows:

- Revision of the state of Alabama Water Quality Monitoring Strategy to document current water quality data needs and methods to meet these needs;

- Initiation of the Coastal Waters Monitoring Program (CWMP) in 2010;

- Initiation of the Wetlands Monitoring Program in 2011.

The presentation will describe the monitoring strategy, as well as the structure and function of the water quality monitoring programs described in the strategy, with emphasis on the Coastal Waters Monitoring Program.

A possible mechanism for toxic *Pseudo-nitzschia* spp. blooms in Coastal Alabama

Water Quality
Oral Presentation

Liefer J.D.[1], Novoveskà, L. [2], MacIntyre, H.L.[3] and Robertson, A.[4]
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Justin Liefer is a postdoctoral researcher at Dauphin Island Sea Lab and University of Alabama. He recently received his Ph.D. in marine science from the University of South Alabama and has studied phytoplankton ecology and toxic *Pseudo-nitzschia* blooms for the past seven years.

The potentially-toxic diatom *Pseudo-nitzschia* is common in the northern Gulf of Mexico (NGOM), including the coastal waters of Alabama. Several toxic blooms have been observed in Alabama coastal waters and the toxin associated with *Pseudo-nitzschia*, domoic acid, has been detected in commercially important fish in the area. The NGOM shoreline near Little Lagoon, Ala., is a hot spot for blooms of *Pseudo-nitzschia* spp. and their population density is highly correlated with discharge from the local aquifer. Salinity and nitrogen concentrations in Little Lagoon are frequently driven by submarine groundwater discharge. Monitoring of *Pseudo-nitzschia* spp. in Little Lagoon shows that blooms have a well-defined temperature and salinity optimum, but blooms only occur in these conditions in months when groundwater discharge is high. Also, toxic blooms of *Pseudo-nitzschia* spp. in the winter/spring of 2008, 2009 and 2010 were all preceded by a large groundwater discharge event that provided a large pulse of nitrate to Little Lagoon. In addition to monitoring, 13 dilution-grazing experiments were conducted in Little Lagoon from April 2009-May 2011. The results of these experiments indicate that *Pseudo-nitzschia* spp. experience less grazing pressure than the rest of the diatom population. These monitoring and experimental efforts suggest a bloom mechanism for *Pseudo-nitzschia* spp. in coastal Alabama, in which blooms are triggered by groundwater discharge events and further promoted due to low microzooplankton grazing pressure.

Stepping towards debris-free seas

Water Quality and Quantity
Oral Presentation
Rebecca Mathias
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Rebecca Mathias is a Bowling Green State University graduate with a bachelor's degree in marine biology. She is a marine education specialist at the Marine Education Center where she works on the Mississippi Marine Debris Removal & Prevention Project to improve coastal stewardship by collecting, sorting and quantifying debris from Deer Island.

The Mississippi Marine Debris Removal and Prevention Project is grant funded by the Mississippi's Department of Marine Resources, Coastal Impact Assistance Program and The University of Southern Mississippi's Gulf Coast Research Lab. This project involves members of the community in the removal of debris from Deer Island and creates an educated cadre of citizens to better understand the importance of marine debris prevention. We will be cleaning up four, half-mile long sites on Deer Island over a period of 3 years. After collection, groups identify, sort and weigh the debris in an effort to determine where the major source of debris on Deer Island. This presentation will provide accurate information on the dangers of marine debris, repercussions of pollution and the ways they can be prevented. We will take a look at how to track your garbage footprint and what you can do to minimize your environmental impact. We will discuss micro-plastics, the potential environmental impacts they have with the review of past and present research on micro-plastics as a transport mechanism for toxic contaminants into the food web. This includes classroom activities and an introduction to the Mississippi Marine Debris Removal & Prevention Project.

Total Debris Collected 2011-2012

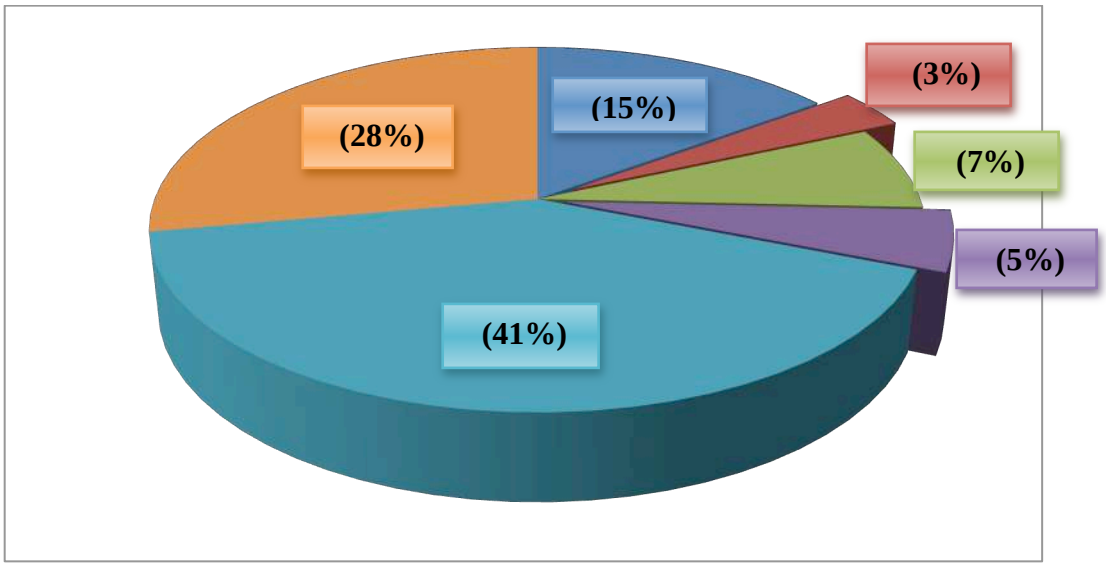

Figure 2: Percentage breakdown of the categories of debris collected:

- **Treated Wood at 2,339.47 lbs comprising 41% of debris collected 2011-2012**
- **Miscellaneous at 1,587.44 lbs comprising 28% of debris collected 2011-2012**
- **Plastics at 848.00 lbs comprising 15% of debris collected 2011-2012**
- **Metals at 421.19 lbs comprising 7% of debris collected 2011-2012**
- **Paper and Tobacco Products at 305.58 lbs comprising 5% of debris collected 2011-2012**
- **Glass 197.07 lbs comprising 3% of debris collected 2011-2012**

Isolation and characterization of Bisphenol A degrading bacteria from coastal Alabama environments

Water Quality and Quantity
Poster Presentation

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Loreen Menn is a graduate student seeking a master's degree in biology at the University of South Alabama. She holds a bachelor's degree in psychology with a minor in biology from the University of South Alabama.

Pharmaceuticals, plasticizers, steroids and trace organics, both natural and anthropogenic, are a growing concern in aquatic ecosystems. Collectively these compounds are referred to as "pharmaceuticals and personal care products" (PPCPs). Some PPCPs have been shown to have detrimental effects, such as endocrine disruption. As such they pose risks to human populations when present in finished drinking water and to aquatic biota when released into the natural environment. Many PPCPs, including widely used cholesterol fighters, tranquilizers and anti-epileptic medications, resist modern drinking water and wastewater treatment processes. Indeed, there are currently no sewage treatment systems specifically engineered to remove PPCPs. Biodegradation by both aerobic and anaerobic bacteria represents one pathway for the removal of PPCPs from the environment. In order to better understand the fate of these compounds in aquatic environments we isolated bacteria capable of degrading Bisphenol A (BPA), a component of polycarbonate plastics. BPA enrichment cultures were established using sediments from the Weeks Bay National Estuarine Research Reserve or water collected from the Dauphin Island beach. The enrichments were incubated with BPA as the sole source of carbon and energy and serially diluted onto agar plates containing BPA in order to obtain pure cultures. Genomic DNA was purified from each isolate and the 16S rRNA gene amplified. Amplified Ribosomal DNA Restriction Analysis of the culture collection was then performed to separate the bacteria into different operational taxonomic units (OTU). Over 80 BPA degrading bacterial isolates were obtained and grouped into five OTUs. Representatives of each phylotype were then selected for sequencing. We are currently screening our isolates with degenerate PCR primers targeting BPA cytochrome P450 monooxygenases to identify potential BPA degradation genes. Our results indicate that coastal Alabama environments host a wide diversity of BPA degrading microorganisms and suggest that these microorganisms may play an important role in the degradation of PPCPs in marine systems.

Stormwater education for coastal Alabama homeowners: Updating efforts of the Coastal Alabama Rain Barrel Project

Water Quality and Quantity
Poster Presentation

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Christian is an extension specialist focusing on issues related to mitigating nonpoint source pollution, and splits time between Mississippi-Alabama Sea Grant, the Mobile Bay National Estuary Program, and the Alabama Clean Water Partnership. Mr. Miller holds a bachelor's in biology from Jacksonville State University and a master's in fisheries science from Auburn University.

Coastal Alabama receives in excess of 5 feet of rain per year. In urban areas most of this water washes across hard, or impervious, surfaces, picking up and carrying pollutants into our waterways. According to the U.S. Environmental Protection Agency, stormwater runoff is the greatest threat to water quality in the United States; as more people continue to move to coastal areas, hard surfaces and volume and velocities of stormwater continue to increase.

Figure1. Residents construct rain barrels at a workshop in Daphne, Ala.

In the Mobile Bay area increases in stormwater runoff are exceeding existing infrastructure capacities, and causing more frequent episodes of flooding, sedimentation, debris polluted waters, habitat destruction and decreased aesthetics and property values. As it flows toward Mobile Bay, stormwater degrades and erodes streams and rivers that provide habitat for fish and wildlife. Stormwater runoff, if not managed to reduce its velocity and pollutants, will deteriorate the quality of water in Mobile Bay, negatively impacting our economy, our coastal ecosystem, and most importantly our quality of life.

Watershed planning in Mobile and Baldwin counties has indicated a need for a sustained outreach and education program focused on mitigating the impacts of residential stormwater run-off. The D'Olive Creek Watershed Management Plan specifically addressed the need for a pilot rain barrel program in coastal Alabama in order to increase the visibility of rain barrels and to promote the use of this and other stormwater retention techniques by property owners. The goal of this effort is to educate the citizens of Mobile and Baldwin Counties on the impacts of stormwater and the benefits of residential rainwater harvesting through Low-Impact Development (LID) demonstrations and rain barrel and rain garden workshops.

The Coastal Alabama Rain Barrel Project enables homeowners to manage stormwater on their property, reducing stormwater flow, and therefore associated negative impacts on Mobile Bay. This educational effort combines LID demonstration sites and educational workshops including information about stormwater, ground water recharge, water conservation, the use of garden-friendly harvested water, and the benefits of harvesting water for our streams and creeks by reducing residential stormwater inputs.

Upon completion of the rain barrel workshop, participants exhibit a gained knowledge of stormwater issues and of the importance of adopting sustainable practices related to residential stormwater runoff. Workshop participants also exhibit gained knowledge of the water cycle, ground water recharge, water conservation, use of harvested water and the benefits associated with reducing residential stormwater. Participants receive a completed rain barrel, which is installed at their residence.

Zeke's Landing fish waste recycling program: A novel and sustainable approach to fish carcass disposal in Orange Beach, Ala.

Water Quality and Quantity
Oral Presentation

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Christian is an extension specialist focusing on issues related to mitigating nonpoint source pollution, and splits time between Mississippi-Alabama Sea Grant, the Mobile Bay National Estuary Program and the Alabama Clean Water Partnership. Mr. Miller holds a bachelor's degree in biology from Jacksonville State University and a master's degree in fisheries science from Auburn University.

Tourism is an important economic driver in Coastal Alabama and Mississippi. Attractions drawing tourists include recreational use of beaches and coastal waters and recreational fishing opportunities. The recreational fishing industry has a significant economic impact on the coastal economy of both states. Alabama and Mississippi anglers made more than three million fishing trips in 2006, and the growth in recreational fishing participation is expected to increase by 18.5 percent by the year 2025.

Figure1. Red snapper carcasses are prepared by a deck hand to be loaded into cold storage at Zeke's Landing Marina.

One of the major challenges for coastal communities is disposal of carcasses and offal generated by the recreational fishing community. Costs associated with disposal, including heavy-duty trash bags and daily trash removal service, can be a heavy financial burden for local operators. Odors associated with fish waste also present an issue for facilities that include restaurant and other waterside tourist attractions. Finally, improper disposal can lead to water quality concerns in areas, such as marina basins and canals, with limited or no water movement.

Zeke's Landing Marina, a large multi-purpose marina and boatyard in Orange Beach, Ala., is home to the largest recreational charter fleet in the State of Alabama. During the peak summer months, the fleet at Zeke's Landing produces, on average, 60,000 pounds of fish carcasses per week. Costs associated with carcass disposal average $5,000/month. A primary concern for the marina operator was mitigating odors associated with the disposal of the fish waste due to customer complaints.

In an effort to find a sustainable solution to the issues associated with fish waste, Zeke's Landing began a fish waste recycling program in 2012. This program, sponsored in part by Mississippi-Alabama Sea Grant Consortium, supplies fish carcasses to Protein Products, Inc. (PPI) which are processed into a high-quality protein source for inclusion into premium pet food products. Carcasses are held in a refrigerated trailer and then transported to the PPI rendering plant in Sunflower, Miss. Although this project is currently limited to one marina, potential exists to expand the program to other fish-waste generating facilities in Coastal Mississippi, Alabama and Northwest Florida.

***Vibrio cholerae*, a common member of the summer microbial community in Mobile Bay, Ala.**

Water Quality and Quantity
Oral Presentation

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Jessica Nash is pursuing her master's in marine science at the University of South Alabama supported by a Dauphin Island Sea Lab/FDA Gulf Coast Seafood Laboratory cooperative research agreement fellowship. Jessica's thesis research is focused on the prevalence and diversity of *Vibrio cholerae* in water, sediment and oysters in Mobile Bay, Ala.

Vibrio cholerae are autochthonous bacteria in estuarine environments. While some *V. cholerae* strains are responsible for the disease cholera, strains found in the Gulf of Mexico are responsible for a less severe form of diarrheal disease. Because *V. cholerae*-related diarrheal disease from Gulf of Mexico seafood has increased in recent years, there is a need to improve our understanding of *V. cholerae* distribution in water, sediment and oysters in this region. Three sites in Mobile Bay, Ala, were selected to study the dynamics of *V. cholerae* abundance along a salinity gradient from the mouth of Dog River (DR), the mouth of Fowl River (FR), to Cedar Point (CP), near the north end of the Dauphin Island Bridge. Abundance was determined by most probable number (MPN)-PCR, and isolates were confirmed as *V. cholerae* by biochemical testing. Samples from each site were collected every two weeks from June-August 2012. The highest numbers of *V. cholerae* were found in CP oysters, DR water and DR sediment with averages of 1.65 MPN/g, 8.02 MPN/ml, and 2.9 MPN/g respectively. *V. cholerae* was most frequently detected in oyster, water and sediment at DR, and was occasionally below detectable levels (<0.03 MPN/g or ml) in FR and CP samples. Surface water temperature and salinity varied over the course of sampling, but no correlation to *V. cholerae* abundance or frequency in water and sediment was observed. However, a trend of rising temperature and abundance of *V. cholerae* in oysters was observed. This study confirms that *V. cholerae* is a part of the water, sediment and oyster microbial communities during the summer months in Mobile Bay, and that abundance in oysters is influenced by water temperature.

Phosphate, freshwater discharge and the distribution of unicellular nitrogen (N_2) fixers in the Mississippi Sound

Water Quality and Quantity
Poster Presentation

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Karen Orcutt is a biological oceanographer with focus on new production (N_2-fixation) and its impact on the cycling of carbon, nitrogen, phosphorus and iron in the Northern Gulf of Mexico. Her interests also include molecular ecology and the design of novel nanosensor applications for detecting biologically available iron.

The Northern Gulf Institute (NGI) monitoring program, conducted by the Department of Marine Science (DMS) at the University of Southern Mississippi (USM), have shown that the ratio between dissolved inorganic nitrogen to phosphate (the N:P-ratio) in the Mississippi Sound is low and well below the Redfield ratio of 16. Marine and brackish water systems with a low N:P-ratio provides a nutrient imbalance for most phytoplankton that prefer dissolved inorganic N:P around 16. The low dissolved N:P-ratios in the Mississippi Sound however, provides a unique environment for diazotrophic cells that require P for N_2-fixation.

In 2009, we found high abundances of coccoid *Synechocystis*-like cells similar to the N_2-fixing *Crocosphaera* sp. (WH8501) in the Mississippi Sound. These cells could be found as individual cells or in defined clusters comprised of single cells that were retained on a 10 µm screen. In 2011, the Bonnet-Carré Spillway was opened in April-May and a surge of freshwater entered the Mississippi Sound. The coastal region also experienced an extremely high amount of rain and river water discharge into the Mississippi Sound within a few days in July of 2011. Both 2010 and 2011 had higher concentrations of dissolved P in surface waters and the abundance of N_2-fixing cells was lower and appeared to be dominated by non-cyanobacterial cells.

Let's talk about our feelings: Stakeholder and public perceptions of aquatic nutrient enrichment in Mississippi

Water Quality and Quantity
Oral Presentation

Samuel C. Pierce[1]*, L. Wes Burger[2], John F. Edwards[3], Kent W. Thornton[4], Trey Cooke[5], Dana Hall[3] and Robert Kröger[1]
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Sam Pierce, a research associate at MSU, grew up in rural Mississippi, where an older brother forced him to seine overgrown ditches at the tender age of 5. Sam has a bachelor's degree in biology from the University of Southern Mississippi and a Ph.D. in biology from the University of Memphis.

Press coverage of the "Dead Zone" in the Gulf of Mexico has brought widespread attention to the reality that excess nitrogen and phosphorus are nonpoint source pollutants that affect the health of freshwater and marine ecosystems. Mississippi, as a state that is economically reliant upon both agricultural production and coastal fisheries, is leading the effort to ensure that management practices for sustainable agriculture also yield sustainable fisheries and vibrant aquatic ecosystems. The success of nutrient mitigation efforts relies upon not only discernment of physical and ecological processes, but also upon recognition of sociological processes producing specific behaviors that decrease nutrient delivery to aquatic systems. As an initial step toward increasing community involvement, potential stakeholders were surveyed regarding their perceptions of nutrient sources, impacts, management, general ideology and self-perceptions. We surveyed members of eight stakeholder groups representing: farmers, agricultural industry representatives, agricultural consultants, agricultural conservationists, local elected officials, environmental regulators, environmental advocates and scientists. Four-hundred ninety Mississippi residents were administered an abbreviated version of the same survey. Stakeholders exhibited similar response patterns on questions about perception of self, other stakeholders and the public. Their view of themselves and fellow stakeholders was positive; whereas their view of the public varied with the type of question. Although stakeholders believed the public was mostly ignorant of issues related to nutrient enrichment, they also believed that private citizens would engage in implementing solutions if their understanding of the issue was improved. The results of the public survey generally paralleled these perceptions. Stakeholders were more informed than the public, but had different priorities. Only one-third of public survey respondents, for example, had heard of the Dead Zone, compared to almost two-thirds of stakeholders. But over 60 percent of public survey respondents thought that protecting the environment (vs. economy) should be a top priority, compared to less than 40 percent of stakeholders. Both responses and sample sizes differed among stakeholder groups, so this unweighted percentage is not representative of all groups. The views of regulators, advocates, and scientists were similar to those of the public. No two stakeholder groups exhibited similar responses for every question, but there were sufficient similarities to generalize differences between the "economy priorities" of farmers, consultants and industry representatives and the

“environmental priorities” of advocates, regulators and scientists. Stakeholder groups whose livelihood depends upon agriculture tended to deemphasize the effects of nutrient enrichment and were more likely to view the contribution of other potential nutrient sources as comparable to agriculture. They were also less likely to support federal or state involvement, but consistent with the overarching principles of the Mississippi Delta Nutrient Reduction Strategy endorsed voluntary, incentive-based solutions.

The results of this survey will serve as a basis to tailor outreach and education programs for general dissemination and for specific audiences as part of a continued research program focused not on the problems of nutrient enrichment, but on the solutions.

Low-grade weirs on the agriculture landscape: Temporal and spatial nutrient trends

Water Quality
Oral Presentation

Beth Poganski[1]*, Robert Kröger[1], Sam Pierce[1], Alex Littlejohn[2] and Corrin Flora[1]
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Beth Poganski is the research program manager for the Water Quality Laboratory at Mississippi State University. She also is a second-year doctoral student within the department. She holds a bachelor's degree in biomedical science and a master's degree in cell and molecular biology, both from St. Cloud State University.

The use of inorganic fertilizers in agricultural production is widely recognized as a source of nitrate contributing to annual hypoxic zones in the Gulf of Mexico. Ecosystem degradation and impacts on freshwater and marine biota from nutrient contamination of surface waters have motivated research efforts to develop and implement innovative nutrient management practices. Such efforts have become a major priority of many landowners, natural resource conservationists, scientists, and government agencies from a local to national scale. Studies have investigated the potential of low-grade weirs as an effective best management practice to reduce nutrient impacts downstream aquatic systems. In replicated experiments, observed hydraulic residence times were significantly higher in weir ditches as compared to non-weir ditches ($P=0.005$) which resulted in ditches with weirs demonstrating a lower ($P \leq 0.001$) median outflow load (47.9 mg/min) of nitrate-N than ditches without weirs (63.2 mg/min). Field scale data on weirs showed between 35-60 percent reductions for nitrate-N concentrations between inflow and outflow for base-flow and storm-flow conditions. Furthermore, a lag-effect in nutrient reductions was observed, which needs to be considered when evaluating BMP efficiencies.

The current experiment investigates how frequency and variable spatial arrangements of weirs within drainage systems impact water quality leaving the agricultural landscape. Preliminary water quality results highlight temporal nutrient trends in agricultural effluent, where concentration spikes were observed during seasons that experience heavy rainfalls and when fertilizer application occurs. Results also showed phosphorous concentrations to be higher in run-off during rain events rather than during baseflows, while nitrate concentrations in runoff were found to be similar regardless of flow regime. This preliminary investigation summarizes environmental variables that effect nutrient loads to downstream waters, which should be accounted for in management strategies and data analysis. Future data analysis will utilize measured environmental variables to create models of competing efficiency between our systems, which can be used to adapt current management practices to maximize nutrient reduction efficiency.

Microbial source tracking techniques reveal a limited community composition of *Escherichia coli* in a coastal lagoon determined by Denaturing Gradient Gel Electrophoresis

Water Quality and Quantity
Oral Presentation

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Daniel Presley is close to completing a master's degree at the Dauphin Island Sea Lab through the University of South Alabama in the Marine Microbial Ecology Laboratory. His research focuses on combining microbial source tracking techniques in order to provide a more complete picture of the source or sources of fecal pollution in Little Lagoon, Gulf Shores, Ala.

Fecal pollution in coastal waters is a common problem that is associated with the closure of beaches, fisheries and recreation. The biggest threat associated with fecal pollution is the introduction of pathogenic organisms, which are difficult to test for directly. This project seeks to examine the source of fecal contamination in Little Lagoon, Ala., a coastal brackish body of water that often is positive for fecal contamination well above the acceptable limits determined by regulatory agencies. This is a dynamic system with multiple factors affecting nutrient input and water quality including surface run-off, tidal effects and groundwater input. Spikes in indicator microbes found through previous monitoring efforts have not correlated with other environmental parameters. We used a combination of microbial source tracking methods in order to create a more accurate picture of the source and mode of entry of fecal contamination into the lagoon, including Denaturing Gradient Gel Electrophoresis (DGGE) and qPCR. DGGE was used to determine the *E. coli* community composition of Little Lagoon in order to compare it with communities from wells, inflows and sediments surrounding the lagoon. All samples were positive for *E. coli*, with some samples having only a few representatives and others having up to 10 unique bands. *E. coli* community composition appears to be predominantly a homogenous mix across the lagoon, while many of the sites where water flows into the lagoon have fewer, different bands. Results indicate that though individual sources of water may have distinct communities, once entering the lagoon dominant strains are mixed creating a single homogenous community.

Theoretical framework for developing a GIS based model to protect groundwater source

Water Quality and Quantity
Poster presentation
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Dr. Asheka Rahman earned a Ph.D. and master's degree in civil engineering from Louisiana State University. She began her career as a research associate with Louisiana Geological Survey of LSU and worked as a post-doctoral researcher at LSU. She accepted a visiting position at School of Construction of USM in 2008.

Dr. Mohammad Rahman is an assistant professor at School of Construction in the University of Southern Mississippi. His research includes decision-making application under uncertainty where little information is available and decision-making is risk-averse. His current works follow stochastic modeling for supply chain problems, intermittent forecasting and reliability models.

This paper presents a methodology to develop Geographic Information Systems (GIS) based model to delineate risk areas to groundwater resources by identifying recharge conditions to the aquifer. A recharge area is the place where water migrates to the underground to refill or contaminate aquifer. Identifying the recharge areas is crucial to control the risk of potential oil spill or hazardous material contaminants into the aquifer. The identification process illustrated here is based upon surface and subsurface geologic conditions. The methodology presents four steps. First step is the data collection regarding the factors that may affect the aquifer recharge. Second step is the development of a geodatabase that brings together the data pertinent to recharge condition. Third step is to generate thematic maps and the boundaries of recharge polygons by collating and analyzing the factors relating to the aquifer recharge using spatial analyses functions in GIS. Final step is the reclassification and recharge area delineation by combining the input maps, and the classification of low, moderate, high and very high recharge areas to indicate different spectrum of risks for potential oil spill or hazardous material contamination. The output map can be used in preparing guidelines to render oil and gas infrastructures permission and pipeline activities to minimize the threat of contamination to the aquifer.

As the factors and properties of the recharge area vary spatially, not all regions are equally vulnerable. A recharge map is necessary for oil-spill planners and responders for best management practices. A recharge map can guide pipeline companies to avoid use of the land that has a high risk of aquifer contamination and choose an alternative route. It may also guide cleaning operations as it determines whether or not the aquifer could become contaminated by the potential oil spill, how fast it would move and how difficult it would be to remediate. The Southern Hills Regional Aquifer system in southwestern Mississippi and southeastern Louisiana is studied as to better understand the risk to groundwater resources due to potential oil spills in the region.

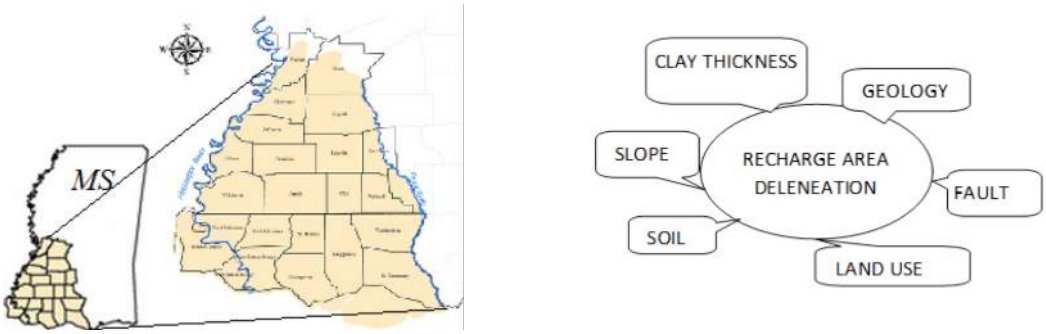

Figure: Map showing Southern Hills Regional Aquifer System in southwestern Mississippi, and Conceptual sketch showing the construction of recharge map.

Continuous measurements of oxidation-reduction potential to determine the capacity of vegetated agricultural drainage ditches for nutrient reduction

Water Quality and Quantity
Oral Presentation

Cory Shoemaker*[1], Robert Kröger[1], Robert Reese[2] and Samuel C. Pierce[1]
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Cory Shoemaker is a master's student in the Water Quality Laboratory at Mississippi State University. His interests include wetlands ecology, water quality and anthropogenic effects on biological systems. He received his bachelor's degree in biology and French from Wittenberg University.

Decreasing source nitrogen inputs and loads reduces nitrogen delivery and impacts on coastal ecosystems. In waterlogged soils, redox potential (Eh) is an important regulatory parameter for biogeochemical cycling, including nutrient reduction. Specifically, soil Eh can be used to classify the potential of a system for nitrate reduction, providing a convenient and inexpensive tool for assessing the capacity of upstream sites for denitrification. Automated data loggers are novel methods, which enable long-term continuous monitoring of Eh in soils; however, no protocol has been developed for testing the accuracy and precision of these loggers. This study tested the accuracy and precision of the Pt tipped soil probes, reference probes, as well as continuous automated data loggers, and found all units to be both accurate and precise within 10 percent accepted error. Furthermore, these loggers were field tested in a vegetated agricultural ditch with weirs and vegetated mesocosms to assess the potential of drainage ditch systems for nutrient reduction. Preliminary field testing of the continuous automated data loggers recorded no spatial differences in soil Eh, but did show temporal variation. This variation corresponded with the presence of vegetation in plots, suggesting the potential increased availability of oxygen in sub-soils as a result of root leaking. Additional testing will occur to evaluate the effects of vegetation and hydrology on the spatial and temporal variation in redox potential in order to better understand nitrate reduction potential and practices at the edge of field scale. This study seeks to quantitatively evaluate drainage ditch management to create conditions favorable for nitrogen removal at source inputs.

Building coastal stewards through recreation and education tourism
Water Quality and Quantity and/or Resilience
Oral Presentation
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Recreational trails, when properly planned and managed, can minimize impacts on coastal environments and serve as a driving force behind a community's resilient character, often being the motivator for building stewards for the natural world where they exist. Recreational trails can connect businesses, schools and special public places and have been known to bring high levels of tourism dollars to communities. Despite such benefits, much remains to be done in creatively fostering connections to education and tourism growth through trails and greenways while safe guarding the quality of coastal destinations.

Since 2007, the National Park Service (NPS) – Rivers, Trails & Conservation Assistance Program (RTCA) has assisted in establishing community partnerships that are working to reconnect residents and visitors to the coastal ecosystems that surround them through recreational trails and conservation education projects. The Heritage Trails Partnership of the Mississippi Gulf Coast (HTP) is working with youth leaders to establish the Mississippi Coastal Heritage Trail (MCHT) from Louisiana to Alabama. While increasing public understanding and providing public access to natural resource interpretive sites, waterways, islands and forests, this trail will also provide an opportunity to educate community members and visitors about the effects of the Deepwater Horizon Oil Spill on Gulf Coast communities and resources. It will serve as an educational tool to teach about the interaction between humans and the marine environment, as well as offer recreational access to a pedestrian/bikeway stretching across the historic and culturally rich Mississippi Gulf Coast that attracts tourists from all over the world. The MCHT will serve as the backbone of the physical network of cultural, historical and natural places where residents and visitors alike can connect with these places.

HTP would also like to promote canoe, kayak and wading trips along the Southeast Coast Paddling Trail (SCPT) that would offer opportunities to explore the effects of water quality on aquatic life and how individuals can help protect our nation's coastal environment. The SCPT will provide unique opportunities for visitors to get a close-up look at coastal wildlife and vegetation.

The MCHT and SCPT will be not only recreational resources where folks can exercise but also educational resources where naturalists could offer insights into the complex but fascinating world of coastal and marine ecology.

HTP would like to encourage community leaders to consider the enormous positive impact on quality of life and tourism economics of providing recreational trails, both land based and water based. The HTP plays an important role in boosting public awareness about wetlands, bays and bayous by providing recreational opportunities and public outreach programs and hopes that through its efforts it will play a role in building enlightened stewards for our coastal world and

create a space where residents can come and “re”create their bodies and minds leading to a more healthy and resilient community.

An automated system configuration for bathymetric data collection using Real Time Network (RTN) GPS technology

Water Quality and Quantity
Poster Presentation

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Thomas Strange is a geospatial/natural resources specialist at the Grand Bay National Estuarine Research Reserve (GBNERR). Much of his work involves using geospatial technology and ecology principles to better understand coastal ecosystems. His research and management interests include habitat mapping, geodetic vertical control, estuarine erosion surveying and historical ecology.

High resolution, GPS-based bathymetry surveying is a proven method for obtaining elevations in subaqueous environments. Bathymetric data is a crucial component for numerous research and management applications including sea-level rise models, hydrodynamic simulations, habitat restoration assessments, benthic habitat mapping and navigation. Much of the data that exists for small estuaries is coarse in resolution and is primarily restricted to larger bodies of water (e.g. bays, rivers). Our objective is to provide a comprehensive, detailed bathymetric dataset for waters located within the boundary of the Grand Bay National Estuarine Research Reserve. To date, only the larger water bodies at the GBNERR have been mapped by NOAA's National Ocean Service. These include the areas of Point aux Chenes Bay, Middle Bay, Grand Bay and Bangs Lake. NERR staff developed a streamlined collection system that is capable of collecting depth soundings in shallow and narrow waterways as well as large water bodies. Data collected with this system will be integrated with the GBNERR's vertical control infrastructure to maintain a standard vertical datum across numerous datasets including surface elevation tables, salt marsh topography, vegetation plots, local benchmarks and a local tide station. The mapping system consists of a Trimble R8 GPS receiver, a dual frequency echo sounder that outputs NMEA DBT (depth below transducer) streams and a Trimble TSC3 data collector. Two standard survey rods were modified to accommodate the positioning of the GPS antenna and echo sounder sensor such that each occupies one end of the same rod. The rod is held in place by a trolling motor mount and fabricated aluminum bars that are attached to the gunwale and center console of the boat to decrease lateral movement. The R8 GPS communicates with a system of Continuously Operating Reference Stations (CORS) via cell phone modem and deposits the data in the TSC3 collector through a wireless Bluetooth connection. The data tethering allows real-time vertical and horizontal positional corrections at a maximum accuracy of 2 cm. The data collector connects to the sounding device through a standard serial connection. All depth soundings are automatically applied to the GPS height yielding accurate elevation points relative to a standard vertical datum. The system requires a small amount of equipment, is lightweight and portable, weather resistant and provides highly accurate elevations and x,y positions compared to other commonly used shallow water sounding configurations.

A Redfish Tale Initiative --- Production of a video series to educate about nutrient over-enrichment and both positive and negative human impacts along the Gulf Coast

Water Quality and Quantity
Oral (Video) Presentation

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Roberta Arena Swann is the director of the Mobile Bay National Estuary Program. Her interests include stormwater management, stewardship programs and marine literacy. She holds a master's degree in business administration in public/non-profit management from Boston University.

In response to increasing concern about the health of Gulf coast watersheds due to excessive anthropogenic nutrient loading, MBNEP has partnered with the Dauphin Island Sea Lab, the Gulf of Mexico Program, Hamline University and a local producer to develop two interactive, touring videos, three interactive, touring kiosks and AMSTI approved supplementary educational material. This program, with English and Spanish translation, will educate children and adults about the impacts of excessive nutrients on Gulf coastal waters and stimulate behavior changes. It will clarify the concepts of "watersheds" and "estuaries" and describe the various sources of nutrient input and impacts. "*A Redfish Tale*" and "*FishSlap*" are two 15-minute videos that showcase both positive and negative human behaviors and their effects on our environmental resources.

Figure 1. Jimbo and Thibodaux

The leading characters of the first video, animated redfish named Jimbo and Thibodaux, return in the second video to provide the continuing prospective of "a fish out of water" to emphasize the sense of urgency in changing the way we treat our environment. Three interactive kiosks have been delivered and are installed at Dauphin Island Sea Lab, Gulf Coast Exploreum Science Center and The Pier Aquarium in St. Petersburg Florida. According to the Gulf of Mexico Alliance Governors' Action Plan, education and outreach are essential to accomplish goals of improving water quality and reducing nutrient input to coastal ecosystems. Human activities on land add excess nutrients to coastal areas or compromise the ability of ecosystems to remove them either from landscapes or from waterways themselves. Nutrient over-enrichment underlies depletion of dissolved oxygen, habitat loss, harmful algal blooms and declines in populations of important marine organisms. The video productions, interactive kiosks and educational material provide an innovative way of raising awareness about Gulf coast assets and motivate human behavior changes to stem negative impacts of human activities on ecosystem health. The video productions and interactive kiosks will be circulated among Gulf coast education venues.

Spatial distribution of biogeochemistry and the effect on light attenuation in a shallow, turbid estuary of the Northern Gulf of Mexico

Water Quality and Quantity
Oral Presentation

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Ryan Vandermeulen recently defended his master's thesis, titled "Factors influencing the spatial and temporal distribution of primary productivity and community respiration in the Mississippi coastal estuarine region," at The University of Southern Mississippi in June 2012. His research interests include ecosystem metabolism, coastal optics and satellite remote sensing.

The Mississippi coastal estuarine waters are characterized by extensive fluvial input, terrestrial runoff and high benthic sediment fluxes, resulting in a highly variable underwater light distribution. The diffuse attenuation coefficient, K_d(PAR), and associated biogeochemistry (particulate inorganic matter [PIM], particulate organic matter [POM], chromophoric dissolved organic matter [CDOM] and Chlorophyll-*a* [Chl-*a*]) were measured at 14 stations throughout the Mississippi Sound and Mississippi Bight at regular, monthly sampling intervals for the year 2011. Here, an empirical model (derived from log-transformed multiple regression analysis) for predicting K_d(PAR) from biogeochemical values is proposed for Mississippi waters. The subsequent partitioning of each biogeochemical parameter using the empirical model reveals that PIM was the dominant contributor to K_d(PAR) in the Mississippi Sound, while Chl-*a* was the dominant parameter in the Mississippi Bight. In addition, relationships between ground measurements of optical properties and satellite-derived products were analyzed to determine whether validation criteria could be achieved. Selected Moderate Resolution Spectroradiometer (MODIS) time-series products showed good correlations with SPM, PIM, CDOM and K_d determined from the limited data set (r^2>0.8), while Chl-*a* did not correlate well (r^2=0.6). The results of this study demonstrate the variability in the ambient concentration and the spectral quality of all the optically active biogeochemical constituents in a turbid shallow estuary.

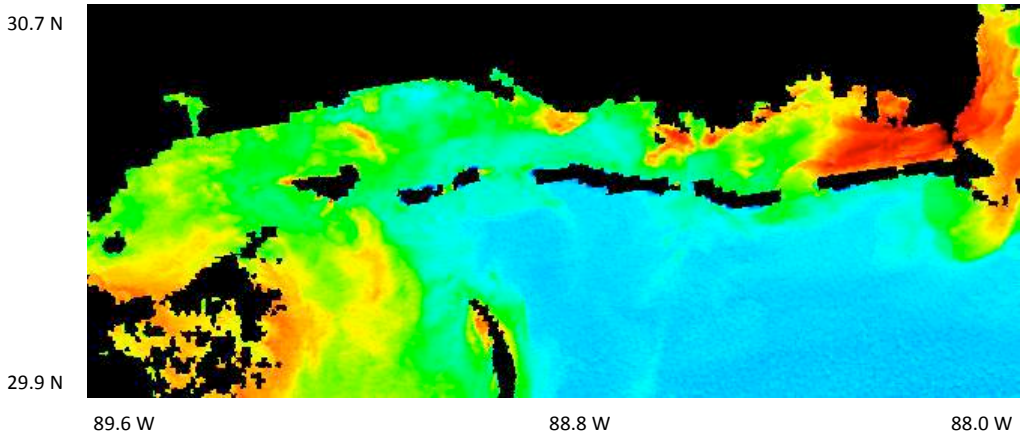

Figure 1. MODIS Aqua high resolution 250 m band 1 (620 – 670 nm) in Mississippi waters.

Microbial source tracking in coastal waters: Enterococci persistence and tracking sources of norovirus

Water Quality and Quantity
Oral Presentation

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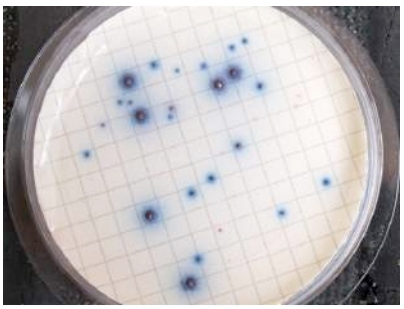
Shiao Wang is a professor in the Department of Biological Sciences at The University of Southern Mississippi. His interests include molecular assays to detect and identify sources of fecal pollution in coastal waters and microbes that decompose salt marsh detritus. He holds a Ph.D. from Louisiana State University.

The quality and safety of coastal waters for recreational use and shellfish harvesting is assessed by quantifying fecal indicator bacteria (FIB). The presence of FIB, such as enterococci, is used to indicate increased risk of the presence of fecal-derived, waterborne pathogens. Their continued use as indicators of water quality is now increasingly questioned. The source of FIB at most beaches is unknown, and is usually attributed to non-point sources. Of increasing interest is persistence and regrowth as a possible explanation of FIB presence at locations where they are not expected and direct detection of human pathogens in recreational waters.

We developed a microcosm that can be deployed at beach sites to study bacterial survivability under natural conditions. They permit exchange of dissolved substances between the content and the beach water in which they are placed but prevent movement of bacteria between the two. Bacteria within the microcosms experience natural fluctuations in temperature and salinity. Early results show that the majority of enterococci found in sewage do not survive in the environment. This suggests the possibility that enterococci found in the environment are a subset of those that normally inhabit the guts of warm-blooded animals. Current research is aimed at testing the genetic distinction between those found at beaches and those in sewage, and differences in their hardiness.

We also developed a method to identify sources of norovirus in the environment. Noroviruses are a human pathogen of interest because they are responsible for approximately 50% percent of gastroenteritis outbreaks and at least 90 percent of those of viral etiology. We first developed a new method to extract and concentrate norovirus RNA for detection by RT-PCR using probe hybridization technology. We then developed the use of the freshwater clam *Corbicula fluminea* as a sentinel of norovirus contamination in freshwater creeks that discharge into coastal beaches. We think the use of the clam as a sentinel and the improved detection assay will provide a method to identify sources of norovirus contamination along the coast when such a need arises in the future for improved watershed management and protection of the public.



A higher elevation *Juncus roemarianus* marsh overcomes sulfide accumulation that inhibits nitrification and denitrification in other vegetated coastal sediment

Water Quality and Quantity
Oral Presentation

Lei Wang [1, 2 *], Rebecca Bernard[1, 3], Behzad Mortazavi[1, 3] and Alice Ortmann [1, 2]
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Lei Wang is a second-year Ph.D. student at Dauphin Island Sea Lab and University of South Alabama. His dissertation focuses on nitrogen cycling processes mediated by microbial communities in coastal waters. The general objective of his study is to identify the factors controlling nitrogen cycling processes in Mobile Bay.

Estuaries and salt marsh systems can play important roles in removing nitrogen (N) and controlling eutrophication in coastal waters. By altering organic matter and O_2 concentrations, the presence of vegetation is one of the factors potentially controlling N removal. To quantify the effects of different vegetation on N cycling processes, four sites were sampled at Point aux Pines, Alabama: bare sediment, a sea grass bed (*Ruppia. sp*), a low elevation *Spartina alterniflora* dominated marsh and a high elevation *Juncus roemerianus* dominated marsh, in August and November. Potential nitrification and denitrification rates were measured and genes associated with nitrification, denitrification and sulfate reduction were quantified. The highest potential nitrification and denitrification rates were observed at the *J. roemerianus* site, but these rates were low at the bare sediment, sea grass and *Spartina* sites. The genes corresponding to nitrification and denitrifitions (*nirS*, *nirK*, and *amoA*), showed similar patterns as the potential rates among sites. Sulfite reduction (*dsrB*) genes were more abundant at all sites compared to the nitrification or denitrification genes, suggesting that sulfate reducers may out-compete denitrifiers. The sulfides produced by sulfate reducers likely inhibit nitrification and denitrification and decreases nitrogen removal. In the higher elevation *J. roemerianus* marsh there is little accumulation of sulfides corresponding to higher denitrification rates, suggesting that sulfate reducers play an important role in regulating denitrification in coastal waters.

Isolation and identification of harmful algal bloom (HAB) toxins from *Karlodinium veneficum* species around the world and the initial studies on their mechanism of action for ichthyotoxicity

Water Quality and Quantity
Oral Presentation

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Amanda L. Waters is a fourth-year graduate student at the University of Mississippi, School of Pharmacy, Department of Pharmacognosy. Her interests include the isolation and elucidation of marine natural products including harmful algal bloom toxins. She holds a bachelor's of science degree in chemistry from the University of Oklahoma.

Figure 1. Massive fish kill in Maryland in 1997 and 2001 due to HAB events.

HAB events are a major financial, ecological and human health problem worldwide. Understanding the structure, nature and mechanism of action (MOA) of an HAB toxin is crucial to beginning the remediation effort. As early as 1957, the HAB *Karlodinium veneficum* was reported to produce karlotoxins (KmTx), which have been shown to have hemolytic, cytotoxic and ichthyotoxic activities and continually associated with fish kills worldwide. Due to technological limitations, the toxic structures were not determined until recently with the absolute configuration not known until 2010. The first part of this project focuses on the development of a fingerprint dataset of all of the KmTx structures known to date via 2D nuclear magnetic resonance (NMR) techniques. Currently there are seven KmTx structures published only three of which are sufficiently unique and not simple chlorinated or sulfonated derivatives. This project has used KmTx2 as a standard for comparison and elucidated the planar structures of 9 new KmTx molecules from varies global locales along with establishing their relative configurations. The second part of this project focuses on developing a better understanding of the MOA of the ichthyotoxicity. In early fish toxicity studies, it was shown that when cholesterol was added to the water in addition to purified KmTx extract a protective effect for the fish was seen. This MOA evidence was briefly mentioned in the 1950s, but was not further explored until recently. Surface plasmon resonance (SPR) studies show the binding preference of KmTx for cholesterol over most other common sterols. Using a variety of overlaid 2D NMR studies, we were able to determine the portions of the molecule, which are significantly interacting with cholesterol. This data puts us closer to fully understanding the harmful MOA of the karlotoxin class of molecules, which in turn will aid in remediation efforts.

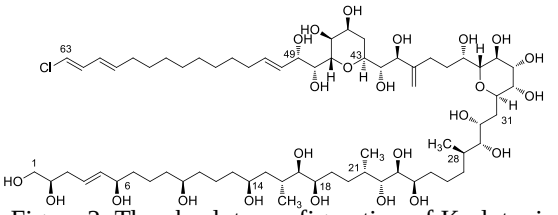

Figure 2. The absolute configuration of Karlotoxin 2 which is the most potent of the suite of toxins elucidated to date from *Karlodinium* blooms worldwide.

Analysis of coastal vegetation types for use in coastal flood modeling

Water Quality and Quantity
Poster Presentation
Jeff Zanotti
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Jeff Zanotti has been a GIS Specialist with AMEC Environment and Infrastructure for 4 years in the Water Resources division of their Birmingham office. He has a degree in geography from the University of Alabama and is a Certified Floodplain Manager.

Considering the highly sensitive nature of coastal areas, and the relative unpredictability of weather patterns in these regions, it has become increasingly imperative that FEMA's flood risk communication tools, such as Flood Insurance Rate Maps (FIRMS) are kept as accurate as possible. This allows for proper risk identification, mitigation, and planning for our coastal communities. Working alongside the Alabama Department of Economic and Community Affairs, Office of Water Resources, AMEC is responsible for ongoing coastal flood modeling and the subsequent revision of the Digital FIRMs for Baldwin and Mobile County, Alabama. This effort involves an arduous data collection process, using remote sensing methods verified by ground-truth data collected in the field, necessary to model over 200 miles of coastline.

AMEC's approach to coastal modeling requires the development of several GIS-based data layers. These layers include a vegetation layer, which is an essential component of modeling the propagation of waves as they interface with the land. Vegetation inputs are needed to be classified in accordance with the required specifications of Wave Height Analysis for Flood Insurance Studies (WHAFIS) software per FEMA's guidelines. AMEC used GAP Landcover data and Forest Inventory and Analysis (FIA) data as a representation of vegetation types on the ground. The GAP data classifications were slightly different from the WHAFIS input requirements creating a need for reclassification into 3 major types and 9 subtypes. The 3 major types were Rigid Vegetation, Marsh Grass and Other. The vegetation layer was smoothed in GIS and checked against the latest aerial photography available.

This method produced great results for "Rigid Vegetation" and "Other" but "Marsh Grass" needed a slightly more sophisticated methodology. After researching online national datasets we were able to obtain a spatial layer from the U.S. Fish & Wildlife Service's National Wetland Inventory. Using this layer with Cowardin classification we refined our Marsh Grass layer. WHAFIS only recognizes two inputs for Marsh Grass in the Gulf region, *Spartina alterniflora* or *Juncus roemerianus*. To properly distinguish between the two we performed field research along selected areas based upon our existing GIS layer. Southwestern Mobile County has many hard to access locations but we were able to partner with the Alabama Department of Conservation and Natural Resources to record data from these locations by boat via mobile data collection using smart phone applications that sent the data directly to our server back at the office.

This presentation will highlight the importance of vegetation data in coastal modeling and the benefits of utilizing GIS in creating this dataset.

BAYS & BAYOUS

SYMPOSIUM 2012

Distinguished Speakers

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SYMPOSIUM 2012

Distinguished Speakers

Distinguished Speakers

David Yoskowitz, Harte Research Institute for Gulf of Mexico Studies

David Yoskowitz is the Harte Research Institute Endowed Chair for Socio-Economics at the Harte Research Institute and professor of economics in both the College of Business and the College of Science and Technology, both at Texas A&M University-Corpus Christi. His work is focused on elucidating the link between environmental well-being and human well-being and moving practice into policy. Currently, he is leading an effort to inventory and value ecosystem services for the Gulf of Mexico region. Additionally, he is exploring the economic impact of climate change on the coastal zone, specifically in the area of sea-level rise and freshwater inflow and is currently working with colleagues in Mexico on the socio-economic assessment of the United Nations Industrial Development Organization's (UNIDO's) Gulf of Mexico – Large Marine Ecosystem project. He serves on the National Research Council Committee on the Effects of the Deepwater Horizon Mississippi Canyon-252 Oil Spill on Ecosystem Services in the Gulf of Mexico. He also sits on the Ecosystem Scientific and Statistical Committee and Socio-Economic Scientific and Statistical Committee for the Gulf of Mexico Fishery Management Council and is a Kavli Fellow of the National Academy of Sciences.

Bea Stong, BP America

Bea Stong in the director of Natural Resource Damages & Regulatory Affairs for BP's Gulf Coast Restoration Organization. She is responsible for continuing the Natural Resource Damage (NRD) program to assess the injury to the natural resources caused by the Deepwater Horizon incident, reach resolution with the NRD Trustees on the restoration requirements resulting from that injury and continue to progress early restoration under the $1 billion Early Restoration Framework agreed by the federal and state NRD Trustees. Bea is the former director of environmental response and regulatory affairs in the Gulf Coast Restoration Organization (GCRO), which included leading the Environmental Section of the Gulf Coast Incident Management Team.

Gary Finch, Finch Productions, LLC

Gary Finch is a professional outdoorsman from Mobile, Ala. He is host of the syndicated outdoor program "Gary Finch Outdoors," which can be seen weekly on WEAR ABC 3 in Mobile and Pensacola, Fla., and WTVY CBS 4 in Dothan/Panama City, as well as regional cable stations. The program has run continuously for 24 years. After Attending the University of Georgia, Finch joined the U.S. Army to serve as a pilot. He now serves on several boards, including the Enrichment Foundation for Baldwin County Schools, and he is a trustee of the Islands of Perdido. He resides in Fairhope, Ala., where he is a member of the Outdoor Writer's Association of America and the Southeastern Outdoor Press Association. Finch has written more than 350 articles for various publications aimed at educating youth about proper safety and conservation.

Distinguished Speakers

Rex Caffey, Louisiana State University

Dr. Rex Caffey is the director of marine extension for the Louisiana Sea Grant College Program and a program specialist in the LSU AgCenter in the topic area of wetlands and coastal resources. He is the founding director of the LSU Center for Natural Resource Economics and Policy. The primary objective of the center is to foster the interaction of environmental economists and policy professionals to address natural resource conservation and management challenges in Louisiana and the southeastern United States. His research interests include wetland policy, marine fisheries management and the economics of coastal wetland restoration.

Thank you to these sponsors for making the 2012 Bays and Bayous Symposium possible.

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