Proposal Prepared in Response to Gulf of Mexico Research Initiative
Request for Proposals: Selection of Research Consortia

LOI Submission Number: GRI12011-1-071

Title of the Consortium: The Effects of the Macondo Oil Spill on Coastal Ecosystems

Lead Institution Name and Location: Louisiana Universities Marine Consortium, 8124 Hwy. 56, Chauvin, LA

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Requested Funding Amount: $13,538,840

Duration of Effort: 3 Years

Proposal Authorization:

Nancy Rabalais

2. Consortium Summary

The Consortium "**The Effects of the Macondo Oil Spill on Coastal Ecosystems**' will address the fundamental objective identified in the RFP of determining the impacts of the oil, dispersed oil, and dispersant on the ecosystems of the Gulf of Mexico within a broad context of improving fundamental understanding of the dynamics of such events and the associated environmental stresses and public health implications. Our fundamental goal is to improve society's ability to understand respond to, and mitigate, the impacts of petroleum pollution and related stressors of the marine and coastal ecosystems, with an emphasis on the Gulf of Mexico region.

Our focus is on GRI Theme 2 (chemical evolution and biological degradation) and Theme 3 (environmental effects). We ask these questions with this proposal, while recognizing that the answers may not be fully revealed by us, or with others within this funding cycle:

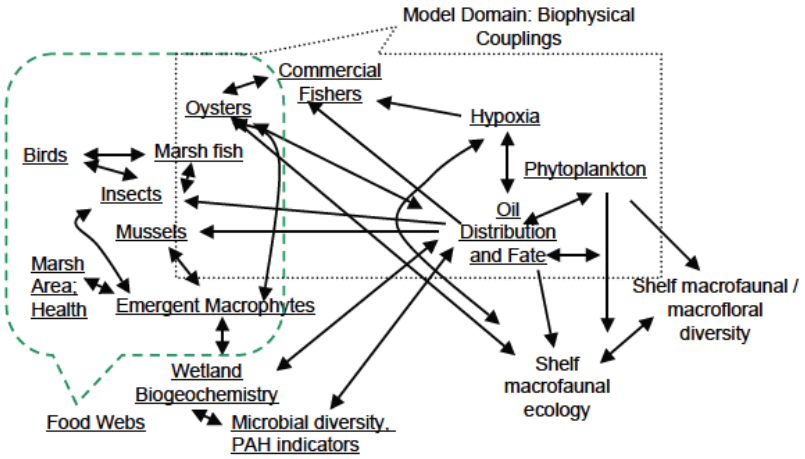
Where is the oil now and how has it changed since 2010?
What are its impacts and how have these impacts evolved since 2010?
Have parts of the ecosystem been resilient, recovered or compromised?
How do the spill-related stressors interact with other stressors?
What indicators of stress and recovery can be developed to manage future stressors?
What data or tools or perspectives need to be applied or developed to improve our understanding?
How has the use of the ecosystem been modified by these stressors and have these ecosystem services recovered?

We are 26 Principle Investigators with 500+ years of research experience in coastal systems from 12 institutions. We will be assisted by 16 post docs, 6 Research Associates, 7 graduate students and dozens of undergraduates. The PIs have received $1.6 million in oil-spill related funds from NSF, NOAA, BP-funded university initiatives, and Sea Grant Programs. Half of the PI have successful administrative experience with several multi-year collaborative grants @ >$1KK/y, and all publish in the best journals *and with our students*. Most have worked with each other before this project and have been studying the impacts of the DWH event since it happened. All are without the appearance of conflicting allegiances to either NRDA or industry.

We bring substantial data collected before the DWH spill to the analysis. Most of the PIs were funded to work together on the DWH spill as soon (or before) as resources became available, and in the Louisiana coastal ecosystems which were disproportionately exposed to the DWH oil spill. Half the PIs are involved in the multi-agency funding (NSF, NGI, BP-funded University Initiatives, Sea Grant) that this proposal evolved from. The PIs coordinated three large-scale sampling efforts in Louisiana coastal marshes in Breton Sound, Barataria Bay and Terrebonne Bay, including a May 2010 field effort that took place just before the landfall of oil. We sampled 125 wetland sites throughout the affected areas to date, with hundreds of water and sediment samples taken for oil analysis (fingerprinting). The evolution of data, tests and analysis lead to the present proposal in which we propose quantifying the effects of stressors – e.g., hydrocarbons, dispersants, freshwater diversion, and other remediation-related human activities -- with two overarching objectives: (1) to investigate the potential impacts of the DWH oil spill now before the signal:noise ratio diminishes, and, (2) to use our extensive pre-spill and 2010 sampling to our best advantage, and in a way that builds long-term data sets that benefit many other purposes.

We propose measuring the effects of stressors on aquatic and wetland soils, marsh plants, insects/spiders, fish, birds, commercial fisheries, and selected mollusk species found in the marsh and pelagic characteristics of adjacent open waters. We also measure changes in the quantity and quality of hydrocarbons as they degrade, alter soil stability, and enter food webs via primary consumers, if marsh erosion is enhanced, indices of avian communities change, and benthic organisms adaptation. Integrative

measures of oil-induced changes in benthic communities and surrogate measures like oxygen concentrations will be quantified. Our goal is to provide a benchmark study in ecosystem change analysis, to identify precursors to ecosystem trajectories before alternative states are realized, and to address societal concerns about wetland stability, and how the oil spill may have affected oxygen concentrations and planktonic and benthic communities. The working relationships between of the main (subjective) research efforts are shown in the figure below. Each of the 17 main components (sub-tasks) has at least two couplings with other tasks, and most are directly connected to the modeling and food web analysis.



The Lead Administrative unit is the **Louisiana Universities Marine Consortium for Research and Education (LUMCON)** - a statutory consortium in coastal Louisiana well known for coastal research. LUMCON manages an average $4.0/Y in expenditures from outside grants and contracts. Its Director, Nancy Rabalais, is the Project Director for this proposed research. She operates at the level of a university vice president for research and development and office of sponsored programs, and signs contracts at the level of a university president.

The **Public Education and Outreach** program will translate and disseminate our research findings to multiple levels of society about the effects of the oil spill on ecosystems and living resources. The Consortium will accede to all GRI instructions for data submission as required from their agreement developed with the Harte Research Institute for Data Management and Discovery. LUMCON and its member institutions are prepared to provide data and metadata suitable for federal databases or nationally recognized repository appropriate for the various disciplines involved here. The Consortium is fully supportive of the goals of the GRI **Data Management** protocol to provide reliable data as soon as possible, allow timely use of the data by the research investigators, and supply of the data and metadata to appropriate federal repositories upon completion of research-based, peer-reviewed publications.

There will be a **Steering Committee** of 9 out of 26 investigators, organized by research theme, to guide the overall sampling strategy and incorporation of the multidisciplinary aspects of the research plan. The Steering Committee is led by 3 executive members who were integral in the development of the overall research plan and its vision for understanding the effects of the BP Deepwater Horizon oil spill on ecosystems of the Gulf of Mexico. The Steering Committee also includes key LUMCON staff for Public Outreach and Education, Data Management, and development and sourcing of the project's web site. We have assembled a **Science Advisory Committee** of outstanding experts on the study of coastal and marine ecosystems.

Table of Contents

4a. **Executive Summary**

The Consortium "**The Effects of the Macondo Oil Spill on Coastal Ecosystems**' will address the fundamental objective identified in the RFP of determining the impacts of the oil, dispersed oil, and dispersant on the ecosystems of the Gulf of Mexico within a broad context of improving fundamental understanding of the dynamics of such events and the associated environmental stresses and public health implications. Our fundamental goal is to improve society's ability to understand respond to, and mitigate, the impacts of petroleum pollution and related stressors of the marine and coastal ecosystems, with an emphasis on the Gulf of Mexico region.

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The Lead Administrative unit is the **Louisiana Universities Marine Consortium for Research and Education (LUMCON)**. The Executive Director, Nancy Rabalais, is the Project Director for this proposed research. There will be a **Steering Committee** of 9 out of 26 investigators to guide the overall sampling strategy and incorporation of the multidisciplinary aspects of the research plan. The Steering Committee is led by 3 executive members who were integral in the development of the overall research plan and includes key staff for Public Outreach and Education, Data Management, and development and sourcing of the project's web site. We have assembled a **Science Advisory Committee** of outstanding experts on the study of coastal and marine ecosystems.

4b. **Narrative Description of the Research Objectives and Goals of the Consortium**

The Consortium **The Effects of the Macondo Oil Spill on Coastal Ecosystems** (EMOSCE) will address the fundamental objective identified in the RFP of determining the impacts of the oil, dispersed oil, and dispersant on the ecosystems of the Gulf of Mexico within a broad context of improving fundamental understanding of the dynamics of such events and the associated environmental stresses and public health implications. Our fundamental goal is to improve society's ability to understand respond to, and mitigate, the impacts of petroleum pollution and related stressors of the marine and coastal ecosystems, with an emphasis on the Gulf of Mexico region.

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Background

The central immediate issue is to obtain rigorously defined information on this stressor before the signal is overwhelmed by the new noise.

Oil sheens and the smell of volatile organics remain in coastal Louisiana 14 months after the 20 April, 2010 BP Macondo (aka, DWH; Deepwater Horizon) oil spill disaster began at Mississippi Canyon Block 252, located about 66 km offshore of the Mississippi River delta. This disaster resulted in 13 deaths and 17 people injured, and released an estimated 4.4 X 10^6 barrels of oil into the Gulf of Mexico (804,877 barrels were also collected at the seafloor, Crone and Tolstoy 2010). It was the largest spill event in US history, equal to 7 times the size of the Exxon Valdez oil spill, and was the fifth largest in the world.

This surfaced DWH oil fouled and killed marine birds, turtles and mammals and was retained in ocean eddies for weeks to months, coating and harming the floating *Sargassum* habitat and exposing associated fish and wildlife. Oil from this industrial accident was first found on the Louisiana beaches on 11 May; fresh sightings of the oily mousse and tar balls in the estuaries continued after the leak was stopped using relief wells on 15 July and officially declared closed on 19 September 2010. The Louisiana coastal ecosystems were disproportionately exposed to the released oil (Table 1). Our priority research sites are, therefore, where the oil landed – in the Barataria and Terrebonne estuaries.

Table 1. Indicators of impact.

Indicators	West coast Florida	Alabama	Mississippi	Louisiana	Texas
Tidal shoreline (miles)	30%	4%	2%	45%	20%
Oiled Shoreline (miles)	16%	9%	15%	60%	0%
Booms deployed					
Turtles oiled (live and dead)	16%	40%	4%	40%	0%
Mammals oiled (live and dead)	17%	0%	67%	17%	0%
Birds oiled (live and dead)	11%	8%	11%	70%	0%
% of the shoreline in GOM that was oiled occurred in	5%	0%	0%	27%	0%

Sources: http://www.nmfs.noaa.gov/pr/pdfs/oilspill/turtle_data.pdf; http://www.nmfs.noaa.gov/pr/pdfs/oilspill/cetacean_data.pdf; http://www.restorethegulf.gov/sites/default/files/documents/pdf/Consolidated%20Wildlife%20Table%20110210.pdf

The coupled natural-social network of the Gulf coast became stressed with the suppression and compromise of multiple ecosystem services. Substantial scientific advances are necessary to assess the subtle, delayed, indirect, and potentially synergistic impacts of these widespread, highly bioavailable, toxic hydrocarbons and chemical dispersants, and the consequences of a massive organic carbon subsidy to the food webs in which they are embedded. Many questions remain about the scope and degree of longer-term impacts and how they influence the functioning of the Gulf ecosystems and the processes that provide resilience to new stressors.

The results from studies examining other oil spills suggests that the oil making its way into coastal ecosystems will persist for decades (Reddy et al. 2002). Its ecological effects may be immediately toxic to a variety of organisms, and the long-term effects last several decades (Teal et al. 1992; Culbertson et al. 2007a, b). Any damage incurred is expected to be dependent on exposure length and frequency. Recovery is possible, but not guaranteed. This is because, in part, oil quality changes with temperature, volatilization, and decomposition, and moved between ocean, estuary and marsh as droplets, tar balls, a brownish mouse with colorful descriptive names, or "mousse". This oil might coat the emergent wetland plants up to the high water mark or weigh them down as far as 10 m into the marsh. Its effects might combine with other influences to have a synergistic and maladaptive outcome. A series of cascading effects on the plant-dependent food web are expected to follow from these impacts.

Field Research is Underway - now

Estimating change is best done against a well-defined set of baseline conditions. We are in the process of creating and analyzing that baseline. In 2010, the PIs coordinated two large-scale sampling efforts in Louisiana coastal marshes from Breton Sound through Terrebonne Bay (east to west) (Fig 1 and 2). The May 2010 field effort took place just before the landfall of oil and the September 2010 trip was post-oiling. NSF RAPID funds supported a third sampling effort in June 2011, and a fourth is funded for Sept 2011. We sampled 125 sites throughout the affected areas to date, with water and sediment samples taken for oil analysis (fingerprinting) at each site. Initial sampling took place over this broad region because: 1) the fate of the spilled oil was unknown in May 2010, and 2) we needed a sampling design in September 2010 to factor in the possible interactive effects of oil landfall and large-scale freshwater diversion on the coastal ecosystem. Our preliminary data highlight two major issues: (1) oil is persisting in some marshes, and (2) spatial heterogeneity of the coastal system makes interpretation of our regional-scale data difficult - an issue that can be addressed by using comparative data from samples collected at much finer spatial scales. These group field trips include sampling for below-ground biomass of the dominant emergent macrophyte(s), soil strength, gps data for estimates of shoreline erosion rates, marsh and adjacent open water mollusks, and ground- and plant-dwelling insects, microbes, stable isotope samples, soil and pore-water chemistry, fish, and spiders, and field observations of birds.

Project Structure

This proposed project is organized as a set of interconnected functions managed and administered by a set of internationally-recognized scientists who are mostly well-known collaborators. Most of us have pre-impact data and on-going projects. We are not starting from scratch. In fact, we don't need much start-up time, except for equipment purchase (a Licor instrument for plant work). Our field work is already planned for the fall 2011 from other funding.

How research will be coordinated and integrated

The skill and experience of the project participants is a strong indicator of project coordination, integration and success. Most were funded to work on these problems as soon as money became available. We are 26 Principle Investigators (PIs; 16 are from GOM) with 513 years of research experience in coastal systems (avg. 20 y), from 12 institutions. We will be assisted by 16 post docs, 6 Research Associates, 7 graduate students and dozens of undergraduates. The PIs have received $1.6 million in oil-spill related funds from NSF, NOAA, BP-funded university initiatives, and Sea Grant Programs. Half of the PI have successful administrative experience with several multi-year collaborative

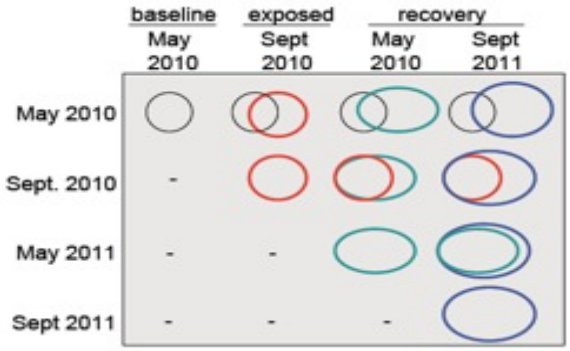
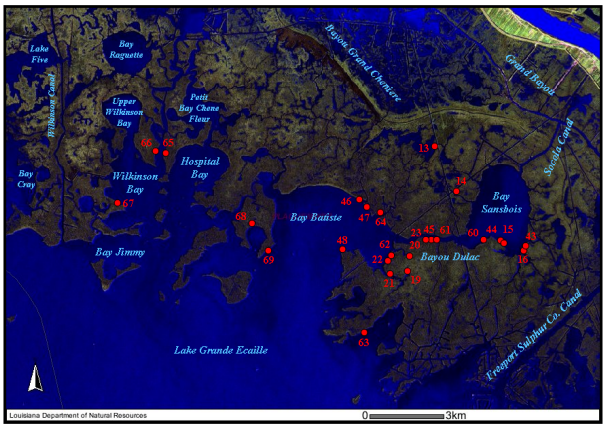


Fig. 1. A schematic representation of overlap in sites sampled within 3 estuaries as a pairwise correlation matrix. Circle color corresponds to sampling date, circle size to number of sampled sites, and circle overlap to the number of sampled sites in common between trips. In May 2010, 32 baseline sites in 3 estuaries were visited. In September 2010, 36 sites, primarily in the Barataria estuary, were sampled. Sampling in June, 2011 included most of the September 2010 sites in the Barataria estuary, and added additional ones. The funded trip in September 2011 will be the largest field sampling, with almost complete overlap anticipated with the preceding one pre-spill strip and two post-baseline trips.



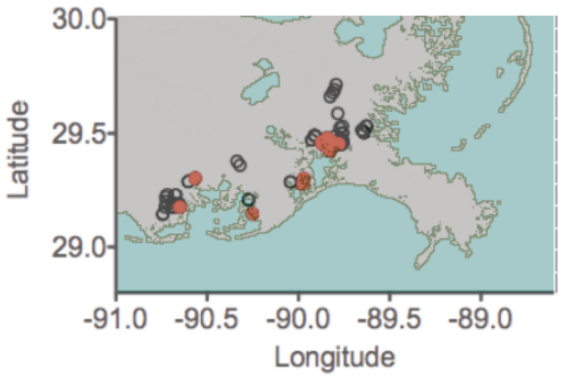


Fig. 2. Field sites in eastern Barataria Bay, Louisiana upper panel) and across the coast (lower panel).

grants @ >$1KK/y, and all publish in the best journals *and with our students*. All are without the appearance of conflicting allegiances to either NRDA or industry.

The proposed set of inquires is fairly intense (Fig. 3). We are determined to measure oil exposure, rather than assume exposure. Overton's extensive fingerprinting and quantification of oil is an essential part of all the other sections, therefore. The microbes may react to the oil and degrade it (Summers-Engel), changing the biogeochemical pathways in soils (Bernhard, Giblin, Roberts), and affect macrofauna (Rabalais, Turner). The biophysical modeling (Justic) demands data input, and gives shape to the temporal and spatial exposure to oil for periods and places when field data is absent. The insects/spicers (Hooper-Bui) are fed upon by birds (Taylor and Stouffer) and marsh fish (Able), and the birds feed upon the fish. The food web analyses (Fry) involve the participation of those studying plants (Turner), fish (Able), mussels (Turner), oysters LePeyre and Brown). The potential effects offshore are being traced with sensitive indicators of stress (Bracken-Grissom, Crandall, Felder, Frederiqc), and data sets on oil, plankton and hypoxia (Parsons, Rabalais, Diaz and Turner) are being examined concurrently to tease out subtleties that may go undetected in rapid-response (one year) data sets.

What we expect is the outcome

The result of these inquiries are intended to yield scientific advances about these ecosystems, even if there are no oil impacts. We have found impacts already (see background section), but the observations to be made are framed with the idea that there are other stressors and many things needed to be known to adapt to future stressors. This is, therefore, the "**Ultimate Goals of the Research Program"** that the RFP asks for: **"to improve environmental health in the face of human activity"**

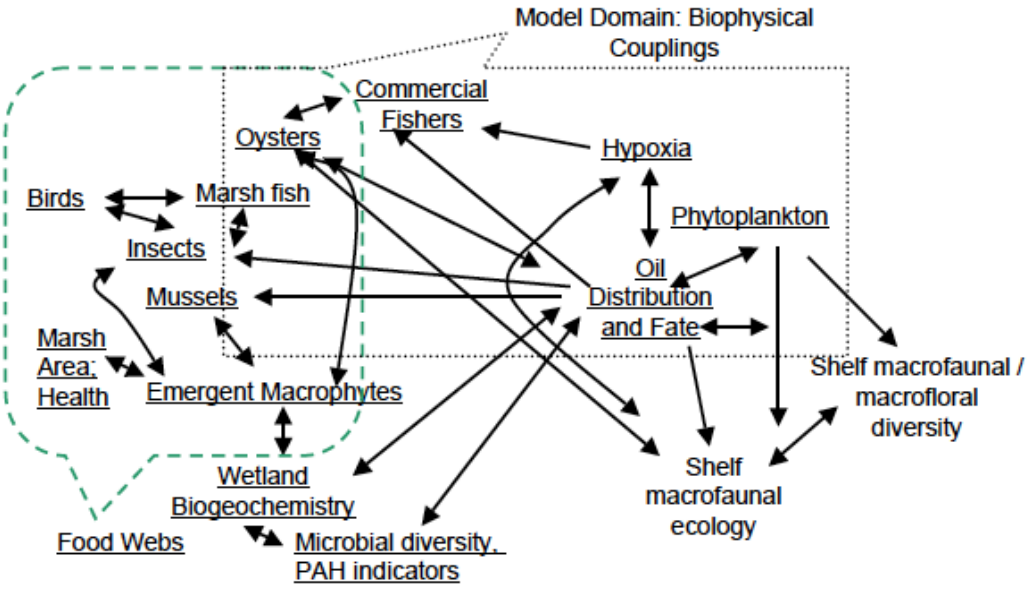


Fig. 3. The working relationships between of the main (subjective) research efforts. Each of the 17 main components (sub-tasks?) has at least two couplings with other tasks, and most are directly connected to the modeling and food web analysis.

A general summary of the intended outcomes are in the text box below. The specifics are described in the narrative of the tasks in the next section (4c), and the organizational framework to accomplish this is described in section 4c (next).

Intended Outcomes

Science

Long-term data base to measure oil/dispersant impacts
Insightful tools to investigate future stressors
Data archived
Trained cadre of scientists
Educational materials and interactions
Publications – lots of them
Insightful analyses of the impacts (if any) from the DWH oil spill
Comparisons with other spills; new, geographic-specific knowledge
Synthesis of efforts

Improvements in Society Understanding and Collaboration with local knowledge

Collaborative engagement with fishing community (oysters/fish)
Evaluation of short- and long-term changes in salinity
Evaluation of consequences of various mitigation measures to wetlands to mitigate damages
Context in which to evaluate the effects of the physical removal of oil

Milestones and Timeline

Annually

2 'Core' field excursions will be organized as a group each year, to minimum of 3 long-term research sites consisting of paired 'oiled' and 'non-oiled' marshes. Most researchers will participate.
Project meetings for all Project Investigators
Annual meeting with the GRI Board
Annual reports

Quarterly
Quarterly reports, including financial reports
Data respository inquiries made, and data submittals updated

Special Events
A organized session at a science meeting will be held in years 2 and 3 that will present findings.
Post-docs will be in place (reassigned or hired) by month 3 after the project starts
All PIs will have gathered data funded by this proposal by month 3 of the project start.
Minimum 3 outreach activities completed in each year

Project-specific timelines or milestones
The SET tables will be installed by month 4 at all sites.
All archived oil samples collected before Sept. 2010 will be completed at the end of Year 1.
A Wormcam will be deployed at two sites by the end of Year 1, before the hurricane season. One will be a contaminated site with oil from the BP spill and the other will be in a non-impacted site. The location will be determined after evaluation of oil slick trajectory data and sediment conditions.
Shipboard fluorometer used during 2010 calibration is completed, factory-checked, and initial comparisons made
Landsat Imagery updated in year 1
Commercial Fisheries data from 2005 to 2010 entered by the end of Year 1
Website established (tested, trial-run, revisions) by the end of Year 1
Phytoplankton data set for 2010 entered and QA/QC at the end of Year 1

4c. **Narrative Description of the Approach**

General Approach We will build upon our previous sampling in the estuary and expand to the coupled coastal waters with two primary objectives: 1) to investigate the potential impacts of the DWH oil spill now, before the signal : noise ratio diminishes, and, 2) to use our extensive pre-spill and 2010 sampling to their best advantage, and in a way that builds long-term data sets that benefit many other purposes.

We will continue our fall and spring sampling of salt marshes with the goal of creating three paired long-term data sets at oiled and un-oiled sites, and 12 other sites of varying exposure to oil within the three estuaries. Individual investigators will sample additional sites in marshes and shorelines within and outside of Louisiana. A backbone analysis of oil remnants at all for these sites will allow us to estimate the spatial variability in hydrocarbon distribution and degradation (both on the marsh surface and with soil depth) at each site. We will use the data from the *in situ* analyses to select sites with a relatively homogenous distribution of oil in the marsh – something that is important for long-term sampling. For example, we can define the maximum horizontal and vertical scale of oil distribution, improve our chances of finding 'hotspots' in marsh drainage networks, and conduct multiple sampling of pore water over a tidal cycle. The insects are, apparently, excellent indicators of stress, and so these studies are continued, and their avian prey now included. Our on-going studies found that oysters and mussels don't incorporate much (if any) of the crude oil carbon into their tissues, but that there are indicators of stress in the shell growth lines. As a result, we expand our studies of oysters and mussel and include a new examination of how fish otoliths are a suitable environmental 'library' of environmental stressors. A biophysical model is added to couple oil transport and fate between offshore and inshore areas.

Our proposed offshore efforts strategically exploit long-term data sets and circumstances that will provide insights into how the system respond(ed) to oil exposure. This includes baseline multi-decadenal data sets on phytoplankton, pre-impact studies suitable for developing indicators of stress, and comparative analyses (time and space) of benthic communities using novel approaches. We will examine a large pre-, and post-spill data set on the offshore and inshore fisheries to assess impacts and recovery from the oil spill. The results from these studies will reveal important information even if no significant oil-related impacts are revealed.

Table 2. Consortium Investigator Leads, Research Areas, collaborators, and indication of pre-project data.

Member	Investigator Lead	Research Area	Post-doc, Res. Assoc. or Graduate Assist.	Data before summer 2010?	Data after DWH & before 10/2011?	Data outside region?
BYU	Crandall, Bracken-Grissom	Genetic Diversity	0.25 Post-doc	no	yes	NA
Connecticut Coll.	Bernhard		0.5 RA	no	yes	LTER
Florida Gulf C.U.	Parsons	Phytoplankton	1 GA	extensive	extensive	
LSU AgCenter	Hooper-Bui	Insects	1.5 RA, 2 GA	extensive	extensive	yes
	Taylor, Stouffer	Birds	1 Post-doc,	no	yes	no
	LePeyre, Brown	Oysters	1 Post-doc, 1 GA	yes	yes	no
LSU	Turner	Marsh Plants	1 Post-doc, 1 RA	extensive	extensive	yes
	Turner, Rabalais	Mussel Population	0.5 Post-doc	2004	yes	no
	Turner	Commercial Fishers		2005-present	yes	NA
	Overton, Miles	Oil distribution and Fate	0.75 Post-doc, 1.25 RA	yes	yes	yes
	Fry	Food Webs	1 Post-doc, 0.5 RA, 1 GA	yes	yes	yes
	Justic	Biophysical Modelling	0.5 Post-doc, 1 GA	extensive	yes	NA
LUMCON	Rabalais	Benthos, Mussels, hypoxia	3 Post-doc, 1 GA, 1	some	yes	yes
	Roberts	marsh N & C cycling	1 Post-doc;	no	no	yes
	Sinclair	Phytoplankton	0.5 RA	1987 to present	yes	NA
MBL, WHOI	Giblin	Soil biogeochemistry	0.25 RA	no	no	LTER
Rutgers	Able, Jensen, Fodrie	Marsh fish	1 Post-doc; 0.25 RA	No	yes	yes
Tennessee	Summers-Engel	Microbial Genetics	1 Post-doc	extensive	extensive	some
ULL	Felder, Frederiqc	Genetic Diversity	1.5 Post-doc	some	yes	NA
Univ. Maryland	Kearney	Marsh area & health	1 RA, 1 GA	1987 to present	yes	yes
VIMS	Diaz	Benthos, hypoxia	0.25 RA	No	no	yes

Oil Distribution and Fate (EB Overton and MS Miles, LSU)

Background We analyzed 125 sediment samples up to March 2011 to identify the source oil, and about 300 water samples between May 2010 and March 2011. The water samples did not have the amorphous mousse or oil slick materials, but consisted of dissolved fractions only. There was no Macondo oil in these water samples. The sediment samples, however, had considerable amounts of Macondo 252 oil in them (Table 3) that is weathered (Fig. 4). There is a background concentration of oil, some of which is identified as diesel oil sources. The concentration of oil 10 m into the marsh and parallel the marsh varied enormously, that leads us to the firm conclusion that ALL sediment sampling MUST have some quantitative analysis of oil concentration, if not quality, if we are to infer cause-and-effect relationships between environmental condition and presumed stressor.

Table 3. The concentration of alkanes (mg Kg^{-1}) and aromatics (µg Kg^{-1}) in south Louisiana salt marsh sediments for 125 samples taken in May and September, 2010, and in February 2011. Samples were separated into those with and without oil signatures indicating a source from the Macondo 252 oil spill.

	All samples Alkanes (mg Kg)	All samples Aromatics (µg Kg)	no 252 present Alkanes (mg Kg)	no 252 present Aromatics (µg Kg)	252 present Alkanes (mg Kg)	252 present Aromatics (µg Kg)
Count	126	126	92	92	34	34
Average	256	9,206	2.23	175	942	33,644
± 1 Std. Error	107	4,142	0.18	83	376	14,695
Minimum	0.0	0.0	0.0	0.0	1.71	6.27
Maximum	8,640	480,000	10.3	7,662	8,640	480,000

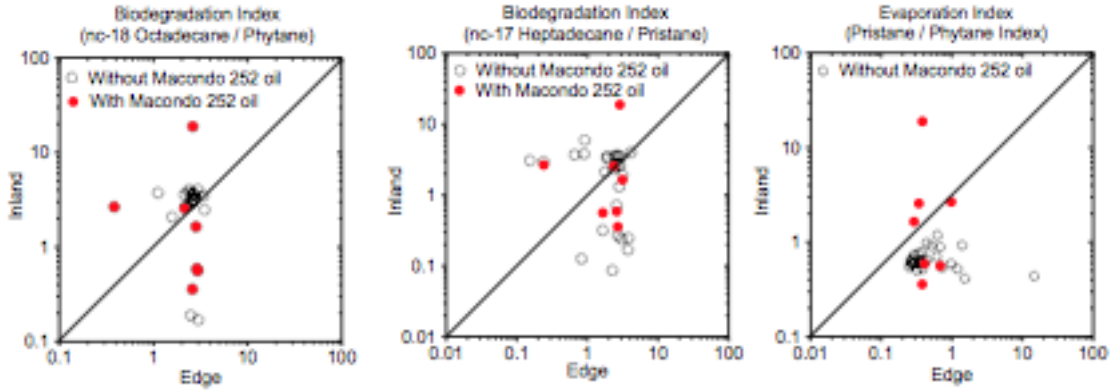


Fig. 4. A comparison of two indices of oil degradation and one of evaporation for samples at one m (edge) or 10 (inland) from the shoreline. Samples are identified that have (filled circles) or do not have (open circles) Macondo 252 oil in them.

The determination of the spatial variability of the oil concentrations in the marsh is best constrained by analytical determinations, and not visual field assessments. While the SCAT team assessments are a first-order and necessary assessment for many purposes, they may not be suitable for quantifying relationships between dose and response, changes with time, or spatial distribution horizontally and vertically. We compared our shoreline measurements of oil concentration in the marsh and found no statistical difference between the highest 3 categories of exposure in the SCAT analyses. Basically, we found that **field studies based on the SCAT studies to select sites are seriously challenged to discriminate oil-impacts from the 252 Macondo oil from all others.**

Objectives Quantify the oil concentration in sediments, water, and tissues; 'fingerprint' the source, esp. oil from the Macondo oil spill, and determine the degradation rates for selected components.

Approach The LSU-Response and Chemical Assessment Team (LSU-RCAT) has been the primary chemical hazard assessment and analytical support team for NOAA's Office of Response and Restoration and samples from most spills in US Coast Guard jurisdictions over 25-year, and characterizing of a variety of samples from the Mississippi Canyon 252 incident. Samples are collected and analyzed using accepted standard operating and QA/QC procedures to prevent contamination and avoid sample degradation. The samples are analyzed by GC/MS (gas chromatography/mass spectrometry) to identify the normal and branched saturated hydrocarbons (from C10 to C35), the one- to five-ringed aromatic hydrocarbons and their C1 to C4 alkyl homologs, and the hopane and sterane biomarkers. All GC/MS analyses use an Agilent 7890A GC system configured with a 5% diphenyl/95% dimethyl polysiloxane high resolution capillary column (30 meter, 0.25 mm ID, 0.25 micron film) directly interfaced to an Agilent 5975 inert XL MS detector system. The MS is operated in the Selective Ion Monitoring (SIM) to maximize the detection of the target constituents unique to crude oil. Data are used to identify impacted samples, study degradation of the petroleum hydrocarbons in the environment, and to correlate sediment data with other observed environmental impacts.

Macroflora and soil stability (RE Turner, LSU)

Background The dominant emergent salt marsh macrophyte in the northern Gulf of Mexico is *Spartina alterniflora*. *Spartina sp.* marshes are an essential habitat used by migratory fish and their prey (Turner 1977). This plant contributes to soil stability through root and rhizome growth (Darby and Turner 2008), and organic accumulation that controls vertical accumulation rates (Turner et al. 2004). Impaired salt marshes have less belowground biomass (Turner et al. 2004), and the ubiquitous eutrophication increases nutrient loading which results in fewer roots and rhizomes and lower soil strength (Turner et al. 2009). If the belowground biomass is compromised, then the marsh may become a mudflat or open water. These stressors makes them susceptible to erosion, and these wetlands were already compromised before the oil spill. Eighteen percent of the coastal land present in the 1930s, for example, is now open water (3,954 km^2). The effect of the oil in the first 10 months appears to have results in lower soil strength and greater shoreline erosion (Fig. 5). We need to continue these patterns to document their persistence or change.

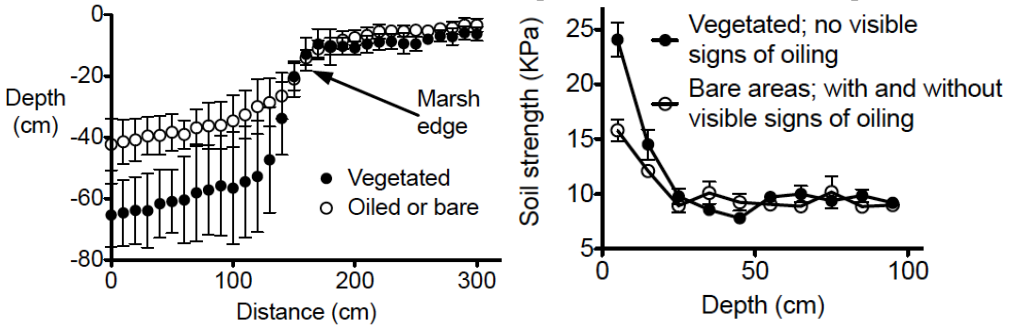


Fig. 5. Oil came ashore on this marsh in southwest Louisiana during the summer, 2010. Some areas became barren and subsequently re-vegetated, while others did not. Both the slope at the marsh-water interface (upper left) and the soil strength (upper right) and in the vicinity of these marshes varied depending on how much oil was there in November, 2010.

Objectives Quantify changes in the biomass, photosynthetic activity, and soil strength of dominant emergent wetland plant exposed to oil in 2010 - *Spartina alterniflora*, and separate out the effects of the background shoreline erosion rates from any effects of the oil.

Approach We collect replicated collections (0.5 m^2) of above- and belowground biomass, sediment cores (min. 30 cm), and measurements of soil stress in 10 cm increments to 100 cm. Derivative measurements include stem number and diameter, tissue constituents, stable isotopes, and root morphology. Plant condition is evaluated in the field using a LICOR Portable Photosynthesis and Fluorescence System, which measures gas exchange and fluorescence simultaneously over the same leaf area. The data on CO2 assimilation rates, stomatal conductance, intercellular CO2 concentrations, carboxylation and light use efficiencies, and CO2 and light compensation points are used to to understand the underlying biochemical

limitations, and relationship to differences between oil and non-oiled sites, including dose-response relationships. Shoreline erosion and oil concentrations are measured seasonally at the existing sites and new ones added. Marsh fertilization experiments will be established and co-sampled by others. Sites sampled are from before, during and after when the oil reached the marshes, and in experimental fertilization plots testing the effects of a common oil-spill remediation approach.

Wetland Biogeochemistry (AE Bernhard, Connecticut College; AE Giblin, Marine Biological Laboratory Woods Hole; BJ Roberts, LUMCON)

Background *Spartina alterniflora* production has been shown to be negatively impacted by oil spills (Pezeshki et al. 2000) either directly through vegetation death or indirectly through decreases in substrate quality, but both routes result in a reduction in sediment accretion. Further, oiling may result in increases in organic matter availability (both in the form of hydrocarbon molecules themselves and the increase in dead vegetation) that may stimulate soil microbial respiration rates and sediment decomposition leading to further decreases in sediment elevation. The combined effect of these changes is likely to be a net loss in elevation in these critical wetland habitats.

Increased organic matter degradation may also lead to changes in the depth of the oxic layer in sediments, thus impacting critical nitrogen and carbon transformations, such as nitrification, denitrification, and methane oxidation. These processes are highly dependent on the activities of diverse assemblages of ammonia oxidizers, denitrifiers, and methanotrophs, yet little is known about the relationship between community diversity and ecosystem function, and even less about community responses to oil pollution or any of the proposed remediation approaches. One proposed remediation activity is to fertilize oiled marshes with nutrients to accelerate the degradation of hydrocarbons, highlighting the importance of understanding how salt marsh nutrient (C and N) cycles are coupled. Nitrogen is arguably the most important nutrient in regulating the productivity of aquatic ecosystems (Vitousek et al. 2002), and studies of nitrogen processes in salt marshes suggest dynamic changes related to season and vegetation (Currin et al. 1996; Eriksson et al. 2003). However, changes in microbial communities and how they relate to ecosystem function remain largely unexplored. Limited evidence from studies of nitrifiers and denitrifiers suggests that process rates are intimately linked to diversity and community composition of microbes (Cavigelli and Robertson 2000; Horz et al. 2004; Webster et al. 2005; Bernhard et al. 2007) while few studies have examined the role of ammonia-oxidizing Archaea (Bernhard and Bollmann 2010) or methanotrophic communities (McDonald et al. 2005; Deborde et al. 2010) in estuaries. How these linkages may be impacted by environmental perturbations such as oil exposure or remediation activities such as nutrient fertilization have not been investigated to date. By combining studies of C and N biogeochemistry and microbial ecology with measurements of above- and below-ground biomass production sediment elevation changes in control, oiled, and fertilized sites in this project, we will greatly improve our understanding of salt marsh ecosystem function and allow us to better understand how these important ecosystems will respond to future hydrocarbon exposure events.

Objectives Evaluate the impact of oil exposure and remediation activities on marsh elevation, carbon and nitrogen biogeochemical processes, and microbial communities.

Approaches We will install continuously measuring water level and temperature loggers, 3 sediment elevation tables, and place marker horizons at each oiled site and paired control site (n=18). We will measure soil respiration and greenhouse gas fluxes at these sites using a Shimadzu GC-2014 gas chromatograph and gas analyzer unit (floating chamber). We will measure microbial community abundance, community composition, and transcriptional activity, soil respiration and greenhouse gas fluxes (CO_2, CH_4, and N_2O) twice annually; potential CH_4 oxidation at sites with methane production, potential nitrification, and both actual and potential DNRA and denitrification rates will be measured 4-8 times per year. Samples are always taken for water content, grain size, C and N content, and porewater DOC, DON, NO_3^-, NH_4^+, SRP, H_2S concentrations, and the Eh and pH are recorded. We measure methane oxidation using a modification of Bowles et al.'s technique (2011) under both oxic and anoxic conditions. Denitrification of nitrate, coupled nitrification-denitrification, and DNRA rates are quantified under flooded conditions using whole sediment core incubations with $^{15}NO_3^-$ additions (Koop-Jakobsen and Giblin 2010). We use standard measurements of potential nitrification and potential denitrification

and DNRA we adapted for use in marshes (Bernhard et al. 2007). Denitrification rates are calculated using the isotope pairing technique (Nielsen 1992). The DRNA rates are based on the $^{15}N\text{-}NH_4^+$ production and isotope pairing technique (Christensen et al. 2000).

We will also characterize the microbial community composition, abundance, and transcriptional activity, and identify relationships among community measurements, process rates, and abiotic variables in oiled and un-oiled sites, and in oiled sites receiving nutrient fertilizations. Community composition and abundance data will be related to biogeochemical processes (nitrification, denitrification, and methane oxidation) to identify linkages between diversity and ecosystem function. We will measure the abundance, community composition, and transcriptional activity of ammonia oxidizing archaea (AOA), bacteria (AOB), denitrifying bacteria, and methane oxidizing bacteria (MOB) by targeting genes for functional enzymes (*amo*A, *nir*S, *nir*K, and *pmo*A). We will generate DNA "fingerprints" using Terminal Restriction Fragment Length Polymorphism (TRFLP) analysis and quantify functional genes using real-time PCR assays. Sample subsets will comprise gene clone libraries to analyze phylogenetic relationships among sequences and to identify specific peaks in the TRFLP analysis. Another subset will be selected for in-depth sequencing effort via pyrosequencing to provide a better picture of prokaryotic diversity, and to highlight differences among sites missed by traditional cloning and sequencing. We will measure transcriptional activity using reverse-transcription coupled with real-time PCR of functional genes. Analyses are conducted using published primer sets and protocols (Bernhard and Bollmann 2010 for AOA & AOB; Castro-Gonzalez et al. 2005 for denitrifiers; and Tavormina et al. 2010 for MOB).

<u>Wetland microbial genetics</u> (A Summers-Engel, U Tennessee)

Background The distribution of microbial communities are related to changes in the geochemical gradients within the marsh sediment, but this could be related to sediment depth, spatial distribution of vegetation and macro-benthos distribution, proximity to tidal channels, inlets, freshwater sources, and even storm history. Each of these factors will be evaluated in a number of ways to examine how exposure to oil affects microbial processes and community structure. Variation in community structure will be explored via non-metric multidimensional scaling to identify potential diversity patterns (Peres-Neto and Jackson 2001; Ramette 2007). These results will provide baseline information for how the microbial communities are distributed, and turned-over within the sediments, and will provide powerful clues about the mechanisms controlling shifts in the communities through time and following stressful disturbances. Evaluation of hydrocarbon degradation abilities will be done by linking an organism's identity with its biological function under conditions approaching those *in situ* using stable isotope probing (Radajewski et al. 2000; Radajewski et al. 2003). We hypothesize that hydrocarbon degradation rates by the microbial communities in the marsh sediments will be higher in areas receiving less to no exposure to hydrocarbon contamination over time, and that community response and degradation abilities will diminish due to increased exposure and saturation of the metabolic potential of the community. Shifts in degradation abilities will be related to dramatic changes in the community composition over time.

Objectives To provide baseline information on how the microbial communities are distributed, and turned-over within the sediments, and insights about the mechanisms controlling shifts in communities following stressful disturbances, and their hydrocarbon degradation abilities.

Approach Marsh edge sediment samples, since May 2010, are subdivided into 1 cm increments for the following analyses: sediment inorganic and organic geochemistry, POC/N, total abundance and biomass, and microbial community environmental sequencing.

Community DNA is isolated using bead-beating methods that yield high quality results (PowerSoil DNA or Ultra-Clean Soil DNA isolation kits, Mo Bio Laboratories) in at least three separate extractions and combined before purifying the DNA and sequencing. Complementary gene sequencing will characterize the microbial community composition from the marsh sediments. Amplification of 16S rRNA genes is done with a mixture of bacterial and archaeal 16S rDNA primers to create clone libraries. PCR conditions are based on low cycle, pooled amplifications with a reconditioning step (Acinas et al. 2005) to minimize PCR biases. Amplified products are cloned and sequenced by Sanger sequencing to obtain ~300 near-full length16S rDNA genes per subcore depth. Sequences are assembled, screened for chimera (DeSantis et al. 2006a, b), and subjected to BLAST searches to determine similarities to cultured

and not-yet-cultured organisms (GenBank; http://www.ncbi.nlm.nih.gov/). Alignments is done in MAFFT (Katoh & Toh 2008). Operational taxonomic units (OTUs), or phylotypes, are defined at varying levels of sequencing similarity (95-100%). We apply 454 tag pyrosequencing of 16S rRNA gene sequences (DeLong et al. 2006; Sogin et al. 2006) for rarer taxa. Mass parallel sequencing of theV1 through the V5 region of the 16S rRNA gene is done for pooled samples by adding unique bar codes. Raw sequences for each of the amplicons are screened computationally by bar codes, and filtered to minimize poor sequence quality and errors. The Mothur program (Schloss et al. 2009) and the RDP Pyrosequencing Pipeline (Cole et al. 2009) is used for pyrotag bioinformatics. Taxonomic richness is determined from Mothur and other statistical programs (Oksanen et al. 2009).

We will evaluate the hydrocarbon degradation abilities of the microbes over time. Active and inactive microbes can be separately identified by labeling with ^{13}C-acetate, ^{13}-leucine, and even ^{13}C-hydrocarbon compounds. Samples for ^{13}C-incubations use established methods (Morris et al. 2002), during which labeled RNA is extracted, and used for phylogenetic assessment of 16S rRNA through pyrosequencing.

Food Webs (B Fry, LSU)

Background Stable and natural isotopes can be used to will test for the incorporation of Deepwater Horizon oil into estuarine animals, and accompanying oil alteration of food webs. Our initial work has shown that oil incorporation can be surveyed relatively cheaply with stable isotope d^{13}C measurements and more sensitively with D^{14}C radiocarbon measurements (White et al. 2005, Feng et al. 2008, Griffith et al. 2009). For example, barnacle samples were collected in late August 2010, one month after the DWH spill stopped, along an ocean-to-freshwater transect in Barataria Bay near marshes that had received oil.

The initial results show no (0.2±0.4%) incorporation of oil into the barnacle food web. This same result applies for barnacle shells, so that bacterial respiration of oil also was not contributing significantly to estuarine inorganic carbon pools. These "no effects" results were obtained with expensive D^{14}C measurements, and subsequent d^{13}C analyses of marsh mussels (*Geukensia demissa)* from paired oiled and un-oiled marshes shows the same ""no effects" result. Certainly, oil is being degraded, but the oil came ashore weathered and degradation may now be slow.

Stressed plants often change elemental composition and stable isotope values, so that leaf chemistry is a good indicator of growth conditions in the field. For example, we predicted that plant resistance to sulfide entry from sediments will change in stressed plants, with sulfide entry into coastal *Spartina alterniflora* plants resulting in higher S concentrations and lower δ^{34}S values (Carlson and Forest 1982). We have sampled *Spartina* plants at 30 locations in areas affected and unaffected by oil, and found the expected correlations with %S and d^{34}S, but also correlations with d^{13}C and d^{15}N. Our preliminary interpretation is that the combination of these four chemical markers is tracking the plant productivity response occurring in the field, with lower CNS isotope values and higher %S values observed in the more productive plants (Fig. 1). These interpretations are still at an early stage, but the results are consistent with a wider plant ecology literature that chemical markers indicate plant metabolic status, e.g. d^{13}C is useful in studies of plant water use efficiency (Pataki et al. 2010).

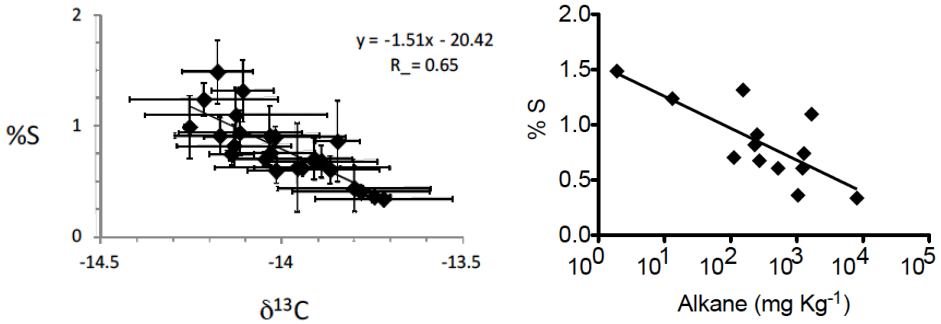


Fig. 1. Chemical markers (d^{13}C, %S) in *Spartina* from a range of oiled and un-oiled sites in northern Barataria Bay, 2010. Plants with lower d^{13}C and higher %S are likely higher-productivity plants, and plants from oiled sites have higher d^{13}C and lower %S (left panel). Marshes with higher oil (from the 252 Macondo spill) have lower %S values (right panel).

Objectives Determine if crude oil is incorporated into organisms, and develop various indices of stress by using stable isotope measurements (relatively inexpensive and easy to use), and to track observed changes in oil impacts at various sites over the next three years.

Approach We will examine the effects of oil exposure on marsh plants using elemental as well as stable isotopic proxies. Stressed plants generally have altered elemental and stable isotope compositions. For example, resistance to sediment sulfide can decrease in stressed plants, leading to higher S concentrations and lower $\delta^{34}S$ values (Carlson & Forest 1982) in their tissues. Stressed plants may also alter their C and N metabolism, which can be detected via changes in isotope values (Pataki et al. 2010, Fry & Cormier 2010). We have sampled *Spartina* plants at 30 locations in areas affected and unaffected by oil, and found the expected correlations with %S and $d^{34}S$, but also correlations with $d^{13}C$ and $d^{15}N$. Our proposed new work will test predictive power of these chemical CNS isotope and element indicators for Spartina sampled in different salinity zones, in oil affected areas, and in ongoing field fertilization experiments that were started several years ago (Darby and Turner 2008) and are still ongoing.

We will test for oil exposure by measuring the radiocarbon age of animal tissues and shells (the tissue has hydrocarbon-derived carbon—which lacks ^{14}, then the 'age' of the tissues and shells will be older than expected). Such isotope tracer analyses using shell carbonate are widely used to trace oil metabolism (Feng et al. 2008). The proposed work will test for hydrocarbon incorporation into estuarine foodwebs.

As with plants, $\delta^{13}C$, $\delta^{15}N$, and $\delta^{34}S$ can be used in combination as a proxy for the incorporation of hydrocarbons into animal tissues. Samples of oysters and mussels have been collected pre- and post-spill under the supervision of L. Anderson, and these samples along with newly collected samples will be analyzed for carbon, nitrogen and sulfur stable isotopes to test for incorporation of oil into marsh food webs. During this study, a parallel pilot analysis of insects/spiders collected pre- and post-oil landfall will be conducted to further investigate the introduction of oil through additional trophic pathways. We propose additional tests for the incorporation of Deepwater Horizon oil into estuarine animals, and accompanying oil alteration of food webs. Initial work has shown that oil incorporation can be surveyed relatively cheaply with stable isotope $d^{13}C$ measurements and more sensitively with $D^{14}C$ radiocarbon measurements (Feng et al. 2008, Griffith et al. 2009). We will follow the possible longer-term use of oil by examining marsh platform insects, infauna and fish (especially the common marsh minnow, *Fundulus heteroclitus*), rather than the previous focus on the planktonic ecosystem sampled by barnacles and mussels. Planned food web work will be conducted seasonally and across salinity gradients to test how strongly oiling affects marsh food webs versus the perhaps stronger seasonal and hydrographic influences on trophodynamics.

Insects (L Hooper-Bui, LSU AgCenter)

Background There are no comprehensively examined the effects of oil, other associated pollutants, and cleanup efforts on the invertebrates of the banks and shores associated with oil spills in North America. Research on the effects of oil contamination of soil on ground-dwelling or plant-dwelling arthropods is, in fact, sparse. The insect community in coastal Louisiana, however, is likely to be a good harbinger of oil spill impacts. Harrell (1985), for example, determined that oil contamination leads to water parasites and other invasive species such as bloodworms and blind mosquitoes. Faulkner and Lochmiller (2000) concluded that the oil significantly altered arthropod species assemblages in abandoned oil refineries. Ants and other arthropods that cannot escape oil pollution have strong likelihood of asphyxiation (Ambethgar 2009).

We have measured how insects and spiders, which are a cornerstone of the coastal food web, are valuable indicators of the effect of multi-stressors on ecosystem health. **Ants, in particular, are excellent indicators of the presence of oil, dispersants, dispersed oil, and poly aromatic hydrocarbons (PAH).** Ants are one of the most important invertebrate taxa in terrestrial ecosystems because of their cryptic, yet immense biomass, and subsequent ecological dominance and nutrient cycling (Alonso and Agosti 2000; Lafleur et al. 2005, Hölldobler and Wilson 1990). The diversity of ants in a community is a good indicator of the diversity of other invertebrate species (Alonso 2000, Lawton et al. 1998, Majer 1983). Our sampling from before and after habiat oiling, experiments, and site recovery has revealed some significant changes in the ant community (Table 4).

Table 4. Some results from examination of how insects respond to oiling the marsh.

Taxa/area	Oiled	Unoiled
Ants/beach	Lost 2 native sp. add 1 invasive sp	No change
Mirids/salt marsh	46±14.9; paired t-test, p=0.002; Sept 2010 data)	243±32.7; mean±SEM
Spiders/salt marsh	2.3±1.5 in **lightly oiled** marsh (p=0.005). only 2 spiders collected in 4 **heavily oiled areas**	7.2 ±1.68
Caged crickets/salt marsh	Low tide/ low wind: 0% survival Med tide/low wind: 19±0.02% (mean±SEM) survival	65% survival 44±0.1%. (rep = 3, t-test, p<0.038) survivial

Objectives To measure insect species abundance, richness and turnover which we predict will track the long-term health of the *Spartina* community, and precede obvious changes in above- and belowground plant biomass. We also predict that species turnover will be greater as stressors increase. We will test whether the chronic stress of oil will alter life history traits of primary consumers (directly through toxicity, and indirectly through changes in primary production), such as insects and spiders, leading to increased mortality and recruitment.

Approach We will measure insect species abundance, diversity and turnover using nets, traps and field experiments. These data will build upon the dozens of field trips at many sites, and repeated sampling of a few sites over the last 15 months. We will measure ant diversity and abundance on salt marshes, coastal dunes, and beaches on transect ranging from from Texas to Florida – 13 stations using quadrat sampling and hand collecting, and ID to species, and, measure insect spider diversity and abundance on *S. alternaflora* marshes via sweep nets (40m transects) and clip plots.

We will continue laboratory experiments, and field cage insect and common garden experiments – moving insects from un-oiled areas to oiled areas, and examine the effects of direct oiling and volatiles on insects. We will examine the stomach contents of seaside sparrows, *Fundulus,* and Atlantic croaker for insects and spiders, and conduct DNA fingerprinting of stomach contents to compare the species with GeneBank. We will analyze insects and spiders to determine whether crude oil is a significant carbon source which will be revealed if they are significantly depleted in ^{13}C and ^{14}C.

Birds (S Taylor and PC Stouffer, LSU AgCenter)

Background Our proposed work on marsh birds compliments the overall consortium goal of tracking and understanding ecosystem function and recovery by studying how marsh bird demographic processes are affected and recover following exposure to crude oil. By including a top trophic- level consumer into a data matrix that already includes considerable data on marsh soils and invertebrates, we will develop an ecosystem-scale understanding of the fate of the oil and its byproducts in marshes, and generate key insights into ecosystem recovery processes. **The two overarching goals** of our work involve (1) Quantifying and tracking avian exposure to oil over time, and (2) Measuring avian population and demographic trends. Both components are studied in a comparative framework across a contamination gradient, from sites unexposed to heavily exposed to oil.

Our study will focus on marsh bird populations, using Seaside Sparrow (*Ammodramus maritimus*) as a model species. The Seaside Sparrow is an ideal marsh bird representative because it (a) is endemic to salt marsh, (b) is sedentary (non-migratory) along the Gulf Coast, (c) is a top-level consumer in this ecosystem, and (d) is relatively abundant in the study area.

The main working model is a simple one:

[Exposure to oil → Diet → Adult Survival/Nest Success → Demographic/Population Trends], where arrows indicate a causal pathway, and where all factors will be quantified over the 3-years of this study. Our study area is nested within the ongoing sampling framework of our collaborators (PIs Turner, Hooper-Bui et al.), and will include replication of unoiled, moderately oiled, and heavily oiled sites. **Preliminary data (June 2011) from a subset of these sites (S. Woltmann, *unpub. data*) show that, although Seaside Sparrows are nesting in all sites across the contamination gradient, population densities are reduced up to 5-fold in oiled sites.**

Objective The main objective is to determine how oil exposure affects the diet of the Seaside Sparrow (*Ammodramus maritimus*), the Adult Survival/Nest Success, and if exposure causes a detectable Demographic/Population change.

Approach This study is nested within the ongoing sampling framework of our collaborators, and will include replication of un-oiled, moderately oiled, and heavily oiled sites.

Bird exposure to oil is done in three ways: 1) our collaborators will continue to monitor oil and its byproducts in soil and invertebrates. 2), because crude oil is relatively depleted in ^{14}C, its concentration in bird feathers tracks exposure in oiled, un-oiled sites, as well as museum specimens (which provide pre-spill data), and 3), we will measure the degree of up-regulation of cytochrome P4501A (CYP1A) gene expression in Seaside Sparrows, which is a standard way to monitor the physiological effects of oil exposure in birds and other wildlife. We will also quantify the bird's fecal and stomach samples to better understand how birds may adapt to changing conditions, and to assess the importance of dietary exposure.

We will: 1) monitor adult survival and nest success in replicate sites across a contamination gradient, and analyze the results in an information-theoretic framework to quantify the relative influence of both oil contamination and a suite of natural factors (e.g., predation, weather, tides) affecting nest success; 2) compare population densities and census size (N_c) among sites along the contamination gradient, 3) estimate genetic effective population sizes (N_e; a more important parameter than N_c due to reproductive variance among individuals), and, 4) test whether populations have experienced recent population bottlenecks via genetic (microsatellite) analyses. Population genetic approaches will also be used to better understand dispersal tendencies of Seaside Sparrows. This is important because the scale and degree of gene flow within the system determines re-colonization potential after population crashes caused by other factors. Data regarding oil exposure at all levels will be included in models of adult survival and nest success, thus pinpointing the main factors (if any) affecting basic demographic parameters. Bird sampling (census, capture, marking, diet, and DNA sampling) begins Sept 2011 and continues at 6-month intervals through Sept 2014. Nest success data will be collected March-June of 2012-2014. Genetic and diet data will be analyzed on a continuous basis beginning Sept 2011.

<u>Marsh Fish</u> (KW Able and OP Jensen, Rutgers; FJ Fodrie, UNC at Chapel Hill)

Background Killifishes are optimal indicator species because they are largely limited to marshes and often have a high degree of site fidelity throughout their life history. We have decades of experience in natural, altered and restored saltmarsh systems using killifishes as indicators of marsh habitat quality (Able et al 2010). These studies have included quantifying habitat specific distributions, determining spatial and temporal variation in movement and residency, trophic ecology, growth, and production of killifishes. In addition, the formation of daily increments in killifish otoliths has been validated, and this makes back-calculation of growth, an important indicator of habitat quality, possible. The potential effects of the DWH oil spill range from direct mortality to sub-lethal effects (e.g., reduced predator avoidance ability or reductions in growth or fecundity). These sub-lethal effects can also lead to reductions in abundance by limiting a species' ability to replace individuals dying of natural causes. Therefore, our general approach is to consider both the lethal and sub-lethal effects of oil contamination in coastal marshes by combining information on killifish abundance and growth patterns.

Objectives We will evaluate the habitat-specific response of killifish (*Fundulus* sp.) to petroleum in contaminated and uncontaminated marshes and follow the response (if any) of fishes through time to understand the mode and tempo of marsh recovery. We will do this by revealing the environmental history recorded in earbones (otoliths).

Approach We will collect fish from contaminated and uncontaminated marshes to determine daily growth. We focus on growth as a measure of marsh habitat quality because it implies that there is sufficient food available, that fast growing individuals may achieve a size refuge from predation earlier, and, that individuals may be larger at the end of the growing season, thus enhancing the chances of overwinter survival and increasing their fecundity. While it is impossible to go back in time and sample before the oil spill, fish otoliths provide a record of a fish's chemical environment and growth rate before, during, and after the spill. We will analyze the otoliths of fishes from contaminated and uncontaminated marshes to investigate marsh impacts using a *de facto* before-after-control-impact (BACI) design.

We will also conduct chemical analyses of the otoliths and soft tissues to measure daily growth patterns to test if there is a direct link between individual growth rates and oil contamination. We will test for pollution signals within otolith bands in which daily rings indicate diminished growth rates for fishes collected from impacted marshes. We will quantify trace elements concentrations in the otoliths of fishes using laser ablation with highly sensitive mass spectrometry (Fodrie and Levin 2008). Certain elements, e.g., Cu and Pb, are indicators of pollution, and thus we expect is possible to reconstruct (at the level of days to weeks) if and when contaminant levels changed for larval and juvenile fishes. We have some archived samples to work with and new samples will be collected at the group's long-term Core stations.

We will use $\delta^{13}C$ as a tracer for oil-derived carbon (carbon isotope ratio depletion). This tracer has been used to demonstrate the presence of oil pollution in coastal food webs following the Deepwater Horizon spill (Graham et al. 2010). The otolith-based growth rates and $\delta^{13}C$ measures will be compared to test for oil-related growth penalties. Simple age or stage structured population models will be used to scale-up results of our abundance (size-structured) and growth (otolith) analyses. Potential changes in growth rate will be parameterized in the model from the distribution of back-calculated growth rates from otolith analyses. Uncertainty in population model parameters can be carried through to model outputs using Monte Carlo simulation (Jensen et al 2009). This combination of directed field studies and published data will allow population-level inferences DWH oil spill impacts on salt marsh fishes.

Estuarine Macrofauna (NN Rabalais, LUMCON; RE Turner, LSU)

Background Infauna, including the ribbed mussel (*Geukensia demissa)* and fiddler crabs (*Uca longisignalis* and sesarmid crabs (*Armases cinereum* and *Sesarma nr. reticulatum*), polychaetes and pericaridean crustaceans are important bioturbators of the Louisiana marsh ecosystem and serve as basic components of the marsh food web. They are variably affected by hydrocarbon contamination, and their recovery and re-establishment of communities is critical to aeration of marsh soils and the subsequent degradation of petroleum hydrocarbons by aerobic bacteria.

Objectives 1) To determine the effect of Macondo oil on macroinfaunal communities, macroinfauna burrowing on aeration of the marsh substrate and subsequent hydrocarbon degradation, and the changes in macroinfauna in the marsh and at the marsh edge where marsh degradation and erosion are occurring. 2) To test for changes in the mussel population abundance and relative growth in the Bay Jimmy area.

a) Marsh water edge

Approach The benthic infaunal community composition between marsh culms will be determined in oiled and un-oiled sites in the Barataria Bay system and compared between sites with historic data from "healthy" and "degraded" marshes of an EMAP-Wetlands study (Rabalais and Smith 1998). The presence/absence of larger burrowing organism, such as fiddler and sesarmid crabs, will be determined by counting burrow openings in 0.5-m^2 plots along a transect in oiled and un-oiled marshes as a proxy for crab abundance (Krebs and Valiela 1978). We will determine the structure and volume of fiddler crab burrows along similar transects in comparative sites by making casts with Plaster of Paris or resin, and calculating burrow depth and volume (Culbertson et al. 2007b). We will also collect benthic infaunal samples along a marsh to subtidal sediments transect from oiled marsh edges compared to un-oiled marsh edges. We will use a sediment profile camera (WormCam) and sediment x-radiographs to determine the effectiveness of infaunal burrowing in aerating sediments along oiled and un-oiled transects.

b) Mussels

Approach Mussels will be collected in salt marshes along creeks and shores near Bay Jimmy (near Port Sulphur), which received much attention from the media because of the heavily oiled marshes there. We will measure mussel abundance and growth increments at a range of oiled and un-oiled sites. These data will be compared to the results of a comparable collection from the area made in October 2004, and to test for differences in the mussel population abundance and relative growth in the Bay Jimmy area.

Commercial Fisheries (RE Turner, LSU)

Background Commercial fishing in coastal Louisiana was halted for months with consequences rippling throughout the culture and economy locally and nationally. The predator-prey relationships in the fish community changed dramatically. Independent fishing boat captains (non-commercial or agency boats),

for example, observed what they thought were fewer sharks following their nets. What species recovered (or not)? What boats returned to fish again and in what areas? Have the landings changed?
Objectives Measure changes in the commercial fisheries landings and effort in Barataria Bay from 2005 to 2012.
Approach We will examine the 'trip tickets' from a major Barataria Bay fisheries dealer (who wishes to remain anonymous for now) that are accessible for 2005 to 2011, and promised for 2012 to 2014. The annual landings before the spill was10 million lbs of shrimp, and thousands of lbs of other species, including groundfish, crabs, amberjack and freshwater turtles. Individual boats are identified with an estimate of fishing time and location, and species sold. After this data is hand entered into a computer program, we will analyze these data to test for variance in fishing effort time and location, turnover, landings volume and species caught. Data will be compared with the Louisiana Wildlife and Fisheries fisheries-independent trawl data accessible upon written request and used previously by the PI.

Marsh Health and Shoreline Erosion (MS Kearney, U Maryland)

Background The initial and long-term impacts from the oil occurs within a constellation of interrelated hydrological, chemical and biological factors - notably tides, soil oxidation/reduction, organisms, excess nutrients, and soil redox state. This complexity increases the likelihood that relationships between oil toxicity and the oil impacts and recovery rate (if any) are not linear. The results of lab and field experiments demonstrate non-linear responses to oil toxicity by the aboveground biomass, and the threshold point of maximum change is not the same for all plant parts (Lin et al. 2002). A series of cascading effects on the plant-dependent food web are expected to follow from these impacts, and to have their different non-linear interaction responses. It may take decades to understand the significance of any direct and indirect impacts from this spill, or if reversals occur. Initial results at some areas indicates that shoreline erosion was increased because of oiling. The background erosion rate is a confounding factor. Marshes in the Bay Jimmy area, for example, were eroding at 1 m / y from the 1930s to 2001.
Objectives Construct a broad multi-decadal, interannual record of variations in vegetation vigor and coverage in the study area, including variations between wet or dry, and hot and cool summers, and changes in marsh vegetation phenology, and then separate out the effects, if any, at the three 'Core' study areas (paired control and oiled sites) and the several dozen other sites we sampled in 2010. The key question is: has either marsh health or shoreline erosion changed because there is oil in the wetlands?
Approaches We will expand a record of the trends in vegetation vigor coverage across the whole study area by using remote sensing data from three different sources. Landsat TM and TM is available for 27 year at 30 m and we have worked with it extensively in the region. Kearney, et al (2011) made an extensive and comparable investigation in the Mississippi River deltaic plain using Landsat TM imagery, having modified spectral mixture models (Normalized Difference model and K-means model) developed for assessing marsh loss on the east coast (Rogers and Kearney 2004). Moreover, because the Landsat TM covers almost three decades, there are a sufficient number of scences from summers to reliably determine long-term trends in nominal vegetation vigor and coverage. ASTER imagery offers higher resolution (15 m, VNIR instrument) and greater spectral sensitivity in the near infrared part of the spectrum that could give a better idea of the vegetative characteristics of oil-affected marshes. Moreover, the instrument has a thermal band, which may shed light on the limits on oil intrusion. MODIS will be used to test for differences between oil-affected plants and non-oil affected plants with respect to fPAR. fPAR can be used as indicator of photosynthetic activity because the greater the absorption in the 0.4-0.7 nm range, the more the likely the greater efficiency of photosynthesis. Lastly, we will use relevant overflights (0.5 to 1 m resolution) from industry or agencies if they become available before the end of the project.

Oysters (J La Peyre, LSU AgCenter; K Brown, LSU)

Background The eastern oyster, *Crassostrea virginica*, is a major component of the Gulf Coast seafood industry and creates habitats providing critical spawning, nursery and foraging grounds for many species, including economically important macro-invertebrates and fishes. Maintenance of these oyster beds ultimately depends on the ability of individual oysters to survive, grow and reproduce. Oysters, with considerable filtration capacity and low detoxification capability, accumulate and are susceptible to

contaminants from oil. Reduced growth, immunocompetence and reproductive capability, increased susceptibility to diseases, histopathological abnormalities and death have all been associated with oil contamination. Oil from the Deepwater Horizon Event (DHE) entered Barataria and Terrebonne Bays and came in contact with productive oyster growing areas. The extent of oil contamination and its long-term impact on oysters have yet to be determined, and a portion of Barataria Bay remains closed to harvesting.

We caged oysters across coastal Louisiana before the DHE and sampled them in May 2011, prior the DHE oil reaching the coast, and again in October 2011 to determine acute responses to PAHs using several biomarkers. Findings included inflammation and increasing numbers of brown cells, which function in detoxification, in tissues of oysters off Queen Bess and Grande Terre Islands, a DHE oiled area (La Peyre et al. 2011) and increased mortalities in Breton Sound oysters caused by low salinities from the Caernarvon Diversion which flowed at full levels through August 2010, and from high rainfall (Eberline et al. 2010). We also monitored survival and growth of oysters at several sites in Barataria and Black Bays in 2010. Condition indices seemed more affected by fresh water from increased flow from diversions from the Mississippi River than oil contamination (Brown and Brown 2011). This work continues in 2011 to determine impacts at more heavily oiled sites like Bay Jimmy.

Objectives Determine the long-term impacts of oil hydrocarbon on the oysters in Barataria Bay.

Approach We will combine field and laboratory studies and merge them with Louisiana Wildlife and Fisheres (LWLF) data on commercial oyster beds. The field studies include evaluating the recruitment of oysters and continuing to compare the health of caged oysters deployed in oil impacted and reference sites selected for long-term monitoring. We will extend our suite of biological effects measurements to include whole organism responses (survival, growth, condition, reproductive potential, dermo infection intensities), tissue responses (histopathology), cellular and immunological responses (hemocyte density, viability, phagocytosis, reactive oxygen species production) and subcellular responses (lysosomal stability, Hsp70 proteins, DNA damage, glutathione concentration, lipid peroxidation). Selection of these stress biomarkers are based on recommendations by the International Council for the Exploration of the Sea working group on suggested biological effects for use in monitoring. Seasonal measurements of these biomarkers over three years will be critical to define baseline values and to develop an integrated biomarker response index to assess oyster health and to monitor oil impact in this and future spills. Laboratory studies will examine the effects of oil and sediment quality on oyster health at low and high salinities (10, 25 ppt) in summer and in winter, and in dermo-infected oysters.

We will use data on oyster recruitment (determined from settlement plates immersed at sites varying in oil exposure and salinity) to understand the interaction of these two variables. We will also use data on oyster survival and growth in impacted and reference sites (e.g., recruitment data from settlement plates and survival and growth of several size classes) to model the effects of PAH contamination on oyster production, and include the long-term data sets on oyster density and size distributions collected by the LDWF. This will be crucial to help the LDWF predict the long-term impacts on the oyster fishery.

Oil Transport (D Justic, LSU)

Background A hydrodynamic-biological model is needed to link the movement of oil between source (Block 252), shelf and estuary.

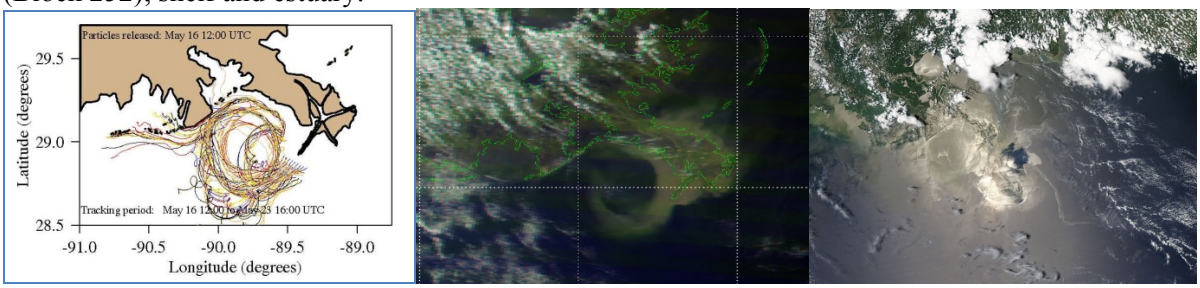


Fig. 1. Simulated Lagrangian particle trajectories of surface oil during the period from May 16 to May 23, 2010 (left panel). The model forecast is in good agreement with the Terra MODIS (middle panel) and Aqua MODIS (right panel) obtained from the LSU Earth Scan laboratory (Justic and Wang, in prep.)

Objective The primary goal of this effort is model the entrainment of oil and other pollutants in the anticyclonic gire just to the west of the Mississippi River delta and their transport into the Barataria Bay estuary (Fig. 1). Our specific objectives are: 1) to determine which areas of the Barataria Bay would be most susceptible to oil spill impacts, and, 2) evaluate tradeoffs associated with different dispersant treatments, and river management options associated with threats to near-shore environments.
Approach We will use two published high-resolution coupled hydrodynamic-biological models implemented as part of NOAA research programs: 1) the 3-dimesional unstructured-grid Finite-Volume Coastal Ocean Model of the Louisiana-Texas shelf (FVCOM La-Tex) (Wang and Justic 2009; Justic and Wang 2010) and the high-resolution (100 m) 2-dimensional coupled hydrology-hydrodynamic-biological model of the Barataria Bay estuary (Das et al. 2011). The Navy Coastal Ocean Model (NCOM) will be used to provide boundary conditions for the FVCOM La-Tex model. In this proposed effort (Years 1-3), we will use the FVCOM La-Tex model to provide boundary conditions for the Barataria Bay model. Depending on available funding, in year 4 a high resolution FVCOM grid (~20-100 m) will be developed for the Barataria Bay estuary, thus providing a unified model grid over the entire study area.

Shelf Macroinfauna

(**DL Felder and S Fredericq, U LA at Lafayette; H Bracken-Grissom and K Crandall, BYU**)
Background This project builds upon pre-spill data and method development funding to the PIs by DOE and NSF. Those awards were intended to genetically and taxonomically characterize potentially endemized assemblages of benthic macrocrustaceans and macroalgae under the assumed threat from Gulf of Mexico (GOM) oil and gas development. The results allow for the analyses of genetic structure and dynamics of indicator populations, and comparison to pre-event measures. This provides indices of response to the recent DWH oil spill and potential future disturbances, while also allowing near-term assemblage composition measures to gauge recovery. The focal habitats are deep bank rubble habitats of the continental shelf, which are prominent features harboring the highest known diversity of marine macrobiota in the northern GOM. Field sampling involves vessel-deployed dredges on rocky rubble substrates in depths of 45-90m, augmented by sampling with benthic skimmers on less coarse sediment slopes to 200m. The sampling is targeted to revisit sites for which the investigators hold substantial pre-event data. Proven methods for multiple-gene analyses can be applied to test hypotheses regarding altered population structures within and among species comprising macroalgal and crustacean assemblages of these sites. Differential survival and success of previously defined "ecologically informative" genetic clades can be linked to discrete morphological and physiological phenotypes, and some may be hydrocarbon tolerant. In addition expressed gene analyses can be applied to selected model organisms (macroalgal and decapod) taken in the wild from hard banks at varied distances from recent spill impacts, as well as conspecifics returned to the lab and maintained under varied hydrocarbon exposures; provided such evidence, genomes of multiple deep bank species will be examined to determine whether similar mechanisms lurk unexpressed, as pre-adaptation to hydrocarbon exposures.
Objectives To compare pre- and post-event measures of the genetic structure and dynamics of key indicator populations on rocky rubble substrates in depths of 45-90m and less coarse sediment slopes to 200m. These areas harbor the highest known diversity of marine macrobiota in the northern Gulf of Mexico. This work will provide indices of response to the recent DWH spill and potentially future disturbances, and measures to gauge recovery.
Approach Field sampling is targeted to revisit sites that the investigators hold substantial pre-event data to compare: 1) assemblage composition of deep banks (richness, dominance, community structure) by phenotype and genotype to pre-event measures for indicator macroalgal and decapod populations, ii) reproductive states in these assemblages at comparable seasons and settings to those of pre-event measures, iii) genetic measures of population diversity and clade associations within selected dominant species of these assemblages, and iv) gene expression in lab-conditioned and wild-caught deep bank organisms of varied hydrocarbon exposure histories, developing/utilizing 454 pyro-sequencing methodologies. Key species (i.e. decapod crustaceans, macroalgae) and genes will be selected/and or

identified as "stress indicators" and the organism's response evaluated (resilient vs. vulnerable species). Tissue will be homogenized in Trizol or RNALater, and shipped for RNA extraction and cDNA preparation. Current protocols use Trizol or Clontech column kits for RNA extraction, followed by use of the SMARTer cDNA synthesis kit (Clontech) for cDNA preparation. We will quantify RNA and cDNA using a Qubit fluorometer (Invitrogen). For those samples that are primarily targeting low-copy genes, we will normalize cDNA using the Trimmer kit (Evrogen).

Benthic Responses (**RJ Diaz, Virginia Institute of Marine Science**)

Background The sediments are the repository of remaining DWH oil. The oil's impacts on the benthos may be expressed as depressed soil redox, benthic community changes (e.g., from burrowing depth, activity or species matrix), and bacterial mat accumulations. These features can be explored (tested) with *in situ* instrumentation that the PI has used extensively elsewhere.
Objectives To determine if oil remnants in sediments on the continental shelf have changed the soil redox conditions and community bioturbation of the benthic community.
Approach We will deploy a shallow water (< 100 m) sediment profile camera system (Rhoads and Cande 1971) at a series of stations to collect sediment profile images (SPI). Extra stations will be added in areas of high concentrations of oil. Data to be retrieved from the images include gas void number and size, epifauna presence/absences, tubes type and density, surface features (pelletal layer, bacterial mats), redox discontinuity depth, and sediment surface relief. The WormCam is an *in situ* benthic observing system that is a combination of a sediment profile camera and water quality data sonde collecting a time-lapse series of images and DO data. Sediment for hydrocarbon, grain size, TOC analysis, benthic infauna (> 0.5 mm) and x-radiography will be collected with a GOMEX box corer Benthic infauna data will be compared with historic collections from the Louisiana Bight (Rabalais et al. 1992, 2001, unpubl. data) for which there are complementary historical hydrocarbon analyses. Data from the WormCam, infauna community, x-radiography and ancillary sedimentary characteristics will be synthesized into an overall disturbance profile. Sediment at each station will be collected from five intact GOMEX box cores (surface area 0.09 m^2), subsampled with an Ekman grab and acrylic tubes (7.6 cm diameter) for hydrocarbon, sediment grain size and sediment TOC samples and x-radiography. The contents of the Ekman grab will be enumerated according to standard benthic community analyses. Sediment cores will be digitally x-radiographed for bioturbation structure. The sediment percent total organic carbon by weight will be determined with a Perkin Elmer CHN Model 2400 elemental analyzer, and sediment grain size will be determined with a Coulter laser particle counter. Overlying bottom-water DO concentration will be determined with a YSI 6820 with optical DO probe. Multivariate analyses will be used to identify parameters important in defining the benthic community structure.

Phytoplankton (**ML Parsons, Florida Gulf Coast University; GA Sinclair, LUMCON)**

Background Numerous studies have examined the toxic effects of oil, the associated water soluble fraction, and dispersants (Corexit) on various phytoplankton species. As the composition of crude oil varies according to the geographic region from which the oil was extracted, different crude oils have been tested for toxicological effects (Adekunle et al. 2010; Prudhoe Bay crude oil, Harrison et al. 1986). The following commonalities are noted: 1) oil is more toxic to diatoms than other phytoplankton groups; 2) toxic effects are greater with increasing light and temperature; and 3) toxicity was associated with continued exposure to the weathering oil, not in response to volatile aromatic hydrocarbons. Therefore, because diatoms are the dominant group of phytoplankton on the Louisiana shelf and serve as the base of the foodweb for higher trophic levels, exposure to fresh and weathered crude oil will likely reduce diatom biomass. Other, less affected groups will subsequently increase in abundance (e.g., flagellates), which may divert the trophic transfer of organic matter away from diatom-eating copepods towards ciliates and heterotrophic flagellates, resulting in a TROPHIC CASCADE. In such cases, the resultant biomass will not be transferred into commercially important species (e.g., menhaden and shrimp), but jellyfishes and comb jellies (Greve and Parsons 1977). Our ongoing research has produced a database (1990-2006) to assess the impact of oil on the phytoplankton of the GOM.

Objectives Test if the 2010 oil spill caused a change in the phytoplankton community on the Louisiana continental shelf; determine if there was a unique phytoplankton community in 2010.
Approach A Phytoplankton Database for the Louisiana continental shelf has phytoplankton species abundance and associated environmental data from 1989 to 2006. It will be updated with data from 2010 and for 2011 to 2014. We will determine typical seasonal phytoplankton compositions and concentrations to serve as a baseline against which future perturbations assessed. Samples collected during the DWH oil spill will be compared with the baseline data to determine how/if the oil spill impacted the phytoplankton assemblage, providing a "positive control" for the modeling results. We will also collect and analyze water samples for hydrocarbon signatures to verify the above exposure categories, analyze the 2010 phytoplankton data (which also includes pre-impact samples collected prior to 20April 2010) and compare against the pre-impact baseline conditions over a 15-year period, and a baseline constructed from previous years that best match 2010 conditions. Modeling efforts (Parsons et al. 2010) include ^{o}C, PSU, light and nutrients (nitrogen, silicate, and phosphate) growth parameters of a selected common phytoplankton (e.g., *Skeletonema costatum, Pseudo-nitzschia calliantha*); simulated grazing rates; and an export term. We will use these data and model results to test if diatom abundance is lower in the presence versus absence of oil, because of the sensitivity of diatoms to the toxic effects of oil; or if autotrophic flagellate, Cyanobacterial, heterotrophic flagellate or ciliate abundance is higher in the presence versus absence of oil, because of, a combination of factors related to the relaxation of competition caused by reduced diatom biomass, stimulatory response of oil degradation products (Chaillan et al. 2006), or more prey items (autotrophic flagellates, cyanobacteria, and heterotrophic bacteria).

<u>Hypoxia and Oil</u> (N Rabalais, LUMCON; RE Turner and E Overton, LSU; R Diaz, VIMS)
Background The Mississippi River-influenced coastal ocean is characterized by high surface primary production and bottom-water with low dissolved oxygen (Hypoxia = DO < 2 mg l^{-1}; Rabalais et al. 2007). The carbon from photosynthetic activity in surface waters provides an organic substrate for decomposition by aerobic bacteria similar to the specialized bacteria that degrade and metabolize hydrocarbons. High organic carbon from primary production and hydrocarbon contamination co-existed in time and space in the area of perennial hypoxia along the Louisiana coast. Concerns expressed during the oil spill and documented in water depths of 1200 to 1500 m were that the petroleum hydrocarbons helped create hypoxic areas (Kessler et al. 2011) or had the potential "to lead to the extensive and persistent depletion of oxygen in hydrocarbon-enriched waters" (Joye et al. 2011). However, none of the dissolved oxygen conditions documented approached a level of low oxygen that would affect the behavior, physiology or capacity to survive (Rabalais and Turner 2001) or approached the lower oxygen values in the well-documented oxygen minimum layer in the open GOM (Rabalais et al. 2002). Similar concerns were expressed concerning continental shelf waters where hypoxia is a persistent problem. We have extensive data sets and sample archived to address this concern, which will unnecessarily fester doubts in the literature for decades if we don't address these questions.
Objective Determine the relationship between dispersed Macondo well oil with dissolved oxygen conditions on the Louisiana continental shelf in 2011 and with long-term oxygen trends.
Approach Water samples for hydrocarbon analysis will be compared with data derived from the oil fluorescence probe of the SeaBird CTD on the R/V *Pelican* and with DO concentrations during the spill to determine any relationships or deviations from the long-term dissolved oxygen data from the region (Gilbert et al. 2010). Differences in oil and oxygen conditions in relationship to other hydrographic parameters collected in 2010 (e.g., chlorophyll *a*, POC, TOC, TN, TC *in vivo* fluorescence) will be determined through multivariate analysis.

4.d. Qualifications of the Consortium

The **Louisiana Universities Marine Consortium for Research and Education (LUMCON**; http://www.lumcon.edu) was formed by the Louisiana Legislature in 1979 "with the primary function of conducting research and promoting education in the marine sciences and marine technology, particularly where related to coastal resources and the impact of energy related industries upon these coastal resources." LUMCON researchers since then have provided leadership in coastal research concerning living marine resources, human impacts on coastal habitats, biological productivity, effects of energy and other industries, and ecosystem studies at the level of coastal landscapes and land/ocean interactions. LUMCON provides coastal laboratory facilities to Louisiana universities, teaches graduate and undergraduate courses that accrue credits to member universities, mentors graduate students, and performs extensive public outreach activities.

LUMCON is a body corporate under the Louisiana Board of Regents, serving as a consortium of Louisiana institutions that has as its members all four-year institutions of higher education in the State and many private universities and state agencies. Consortium members with projects in the proposal are Louisiana State University, LSU Ag Center and University of Louisiana at Lafayette. Within-LSU departments represented are Oceanography & Coastal Sciences, Environmental Studies, Biological Sciences, Entomology, Renewable Natural Resources, and Veterinary School. The Consortium incorporates established, long-term colleagues from across the Gulf coast and nation, representing eight institutions.

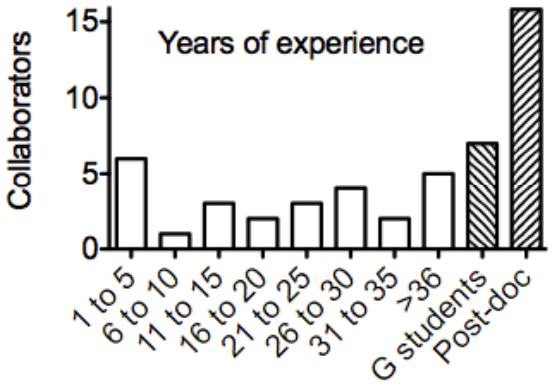
With its unique laboratory facilities in Cocodrie at the LUMCON Marine Center, its location in a vast salt marsh between the major deltas of the Mississippi River, access to nearby study areas and Gulf of Mexico waters, and its small boat fleet and two research vessels, the R/V *Pelican* and the R/V *Acadiana*, LUMCON is a portal to Gulf research and educational opportunities for all educational institutions in the state, regionally and meets the needs of many national programs. The LUMCON Woody J. DeFelice Marine Center in Cocodrie, LA, serves many outside researchers with wet lab facilities and supports several in-marsh sampling platforms and plots. An additional field laboratory, Port Fourchon, is located close to Grand Isle and is the ideal staging area for studies in the Barataria Bay ecosystem where many of the oiled marshes are located. The Marine Center is a state-of-the-art research and education facility with 75,000 square foot complex of research, instructional, housing, and support facilities. The Center includes 26,000 net usable square feet of laboratory, classroom, office, and library space. Dormitory rooms, five apartments and a cafeteria provide housing and support for up to 87 persons and are available for use by students, visiting investigators, and instructors. A 99-seat auditorium facilitates teaching activities, presentation of seminars, and the convening of conferences. The LUMCON Marine Center has hosted many conferences, workshops, intersession and summer classes, and on-line conferences and training.

LUMCON supports a fleet of research vessels including the R/V *Pelican*, a 116 ft. vessel that is the most heavily used vessel of its size class in the University-National Oceanographic Laboratory System (UNOLS) fleet, averaging 250 days per year for the past four years. LUMCON also operates the R/V *Acadiana*, a 58 ft. research vessel with a 144 ft^2 laboratory that is equipped with a SeaBird CTD system, and can deploy a range of equipment using its winches and Aframe. There are additionally small boats for use in the marsh, larger offshore boats, and an airboat for marsh work.

Unique capabilities of LUMCON are its raceway flume with laser Doppler velocimeter and Environmental Monitoring System with an atmospheric Doppler profiler, five real-time hydrographic and meteorological stations in south Louisiana and two offshore coastal ocean observing systems.

Key research capabilities are represented among the Consortium members, accumulating over 500 years of experience. The skill and experience of the project participants is a strong indicator of project coordination, integration and success. Most were funded to work on aspects of the oil spill as soon as money became available. We are 26 investigators (16 are from the GOM) with 513 years of research experience in coastal systems (average 20 y), from 12 institutions. We will be assisted by 16 Postdoctoral Research Associates, 11 Research Associates, seven graduate students and dozens of undergraduates. The

PIs have received $1.6 million in oil-spill related funds from NSF RAPID, NOAA, BP-funded university initiatives, and Sea Grant Programs. Half of the Investigators have successful administrative experience with several multi-year collaborative grants at > $1 million. All publish in the best journals and with students. All are without the appearance of conflicting allegiances to the NOAA NRDA process, industry, or potential litigants. Research qualifications are too numerous to provide, but include examples as:



Dr. Rabalais, LUMCON PI/PD, has almost 40 yrs of experience in organismal and ecosystem understanding of Gulf estuarine and continental shelf environments. She is an expert on Mississippi River/Gulf of Mexico interactions. She serves many national boards, panels, and societies, and served on the National Research Council, Oil in the Sea III Committee. She has experience with coastal and offshore petroleum industry pollutant fate and effects, and almost 30 yrs of administration of large research programs and 6 yrs as executive director of LUMCON. She has over 100 publications and an H factor of 35.

Dr. Gene Turner, LSU, has 37 years research and academic experience ranging over wetland ecology and restoration, microbial ecology, landscape alterations, nutrient chemistry and ecology of phytoplankton, ecosystem studies of the Gulf of Mexico, fisheries analyses, and food web studies, and serves many national and international organizations and commissions. He has over 150 publications and an H factor of 41.

Dr. Ed Overton, LSU, has over 35 yrs of experience in trace detection of hydrocarbons in marine environments, and working on the mitigation and consequences of oil spills in all marine areas under US jurisdiction (and international spills), as well as providing chemical hazard assessments to NOAA's Office of Emergency Response.

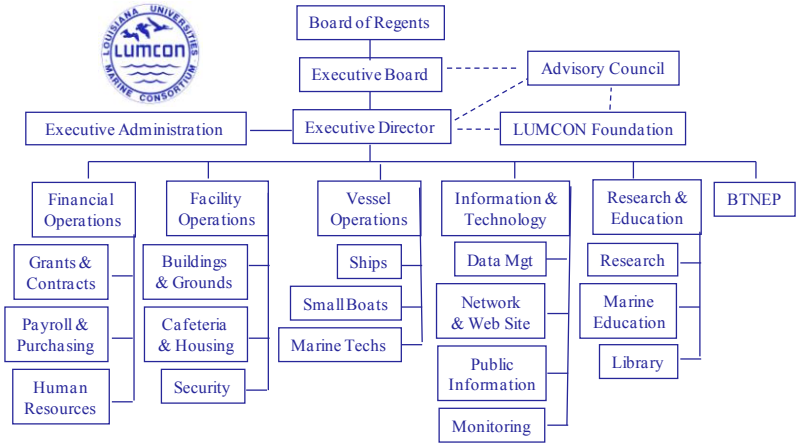
Similar Initiatives

LUMCON manages an average of $3.5 - 4.0 million in expenditures from outside grants and contracts for LUMCON researchers, with 45-55 ongoing awards per annum, in the last five years. LUMCON serves as the fiscal agent and contracting officer for the U.S. Environmental Protection Agency, Barataria-Terrebonne National Estuary Program at $1.3 million per annum, the U.S. Army Corps of Engineers, Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Science Advisory Team at $1.0 million per annum, and the NOAA, Office of Response and Restoration program Coastal Restoration through Enhanced Science and Technology (CREST) at $900,000 to $2.0 million per annum over the last six years. LUMCON develops, administers and supervises multiple subawards each year for the BTNEP (average 25), CWPPRA (average 10), CREST (average 7), and for its internal research programs (average 10). The LUMCON Executive Director and PI/PD for this proposal, Nancy Rabalais, is the signatory authority for LUMCON and supervises directly the expenditures for BTNEP, CWPPRA and CREST.

Dr. Rabalais has managed several large research grants directly under her supervision since 1985. These include multiple institution, interdisciplinary research for BOERME (Bureau of Ocean Energy Management, Regulation and Enforcement, was Minerals Management Service, MMS), National Science Foundation EPSCoR, NOAA Coastal Ocean Program and Center for Sponsored Coastal Ocean Research studies on the Gulf of Mexico river-dominated ecosystem, U.S. Environmental Protection Agency Gulf of Mexico Program, National Science Foundation, and Louisiana Sea Grant. Her research portfolio averaged $300,000 per year for the last 10 years within 20 awards. Dr. Rabalais' research programs and the three major awards that she administers for LUMCON equates to the level of award being sought in this proposal, $4.4 per annum, with fewer subawards per annum.

Financial Administration

The LUMCON Executive Director and PI/PD for this proposal, is the signatory authority for LUMCON with regard to budget development and oversight, administration of all expenditures, contracts, and memoranda of understanding, and supervises directly the expenditures for BTNEP, CWPPRA and CREST. She operates at the level of a university vice president for research and development and office of sponsored programs, and signs contracts at the level of a university president (with oversight from the LUMCON Executive Board and the Louisiana Board of Regents). The Louisiana Board of Regents is the fiscal authority and the Executive Board is the governance authority. The Financial Operations Manager has been with LUMCON for 13 years and 7 years as Manager. The Contracts Officer has been with LUMCON for 15 years and as Contracts for 10 years. Contracts exceeding $20,000 are vetted by the State of Louisiana, Division of Administration, Office of Contractual Review. All subawards must adhere to the laws of the State of Louisiana and cognizant federal agencies. LUMCON has received no findings in the six years of Dr. Rabalais' administration in State procedural, financial or compliance, or Federal financial audits.



Human Resources LUMCON follows all State of Louisiana Civil Service Laws for unclassified employees (serve at the will of the State); all directives of the State of Louisiana, Department of Civil Service, Louisiana Board of Ethics, including Sexual Harassment; and all Federal laws concerning Equal Employment Opportunity Commission, Age Discrimination in Employment Act of 1967, American Disabilities Act, Non-Retaliation Requirements of the Civil Rights Law of 1991, and the Drug-Free Workplace Act of 1988. All employees sign a statement that they understand that they are employed under these circumstances and that deviation will require disciplinary action. All employees are evaluated on an annual basis, with the evaluations kept on record in the Human Resources Office. Additional reviews, statements, disciplinary actions, and commendations are filed as necessary. The individuals of concern in the LUMCON management structure for this proposal have received annual reviews of Very Good to Excellent for the past many years. The LUMCON staff is dedicated to high performance and service for the employees of LUMCON and all visitors to the facility.

Graduate Student and Postdoctoral Career Mentoring

Professional development mentoring will be conducted in monthly lab meetings by the PIs. The goal is to prepare students and postdocs with the knowledge, skills, and experience to have successful, independent careers. Initially, an *individual development plan* will be developed by the PI in consultation with the postdoc or graduate student depending on the individual's career goals. This plan will be the basis for an annual performance review. Topics for mentoring will include data collection and security, scientific conduct, collaboration, scope and role of faculty jobs, professional presentations, and scientific writing. Lab meetings also provide opportunities for informal presentation of results to date and discussion. Advanced graduate students and postdocs will be encouraged to participate in university-wide workshops on grant writing, CV preparation, and interview skills. Postdocs and graduate students will meet individually with their respective PI (on a schedule determined between the two). After appropriate research progress, graduate students and postdocs will be encouraged to attend and present at scientific meetings. Support for these activities is included in this proposal. Postdocs and graduate students will be offered opportunities to participate in teaching and outreach regarding the proposed research.

4.e. Public Education and Outreach

The Public Education and Outreach program will translate and disseminate our research findings to multiple levels of society about the effects of the oil spill on ecosystems and living resources.

Objective 1: Translate and disseminate the findings of the research through broad-based socio-ecological education programs

The public has many misperceptions about the ecological effects of the oil spill. We will share scientifically-based information regarding the stresses, outcomes and resilience of natural systems with communities and other stakeholders to enable them to make more informed decisions about environmental issues such as oil spills. We will use established education and outreach programs that we have used effectively in the past to communicate science to the public.

Task 1. Leverage proven partnerships at the local, regional, and national levels as dissemination channels. The research collaborative will leverage our *local, regional and national outreach partners*, as proven successful dissemination channels of the research conducted. Key partners include: the Louisiana Universities Marine Consortium environmental K-12, teacher-, university- and public-education program, the Barataria-Terrebonne National Estuary Program, the Louisiana Sea Grant College Program, the Pontchartrain Institute for Environmental Science of the University of New Orleans, the Gulf of Mexico Alliance, the NOAA Northern Gulf Institute, and the Gulf of Mexico Coastal Ocean Observing System Education and Outreach Committee. The Gulf of Mexico Sea Grant College Programs are working with the GRI to develop a mechanism for their regional efforts in marine education to facilitate and guide the GRI public education and outreach program. The Louisiana Sea Grant (LSG) will offer assistance in the development and implementation of an outreach plan. The final plan will depend on decisions by GRI, but LSG anticipates hiring an oil spill specialist to serve in the LSG Marine Extension program and to coordinate resources for LSG overall extension network and parish-based activities. This individual will take a leadership role in organizing and managing workshops, town hall meetings and other interactions in coastal parishes. The new specialist will also develop communication tools to bring research results to the communities and, in turn, provide feedback to the investigators so that they can respond to community concerns. Science teams will speak at workshops and other public forums. The specialist will assume maintenance of a previously-constructed regional oil spill web site and post new information in response to public inquiries and the findings generated in this project.

Task 2. Integrate STEM within the education system. Through the NCSE's EnvironMentors, a collaborative program between the LSU School of the Coast and Environment and the East Baton Rouge Parish School System, faculty and graduate students engage under-represented high school students to reduce drop-out rates, foster higher education and promote interest in STEM disciplines in a high risk student population. LUMCON will provide learning experiences for these students through field trips and other hands-on learning. LUMCON will also incorporate applicable research findings into the already successful joint service-learning program by Tulane students for underserved, under-represented youngsters in New Orleans schools, public and charter. The LUMCON Bayouside Classroom program reaches schools across Louisiana and other states with hands-on learning opportunities that have been incorporated into advanced biology curriculum in Terrebonne and neighboring parishes, as well as reaching under-represented and under-served schools throughout the region. Other PIs will be involved in mentoring and outreach within the scope and structure of LUMCON's program.

Objective 2: Demonstrate to the public the important service to society that coupled natural and human systems and natural ecosystem services provide.

All outreach activities emphasize the interdependence of the coupled response of natural and human systems to perturbations such as the oil spill. For example, LUMCON's program will strengthen the

awareness and knowledge of policy makers and communities about how the natural resilience of the environment helps to assimilate oil and dispersants from spills through weathering processes.

Task 1. Target policy makers and communities. Adult learning requires instructional design strategies selecting and delivering content of immediate relevance. This is particularly the case for policy makers and communities. We will organize Legislative Briefings for key committees including the LA Senate Select Committee on Coastal Restoration and Flood Control, Senate Committees on Environmental Quality, Health and Natural Resources, Health and Welfare, and the House Committee on Natural Resources and Environment. Resource managers from LA state agencies such as Department of Environmental Quality, Department of Health and Human Resources (oversees seafood safety), Department of Natural Resources, Department of Wildlife and Fisheries and Governor's Office of Coastal Protection and Restoration will be invited to these briefings.
Task 2. Build on established community education programs to engage adults. LUMCON's established "Lagniappe" community education program will bring together consortium researchers and LUMCON marine educators to conduct workshops concentrating on a different aspect of the oil spill and the interconnectedness of humans with the ecosystem and living resources. Workshops will combine a researcher presentation and related field and laboratory activities.

Objective 3: Strengthen the knowledge and skills of educators and environmental professionals.
Task 1. Conduct Louisiana Environmental Education Commission (LEEC) activities. PI/PD Rabalais is the Louisiana Governor's appointee to the Louisiana Environmental Education Commission representing the LA Board of Regents and as such has statewide access to environmental educators and their programs. Leveraging the LEEC, the research collaborative will engage Theme 3 researchers and environmental educators for grades K-12 at the annual Environmental Education Symposium with interactive, transdisciplinary, 2- or 4-hour workshops that provide continuing education credits to teachers. Rabalais is also chair of the EEC Environmental Literacy Plan steering committee and will work to insert oil-spill related environmental education into the state's plan.

Task 2. Engage journalists as educators of the public. The media coverage and initial efforts at dissemination of the results of research results on the BP Macondo oil spill were often inaccurate, and perceived by many as confusing, naïve, misleading, disparate and incomplete. With funding from an NSF RAPID grant, LSU and LUMCON partnered with the URI Metcalf Institute to help journalists and informal educators better understand the science behind questions about the spill's impacts and to promote clear and accurate reporting of science and environmental news, strengthen understanding and working relationships among scientists and the media, and provide opportunities for the interface of science and policy. Drs. Ed Overton, R.E. Turner and Nancy Rabalais interacted directly and often with a range of media from newspapers (New York Times, Los Angeles Times, Washington Post, Advocate, Times-Picayune, Wall Street Journal), *Science* and *Nature* reporters, radio (NPR, Talk of the Nation, Science Friday), television (local and national), documentary film makers and authors (e.g., Carl Safina, *A Sea in Flames, The Deepwater Horizon Oil Blowout*, 2011, Crown Publishers, New York).

Task 3. Conduct professional development education. LUMCON and its environmental education partners conduct many 3-5 day workshops at the LUMCON Marine Center with follow-up activities through the subsequent school with student activities and field trips. LUMCON also engages trained, experienced teachers as mentors to new teachers in the programs. These workshops are similar to the NOAA BWET (Bay Watershed Education and Training) for which LUMCON was one of four Louisiana partners. We propose similar workshops over the course of the research.

Objective 4. Disseminate research-based results into information for citizens in the affected parishes and states and across the U.S.

Task 1. Provide a well-designed, informative web site for research results translated into multiple understanding levels. Our desire is to put effective information at the fingertips of concerned citizens in a timely manner. This is usually accomplished by web sites, but more recently Facebook, Twitter and continually evolving social media. For example, Hooper-Bui has a Facebook page with >2700 "friends" that is almost exclusively used for oil-spill related communication. The goal is to be correct, credible and timely as the research results are ready for dissemination, or even as research plans and results are evolving. LUMCON developed and hosts the web site for the Bayouside Classroom, the Gulf of Mexico Hypoxia site, and the Coastal Restoration through Enhanced Science and Technology (CREST) program of NOAA's Office of Response and Restoration. A web site will be developed for exchange of information among the researchers, but will also provide information to the public. A LUMCON Information and Technology specialist will handle the data management and the web site, and a marine educator who develops web sites will work with her to develop the research generated information. Researchers will be required to submit research results that are suitable for public information, through the editorial process of the web master and a marine educator.

Task 2. Employ the use of videos for YouTube. Dr. Fredericq utilizes YouTube videos in her National Science Foundation REDToL Channel (for instruction, posting media coverage, methodology development, a day in the life of an REU student, and entertainment that conveys research results). For a sample, visit (http://www.youtube.com/user/TheREDToLNSF). We will use the experience of Dr. Fredericq to utilize YouTube similarly for the full research program.

Evaluation

Assessment tools are well developed within the environmental education network of Louisiana. These tools include pre- and post-workshop surveys that include questions about content, attitudes towards the environment, and plans of how they will use the information they have been given. A participant evaluation will also be provided so that each participant can make additional comments about each workshop. Results from the surveys will continue to be used to enhance the activities. Other metrics will be number of teachers, environmental educators, adults, students, attendees at Environmental Education Symposium workshops, survey instruments to ascertain what students are learning and doing as a result of their involvement in the program(s), as well as what/how teachers are implementing activities and information from the program. Instruments such as the Environment Scale (Mussler and Malkus 1994) will be developed for members of the public in pre- and post-surveys. LUMCON University Educator has completed an online course through the University of Wisconsin – Stevens Point for developing evaluation materials for environmental education programs and has developed metrics to evaluate programs and provide information on how to improve LUMCON education experiences.

Management

The Public Education and Outreach component of the Consortium will be overseen by the Steering Committee. The theme area PIs will work with the education and outreach PI to assure all opportunities for research translation are realized and dissemination is tailored for maximum yield, by building on proven outreach and dissemination infrastructure already in place through funded research from Consortium scientists and trusted community partners already linked with our target audiences. Dr. Nancy Rabalais, PI/PD, will ensure that research results from the multiple themes will be integrated into usable information and activities. The public information assets of many of the Consortium members will also be utilized.

4.f. Data Management

Conceptual Agreement on Data Management

The Consortium will accede to all GRI instructions for data submission as required from their agreement developed with the Harte Research Institute for Data Management and Discovery. LUMCON and its member institutions are prepared to provide data and metadata suitable for federal databases or nationally recognized repository appropriate for the various disciplines involved here. Obviously, until more is known, data policies will have to evolve accordingly. The Consortium is not currently knowledgeable of the details of this memorandum of agreement, and thus is not able to provide methods to adhere to Harte Research Institute requirements. However, the expected type of data and suitable avenues of data and metadata submission are practiced by multiple members of the Consortium in adherence to NSF, NOAA, ONR, BOERME, USGS and other agency requirements. These data will include a range across broad categories including genomics, model results, biodiversity, descriptive data of hydrocarbons, water quality, and sediment grain size, the Consortium will accede to the GRI's requirement for a rapidly and coherent database that is fully accessible. Depending on the eventual GRI Administrative Unit's contractual development for maintenance of a public database with the Harte Research Institute, the Consortium is prepared to provide data and metadata suitable for federal databases or nationally recognized repository appropriate for the various disciplines incorporated with the research program. The types of data to be collected and public health data. Examples of the types of data to be collected and suggested relevant national database repositories are given below; details of data submission with the Harte Research Institute will be developed post-award. Additionally, any data collaboration between GRI and the GCOOS-Regional Association (Gulf of Mexico Coastal Ocean Observing System) that are not yet public will also be acceded to. It is difficult for applicants to the GRI RFP-I to know the limits of their data submission requirements in relation to contractual data management providers.

The Consortium is fully supportive of the goals of the GRI Data Management protocol to provide reliable data as soon as possible, allow timely use of the data by the research investigators, and supply of the data and metadata to appropriate federal repositories upon completion of research-based, peer-reviewed publications. Likewise, the Consortium expects that Federally-acquired data in the phase of the spill response and initial assessment, the NRDA post-spill assessment and follow-on studies to be readily available to researchers of this Consortium as they proceed with their research programs. The sequestering of federally-acquired data in anticipation of litigation will not support the open and transparent exchange of data for the fulfillment of the research programs proposed by this Consortium.

Field data collections can be as basic as prepared log sheets for later laboratory analyses, or profile data from a CTD unit or imagery from a Sediment Profile Camera. These data are usually collected for later analysis and synthesis into manageable data basis for statistical comparisons and sharing with other investigators. Data deemed suitable for peer-reviewed publication is made available through those publications. Data for journal papers, for example, will be stored on journal web pages, if available. Participating students will have relevant data archived in thesis/dissertation appendices. In addition, we will contribute data to oil-spill related data repositories (e.g., NOAA, Louisiana Oil Spill Coordinators Office; EPA). Activities also will be listed in significant web-based systems, including http://gulfseagrant.org/oilspill/database.htm.

Data Management Goals

Our overall goal is to ensure that quality data are generated that are based on solid scientifically defensible methods allowing for the accelerated transfer of the results into the user community. Additionally, the plan will facilitate the open sharing of recent results among LUMCON PIs and other funded consortium members to ensure that developing results can be incorporated into on-going research activities of the various work groups.

Data Types

The Consortium will undoubtedly collect a diverse series of data that reflect ecosystem measurements, process studies, biodiversity, oceanographic data, genetic data, isotope studies, x-radiographs, and qualitative image analyses. Should the LUMCON proposal be funded, an Information Management System (IMS) will be designed to provide a formal working framework for each project to provide and utilize data as research proceeds.

Organism and Ecosystem Core Data

***Spartina,* microbial, and biodiversity genomics data:** (1) DNA sequence data derived from "next generation" metagenomic approaches, (2) DNA sequence data derived from Sanger-sequencing approaches, (3) Multi-locus genotype data from DNA fragment size analysis (i.e., AFLP, microsatellites, PCR-RFLP approaches). Materials to be produced: (1) DNA extractions, (2) Metagenomic DNA sequence databases, (3) plant genotype databases. National repository: National Center for Biotechnology Information (Genbank) Knowledge Network for Biodiversity (KNB), http://www.ncbi.nlm.nih.gov/. Standards for data and related metadata format: NCBI data and metadata standards; Morpho data management software (used to query, view, retrieve and manipulate ecological data from the KNB network). Data archiving: NCBI with DNA sequence data and remaining samples locally archived. Access: data will be accessed from NCBI with the assistance of the data management group at Harte Research Institute.

Biodiversity data: Sequence data will be submitted to GenBank (http://www.ncbi.nlm.nih.gov/genbank/GenbankSearch.html) and BOLD (Barcode of Life; www.barcodinglife.org) fully available to public; FASTA file format. Specimen archival: tissues and DNA extracts from archived specimens temporarily held in -80 C, discarded after 12 months, permanent repositories either ULLZ (University of Louisiana – Lafayette Zoological Collection; public catalog access at: http://biology.louisiana.edu/Felder/ULLZDbase.html) or NMNH (National Museum of Natural History, Smithsonian Institution, Washington; public catalog access at: http://collections.nmnh.si.edu/emuwebizweb/pages/nmnh/iz/Query.php).

Water quality data: NOAA National Oceanographic Data Center (NODC); FGDC-compliant metadata.

Diversity Data: species counts and enumeration are also deposited with NOAA NODC similar to procedures followed for MMS studies (now BOEMRE).

Biogeochemical process data: As required by the National Science Foundation, Biological Oceanography's requirement for BCO-DMO (an oceanographic database) but others are possible.

Goals for Data Sharing

Given the pressure to share data and to come to conclusions on BP-oil spill related research, Consortium members will be encouraged to post data as soon as possible. However, this is a research program, and academic researchers are protective of data prior to publication. Our Consortium members will share data on a protected area of the Consortium web site, but release relevant data for other researchers as soon as possible. As evidenced by the NSF RAPID awards, from time of funding to earliest research publication (Camilli et al. 2010), the time was an exceptionally speedy six months. Not all research will proceed this rapidly, but the goal of the Consortium is to bring research results to fruition as rapidly as possible. The LUMCON Data Management team will host a password-protected portion of the web site for data sharing among investigators, and a public data sharing site for released data. As soon as papers are accepted for publication, the data supporting the results will be posted to the public, and a URL to the accepted publication will be provided. Data provided for use of other research consortia will be tagged as "proprietary" to the generating investigator. Should they be requested the investigators will come to an agreement about data sharing. Data products, data results, publications, video tracks and public education and outreach materials are fully accessible to the research community and the public, except where protected by copyright.

Data Management Plan

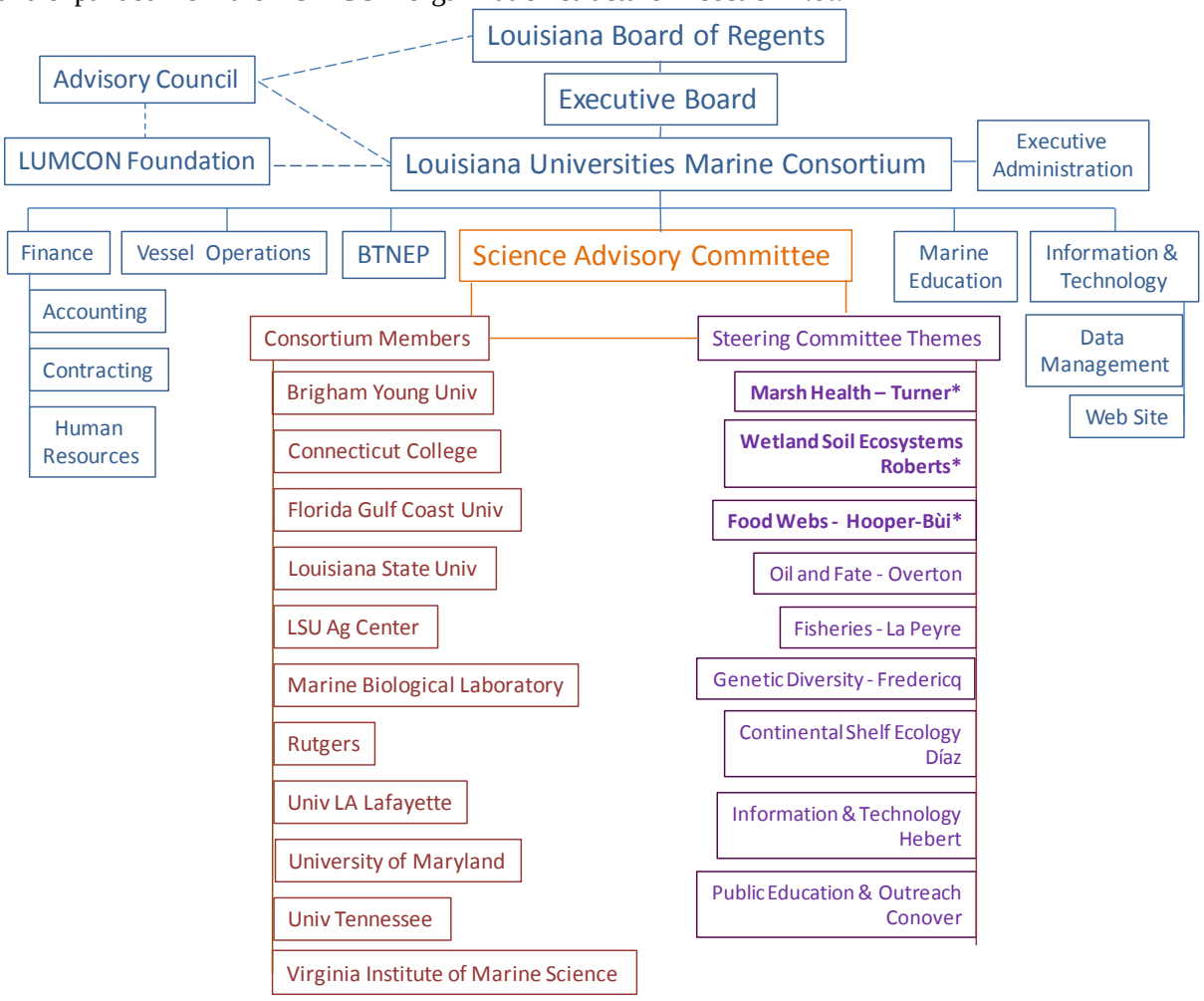
The general protocol for data management will apply to all Consortium research, but will be adapted according to discipline-specific needs. The protocol has the following common elements:

1. Experimental Method Selection. The various activities proposed involve complex experimental designs with their effectiveness based on methods employed to generate data. An open sharing of experimental and analytical methods will be organized not only to the Consortium membership, but the wider scientific community. This should benefit other research consortia funded by the GRI. Where appropriate, utilization of already developed methods from USEPA, API, and ASTM will be emphasized for preferential selection the Data Management Policy Group. Modifications and development of new methods (a very likely potential product of the LUGCR) will be documented and shared among the membership. Given the many experimental facets proposed here, the actual individual methods to be employed by each project will not be listed. The reviewers are requested to consider the quality and experience reflected within the CVs of the project team to gain comfort as to the ability to use effective methods for implementation of the research plans.
2. QA/QC Plan. LUMCON will develop a formal Quality Assurance/Quality Control (QA/QC) plan in collaboration with its investigators. LUMCON already has several AQ/QC Plans accepted by the U.S. EPA. Further, the chemical analyses to be conducted by Dr. Ed Overton are already in compliance with NOAA HAZMAT standards. In general, standard resources for QA/QC techniques will be used in the drafting of the QA/QC Plan (i.e. USEPA SW846, ANSI/ASQC, and Standard Methods). The primary aspects of the QA/QC plan will include details on sample collection, shipment, and storage of all samples (sample replication, appropriate sample storage bottles, sample preserving, allowable holding times, method standards, sample logging, etc.).
3. Data Sharing and Archiving. A significant volume of valuable data will be generated as a result of the Consortium activities. A centralized LUMCON data archive system will be designed and implemented for the appropriate archiving of reduced data. The archive will be designed following different phases of data availability. Additionally, the interaction of the Consortium archived data with several other existing databases will be explored to facilitate rapid transfer of data to the scientific community.
4. Technology Transfer Vectors. The overall goal for the Consortium is the rapid and effective transfer of results to the overall user community. Hence, the researchers of the Consortium will be encouraged to present and publish their original results. A policy will be implemented for the use of shared data that no group can utilize data generated in part or wholly by another member in any public disclosure without approval of that investigator/member and the Executive Steering Committee. This policy will ensure that open sharing of data is accomplished to optimize the performance of the various projects without compromising investigators prerogative for first use of the data they collect.

Atmospheric Doppler profiler data, five real-time hydrographic and meteorological stations in south Louisiana and two offshore coastal ocean observing systems are available on-line through the LUMCON Environmental Monitoring system (http://weather.lumcon.edu). Additionally LUMCON ocean observing data with regard to dissolved oxygen and ancillary data are stored at LUMCON and at LSU WavCIS. Many long-term data for offshore oceanographic conditions are stored at NOAA's National Oceanic Data Center (NODC) with relevant metadata. The Data Management team at LUMCON for the Environmental Monitoring Data and the long-term hypoxia studies of Rabalais et al. are fully qualified for data acquisition, quality control/quality assurance, and generation of metadata for submission to national oceanographic data repositories.

4. g. Management Plan

Organization. The Louisiana Universities Marine Consortium for Research and Education (LUMCON) proposal to BP GRI encompasses 12 institutions and Co-PIs, 26 investigators, and numerous administrative, research, data management, public outreach and education staff, a Steering Committee, and a Science Advisory Committee. The management umbrella is the Louisiana Board of Regents with financial responsibility and the LUMCON Executive Board of senior administrators from Louisiana State University, University of Louisiana at Lafayette and Nicholls State University. The Consortium serves all 4-year higher education institutions in the state and several private universities and state agencies. Three members of the LUMCON Consortium are lead institutions in the proposal. The remaining institutions come from across the Gulf coast and the nation. LUMCON is the fiscal agent and guiding institution for the conduct of the research, its management, and its dissemination to multiple members of the public. The organization of the management structure of LUMCON and its consortium members is provided below, and expanded from the LUMCON organization structure in section **4.d.**:



The LUMCON Executive Director, PI/PD, has final authority in the conduct of the Consortium for the GRI program on "The Effects of the Macondo Oil Spill on Coastal Ecosystems." *Dr. Rabalais' management philosophy over the last 25+ years is to engage all members of the research team as equal partners, including research staff, in the development of hypotheses and methods of discovery, sample design and strategy, and synthesis of results into scientifically competent, peer-reviewed research results and dissemination of research to public at multiple levels.* She has a long history of conducting research

in the Gulf of Mexico, and as specifically related to the themes of this proposal. She is a recognized national and international scientist in the interaction of rivers and oceans, benthic ecology, eutrophication, harmful algal blooms, and hypoxia (low oxygen). She is equally recognized as a national and international science leader. She served as Chair of the Ocean Studies Board of the National Research Council, currently serves on two NRC committees, the Council for the University-National Oceanographic Laboratories, as a Trustee for the Consortium on Ocean Leadership, Vice Chair of the National Sea Grant Advisory Board, Board of Directors for the Gulf of Mexico Coastal Ocean Observing System, and President Elect of the Southern Association of Marine Labs. She is a past member of the NSF Advisory Committee for Environmental Research and Education and President (series) of the Coastal Estuarine and Research Federation. Dr. Rabalais is an American Association for the Advancement of Science Fellow, an Aldo Leopold Leadership Program Fellow, and a National Associate of the National Academies of Science. She is a member of the Louisiana Environmental Education Commission, appointed by the Governor to represent the Louisiana Board of Regents.

The management structure as diagrammed above provides for the LUMCON fiscal, management and scientific leadership, with the inclusion of 11 research institutions as Co-PIs. Each Co-PI is in her/his own right leaders of research programs. These include: Gene Turner, LSU, with Dubravko Justić (fate of oil), Brian Fry (food webs), Ed Overton (oil fate, with Scott Miles), Ken Brown (food webs); Linda Hooper-Bùi, LSU AgCenter (insects/spiders and food webs), with Jerome La Peyre (oysters), Phil Stouffer and Sabrina Taylor (impacts on the diet of the Seaside Sparrow in oiled marshes); Anne Giblin, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, involvement with two NSF Long Term Ecosystem Research programs and expert on nutrient and organic fluxes in salt marshes; Darryl Felder and Susan Fredericq of ULL for hard bank epifauna and epiflora and genetic biodiversity, who have discovered oil on these topographic features in an NSF RAPID grant and have an ensuing GRI RFP-III for follow-up studies (as does Rabalais, LUMCON, as part of Wei-Jun Cai and continental shelf hypoxia). We also have a suit of genetic biodiversity experts from Brigham Young University (Crandall and Bracken-Grisson), Connecticut College (A.E. Bernhard), and Univ of LA at a Lafayette (Felder and Fredericq), and experts on continental shelf ecosystems (Rabalais, Díaz, Parsons, Felder and Fredericq).

There will be a **Steering Committee** of 9 out of 26 investigators, organized by research theme, to guide the overall sampling strategy and incorporation of the multidisciplinary aspects of the research plan. The Steering Committee is led by 3 executive members, Dr. Gene Turner, LSU, Dr. Brian Roberts, LUMCON, and Dr. Linda Hooper Bùi, LSU AgCenter. These individuals were integral in the development of the overall research plan and its vision for understanding the effects of the BP Deepwater Horizon oil spill on ecosystems of the Gulf of Mexico. Other members represent varying research emphases. The Steering Committee includes key LUMCON staff for Public Outreach and Education, Data Management, and development and sourcing of the project's web site. While the members of the Consortium have been meeting to develop the research program over the last year and conducting research activities in affected areas of the oil spill, they will come together at the beginning of the research project to further delineate research hypothesis and plans for scientific discovery. These meetings will take place on an annual basis at the beginning of the research and at the end of years 1, 2, and 3. The Steering Committee will meet by video conferencing on a quarterly basis. The Executive Members of the Steering Committee (bold and * in the diagram above) will meet more frequently through video conferencing to assess status of research progression, accomplishments and redesign of objectives as necessary.

We have assembled a **Science Advisory Committee** of experts on the study of coastal and marine ecosystems. They include Dr. Craig Osenberg, University of Florida, who is a leading ecologist in population and community ecology, working in freshwater and marine systems; Dr. Lisa Levin, Scripps Institution of Oceanography, has research emphases on wetland, coastal ocean and deep-sea ecosystems with special emphasis on wetland ecosystem function, deep-sea hypoxia and deoxygenation, and biogeochemical processes in anoxic environments; Dr. Bob Christian, Professor Emeritus of East Carolina University, and lead for the Virginia Coastal NSF LTER; Dr. Linda Deegan, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, with involvement in multiple NSF LTERs; and Dr.

Jim Morris, Director of Belle Baruch Marine Laboratory, and well-known marsh ecologist who is involved in long-term research programs with the Smithsonian Environmental Research Center and the Virginia Coastal LTER. The SAC will interact with the Co-PIs and the Steering Committee to advise the Consortium on research goals, prioritization over three years, shifts in research emphases and development of future research programs. The Consortium is prepared to end research projects that have reached a culmination of information and results and add new research emphases as identified in research results. The project will be evolving as the research is conducted and as results are identified and synthesized into an overall ecosystem response matrix. The budgets proposed for the three years of research are open to modification and redirection of research as the program evolves.

Management Issues
Each PI is responsible for their respective samples and analyses. Results of sample analyses from all presently-funded field campaigns will be used to measure the effects of short-term (3 months) and longer-term (1 year and 1.5 years) exposure to stressors (oil, toxins, dispersant, and nutrients), and to provide a basis for additional measurements over several years, as supported by this and future funding initiatives or shifted within this Consortium program. These efforts will be coordinated in quarterly research-group meetings of all collaborators, either by teleconference, video-conferencing, or in-person meetings of smaller research groups. The interaction of the Steering Committee, the engaged research institutions and the governance of the Louisiana Universities Marine Consortium will resolve any conflicts of research administration, accomplishments, reporting, and dissemination of results. This research group was formed from the bottom-up, is investigator-driven, and provides for the good will of research collaborators, who have a long history of integration, science programs, and publication. We do not anticipate any problems. Of course, these will sometimes surface and will eventually be decided by the Consortium lead PI/PD, Dr. Nancy Rabalais, the Science Advisory Committee and the Executive Members of the Steering Committee through fully-vetted communications that include the input of all members of the Consortium.

Other Responsibilities
Many members of the research Consortium have large, ongoing, multidisciplinary research programs that accede to requirements for safety, subcontractual agreements, reporting requirements at various levels, and adherence to Federal agency requirements, including those of the National Science Foundation. There exists a community responsibility to adhere to these requirements and address them in a correct and timely fashion. The Consortium does not expect any deviations from these requirements.

4.h. Supplementary Objectives

Capacity Building
LUMCON and the Consortium members have many opportunities to increase the capacity of students, early career scientists and members of the community.

I**ncreasing Diversity** is more than a nominal goal for the LUMCON Consoritum and its members. LUMCON in its programs seeks to reach under-represented and disadvantaged members of the south Louisiana coastal community. Its programs with the University of Florida Environmental Literacy Program placed LUMCON environmental educators in under-represented schools in Cameron Parish, LA, and Lafourche Parish, where 95% of the students qualify for school lunch supplements. The LSU Graduate Student EnvironMentors program, supports under-represented high-school students in Baton Rouge that take field trips to the Marine Center in Cocodrie and whom benefit from the one-on-one attention of Dept of Oceanography and Coastal Sciences graduate students. Recent participants in the EnvironMentors program interacting with LSU graduate students and Marine Educators from LUMCON won awards at the state EnvironMentors science fair and traveled to the national science fair, where one student garnered a top award for her EnvironMentors Science Fair project. Overall, the students attending the national program participated on a trip to the Anacostia River, similar to the LUMCON R/V *Acadiana*

trip with LUMCON educators. They were far from pleased with the Anacosta trip compared to the LUMCON field trip, which was "truly awesome" and "made them realize how lucky they were to have that experience at LUMCON." They also said that LUMCON personnel treated them so nicely, taught them a lot and that they had a really great time and have high expectations for field trips, and they will always compare it [future field trips] to their LUMCON trip! There is no better testimony for the LUMCON Marine Education Program than the continuous accolades we receive from our participants, including minorities, visually and hearing impaired students, and under-represented members of the south Louisiana community.

One of the Consoritum members at Connecticut College developed the Science Leaders program through an NSF-S-STEM grant to attract and retain students from socio-economically disadvantaged backgrounds. Science and math faculty travel to partnership schools in Connecticut and New York and spend a day interacting with students, and generating buzz about pursuing science at Connecticut College. Each year, 16 freshmen are accepted into the program to pursue science or math. The emphasis is on engaging students immediately in faculty research, and students work closely with faculty mentors during their college career. The approach is designed to not only retain the students in the program, but also to foster a desire to pursue graduate studies in science or math. The program, now in its fourth year, has been extremely successful. Retention in the program is >90%, and the 26 students of color in the program outperformed other students of color taking the same STEM courses over the past 5 years, despite their incoming SAT scores being significantly lower than the non-Science Leader students of color. Science Leaders will be recruited to participate in the project as summer research students or to complete independent study credits during the academic year at Connecticut College. Bernhard has participated in the program for three years and has mentored four Science Leaders in her lab. Other members of the Corsortium also mentor under-represented students in programs such as McNair Scholars (Hooper-Bui).

Early Science Career Development at the Undergraduate Level. LUMCON and Univ of Louisiana at Lafayette (ULL) have NSF REU programs that immerse undergraduates in research programs for 8 weeks at a university or marine laboratory. The REU programs partner faculty research scientists with upper level undergraduate students for a summer of developing research projects, carrying them to completion, and learning the process of scientific inquiry and experimentation. These REU programs under the direction of Dr. Brian Roberts, LUMCON, and Dr. Suzanne Fredericq, ULL, will engage undergraduates in oil spill research.

Undergraduate and Graduate Courses

The PIs of this project teach undergraduate and graduate courses, and their research results are incorporated into and serve to shape educational activities both on- and off-campus. For example, Turner has two relevant wetland courses: Wetland Loss, Restoration and Management; and Restoration Ecology/ Ecological Restoration. Research results also are incorporated into a lecture for Fry's Introduction to Oceanography course, with 20-100 LSU students a year. Hooper-Bùi will incorporate knowledge gained and research results in her spring course Insect Ecology class with graduate and undergraduate students from numerous departments (Entomology, Biological Sciences, Plant Pathology, Agronomy, History, Philosophy, Horticulture and Renewable Natural Resources). The LUMCON spring semester video learning course "Changing Coastal Oceans" incorporates the latest marine research including results from the oil spill research. Postdoctoral research associates and graduate student educational opportunities were addressed in **section 4.d.** Other PIs will incorporate results into teaching as appropriate.

5. Facilities of the Consortium and unique elements of consortium members

Louisiana Universities Marine Consortium, at the DeFelice Marine Center in Cocodrie, LA also has a field laboratory, Port Fourchon, close to marsh study areas in Barataria Bay. The Marine Center is a state-of-the-art research and education facility with 75,000 ft^2 of research, instructional, housing, and support facilities. The Center's location on north Terrebonne Bay provides an ideal venue for marsh and coastal ecosystems. There are 26,000 ft^2 of laboratory, classroom, office, and library. Some labs are equipped with running sea water and others house instrumentation. Dormitories, apartments and a cafeteria provide housing and meals for 87 persons. A 99-seat auditorium facilitates teaching, seminars, and conferences. Distance-learning video conference center accommodates video conferencing between collaborators. LUMCON has a fleet of research vessels such as 116-ft R/V *Pelican* (member of UNOLS fleet) the R/V *Acadiana* (58 ft), offshore-, bay- and air-boats. LUMCON maintains an Environmental Monitoring System with five hydrographic and meteorological coastal stations and two ocean-observing systems.

Equipment: Lachat Instr. QuickChem FIA+ 8000 series autoanalyzer (in-line unit, organic P&N); CE Elantech Flash EA 1112 Series CHN analyzer; Hidex Scintillation Counter; Perkin Elmer AAnalyst 800 Atomic Adsorption unit; Partec PAS flow cytometer; Waters HPLC; Unicam UV/VIS spectrophotometer; Coulter LS 13320 Laser Diffraction Particle Size Analyzer; LOGOS Digital X-radiography; Shimadzu TOC-VCSH Analyzer with TNM-1 (Total Nitrogen Measuring kit); Shimadzu GC2014 greenhouse gas analyzer; Pulse Amplitude Modulated fluorometer, SUNA nitrate analyzer. Other facilities: racetrack flume; environmental chambers; oil fluorometers, and Seasciences Acrobat undulating profiler.

Louisiana State University Laboratory ECE has >14,000 ft^2 of offices, laboratories, and conference rooms. Relevant equipment are Lachat autoanalyzers, Perkin Elmer CHNS/O 2400- & Shimadzu Carbon 5000A- analyzers, Alpha scintillation counters, Liquid scintillation counter, ATP analyzer, Perkin Elmer AAnalyst 300), gamma spectroscopy (^{137}Cs, ^{210}Pb), spectrophotometers, Thermoquest Finnigan isotope ratio mass spectrometers, New Wave laser system, and Carlo Erba elemental analyzer system. LSU's chemical analytical capabilities include Agilent 7890 GC interfaced to an Agilent 5875 inert XL MSD, Hewlett Packard 6890 GC interfaced to a HP 5973 MS, HP 5890 GC interfaced to a HP 5972 MS. CSI provides electronics, construction and bay-boat rental. CSI lab houses 13 Pentium PCs (3 LINUX and 11 Windows) and one SGI workstation for hydrodynamic model simulations. "SuperMike", a Beowulf-class supercomputer for large-scale scientific parallel computations, is available at the Center for Applied Information Technology and Learning. It provides multiple servers, 512 dual-processor clients with Intel P4 dual Xeon processors at 1.8 GHz and 2GB memory, connected via a high-speed network (Myrinet), a portable ASI dual column microFAST GC with flame ionization detection.

LSU Ag Center houses the Conservation Genetics Lab, Conservation Genetics Ancient DNA Lab, a microplate fluoremeter & luminometer, flow cytometer, protein purification, image acquisition & analysis system, gene expression equipment homogenizers, Typhon #9410 imager for 2D-DIGE gels, Progenesis same-spot fast-track analysis software for 2D-DIGE gel analysis and 8 recirculating water systems.

Connecticut College: Bio-Rad iQ iCycler, gel electrophoresis equipment, BioSpec Beadbeater, BioRad Microplate Reader software for DNA sequence and TRFLP analysis (Sequencher, MacVector, GeneMarker, ARB), Bio-Rad Gel Documentation System, and MyCycler PCR machine.

The **Ecosystems Center at the MBL** has a shared facility for stable isotope use with several isotope ratio mass spectrometers and a membrane inlet mass spectrometer (MIMS) for much of the N cycling work.

University of Maryland Laboratory for Global Remote Sensing in the Dept of Geography has advanced visualization & digital arts facility and high performance storage in 3 laboratories for processing and analyzing RS data with >100 networked PC and UNIX workstations, complete with imaging software packages ERDAS Imagine, ENVI, and PCI, complemented with 2 networked GIS laboratories.

University of Tennessee, Center for Environmental Biotechnology is fully equipped for analyzing contaminants and microbes in the environment, including nucleic acid extraction and real-time PCR assays, including at Biosafety Level and a MJ Chromo4 real-time PCR thermal cycler. Genome Sequencer FLX System for 454 sequencing is at the UT-Oak Ridge National Laboratory Joint Institute for Biological Sciences facility.

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8a. Biographical Sketches

K.W. Able, Rutgers University
A.E. Bernhard, Connecticut College.
H. Bracken-Grissom**,** Brigham Young University
K.A. Brown, LSU
K. Crandall, Brigham Young University
R.J. Diaz, College of William and Mary
D.L. Felder, University of Louisiana at Lafayette
F.J. Fodrie, UNC at Chapel Hill
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M.S. Miles, LSU
E.B. Overton, LSU
M.L. Parsons**,** Florida Gulf Coast University
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Education

Ph.D. 1974 College of William and Mary, Biological Oceanography
B.S. 1967 Marian College, Biology

Professional Experience

Professor II (Distinguished Professor), Department of Marine and Coastal Sciences, Institute of Marine and Coastal Sciences, Rutgers University, 2002 - present.
Professor, Department of Marine and Coastal Science and Biological Sciences, Institute of Marine and Coastal Sciences, Rutgers University, 1988 - 2001.
Director, Marine Field Station at Tuckerton, Rutgers University, 1987 - present.

Five publications most relevant to the proposed activities

Able, K.W. and M.P. Fahay 2010. Ecology of Estuarine Fishes: Temperate Waters of the Western North Atlantic. Johns Hopkins University Press, Baltimore, MD. 566 p.
Able, K.W., T.M. Grothues, S.M. Hagan, M.E. Kimball, D.M. Nemerson, and G.L. Taghon 2008. Long-term response of fishes and other fauna to restoration of former salt hay farms: Multiple measures of restoration success. **Rev. Fish Biol. Fisheries** 18: 65-97.
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Able, K.W. and M.P. Fahay 1998. The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight. Rutgers University Press. 342 p.

Five other significant publications

Hunter, K.L., M. Fox, and K.W. Able 2007. Habitat influences on reproductive allocation and growth of the mummichog (*Fundulus heteroclitus*) in a coastal salt marsh. **Marine Biology** 151: 617-627.
Rountree, R.A. and K.W. Able 2007. Spatial and temporal habitat use patterns for salt marsh nekton: Implications for ecological functions. **Aquatic Ecology** 41: 25-45.
Hunter, K.L., D.A. Fox, L.M. Brown, and K.W. Able 2006. Responses of resident marsh fishes to stages of *Phragmites australis* invasion in three mid-Atlantic estuaries, U.S.A. **Estuaries and Coasts** 29(3): 487-498.
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Recent Synergistic Activities

Scientific and Statistical Committee, Mid-Atlantic Fishery Management Council (1997-2000)
National Research Council, Ocean Studies Board, Committee on Improving the Collection and Use of Fisheries Data, 1998-2000.
Consultant for New Jersey Dept of Environmental Protection, Endangered and nongame species program, 2003-2004
Co-developer of research and education web site on striped bass (www.stripertracker.org)
Advisory Board, Partnership for Mid-Atlantic Fisheries Science

Collaborators over the last 48 months:

M.P. Fahay, NOAA/NMFS, Sandy Hook, NJ (retired); J. Hare, NOAA/NMFS Beaufort, NC; K.M.M. Jones, Cape Breton Univ.; D.A. Fox, Delaware State Univ.; M.J. Wuenschel, NMFS/NEFSC, Woods Hole, MA; D. Byrne, NJ DEP; M. J. Neuman, NOAA/NMFS, Long Beach, CA; T.M. Grothues, Rutgers Univ.; J. Carter, Univ. New England; T.W. Arienti, Univ. New England; M.C. Sullivan, Richard Stockton College of New Jersey; D. H. Wilber, Bowhead Information Technology Services, Inc.; A. Muzeni-Corino, NJ DEP; D.G. Clarke, U.S. Army Engineer Research and Development Center; M. E. Kimball, Guana Tolomato Matanzas Research Reserve, DEP, FL; G. Bath-Martin, NOAA/NMFS, Beaufort, NC; J. C. Taylor, NOS/NOAA, Beaufort, NC; A.A. Hohn, NMFS/SEFSC, Beaufort, NC; J. M. Vasslides, Barnegat Bay Partnership; D.N. Vivian, U.S. EPA, Gulf Breeze, FL; J.T. Turnure, Univ. New England; D.M. Allen, Univ. South Carolina; D.E. Hoss, NOAA/NMFS/SEFSC, Beaufort, NC; K.E. Marancik, NOAA/NMFS/NEFSC, Narragansett, RI; P.M. Powles, Trent Univ.; D.E. Richardson, NOAA/NMFS/NEFSC, Narragansett, RI; J. C. Taylor, NOAA/NMFS/SEFSC, Beaufort, NC; H.J. Walsh, NOAA/NMFS/NEFSC, Narragansett, RI; S.M. Warlen, NOAA/NMFS/SEFSC, Beaufort, NC; C. Wenner, Dept. Natural Resources, SC.

Graduate advisor: J.A. Musick, College of William and Mary
Postdoctoral advisor: W.C. Leggett, McGill University

Graduate students (past 10 years, total 40)

Diana Raichel, A.S. Greene Environmental Consultants; Edward Martino, Univ. Maryland Graduate School; Gregg P. Sakowicz, Jacques Cousteau National Estuarine Research Reserve; Clare Ng, Marine Academy of Science and Technology, Sandy Hook; Jacalyn Toth, Rutgers Univ. Marine Field Station; Matthew Kimball, Guana Tolomato Matanzas Research Reserve, DEP, FL; James Vasslides, Barnegat Bay Partnership; Jason Turnure, Univ. New England. Current Students (in progress): John H. Balletto, Jamie Caridad, Matthew Yergey.

Postdoctoral fellows (past 10 years, total 23)

Thomas M. Grothues, Rutgers Univ.; Melissa J. Neuman, NOAA/NMFS Long Beach, California; Guillermo Ruess; Phillip R. Light, Florida; Dewayne A. Fox, Delaware State Univ.; M. Martha Jones, Univ. Cape Breton; David Taylor, Roger Williams Univ.; Mark Sullivan, Stockton College; Mark Wuenschel, NOAA/NMFS/NEFSC, Woods Hole, MA.

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Education

Ph.D.	2000	Oregon State University, Microbiology
M.S.	1993	Western Washington University, Environmental Science
B.S.	1987	Texas A&M University, Biology

Professional Experience

2010-present	Associate Professor, Connecticut College, New London, CT
2004-2010	Assistant Professor, Connecticut College, New London, CT
2000-2004	Postdoctoral Research Associate, University of Washington, Seattle, WA
1995-1996	Research Assistant, University of Texas Health Science Center, Houston, TX
1994-1995	Instructor, Western Washington University, Bellingham, WA
1993-1994	Research Assistant, University of Alaska-Fairbanks, Juneau, AK
1988-1991	Research Assistant, University of Texas Health Science Center, Houston, TX
1987-1988	High School Teacher, Incarnate Word Academy, Houston, TX

Five publications most relevant to the proposed activities (undergraduates authors underlined**)**

Bernhard A.E. and A. Bollmann 2010. Estuarine nitrifiers: New players, patterns, and processes. **Estuarine Coastal and Shelf Science** 88: 1-11. Invited Feature Article.

Moin, N.S., K.A. Nelson, A. Bush, and A.E. Bernhard 2009. Distribution and diversity of archaeal and bacterial ammonia oxidizers in salt marsh sediments. **Applied and Environmental Microbiology** 75: 7461-7468.

Bernhard, A.E., J. Tucker, A.W. Giblin, and D.A. Stahl 2007. Functionally distinct communities of ammonia oxidizing bacteria along an estuarine salinity gradient. **Environmental Microbiology** 9: 1439-1447.

Könneke, M., A.E. Bernhard, J.R. de la Torre, C.M. Walker, J.B. Waterbury, and D.A. Stahl 2005. Isolation of an autotrophic ammonia-oxidizing marine archaeon. **Nature** 437: 543-546.

Bernhard, A.E., T. Donn, A.E. Giblin, and D.A. Stahl 2005. Loss of diversity of ammonia-oxidizing bacteria correlates with increasing salinity in an estuary system. **Environmental Microbiology** 7:1289-1297.

Five Additional Publications

Nelson, K.A., N.S. Moin, and A.E. Bernhard 2009. Archaeal diversity and the prevalence of *Crenarchaeota* in salt marsh sediments. **Applied and Environmental Microbiology**. 75: 4211-4215

Bernhard, A.E., Z.C. Landry, A. Blevins, J.R. de la Torre, A.E. Giblin, and D.A. Stahl 2010. Abundance of ammonia-oxidizing *Archaea* and *Bacteria* along an estuarine salinity gradient in relation to potential nitrification rates. **Applied and Environmental Microbiology** 76: 1285-1289.

Bernhard, A.E., D. Colbert, J. McManus, and K.G. Field 2005. Microbial community dynamics measured by 16S ribosomal DNA profiles along a salinity gradient in a shallow Northwest estuary. **FEMS Microbiology Ecology** 52: 115-128.
Bernhard, A.E., K.G. Field 2000. Identification of nonpoint source pollution in coastal waters by using 16S ribosomal DNA genetic markers from fecal anaerobes. **Applied and Environmental Microbiology** 66: 1587-1594.
Bernhard, A.E. and E.R. Peele 1997. Nitrogen limitation of phytoplankton in a shallow embayment in Northern Puget Sound. **Estuaries** 20: 759-769.

Recent Synergistic Activities

Educational resource development:

Bernhard AE (2010) The Nitrogen Cycle: Processes, Players, and Human Impacts. *Nature Education Knowledge* 1(10):12. (http://www.nature.com/scitable/knowledge/library/the-nitrogen-cycle-processes-players-and-human-15644632).
Biology Scholars Research Residency participant, 2011, American Society for Microbiology

Mentoring activities:

Faculty Fellow, Connecticut College Center for Teaching and Learning (CTL), 2011-present; mentor incoming faculty and plan CTL programs for faculty teaching development
Undergraduate research advisor, 2004-present; advise 3-4 students per year on independent research projects

Activities to broaden participation of underrepresented groups in science:

Co-organizer of the Science Leaders program at Connecticut College; attend recruiting trips to partnership high schools in CT and NY; provide research opportunities for students in the program

Collaborators over the last 48 months:

Annette Bollmann, Miami University, Anne E. Giblin, Marine Biological Laboratory, David A. Stahl, University of Washington, José R. de la Torre, San Francisco State University, Ivan Valiela, Marine Biological Laboratory

Graduate and Post-doctoral Advisors

M.S. advisor: Emily Peele (retired)
Ph.D. advisor: Katharine G. Field (Oregon State University)
Post-doctoral advisor: David A. Stahl (University of Washington)

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Education

Ph.D. 2008 University of Louisiana-Lafayette, Evolutionary Biology
B.S. 2002 University of California-Santa Barbara, Aquatic Science

Professional Experience

Postdoctoral Researcher	Brigham Young University	2008-present
Research Fellow	University of Louisiana-Lafayette	2004-2008
Teaching Assistant	University of Louisiana-Lafayette	2003-2008

Five publications most relevant to proposed activities

Bracken-Grissom, H.D., T. Enders, C. Jara, and K. Crandall 2010. Molecular diversity of river versus lake freshwater anomurans in southern Chile (Decapoda: Aeglidae) and morphometric differentiation between species and sexes. In: C. HELD, C. SCHUBART, S. KOENEMANN (eds.). *Phylogeography and population genetics in Crustacea (Crustacean Issues), Taylor and Francis/CRC Press, Bocan Raton.* In Press.

Bybee, S.M., H.D. Bracken-Grissom, R. Hermansen, D.L. Felder, and K.A. Crandall 2010. Directed next generation sequencing for phylogenetics: An example using Decapoda. **Zoologischer Anzeiger** In Press.

Bracken, H.D., S. De Grave, A. Toon, D.L. Felder, and K.A. Crandall 2010. The Phylogenetic position, taxonomic status, and divergence time of the Procarididea Felgenhauer & Abele, 1983. **Zoologica Scripta** 39(2): 198-212.

Bracken, H.D., A. Toon, D. Felder, J. Martin, M. Finley, J. Rasmussen, F. Palero, and K.A. Crandall 2009. The decapod tree of life: Compiling the data and moving toward a consensus of decapod evolution. **Arthropod Phylogenetics and Systematics** 67(1): 99-116.

Bracken, H.D., S. De Grave and D.L. Felder 2009. Phylogeny of the infraorder Caridea based on mitochondrial and nuclear genes (Crustacea: Decapoda). In: J. Martin, K.A. Crandall, D.L. Felder (eds.). *Decapod Crustacean Phylogenetics (Crustacean Issues), Taylor and Francis/CRC Press, Boca Raton.* Pp. 281-305.

Other significant publications

Felder, D. L., P. C. Dworschak, R. Robles, H. D. Bracken, A. M. Windsor, J. M. Felder, and R. Lemaitre 2009. Obvious invaders and overlooked infauna: Unexpected constituents and new discoveries of the decapod crustacean assemblage at Twin Cays, Belize. **Smithsonian Contributions to Marine Sciences** 38: 181-188.

Recent Synergistic Activities

Competitive Awards

2011-Present FIRST (Faculty Institutes for Reforming Science Teaching) IV Scholar. National Science Foundation.
2008 Travel Student Support, Charlotte Mangum Student Support

Program. Society for Integrative and Comparative Biology.
2007 Research Travel Grant. University of Louisiana at Lafayette, Lafayette, Louisiana.
2007 Peoples Choice Award, Best Student Presentation. Graduate Student Symposium. University of Louisiana at Lafayette, Lafayette, Louisiana.
2006-2007 Research Travel Grant. University of Louisiana at Lafayette.
2005-2007 Research Funds Grant. University of Louisiana at Lafayette.
2004-2007 Rockefeller State Wildlife Scholarship. Louisiana Office of Student Financial Assistance.
2002 Darling Marine Center Internship. University of Maine, Walpole, Maine.
2001 Research Experience for Undergraduates. National Science Foundation. Dauphin Island Sea Lab, University of Southern Alabama, Dauphin Island, Alabama.
2001 Research Experience for Undergraduates. National Science Foundation. The Whitney Laboratory, University of Florida, Marineland, Florida.
2000-2001 Dean's Honors List. University of California Santa Barbara, Santa Barbara, California.

Web Pages

Kids do Ecology (National Center for Ecological Analysis and Synthesis, NCEAS): http://kids.nceas.ucsb.edu/

Professional Society Memberships

The Crustacean Society
American Association for the Advancement of Science (AAAS)
Society for the Study of Evolution

Service to Scientific Community

Decapod Taxonomic Consultant for Ecological Associates, Inc. 2011-Present.
Ad hoc reviewer for: Molecular Phylogenetics and Evolution, Journal of Crustacean Biology, Zootaxa, Invertebrate Systematics, Journal of the Marine Biological Association of the United Kingdom, Phylogeography and population genetics in Crustacea (Crustacean Issues)
6th Grade Biology Laboratory. 2009-2010. American Leadership Academy (ALA).
Student Poster Session Judge. 2010. Brigham Young University. March 25th 2010.
Society for Integrative and Comparative Biology. 2008. Symposia Volunteer.
Graduate Student Symposium Organizing President. 2006. Department of Environmental/Evolutionary Biology, University of Louisiana, Louisiana.

Collaborators last 48 months

Sammy De Grave (Oxford University Museum of Natural History), Alicia Toon (Griffith University), Darryl Felder (University of Louisiana-Lafayette), Keith Crandall (Brigham Young University), Joel Martin (National History Museum of Los Angeles County), Ferran Palero (Universitat de Barcelona), Carlos Jara (Universidad *Austral de Chile*), Peter Dworschak (Naturhistorisches Museum Wien), Rafael Robles (Florida State University), Amanda Windsor (University of Louisiana-Lafayette), Rafael Lemaitre (National Museum of Natural History, Smithsonian).

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Education
Ph.D. 1976 University of Iowa, Ecology
M.S. 1972 Washington State University
B.S. 1970 Arizona State University

Professional Experience
Associate Dean of Basic Sciences 1997- 2003, 2006
Professor of Biological Sciences, Louisiana State University, 1991 - present
Associate Professor of Zoology, Louisiana State University, 1985-91
Director, Crooked Lake Field Station, 1979-85
Associate and Assistant Professor of Biology, Purdue University at Fort Wayne, 1977-85

Five Publications (of 70) most relevant to the proposed activities
Brown, K.M., G.J. George, G.W. Peterson, B.A. Thompson, and J.H. Cowan, Jr. 2008. Oyster predation by black drum varies spatially and seasonally. **Estuaries and Coasts** 31: 597-604.
George, G.J., K.M. Brown, G.W. Peterson, and B.A. Thompson 2008. Removal of black drum on Louisiana reefs to increase oyster survival. **North American Journal of Fisheries Management** 28: 1802–1811
Hulathduwa,Y. and K.M. Brown 2006. Relative importance of hydrocarbon pollutants, salinity and tidal height in colonization of oyster reefs. **Mar. Env. Res**. 62: 301-314.
Banks, P.D. and K.M. Brown 2002. Hydrocarbon effects on fouling assemblages: the importance of taxal differences and spatial and tidal variation. **Mar. Env. Res**. 53: 311-326.
McCoy, D. and K.M. Brown 1998. Short term changes in recruitment of the barnacle *Balanus eburneus* due to oil pollution. **Mar. Env. Res**. 45: 209-224.

Five other significant Publications
Brown, K.M., B. Aronhime, and X. Wang 2011. Predatory blue crabs induce byssal thread production in hooked mussels. **Invertebrate Biology** in press.
Aronhime, B. and K.M. Brown 2009. The roles of profit and claw strength in determining mussel size selection by crabs. **J. Exp. Mar. Biol. Ecol**. 379: 28-33
Hulathduwa, Y., W.B. Stickle, and K.M. Brown 2007. The effect of salinity on survival, bioenergetics and predation risk in the mud crabs *Panopeus simpsoni* and *Eurypanopeus depressus*. **Marine Biology** 152: 363-370.
Brown, K.M., S. F. Keenan, and P. D. Banks 2005. Dominance hierarchies in Xanthid crabs: roles in resource holding potential and field distributions. **Marine Ecol. Prog. Ser**. 291: 189-196
Brown, K.M. and D.C. Swearingen 1998. Effects of seasonality, length of immersion, locality and predation on an intertidal fouling assemblage in the northern Gulf of Mexico. **J. Exp. Mar. Biol. Ecol.** 225: 107-121.

Recent Synergistic Activities
Editor-in-Chief, *American Malacological Bulletin*, 2007 -
Secretary of the Aquatic Ecology Section, Ecological Society of America, 1990-92
Associate Editor, Journal of the North American Benthological Society, 1987-90

Since 2007, I have been editor in chief of the *American Malacological Bulletin*. I gave invited, plenary talks on gastropod conservation (2000 and 2008, Freshwater Mollusk Conservation Society), chaired the gastropod conservation committee for the same society, and consulted with the Nature Conservancy on aquatic biodiversity in the southeastern U.S.

I served on a number of editorial boards (*Southeastern Naturalist*, Mollusk Conservation Society, *JNABS*), co-organized a national meeting (1999 Benthic Ecology Meetings), and reviewed proposals or articles for NSF (multiple proposals), *MEPS*, *Ecology, Oecologia, Ecol. Applications, JNABS,* and *Estuaries*. I served on the local arrangement committee for NABS in 2005 and co-organized a workshop on gastropod conservation for FMCS in 2004. At the state level, I consult frequently on the conservation of freshwater mussels with state agencies, giving several presentations.

I teach ecology at LSU, and have guided a number of graduate students on to important ecological and conservation work. Patrick Banks (MS, 2000) is head of the Louisiana Oyster program at the Department of Wildlife and Fisheries, Susan Bolden (MS, 2001) is a research associate at Yale studying gastropod conservation, Paul Johnson (Ph.D., 2000) was president of the Mollusk Conservation Society and directs Alabama's endangered species research center, Jerry George (MS, 2007) is a fisheries research technician, and Raynie Bambarger (MS, 2006) is a fisheries research technician in Renewable Resources at LSU.

I have also had undergraduate student researchers author papers or be awarded research grants.

Collaborators over the last 48 months:
J. Fleeger, J. Cowan, W. Kelso,and K. Carman (LSU), D. Lodge (U. Notre Dame), R. Stein (Ohio State U.), A. Covich (U. Georgia), J. Thorp (U. Kansas) and J. Alexander (U. Louisville

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Education

Ph.D. 1993 Washington University, (Biology and Biomedical Sciences)
M.A. 1993 Washington University, (Statistics)
B.A. 1987 Kalamazoo College (Mathematics & Biology)

Professional Experience

Professor & Chair	Department of Biology, BYU	2006-present
Curator	Monte L. Bean Museum, Brigham Young Univ.	1997-present
President	Society of Systematic Biologists	2010
Editor	*PLoS Currents: Tree of Life*	2010 - present
Associate Editor	Genome Evolution: *BMC Evolutionary Biology*	2011 - present
Associate Editor	*Journal of Crustacean Biology*	2002 - present
US Node Chair	International Barcode of Life	2010 - present
Editorial Board	*Bioinformatics*	2007 - 2010

Five publications most relevant to proposed activities (of > 205).

Martin, J.W., K.A. Crandall, and D.L. Felder 2009. ***Decapod Crustacean Phylogenetics***, Crusacean Issues 18, Taylor-Francis/CRC Publishers, Cold Spring Harbor, NY.

Bybee, S.M., H. D. Bracken-Grissom, R. A. Hermansen, M. J. Clement, K. A. Crandall, and D. L. Felder 2011. Directed next generation sequencing for phylogenetics: An example using Deacapoda (Crustacea). **Zoologischer Anzeiger** in press.

McLaughlin, P. A., R. Lemaitre, and K. A. Crandall 2010. Annotated checklist of anomuran decapod crustaceans of the world (exclusive of the Kiwaoidea and families Chirostylidae and Galatheidae of the Galatheoidea) Part III - Aegloidea. **The Raffles Bulletin of Zoology** Supplement No. 23: 131-137.

Hendry, A. P., L. G. Lohmann, J. Cracraft, S. Tillier, C. Haeuser, D. P. Faith, S. Magallon, E. Conti, R. Zardoya, K. Kogure, A. Prieur-Richard, K. A. Crandall, C. A. Joly, C. Moritz, T. Yahara, and M. J. Donoghue 2010. Evolutionary biology in biodiversity science, conservation, and policy: A call to action. **Evolution** 64(5): 1517-1528.

Bracken, H.D., S. DeGrave, A. Toon, D.L. Felder, and K.A. Crandall 2010. Phylogenetic position, systematic status, and divergence time of the Procarididea (Crustacea: Decapoda). **Zoologica Scripta** 39(2): 198-212.

Five other significant publications

Crandall, K. A. and J. Buhay 2004. Genomic databases and the Tree of Life. **Science** 306: 1144-1145.

Pearse, D. E., and K. A. Crandall 2004. Beyond F_{ST}: Analysis of population genetic data for conservation. **Conservation Genetics** 5(5): 585-602.

Posada, D. and K. A. Crandall 2001. Evaluation of methods for detecting recombination from DNA sequences using computer simulations. **Proceedings of the National Academy of Sciences, U.S.A.** 98(24): 13757-13762.

Crandall, K.A., O,R.P. Bininda-Emonds, G.M. Mace, and R.K. Wayne 2000. Considering evolutionary processes in conservation biology: Returning to the original meaning of "evolutionarily significant units". **Trends in Ecology and Evolution** 15(7): 290-295.
Posada, D. and K. A. Crandall 1998. Modeltest: Testing the model of DNA substitution. **Bioinformatics** 14(9): 817-818.

Recent synergistic activities

Alfred P. Sloan Young Investigator Award	1996
NSF CAREER Award	1997-2002
Fulbright Scholar Oxford University	2000-2001
Batts Foundation Natural History Lecturer, Kalamazoo College	2003
Karl G. Maeser Research and Creative Arts Award, BYU	2004-2005
PhRMA Foundation Sabbatical Fellowship in Informatics	2005-2006
ISI Highly Cited – Ecology/Environment	2010

Mentored 14 Graduate students, 12 Postdoctoral advisees. Service on NSF (9) panels, Chaired NESCent Site Review for NSF, NIH (6) study sections, SFI (Ireland – 3) panel; past Associate Editor for *Bioinformatics, Evolution, Systematic Biology, Molecular Biology and Evolution, Zootaxa,* and Editor for *Animal Conservation*.

Collaborators last 48 months

J. W. Martin, Los Angeles County Museum of Natural History; D. L. Felder, University of Louisiana, Lafayette; R. Feldmann and C. Schweitzer, Kent State University; S. De Grave, Oxford University; P. Ng, National University of Singapore; C. Schubart, Regensberg University, Germany; T. Y. Chan, National Taiwan Ocean University; K. H. Chu, L. M. Tsang and K. Y. Ma, Chinese University of Hong Kong; S. Ahyong, Australian Museum, Sydney; D. Tshudy, Edinboro University, Pennsylvania; R. Robles, University São Paulo, Brazil; F. Palero, University of Barcelona; M. Pérez-Losada, Universidade do Porto, Portugal; M. L. Porter, University of Maryland, Baltimore.

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Education

Doctor Honoris Causa, Gothenburg University, Sweden
Ph.D. 1977 University of Virginia, Marine Science
M.S. 1971 University of Virginia, Marine Science
B.A. 1968 La Salle College, Biology and Chemistry

Professional Experience

Professor, College of William and Mary, Virginia 1996-
Associate Professor, College of William and Mary, Virginia 1984-96
Assistant Professor, College of William and Mary, Virginia 1978-84

Five publications most relevant to the proposed activities

Brandt, A., A.J. Gooday, S.N. Brandao, S. Brix, W. Brökeland, T. Cedhagen, M. Choudhury, N. Cornelius, B. Danis, I. De Mesel, R.J. Diaz, D.C. Gillan, B. Ebbe, J.A. Howe, D. Janussen, S. Kaiser, K. Linse, M. Malyutina, J. Pawlowski, M. Raupach, and A. Vanreusel 2007. First insights into the biodiversity and biogeography of the Southern Ocean deep sea. **Nature** 447: 307-311.

Diaz, R. J. 2004. Biological and physical processes structuring deep-sea surface sediments in the Scotian and Weddell Seas, Antarctica. **Deep-Sea Research II** 51: 1515-1532.

Diaz, R. J. and J. H. Trefry 2006. Comparison of sediment profile image data with profiles of oxygen and Eh from sediment cores. **Journal of Marine Systems** 62: 164-172.

Diaz, R.J., L.J. Hannsson, R. Rosenberg, P. Gapcynski and M. Unger 1993. Rapid assessment of sedimentological and biological characteristics of a hydrocarbon pollution gradient. **Water, Air and Soil Pollution** 66: 251-266.

Diaz, R.J., G.R. Cutter and D.C. Rhoads 1994. The importance of bioturbation to continental slope sediment structure and benthic processes off Cape Hatteras, North Carolina. **Deep-Sea Research II** 41: 719-734.

Five other significant publications

Rabalais, N.N., R.J. Díaz, L.A. Levin, R.E. Turner, D. Gilbert, and J. Zhang 2010. Dynamics and distribution of natural and human-caused hypoxia. **Biogeosciences** 7: 585–619.

Diaz, R.J., D.C. Rhoads, J.A. Blake, R.K. Kropp, and K.E. Keay 2008. Long-term trends of benthic habitats related to reduction in wastewater discharge to Boston Harbor. **Estuaries and Coasts** 31: 1184-1197.

Diaz, R.J. and R. Rosenberg 2008. Spreading dead zones and consequences for marine ecosystems. **Science** 321: 926-928.

Diaz, R.J. and G.R. Cutter 2001. *In situ* measurement of organism-sediment interaction: rates of burrow formation/abandonment and sediment oxidation/reduction. p. 19-32. *In*: Aller, Aller, and Woodin (eds.), Animal-sediment interactions, University of South Carolina Press.
Cutter, R.G. and R.J. Diaz 2000. Biological alteration of physically structured flood deposits on the Eel margin, northern California. **Continental Shelf Research** 20: 235-253.

Recent Synergistic Activities
Board Member, Coastal and Estuarine Research Federation.
Google Oceans, data layer on distribution of dead zones.
World Resources Insitute website on Eutrophication and Hypoxia: http://www.wri.org/project/eutrophication
EPA Science Advisory Board, Co-Chair, numerical nutrient criteria for Florida coastal and estuarine waters.
MMS, Outer Continental Shelf Scientific Advisory Committee, Chair.
Adviced Secretaria de Medio Ambiente y Recursos Naturales, Gulf of Mexico Large Marine Ecosystem Project on baseline studies relative to BP oil spill impacts in Mexican waters.
Member of UN Global Environmental Facility Scientific and Technical Advisory Panel on nutrient reduction to reduce hypoxia.
Member of UNESCO working group on global nutrient reduction and environmental effects.
Advisor to Baltic 2020 Program on how best to reduce hypoxia in the Baltic Sea.

Collaborators over the last 48 months:
Rutger Rosenberg, U. Gothenberg; Ken Able, Rutgers; Dan Dauer, Old Dominion U.; Lisa Levin, Scripps.; Nancy Rabalais, LUMCON; Jim Blake, AECOM; Denise Breitburg, SERC, MD.

Graduate Advisors:
M.S. Morris Brehmer, Deceased
Ph.D. Michael Bender, Deceased

Thesis Advisor and Postgraduate-Scholar Sponsor:
Total of 22 graduate students advised and 5 postgraduate-scholar sponsored.
Ph.D.s: Arron Bartholomew, American U, Dubi, UAE; Giancarlo Cicchetti, EPA Naragannsesette; Janet Nestlerode, EPA, Gulf Breeze; Kersey Sturdivant, NOAA, Silver Springs; Robert Llanso, Versar, MD; Linda Schaffner, VIMS, College of William and Mary; Gary Gaston, U MS, Oxford; Don Weston, U CA, Davis; Tom Fredette, Corps of Engineers; Brian Meehan, DNA Security.

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Education
Ph.D. Louisiana State University, Zoology & Physiology, 1975
M.S. Texas A&I University, Biology 1971
B. S. Texas A & I University, Biology 1969

Professional Experience
1998-present Associate Research Scientist, National Museum of Natural History, DIZ
1986-2009 Biology Department Head, UL Lafayette
1986-present Full Professor, Biology Department, UL Lafayette (Dept Head 1986-2009)
1979-present, Director, Laboratory for Crustacean Research, UL Lafayette
1978-1979 Director, Marine Consortium (LUMCON) Planning Office
1975-1986 Assistant, Associate Professor of Biology, UL Lafayette

Five publications most relevant to proposed activities (of > 130)

Bybee, S.M.. H.D. Bracken-Grissom, R.A. Hermansen, M.J. Clement, K.A. Crandall, and D.L. Felder in press. Directed next generation sequencing for phylogenetics: An example using Decapoda (Crustacea). **Zoologischer Anzeiger** (In press).

Felder, D.L., D.K. Camp, and J.W. Tunnell, Jr. 2009. An introduction to Gulf of Mexico biodiversity assessment. Pp. 1-13 *in* D.L. Felder and D.K. Camp, eds., ***Gulf of Mexico Origin, Waters, and Biota. Volume 1, Biodiversity***. Texas A&M University Press, College Station.

Felder, D.L, F. Álvarez, J.W. Goy and R. Lemaitre 2009. Decapoda (Crustacea) of the Gulf of Mexico, with comments on the Amphionidacea. Pp. 1019-1104 *in* D. Felder and D. Camp, eds., ***Gulf of Mexico Origin, Waters, and Biota. Volume 1, Biodiversity***. Texas A&M Univ. Press, College Station.

Bilodeau, A.L., D.L. Felder**,** and J.E. Neigel 2005. Population structure at two geographic scales in the burrowing crustacean *Callichirus islgrande* (Decapoda, Thalassinidea): Historical and contemporary barriers to planktonic dispersal. **Evolution** 59: 2125–2138.

Felder, D.L and R. B. Griffis 1994. Dominant infaunal communities at risk in shoreline habitats: Burrowing thalassinidean Crustacea. ***OCS Study/MMS 94-0007***. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Regional Office, New Orleans. 86 pp.

Five other significant publications

Bracken, H.D., S. De Grave, A. Toon, D.L. Felder, and K.A. Crandall 2010. Phylogenetic position, systematic status, and divergence time of the Procarididea (Crustacea: Decapoda). **Zoologica Scripta** 39: 198–212.

Felder, D.L**.** and R. Robles 2009. Molecular phylogeny of the family Callianassidae based on a preliminary analyses of two mitochondrial genes. ***Crustacean Issues: Decapod***

Crustacean Phylogenetics**,** J. W. Martin, K. A. Crandall, and D. L. Felder (eds). Taylor and Francis/CRC Press: pp. 327-342.
Klerks, P.L., D.L. Felder**,** K.M. Strasser, and P.W. Swarzenski 2007. Effects of ghost shrimp on zinc and cadmium in sediments from Tampa Bay, FL. **Marine Chemistry** 104: 17-26.
Hasek, B. and D.L. Felder 2006. Biochemical contents of the ovary and hepatopancreas of *Uca longisignalis* and *Uca* nr. *minax*. **Scientia Marina** 70(3): 505-517.
Felder, D.L**.** 2001. Diversity and ecological significance of deep-burrowing macrocrustaceans in coastal tropical waters of the Americas (Decapoda: Thalassinidea). **Interciencia** 26: 2-12.

Recent synergistic activities

Graduate students directed 22 (13 doctoral); Postdoctoral Advisees, 7
Smithsonian (NMNH/DIZ) Associate Scientist (1998 to present), Fort Pierce Marine Laboratory Management Board, 12 years (1997-2008); continuing active research programs in Ft. Pierce, Carrie Bow Cay Belize, and Smithsonian Tropical Research Institution, Panama; Founding Board Member, The Crustacean Society, 1979-1981, Governing Board member 1979-present, former President; Editorial Board Service: Gulf and Caribbean Science; Southeastern Naturalist; Series Coordinator/Co-Editor, The Gulf of Mexico: Its Origins, Waters, and Biota (for Harte Research Institute for Gulf of Mexico Studies, TAMUCC); co-Editor Volume I "Biodiversity" TAMU Press, 2009; co-Editor for Crustacean Issues: Decapod Crustacean Phylogenetics, Taylor and Francis/CRC Press, 2009. University of Louisiana Lafayette Foundation Distinguished Professor; Special Citation, Louisiana Board of Regents, top state biology program leadership, 1990; Board-Elected Fellow, 2002, American Association for the Advancement of Science (AAAS); Career Research Excellence Award, Brazilian Society of Carcinologists, 2004, Florianopolis; Professional Achievement Award, Instituto de Biología, 2006, Universidade Nat. Autonoma de Mexico; Career Excellence in Research Award, The Crustacean Society [international], 2009, Tokyo. Nine national/international/regional media interviews regarding Deepwater Horizon oil spill over last 14 months.

Collaborators over last 48 months

J. W. Martin, Los Angeles County Museum of Natural History; P. Klerks, J. Neigel, A. Chistoserdov and S. Fredericq, University of Louisiana, Lafayette; R. Feldmann and C. Schweitzer, Kent State University; S. De Grave, Oxford University; R. Lemaitre, C. Meyer and A. M. Windsor, NMNH Smithsonian Institution; R. Collin and A. Anker, STRI Smithsonian Institution; C. Tudge, American University; P. Ng, National University of Singapore; C. Schubart and R. Landsdorfer, Regensberg University, Germany; T. Y. Chan, National Taiwan Ocean University; K. H. Chu, L. M. Tsang and K. Y. Ma, Chinese University of Hong Kong; S. Ahyong, Australian Museum, Sydney; G. Poore, Museum Victoria, Melbourne; P. C. Dworschak, Natural History Museum Vienna, Austria; D. Guinot, Paris Museum; P. Clark, British Museum Natural History; J. A. Cuesta, Univ. Andalucia, Spain; D. Tshudy, Edinboro University, Pennsylvania; R. Robles, University São Paulo, Brazil; F. Palero, University of Barcelona; K. A. Crandall and H. D. Bracken, Brigham Young University, Provo; J. Goy, Harding University, Arkansas; F. Alvarez, National University of Mexico; J. W. Tunnell and S. A. Earle, Harte Institute for Gulf of Mexico Studies, Texas A&M University, Corpus Christi.

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Education

Ph.D. 2006 Scripps Institution of Oceanography (UCSD), Biological Oceanography
B.A. 1999 University of North Carolina at Chapel Hill, Biology w/ Highest Honors, and History

Professional Experience

Assistant Professor, Institute of Marine Sciences & Department of Marine Sciences, University of North Carolina at Chapel Hill, Morehead City, NC 2010-
Research Assistant Professor, Institute of Marine Sciences & Department of Marine Sciences, University of North Carolina at Chapel Hill, Morehead City, NC 2009-2010
Research Senior Marine Scientist I, Dauphin Island Sea Lab, Dauphin Island, AL 2008-2009

Five publications most relevant to the proposed activities

Fodrie, F.J. and K.L. Heck, Jr. 2011. Response of coastal fishes to the Gulf of Mexico oil disaster. **PLoS One** (*In press*).
Fodrie, F.J., K.L. Heck Jr., S.P. Powers, W.M. Graham, and K.L. Robinson 2010. Climate-related, decadal-scale assemblage changes of seagrass-associated fishes in the northern Gulf of Mexico. **Global Change Biology** 16: 48-59.
Fodrie, F.J., L.A. Levin, and A.J. Lucas 2009. Use of population fitness to evaluate the nursery function of juvenile habitats. **Marine Ecology Progress Series** 385: 39-49.
Fodrie, F.J. and L.A. Levin 2008. Linking juvenile habitat utilization to population dynamics of the California halibut. **Limnology and Oceanography** 53(2): 799-812.
Powers, S.P., F.J. Fodrie, G.W. Stunz, S.B. Scyphers and R.L. Shipp (*in review*) Basin-wide elimination of large sharks from the Gulf of Mexico documented by generations of fishermen. **Conservation Biology**.

Five publications most relevant to the proposed activities

Fodrie, F.J., B.J. Becker, L.A. Levin, K. Gruenthal, and P.A. McMillan 2011. Connectivity clues from short-term variability in settlement and geochemical tags of mytilid mussels. **Journal of Sea Research** 65: 141-150.
Dick, G.J., S.M. Webb, B.G. Clement, F.J. Fodrie, J.R. Bargar and B.M. Tebo 2009. Enzymatic microbial Mn (II. oxidation and Mn biooxide production in the Guaymas Basin deep-sea hydrothermal plume. **Geochimica et Cosmochimica Acta** 73: 6517-6530.
Fodrie, F.J. and S.H. Herzka 2008. Tracking juvenile fish movement and nursery contribution within arid coastal embayments via otolith microchemistry. **Marine Ecology Progress Series** 361: 253-265.
Becker, B.J., L.A. Levin, F.J. Fodrie and P.A. McMillan 2007. Complex larval connectivity patterns among marine invertebrate populations. **Proceedings of the National Academy of Sciences** 104(9): 3267-3272.

Becker, B.J., F.J. Fodrie, P.A. McMillan, and L.A. Levin 2005. Spatial and temporal variability in trace elemental fingerprints of mytilid mussel shells: a precursor to invertebrate larval tracking. **Limnology and Oceanography 50**(1): 48-61.

Recent Synergistic Activities

2011 "Response of coastal fishes to the Gulf of Mexico oil disaster" (Oral) Benthic Ecology Meetings, Mobile, AL.

2010 Panelist, Capitol Hill Ocean Week (National Marine Sanctuary Program) "Clean Energy and a Healthy Ocean: Navigating the Future" / "Today's Energy Mix: Impacts on Ocean and Coastal Resources"

2010- Faculty Fellow, Center for Galapagos Studies, University of North Carolina

2009 "Are there "big ones" left in the Gulf of Mexico: evidence from fishery dependent catch data and inter-generational perceptions among fishers?" (Oral, Invited Talk) Center for Marine Sciences and Technology, Morehead City, NC.

2009 "Climate- and harvest-related shifts in fish communities of the northern Gulf of Mexico" (Oral, Invited Talk) Gulf Coast Research Laboratory, Ocean Springs, MS.

2009- Faculty Fellow, Institute of the Environment, University of North Carolina

2008 "From finfish to jellyfish: Incorporating gelatinous plankton in ecosystem-based fisheries management" (Oral) Pelagic Fisheries Research Program Annual Meeting, Honolulu, HI.

2008 "Decadal-scale assemblage changes of seagrass-associated fishes in the northern Gulf of Mexico: Are they climate related?" (Oral) Bays and Bayous Symposium, Biloxi, MS.

Awards

2010	University of North Carolina Research Council Development Award
2006	EW Fager Student Award, Scripps Institution of Oceanography
2006	Texas Institute of Oceanography Postdoctoral Fellowship (Declined)
2001-2005	National Science Foundation Graduate Research Fellowship
2001	National Defense Science and Engineering Graduate Fellowship (Declined)
1999	RE Coker Award for Excellence in Undergraduate Research in Ecology: "Site-specific test of source-sink dynamics of a bay scallop population"

Teaching

Masters Advisor: Michelle Brodeur, 2009- (UNC-CH); Sara Coleman, 2011- (UNC-CH)
Ph.D. Committee: Rachel Gittman, 2011- (UNC-CH); Erika Young, 2010- (UNC-CH); Lindsey Carr, 2009- (UNC-CH)
Masters Committees: Lacy Lee, 2011- (USA); Luke Dodd, 2011- (UNC-CH); Rebecca Gericke, 2011- (USA); Shanna Madsen, 2009- (USA); Karen Fisher, 2009-2011 (USA); Erin Money, 2008- (USA)
National Science Foundation Research Experience for Undergraduates: Shanna Madsen, 2007 (USA, co-mentored with SP Powers)

2010- Co-Instructor (1 of 2): Graduate course "Biological Oceanography" University of North Carolina at Chapel Hill

2009- Co-Instructor (1 of 4): Undergraduate course "Estuarine and Coastal Marine Ecology" University of North Carolina at Chapel Hill

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Education

Ph.D. 1988 Department of Biology, Univ. North Carolina at Chapel Hill, Botany
M.S. 1984 Department of Biology, George Mason University, Biology
Kandidaat' in the Sciences 1978 State University of Gent, Belgium, Biology

Professional Experience

2007-present Professor of Biology, University of Louisiana at Lafayette, Dept. of Biology
2002-present. Freeport-McMoRan.Board of Regents Support Fund Professorship for Coastal Biodiversity Research, UL Lafayette
2010-2011 University of Louisiana at Lafayette Distinguished Professor
2007-current Appointed Research Associate, NMNH, Smithsonian Institution
2001-2007 Associate Professor, UL Lafayette, Dept. of Biology
1996-2001 Assistant Professor, UL Lafayette, Dept. of Biology
1996-present UL Lafayette Herbarium staff member (LAF)
1994-96 Joint Postdoctoral appointment, Botany Dept. & Molecular Syst. Lab., NMNH, SI
1993-94 A.W. Mellon Foundation Postdoc. Fellow in Plant Systematics, Botany Dept. Duke U
1990-93 Research Associate, Dept. of Biology,Univ. North Carolina at Chapel Hill
1989-1990 Grantee, Collaborative NSF/SI contract, NMNH, Smithsonian Institution
1988-89 Postdoctoral Fellow, Department of Botany, NMNH, Smithsonian Institution.

Five publications most relevant to the proposed activities

Schmidt W.E, C.F.D. Gurgel, and S. Fredericq The taxonomic transfer of the red algal genus *Gloiosaccion* to *Chrysymenia* (Rhodymeniaceae, Rhodymeniales) supported by morphological and molecular evidence. **Phycologia** (In Review).

Arakaki N., M. Suzuki, and S. Fredericq. (Submitted) Systematics of *Halarachnion* (Furcellariaceae, Rhodophyta), including *Halarachnion louisianensis* sp. nov. **Phycological Research**

Krayesky D.M., J.N. Norris, J.A. West, and S. Fredericq 2010. The *Caloglossa leprieurii* complex (Delesseriaceae, Rhodophyta) in the Americas: The elucidation of overlooked species based on molecular and morphological evidence. **Cryptogamie, Algologie** 31: 37-62.

Fredericq S., T.O. Cho, S.E. Earle, C.F. Gurgel, D.M. Krayesky, L.E. Mateo Cid, C.A. Mendoza Gonzáles, J.N. Norris, and A.M. Suárez 2009. Seaweeds of the Gulf of Mexico. *In*: D.L. Felder & D.K. Camp, eds. *Gulf of Mexico: Its Origins, Waters, and Biota*. I. Biodiversity, pp. 187-259. Texas A&M University Press.

Krayesky D.M., J.N. Norris, P.W. Gabrielson, D. Gabriel, and S. Fredericq 2009. A new order of crustose red algae based on the Peyssonneliaceae, with an evaluation of the ordinal classification of the Florideophyceae (Rhodophyta). **Proc. Biol. Soc. Wash.** 123: 364-91.

Five other significant publications

Gabriel D., M.I. Parente, A.I. Neto, M. Raposo, T. Schils, and S. Fredericq 2010. A phylogenetic appraisal of the genus *Platoma* (Nemastomatales, Rhodophyta), including life history and morphological observations on *P. cyclocolpum* from the Azores. **Phycologia** 49: 2-21.

Gabriel D., T. Schils, M.I. Parente, S.G.A. Draisma, A.I. Neto, and S. Fredericq 2010. The correct identity of the species going under the name *Schizymenia dubyi* (Schizymeniaceae, Rhodophyta) in the Azores, based on molecular and morphological evidence. **Phycologia** (In Press).

Won B.Y., T.O. Cho, and S. Fredericq 2009. Morphological and molecular characterization of species of *Centroceras* Kützing, including two new species (Ceramiaceae, Ceramiales). **J. Phycol**. 45: 227-50.

Lin, S.-M., M. Hommersand, S. Fredericq, and O. De Clerck 2009. Characterization of *Martensia* (Delesseriaceae, Rhodophyta) based on a morphological and molecular study of he type species, *M. elegans* Hering and *M. natalensis* sp. nov. from South Africa. **J. Phycol**. 45: 678-91.

Won B.Y., S. Fredericq, and T.O. Cho 2010. Two new species of *Centroceras* (Ceramiaceae, Rhodophyta) from KwaZulu-Natal, South Africa. **Eur. J. Phycol.** 45: 240-6.

Recent Synergistic Activities

press interviews (print, TV, radio): 2010 and 2011: KATC TV3 Lafayette-Lake Charles interview. KRVS Lafayette-Lake Charles radio interview. Article in *The Daily Advertiser*, Lafayette LA;. KATC TV3 Lafayette-Lake Charles interview;. KRVS Lafayette-Lake Charles radio interview. TV interview with *Telegraph TV* (UK);. Invited Panel Discussion Member, AcA, Lafayette LA. Article in *The Daily Advertiser*, Lafayette LA;. Video interview from GCRL for MS PBS TV. KFLY Lafayette-Lake Charles TV interview;. Radio Interview, Louisiana Radio Network;. Article in *The Advocate*, Baton Rouge LA;. Article in *The Vermilion*, UL Lafayette. Florida State Univ. GulfPhoto Workshop invited participant; Poster at LA Gulf Oil Research Conference, New Orleans, LA BoR;. Article in *Texas Park & Wildlife Magazine*;. Article in *The Washington Post*;. Invited Speaker (Felder) & poster at DWH Oil Spill Conference, LSU, Baton Rouge

Collaborators over the last 48 months: T.O. Cho (Chosun U, S Korea), W.D. Freshwater (UNC-W), M. Toyota Fujii (Bot. Institute, São Paulo), S. Guimarães (Bot. Institute, São Paulo), M.H. Hommersand (UNC-CH), S.M. Lin (National Taitung U, Taiwan), J.N. Norris (Smithsonian Inst.), C. Mendoza Gonzales (IPN Mexico City), L.E. Mateo Cid (IPN Mexico City), M.E. Ramírez (NMNH Museum, Santiago Chile), B. Wysor (Roger Williams U), P. Gabrielson (UNC-CH), J. West (U Melbourne), D. Gabriel (U Azores), R. Collin (STRI, Panama), E. Hickerson (FGBNMS)

Postdoctoral Advisees: N. Phillips (1999-‘01); J. Lopez-Bautista (‘00-‘03); T.O. Cho (‘01-‘07); F. Gurgel (‘04-‘05); D. Krayesky (‘07-‘08), Wm. Schnidt (‘10-present).
Graduate Advisor of: S.M. Lin Ph.D. (2000); F. Gurgel Ph.D. (2001); B. Wysor Ph.D. (2002); B. Gavio Ph.D. (2002); D. Krayesky Ph.D. (2007); B.Y. Won (Ph.D. 2007); C. Ehrenhaus Ph.D. (2008); Wm. Schmidt (Ph.D. 2009); N. Arakaki Ph.D. (2011). Co-advisor of: D. Gabriel (Ph.D. U Azores, 2008); T. Sauvage (Ph.D. student, ‘11-present); J. Richards (Ph.D. student, ‘11-present); O. Camacho (MS student, ‘10-present); D. V.-Ponton (MS student, ‘10-present).
Doctoral and Postdoctoral Advisors: M.H. Hommersand (UNC-CH), J.N. Norris (NMNH), B. Baldwin (Duke U, currently UC Berkeley), Elizabeth Zimmer (NMNH)

Brian Fry
Department of Oceanography and Coastal Sciences, and, Coastal Ecology Institute
School of the Coast and Environment
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Baton Rouge, Louisiana 70803
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Education
Ph.D. 1981 University of Texas at Austin
M.S. 1977 University of Texas at Austin
B.A. 1972 Cornell University, Ithaca, New York

Professional Experience
Professor, Department of Oceanography and Coastal Studies, LSU, 2001-present
Research Ecologist, Institute of Pacific Islands Forestry, USDA Forest Service, Honolulu, HI, 2001-2002
Associate Professor, Coastal Ecology Institute, LSU, 1998-2001
Associate Professor, Biology Department and Southeast Environmental Research Program, Florida International University, Miami, FL, 1994-1998
Associate Scientist, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA, 1991-1994
Assistant Scientist, The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA, 1985 -1991
Assistant Scientist, Indiana University, Bloomington, IN, 1984-1985
Research Scientist, Indiana University, Bloomington, IN, 1982-1984
Research Scientist, Harbor Branch Institution, Fort Pierce, FL, 1981-1982

Five publications most relevant to the proposed activities
Fry, B. 2006. Stable Isotope Ecology. Springer.
Fry, B. and B. Boyd 2010. Oxygen concentration and isotope studies of productivity and respiration on the Louisiana continental shelf, July 2007. pp. 223-241. In: Naohiko Ohkouchi, Ichiro Tayasu, and Keisuke Koba (eds) "Earth, Life, and Isotopes" Kyoto University Press.
Wissel, B., Z.J. Quiñones-Rivera, and B. Fry 2008. Combined analyses of O_2 and CO_2 for studying the coupling of photosynthesis and respiration in aquatic systems. **Canadian Journal of Fisheries and Aquatic Sciences** 65: 2378–2388.
Wissel, B., A. Gace, and B. Fry 2005. Tracing river influences on phytoplankton dynamics in two Louisiana estuaries. **Ecology** 86: 2751-2762.
Wissel, B. and B. Fry 2005. Sources of particulate organic matter in the Mississippi River, USA. **Archiv fuer Hydrobiologie Supplemental Volume** 155/1-4: 105-118.

Five other significant publications
Fry, B. 2011. Mississippi River sustenance of Louisiana brown shrimp. **Fishery Bulletin** 109: 147–161.
Fry, B. 2008. Importance of open bays as nurseries for Louisiana brown shrimp. **Estuaries and Coasts** 31: 776-789.
Fry, B. M. Cieri, J. Hughes, C. Tobias, L. A. Deegan, and B. Peterson 2008. Stable isotope monitoring of benthic-pelagic coupling with salt marsh fish. **Marine Ecology Progress Series** 369: 193-204.
Chumchal, M.M, R.W. Drenner, B. Fry, K.D. Hambright, and L.W. Newland 2008. Habitat-specific differences in mercury concentrations of largemouth bass (*Micropterus*

salmoides) from Caddo Lake, Texas. **Trans. Am. Fish. Soc.** 137: 195-208.
Demopolous, A., B. Fry and C. Smith 2007. Food-web structure in exotic and native mangroves: a Hawaii-Puerto Rico comparison. **Oecologia** 153: 675-686.

Recent Synergistic Activities

Reviewer for manuscripts and proposals, about 30-50 each year from NSF and various journals
Invited Speaker, about twice each year over the last 5 years for universities along the Gulf Coast and at International Symposia, including the ISO2008 meeting in Tokio, Japan and the Fourth Brazilian Congress of Oceanography in Rio Grande du Sul, May 21, 2010.
Co-organizer, 6th International ISOECOL (Isotope Ecology) meeting in Honolulu, Hawaii, August 2008
Participant in NSF panels during the last 5 years (details available on request)

Collaborators over the last 48 months:

B. Boyd (Delaware), J. Cable (LSU) K.R. Carman (LSU), M.M. Chumchal (TCU), N. Cormier (USGS Lafayette), J. Cowan (LSU), J.W. Day (LSU), L. Deegan (MBL), A. Demopoulos (Florida), K. Ewel (UF), J. Fleeger (LSU), B. Graham (New Brunswick), J. Hughes (Amherst), D. Justic (LSU), P. Kemp (LSU), T. Minello (NMFS, Galveston), T. Mutchler (Mississippi), R. Olson (San Diego), B. Peterson (MBL), B. Popp (Hawaii), N.N. Rabalais (LUMCON), Z. Quinones-Rivera (Saskatchewan), K.A. Rose (LSU), L. Rozas (National Wetlands Center, Lafayette LA), G. Snedden (USGS), T. Smith (USGS Florida), M.J. Sullivan (Mississippi), C. Swarzenski (USGS Baton Rouge), C. Tobias (UNC), R.E. Turner (LSU), Twilley (ULLa), D. Wells (TAMU), B. Wissel (Saskatchewan)

Graduate Dissertation Advisor: Patrick Parker (deceased), University of Texas

Graduate Students Advised: 5

Dr. Fry is one of the 350 most highly cited researchers (worldwide) by the Institute of Science Information in Ecology and Environment.

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Education

Ph.D. 1982 Boston University Marine Program, Woods Hole, MA, Ecology
B.S. 1975 Rensselaer Polytechnic Institute, Troy, NY, Biology

Professional Experience

Senior Scientist, Ecosystems Center, Marine Biological Laboratory (MBL), Woods Hole, MA, 2003-present
Adjunct Associate Professor, Boston University, Boston, MA, 1991-Present
Adjunct Professor, Brown University, Providence, RI, 2007-present
Associate Scientist, Ecosystems Center, MBL, Woods Hole, MA, 1990-2003
Assistant Scientist, Ecosystems Center, MBL, Woods Hole, MA, 1983-1990
Postdoctoral Investigator, Woods Hole Oceanographic Institution, Woods Hole, MA, 1982-1983
Coordinator, Marine Ecology Course, MBL, Woods Hole, MA, Summer 1981
Research Assistant, Boston University Marine Program, Woods Hole, MA, 1977 - 1981
Teaching Fellow, Boston University Marine Program, Woods Hole, MA, 1975 - 1977
Instructor, Freshman Chemistry Lab, Rensselaer Polytechnic Institute, Summer 1975

Five publications most relevant to the proposed activities

Weston, N.B., A.E. Giblin, G. Banta, C.S. Hopkinson, and J. Tucker 2010. The effects of varying salinity on ammonium exchange in estuarine sediments of the Parker River, Massachusetts. **Estuaries and Coasts** 33: 985-1003.

Giblin, A.E., N. Weston, G. Banta, J. Tucker and C.S. Hopkinson 2010. The effects of salinity on nitrogen loss from an oligohaline estuarine sediment. **Estuaries and Coasts** 33: 1054-1068.

Koop-Jakobsen, K., and A.E. Giblin 2010. The effect of increased nitrate loading on nitrate reduction via denitrification and DNRA in salt marsh sediments **Limnol. Oceanogr**. 55: 789-802

Koop-Jakobsen, K. and A.E. Giblin 2009. A new approach for measuring denitrification in the rhizosphere of vegetated marsh sediments **Limnol. Ocean. Methods** 7:626-637.

Giblin, A.E., C.S. Hopkinson, and J. Tucker 1997. Benthic metabolism and nutrient cycling in Boston Harbor, Massachusetts, U.S.A. **Estuaries** 20:346-364.

Five other significant publications

Hopkinson, C.S. and A.E. Giblin 2008. Nitrogen dynamics in salt marsh ecosystems. In: (Eds.) D. Capone, D. Bronk, M. Mulholland, E. Carpenter; Nitrogen in the Marine Environment.- 2nd Edition. Elsevier Publ. Pp 991-1036.

Bernhard, A.E., J. Tucker, A.E. Giblin, and D.A. Stahl 2007. Functionally different communities of ammonia oxidizing bacteria along an estuarine salinity gradient. **Environmental Microbiology** 9: 1439-1447.

Bernhard, A.E., T. Donn, A.E. Giblin, and D.A. Stahl 2005. Loss of diversity of ammonia-oxidizing bacteria correlates with increasing salinity in an estuary system. **Environmental Microbiology** 7: 1289-1297.

Portnoy, J.W. and A.E. Giblin 1997. Effects of historic tidal restrictions on salt marsh sediment chemistry. **Biogeochemistry** 36: 275-303.

Giblin, A.E. 1988. Pyrite formation in marshes during early diagenesis. **Geomicrobiology Journal** 6:77-97.
Giblin, A.E. and R.W. Howarth 1984. Pore water evidence for a dynamic sedimentary iron cycle in salt marshes. **Limnology Oceanography** 29:47-63.

Recent Synergistic Activities
Estuarine Research Society: Governing Board 1988-1990; President-Elect 1997-1999, President 1999-2001, Past President 2001-2003
Member, Science Board for the National Parks Service, Cape Cod National Seashore, 1997-2002
Chair, Cooperative Inst. Coastal & Estuarine Environmental Technology Advisory Bd., 1999-2006
Co-Organizer: ERF 2002 workshop: Estuarine Response to Climate Change and Variability.
Member, Biogeosciences Working Group, AGU-NSF, 2004
Steering Committee: Workshop on Advanced Approaches to Quantify Denitrification, 2004.
Sterring Committee: Denitrification Research Coordination Network 2005-present
Co-Chair, Nutrients and Contaminants Working Group, Workshop on Planning Coordinated Research on Ecosystems, Climate, and Policy in the Northeast. Sponsored by WHOI and NMFS Jan 11-13, 2005.
Teacher in the Semester in Environmental Sciences Program, Marine Biological Laboratory

Collaborators over the last 48 months:
P. Berg, U. Virginia, B. Bowden, U. Vt. J. Cornwell, U. Maryland; K. Foreman, MBL; C. Hopkinson, U Georgia; B. Howes, U. Mass; R. Howarth, Cornell; Kansas State; C. Leucke, U. Utah, G. Luther, U. Delaware; S. MacIntyre, U. California; R. Marino, Cornell; J. McClelland, UT; K. McGlathery, U. Va, R. McKane, EPA; K. Nadelhoffer, U. Michigan; W. O'Brien, UNC; B. Peterson, MBL; E. Rastetter, MBL; G. Shaver, MBL; C. Tobias, UNC; J. Vallino, MBL

Graduate Advisees:
G. Banta, Ph.D. 1992, Boston Univ.; J. Bowen, Ph.D. 2004, Boston Univ.; M. Cole, Ph.D. 2003, Boston Univ.; J. Costa, Ph.D. 1987, Boston Univ.; J. Culbertson, Ph.D. 2007, Boston Univ.; L. Fox, M.S. 2007 Boston Univ.; S. Fox, Ph.D. 2007, Boston Univ.; Robinson Fulwieler, Ph.D. 2007. U. of Rhode Island; Gretchen Gettel, Ph.D. 2006, Cornell Univ.; S. Good, MS. 2004, Boston Univ.; J. Hauxwell, Ph.D. 2000, Boston Univ.; R. Herrold, Ph.D. 2003, Boston Univ.; E. Kinney, Ph.D. 2008, Boston Univ., K. Koop-Jakobsen, M.S. 2003, U. of Roskilde, Denmark; K. Kroeger, Ph.D. 2003, Boston Univ.; M. LaMontagne, Ph.D. 1995, Boston Univ.; T. Mondrup, M.S. 2000, Univ. Roskilde, Denmark; D. Moosavi, Ph.D. 1998, U. of New Hampshire; G. Moore, Ph.D. 2002. Boston Univ.; G. Murray, M.S. 1994, U. of New Hampshire; E. Steive, MS 2001, Boston Univ. Marine; E. Peacock, MS. 2007, Boston Univ.; J. Portnoy, Ph.D. 1995 Boston Univ., M. Tiechberg, Ph.D. 2007, Boston Univ.; D. Varela, MS, 1990, Boston Univ.; J. Walsh, Ph.D. 2000, Boston Univ., J. York, Ph.D. 2006, Boston Univ.; P. Zhao, Ph.D. 2000, Univ. Georgia; C. Zago, Ph.D. 1998, Univ. Venica, Italy.

Reader or Co-Advisor for Undergraduate Senior Theses:
P. Colarusso, 1986, Worcester Polytechnic Institute; F. Boyer, 1997, Stirling Univ., Scotland; S. Rapaport, 1999, Brandeis Univ.; R. Ricard, 2000, Connecticut College; J. Sinaikin, 2000, Brown Univ.; A. Greenbaum, 2001, Wellesley College; K. Witteinghill, 2002, Middlebury College; S. Foster, 2005, Hampshire College; C. McGowen, 2006, Brown Univ.

Post-Doc advises: David Rudnick, George Kling
Advisors: John Teal (Post doctoral advisor), Ivan Valiela (Ph.D. advisor)

Linda M. Hooper-Bùi
Associate Professor
Department of Entomology, and, LSU Agricultural Center
404 Life Science Building
Louisiana State University
Baton Rouge, LA 70803
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Lhooper@agctr.lsu.edu

Educational Background:

Ph.D. 1998 Entomology, University of California, Riverside Dissertation title: The Nutritional Ecology and Effects of Toxicants on Colonies of Argentine Ants *Linepithema humile* (Mayr).

M.S. 1995 Entomology, University of California, Riverside Thesis title: The Biology of the Southern Fire Ant, *Solenopsis xyloni* (McCook) and its Predation of the California Least Tern, *Sterna antillarum browni* (Mearns).

B.A. 1991 Biology, California State University, Long Beach

Professional Experience:

Associate Professor with tenure and Fire Ant Entomologist at LSU Agricultural Center and A&M, Baton Rouge. 80% research and 20% teaching appointment. 2005-present.

Assistant Professor and Fire Ant Entomologist at LSU Agricultural Center and A&M, Baton Rouge. 80% research and 20% teaching appointment 1998-2005.

Part-time lecturer at California State University, Long Beach. 1996-1998.

Five publications most relevant to the proposed activities

Adams, B.J., R.M. Strecker, D. O'Brien, and L.M. Hooper-Bùi. In press. Raft behavior of red imported fire ants. **Insect Science**

Papillion, A.M., L.M. Hooper-Bùi, and R.M. Strecker 2011. Flooding increases volume of venom sac in *Solenopsis invicta* (Hymenoptera: Formicidae). **Sociobiology** 57: 301-308

Hooper-Bùi, L.M., and L. Lach 2010. Chapter 15: Consequences of ant invasions. *In* Ant Ecology. Eds L Lach, C Parr, and K Abbott. Oxford University Press. p 261-286

Dash, S.T. and L.M. Hooper-Bùi 2008. Species diversity of ants in Louisiana. **Annals Amer. Entomol. Soc.** 101: 1056-1066

LaFleur, B, L.M. Hooper-Bùi, E.P. Mumma, and J. Geaghan 2005. Soil fertility and plant growth in soils from pine forests and plantations: effect of invasive red imported fire ants *Solenopsis invicta* (Buren). **Pedobiologia** 49: 415-423

Five other significant publications

Aguillard, D, R. Strecker, LM Hooper-Bùi. In press. Extraction of super colonies of crazy ants from soil and wood. **Midsouth Entomologist**

Adams, B.J., X. Chen, and L.M. Hooper-Bùi 2010. *Odontomachus clarus* Roger (Hymenoptera: Formicidae) Reported in Kisatchie National Forest, Louisiana **Midsouth Entomologist** 3: 104-105.

Hooper-Bùi, L.M. 2008. Ant. World Book Encyclopedia. p. 520-529.

Lee, A., C. Husseneder, and L.M. Hooper-Bùi 2008. Culture-independent identification of gut bacteria in fourth-instar red imported fire ant, *Solenopsis invicta* Buren, larvae. **J. Invertebr. Pathol**. 98: 20–33.

Hooper-Bui, L.M., A.G. Appel, and M.K. Rust 2002. Preference of food particle size among several urban ant species. **J Econ Entomol.** 95: 1222-1228.

Recent Synergistic Activities

Recent Collaborators or Students: A Lee, L Womack, K Landry, M Seymour, B LaFleur, J Rosson, S Dash, L Foil, C Husseneder, S Johnson (LSU AgCenter), MK Rust (UC Riverside), A Appel (Auburn), L Lach (Murdoch University).

I teach Insect Ecology at LSU and give workshops on scientific writing to advanced students (particularly McNair Scholars) on how to write scientific papers and prepare posters and presentations.

In February, I was invited to speak on **Marsh Ecology in the Gulf of Mexico, Post-Macondo** in one of four keynote addresses at U.S. Offshore Oil Exploration: Managing risks to move forward. Presented at Rice University Energy Forum at the Baker Institute. Houston, Texas. In April, I was featured in documentary *Hunting for Oil* by Roshini Thinakaran. It was featured at the Starbucks Environmental Film Festival on 20 April 2011. View at www.snagfilms.com. I was featured in Newsweek's article *Weird Science*. http://www.newsweek.com/2010/08/30/is-research-into-the-oil-spill-s-impact-skewed.html.

I have an active undergraduate research program. I currently have four undergraduates working on independent, directed research in my laboratory. Undergraduate authors, Papillion, Aguillard, and Adams, are first authors on four publications listed above. Adams won the National Conference on Urban Entomology Outstanding Undergraduate award (2010) and was awarded a $2150 research grant. In the past seven years, undergraduates in my laboratory have won the NCUE award every year it was given. Papillion, a McNair Scholar, won a McNair science presentation competition, and Aguillard was recently awarded an undergraduate research grant ($2000).

Recent layperson articles include:

Hooper-Bùi, L. A *Gulf Science Blackout.* NY Times Op-Ed. 25 August 2010. http://www.nytimes.com/2010/08/25/opinion/25hooper-Bui.html. Also appeared in the International Herald Tribune, The Saudi Gazette and was syndicated in 4 newspapers stateside.

Hooper-Bùi, L. *Oil's Stain on Science*. The Scientist. 5August 2010. http://f1000scientist.com/news/display/57610/.

Hooper-Bùi, L. *Gulf Science Sputters*. The Scientist. 16March 2011. http://f1000scientist.com/news/display/58054/.

Hooper-Bùi, L. *Not Yet*. 225 Magazine. 1April 2011 http://www.225batonrouge.com/news/2011/apr/01/not-yet/

Awards:

2004 Youth Service America State Farm Good Neighbor Service-Learning Award.

2001 Orkin Award for Excellence in Research.

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Education

Ph.D. 2007 University of Wisconsin, Limnology & Marine Science
Postdoc. 2008-2010 University of Washington, Fisheries Science
M.S. 2004 University of Maryland, Marine Science
B.A. 1998 Cornell University, Biology & Society

Professional Experience

Assistant Professor, Rutgers U., Dept. Marine & Coastal Sciences 2010–present
David H. Smith Conservation Research Fellow, U. Washington, School of Aquatic & Fishery Sciences 2008–2010
Postdoctoral Research Assistant and Lecturer, U. Wisconsin, Center for Limnology 2007–2008
Knauss Marine Policy Fellow, NOAA-NOS-NCCOS Biogeography Program 2003–2004

Five publications most relevant to the proposed activities

Jensen, O.P., S. Ortega-Garcia, S.J.D. Martell, R. Ahrens, M.L. Domeier, C.J. Walters, and J.F. Kitchell 2010. Local management of a "highly migratory species?" The effects of longline closures and recreational catch-and-release for Baja California striped marlin fisheries. **Progr. Oceanograph**y 86: 176-186.

Gilroy, D.J., O.P. Jensen, B.C. Allen, S. Chandra, B. Ganzorig , Z. Hogan, J. Maxted, M.J. Vander Zanden 2010. Home range and seasonal movement of taimen, *Hucho taimen*, in Mongolia. **Ecol. Freshwater Fish** doi: 10.1111/j.1600-0633.2010.00434.x

Jensen, O.P., D.J. Gilroy, Z. Hogan, B.C. Allen, T.R. Hrabik, B.C. Weidel, S. Chandra, M.J. Vander Zanden 2009. Evaluating recreational fisheries for an endangered species: a case study of taimen, *Hucho taimen*, in Mongolia. **Can. J. Fish. Aquatic Sci.** 66: 1707-1718.

Worm, B., R. Hilborn, J.K. Baum, T. A. Branch, J. S. Collie, C. Costello, M. J. Fogarty, E. A. Fulton, J. A. Hutchings, S. Jennings, O. P. Jensen, H. K. Lotze, P. M. Mace, T. R. McClanahan, C. Minto, S. R. Palumbi, A. M. Parma, D. Ricard, A. A. Rosenberg, R. Watson, D. Zeller 2009. Rebuilding global fisheries. **Science** 325: 578-585.

Jensen, O.P., B.J. Benson, J.J. Magnuson, V.M. Card, M.N. Futter, P.A. Soranno, K.M. Stewart 2007. Spatial analysis of ice phenology trends across the Laurentian Great Lakes region during a recent warming period. **Limnol. Oceanogr.** 52: 2013-2026.

Five other significant publications

Pinsky, M.L., O.P. Jensen, D. Ricard, and S.R. Palumbi 2011. Unexpected patterns of fisheries collapse in the world's oceans. **Proc. Nat. Acad. Sci.** doi/10.1073/pnas.1015313108

Jensen, O.P., S. Hansson, T. Didrikas, J. D. Stockwell, T. R. Hrabik, T. Axenrot, J. F. Kitchell 2011. Foraging, bioenergetic, and predation constraints on diel vertical migration: field observations and modeling of reverse migration by young-of-year herring *Clupea harengus*. **J. Fish Biology** 78: 449-465

White, M.A., K.M. de Beurs, K. Didan, D.W. Inouye, A.D. Richardson, O.P. Jensen, +14 other authors 2009. Intercomparison, interpretation, and assessment of spring phenology in North America estimated from remote sensing for 1982-2006. **Global Change Biology** doi: 10.1111/j.1365- 2486.2009.01910.x

Jensen, O.P. and T.J. Miller 2005. Geostatistical analysis of blue crab (*Callinectes sapidus*) abundance and winter distribution patterns in Chesapeake Bay. **Trans. Am. Fish. Soc.** 134: 1582-1598.

Jensen, O.P., T.R. Hrabik, S.J.D. Martell, C.J. Walters, and J.F. Kitchell 2006. Diel vertical migration in the Lake Superior pelagic community. II. Modeling trade-offs at an intermediate trophic level. **Can. J. Fish. Aquatic Sci.** 63: 2296-2307.

Recent Synergistic Activities

Member, Chesapeake Bay Ecosystem Based Fishery Management-Quantitative Ecosystem Team on Stock Assessment; NSF Grant proposal reviewer, No. Pacific Res. Bd., Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative, and ArcticNet; Manuscript reviewer: Aquatic Living Resources, Can. J. Fish. Aqua. Sci., Climatic Change, Conser. Biol., Ecol. Appl., Ecosystems, Estuaries, Fresh. Biol., Global Ecol. Biogeo., Hydrol. Proc., ICES J. Mar. Sci., J. Climate, J. Fish Biology, Limnol. Oceanogr., Mar. Ecol. Prog. Ser., Oikos, Proc. Royal Soc. B

Collaborators over the last 48 months

R. Ahrens (U. British Columbia), B. Allen (U.C. Davis), A. Bailey (Hubbard Brook Exper. Forest), D. Baldocchi (U.C. Berkeley), J. Baum (Scripps), V. Bakker (Ariz. State U.), B. Benson (U. Wisc.), D. Berlinsky (U. NH), K. de Beurs (Va. Polytechnic Inst.), E. Bochenek (Rutgers U.), C. Boggs (NMFS), J. Brown (USGS), V. Card (Metropolitan State U.), S. Chandra (U. Nevada), J. Collie (U. RI), C. Costello (U.C. Santa Barbara), M. Dettinger (USGS), B. Dickson (No. Ariz. U.), K. Didan (U. Ariz.), M. Domeier (Marine Conservation Science Inst.), T. Essington (U. WA), M. Fogarty (NMFS), B. Fulton (CSIRO, Australia), M. Futter (Trent U.), H. Gibbs (Stanford U.), D. Gilroy (U. Wisc.), J. Grabowski (Gulf of Maine Res. Inst.), A. Haynie (NMFS), R. Hilborn (U. WA), Z. Hogan (U. Nev.), T. Hrabik (U. Minn.), J. Hutchings (Dalhousie U.), D. Inouye (U. MD), S. Jennings (CEFAS, UK), J. Kimball (U. MO), J. Kitchell (U. Wisc.), W. Lauenroth (Colorado State U.), J. Lee (U. ME), W. van Leeuwen (U. Ariz.), X. Lin (Campbell Scientific Inc.), J. Link (NMFS), D. Livingstone (EAWAG, Switzerland), H. Lotze (Dalhousie U.), P. Mace (New Zealand Ministry Fisheries), J. Magnuson (U. Wisc.), S. Martell (U. British Columbia), J. Maxted (U. Wisc.), T. McClanahan (Wildlife Conservation Society), P. McIntyre (U. MI), M. Meili (Stockholm, U.), C. Minto (Dalhousie U.), R. Nemani (NASA Ames Research Ctr), J. O'Keefe (Harvard Forest), J. Olden (U. WA), S. Ortega-Garcia (CICIMAR, La Paz, MX), S. Palumbi (Stanford U.), A. Parma (Centro Nacional Patagónico, Argentina), B. Pine (U. FL), E. Powell (Rutgers U.), D. Ricard (Dalhousie U.), A. Richardson (U. NH), G. Rose (Memorial U.), A. Rosenberg (U. NH), A. Salomon (Simon Fraser U.), M. Schaepman (Wageningen U., Netherlands), M. Schwartz (U. Wisc.), G. Sherwood (Gulf Maine Res. Inst.), J. Stockwell (Gulf Maine Res. Inst.), J. Vander Zanden (U. Wisc.), C. Walters (U. British Columbia), R. Watson (U. British Columbia), B. Weidel (U. Wisc.), M. White (Utah State U.), .G. Weyhenmeyer (Uppsala U.), A. de Wit (Wageningen U., Netherlands), B. Worm (Dalhousie U.), P. Yurista (EPA), D. Zeller (U. British Columbia), G. Zhang (Utah State U.)

Graduate Advisors: T. Miller (U. Maryland), M.S. advisor; J. Kitchell (U. Wisc.), Ph.D. advisor; R. Hilborn (U. WA), Postdoc co-advisor; T. Essington (U. WA), Postdoc co-advisor
Graduate Student Advisees: Mikaela Provost (MS - current); Talia Young (Ph.D.-current)

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Education

Ph.D. 1989 Biological Oceanography, University of Zagreb, Zagreb, Croatia
M.S. 1984 Ecology, School of Graduate Studies, University of Zagreb, Zagreb, Croatia
B.S. 1981 Biology, University of Zagreb, Zagreb, Croatia

Professional Experience

Professor - Department of Oceanography and Coastal Sciences, Louisiana State University, 2005-present
Director - Coastal Ecology Institute, Louisiana State University, 2003-2007
Associate Professor - Coastal Ecology Institute and Department of Oceanography and Coastal Sciences, Louisiana State University, 1999-2005
Associate Faculty - Department of Oceanography and Coastal Sciences, Louisiana State University, 1994-1999
Associate Professor (Research) - Coastal Ecology Institute, Louisiana State University, 1994-1999
Visiting Associate Professor, Louisiana State University, 1991-1993
Associate Professor, University of Zagreb, Croatia, 1989-1994
Visiting Scientist, Florida State University, 1987
Assistant Professor, University of Zagreb, Croatia, 1986-1988

Five publications most relevant to the proposed activities

Das, A., D. Justic, E.M. Swenson, R.E. Turner, M. Inoue, and D. Park 2011. Coastal land loss and hypoxia: The 'outwelling' hypothesis revisited. **Environmental Research Letters** 6: 025001 (9 pp); doi:10.1088/1748-9326/6/2025001.

Wang, L., D. Justic 2009. A modeling study of the physical processes affecting the development of seasonal hypoxia over the inner Louisiana-Texas shelf: Circulation and stratification. **Continental Shelf Research** 29: 1464-1476.

Justic, D., V. Bierman, D. Scavia, and R. Hetland 2007. Forecasting Gulf's Hypoxia: The Next 50 Years. **Estuaries and Coasts** 30:791-801.

Justic, D., N.N. Rabalais, and R.E. Turner 2005. Coupling between climate variability and marine coastal eutrophication: Historical evidence and future outlook. **Journal of Sea Research** 54:25-35.

Justic, D., N. N. Rabalais, and R.E. Turner 2002. Modeling the impacts of decadal changes in riverine nutrient fluxes on coastal eutrophication near the Mississippi River delta. **Ecological Modelling** 152:33-46.

Five other significant publications

Quiñones-Rivera, Z.J., B. Wissel, N.N. Rabalais, and D. Justic 2010. Effects of biological and physical factors on seasonal oxygen dynamics in a stratified, eutrophic coastal ecosystem. **Limnology Oceanography** 55: 289-304.

Quiñones-Rivera, Z. J., B. Wissel, D. Justic, and B. Fry 2007. Partitioning oxygen sources and sinks in a stratified, eutrophic coastal ecosystem using stable oxygen isotopes. **Marine Ecology Progress Series** 342:69-83.

Justic, D., N.N., Rabalais, and R.E. Turner 2003. Simulated responses of the Gulf of Mexico hypoxia to variations in climate and anthropogenic nutrient loading. **Journal of Marine Systems** 42:115-126.

Justic, D., N.N. Rabalais, and R.E. Turner 1996. Effects of climate change on hypoxia in coastal waters: a doubled CO_2 scenario for the northern Gulf of Mexico. **Limnology Oceanography** 41:992-1003.

Justic, D., N.N. Rabalais, R.E. Turner, and Q. Dortch 1995. Changes in nutrient structure of river-dominated coastal waters: stoichiometric nutrient balance and its consequences. **Estuarine, Coastal and Shelf Science** 40:339-356.

Recent synergistic activities

Multiple proposal panel and mail reviews for NOAA, NSF, U.S. EPA, NIGEC, and Sea Grant; Member of the steering committee for the 2nd Annual Gulf of Mexico Hypoxia Research Coordination Workshop (2011); Session chair at ASLO 2011 (Advances in coastal hypoxia modeling); Participant at the Ecosystem Approach to Management (EAM) modeling Workshop (2011); Member of the ERF Biocomplexity Working Group (2003-2004).

Collaborators over the last 48 months

Collaborators (non-LSU): V. Bierman (Limno-Tech, Inc.), C. Chen (UMASSD), M. Dortch (USCOE Vicksburg), R. Hetland (Texas A&M), H. Paerl (Univ. of North Carolina), N. Rabalais (Louisiana Univ. Marine Consortium), B. Roberts (Louisiana Univ. Marine Consortium), J. Sinclair (Louisiana Univ. Marine Consortium), E. Reyes (East Carolina University), D. Scavia (Univ. Michigan)

Graduate advisors: A. Pozar-Domac (Univ. of Zagreb), M. Mestrov (Univ. of Zagreb), T. Legovic (R. Boskovic Institute, Zagreb), L. Rottini-Sandrini (Univ. of Trieste)

Graduate students and postdoctoral advisees: J. Buljan (Univ. of Zagreb), V. Cvitan (Univ. of Zagreb), B. Wissel (Univ. of Regina, Canada), A. Hoda, Z. Quinones-Rivera (Louisiana State Univ.), A. Maier (Louisiana State Univ.), A. Das (Louisiana State Univ.), B. Babin (Louisiana State Univ.)

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Education

Ph.D. 1981 University of Western Ontario, London, Ontario (Geography- Paleoclimatology)
M.A. 1976 Western Illinois University, Macomb, Illinois (Geography-Geomorphology)
A.B. 1973 University of Illinois, Urbana, Illinois (History and Geology)

Professional Experience

Professor, Department of Geography, University of Maryland 2004-present
Affiliate Associate Professor/Professor of Soils, Department of Natural
Resource Sciences and Landscape Architecture, University of Maryland1999-present
Affiliate Associate Professor, Department of Geology, University of Maryland1991-present
Visiting Professor of Geological Oceanography, Department of Oceanography, Old Dominion University, Norfolk, Virginia 1988 (Fall)
Adjunct Associate Professor/Professor, Department of Oceanography, (now Department of Ocean, Earth and Atmospheric Sciences) Old Dominion University, Norfolk, Virginia1988 - present
Associate Professor, Department of Geography, University of Maryland 1987 - 2004
Faculty Member, Marine, Estuarine and Environmental Science Program, University of Maryland 1984-present
Assistant Professor, Department of Geography, University of Maryland 1981 - 1987
Lecturer, Department of Geography, University of Maryland 1980 - 1981

Five Publications Most Relevant to Proposed Activities

Kearney, M.S., A. Riter, and R.E. Turner 2011. Freshwater diversions in marsh restoration in Louisiana: Twenty-six years of change in vegetation coverage and marsh area in three diversions. **Geophysical Research Letters** in revision

Kearney, M.S., and A.S. Rogers 2010. Forecasting sites of future coastal marsh loss using topographical relationships and logistic regression. **Wetlands Ecology and Management** 18: 449-461.

Stevenson, J.C. and M.S. Kearney 2009. Impacts of global climate change on tidal wetlands. In M. Bertness, B. Silliman, and D. Strong (eds.), Anthropogenic Modification of North American Salt Marshes. Berkeley, CA: University of California Press, pp. 171-206

Kearney, M.S. 2008. The potential for significant impacts on Chesapeake Bay: Sea Level Impacts and Ecology. *In:* M. McCracken (ed.), The Likelihood and Character of Large and Disruptive Climate Change. London: EarthScan, pp. 85-100.

Rogers, A.S., and M.S. Kearney 2004. Reducing signature variability in unmixing coastal TM scenes using spectral indices. **International Journal of Remote Sensing** 12: 2317-2335.

Five Other Significant Publications

Kearney, M.S., and J.C. Stevenson 2005. Ecology of the North American Coast. In M. Schwartz and R. Fairbridge (eds.), Encyclopedia of Coastal Science. Kluwer Academic Publishers, pp. 714-721

Stevenson, J.C., M.S. Kearney, and E.M. Koch 2002. Impacts of global warming and sea level rise on tidal wetlands and shallow water habitats**.** In: Fisheries in a Changing Climate (N.A. McGinn, ed.), America Fisheries Society, Bethesda, Md., pp. 23-38.

Kearney, M.S., A.S. Rogers, J.R.G. Townshend, J.C. Stevenson, J. Stevens, E. Rizzo, and K Sundberg 2002. Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware Bays. **Eos, Transactions American Geophysical Union** 83 (16): 173, 177-78.

Kearney, M.S., A.S. Rogers, J.R.G. Townshend, J.C. Stevenson, J. Stevens, E. Rizzo, and K Sundberg 2002. Landsat imagery shows decline of coastal marshes in Chesapeake and Delaware Bays. **Eos, Transactions American Geophysical Union** 83 (16): 173, 177-78.

Ward, L.G., M.S. Kearney, and J.C. Stevenson 1998. Variations in sedimentary environments and accretionary processes in estuarine marshes undergoing rapid submergennce, Chesapeake Bay. **Marine Geology** 151: 111-134.

Recent Synergistic Activities

Reviewer for *Estuaries and Coasts, Wetlands, Journal of Coastal Research*, Sea Grant, and NSF. Participant in the Coastal Change Analysis Program (CCAP) for NOAA and EPA (2007-2008) regarding coastal wetlands. Panelist and collaborator for UNEP Natural Hazards Program on Small Island Nation States and Natural Hazards and their Effects on People and Coastal Resources (2008-2010).

Collaborators During the Last 48 Months

J. Court Stevenson (Horn Point Laboratory, Univ. Maryland Center for Environmental Science), S. P Leatherman (Florida International Univ.), E. M. Koch (Horn Point Laboratory, Univ. Maryland Center for Environmental Science), J. Halka (Maryland Geological Survey), J. Townshend (Dept. of Geography, Univ. Maryland), E. Vermote (Goddard Space Flight Center), G. F. Oertel (Dept. of Oceanography, Old Dominion Univ.)

Jerome F. La Peyre June 2011
Department of Veterinary Science
Louisiana State University Agricultural Center
Baton Rouge, Louisiana 70803
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Education

Ph.D. 1993 College of William and Mary, Gloucester Point, Virginia (Marine Science)
B.A. 1985 University of Miami, Coral Gables, Florida (Biology/Marine Science)

Professional Experience

Associate Professor, Department of Veterinary Science, Louisiana State University Agricultural Center 2006-Present
Assistant Professor, Department of Veterinary Science, LSU Ag Center 2002-2006
Research Assistant Professor, Department of Veterinary Science, LSU Ag Center 1998- 2001:
Senior Postdoctoral Researcher, Department of Veterinary Science, LSU Ag Center 1996-1998:
Postdoctoral Research Associate, Department of Environmental Sciences, Virginia Institute of Marine Science, College of William and Mary 1993-1996

Five publications (of 49) most relevant to the proposed activities

La Peyre M.K., B. Gossman, J.F. La Peyre 2009. Defining optimal freshwater flow for oyster production: effects of freshet rate and magnitude of change and duration on eastern oysters and *Perkinsus marinus* infection. **Estuaries and Coasts** 32: 522-534.

Piazza, B., M.H. Piehler, B. Gossman, M.K. La Peyre, and J.F. La Peyre 2008. Oyster recruitment and growth on an artificial reef structure in Grand Isle, Louisiana. **Bulletin Marine Science** 84: 59-66.

Jenkins, J.A. and J.F. La Peyre 2006. Cell proliferation detected with flow cytometric cell cycle analysis and immunohistochemical detection of proliferating cell nuclear antigen (PCNA) from somatic tissues of eastern oysters, *Crassostrea virginica*. **Environmental Bioindicators** 1: 177-190.

Buchanan, J.T., J.F. La Peyre, R.K. Cooper, and T.R. Tiersch 1999. Improved attachment and spreading in primary cell cultures of the eastern oyster, *Crassostrea virginica*. I**n Vitro Cellular and Developmental Biology** 35: 593-598.

La Peyre, J.F., F.-L.E. Chu, and W.K. Vogelbein 1995. In vitro interaction of *Perkinsus marinus* with hemocytes of eastern and Pacific oysters. **Developmental and Comparative Immunology** 19: 291-304.

Five other significant publications

Itoh, N., Q.-G. Xue, K.K. Schey, Y. Li, R.K. Cooper, and J.F. La Peyre 2011. Characterization of dominin, the major plasma protein of eastern oysters (*Crassostrea virginica*). And a proposed role in host defense. **Comparative Biochemistry and Physiology** 158(B): 9-22.

La Peyre M.K., S. Casas, W. Gayle, and J.F. La Peyre 2010. The combined effects of sub-optimal temperature and salinity on the viability of *Perkinsus marinus*, a protistan parasite of the eastern oyster *Crassostrea virginica*. **Journal of Invertebrate Pathology** 105: 176-181.

Xue, Q.-G., M.E. Hellberg, K.L. Schey, N. Itoh, R.I. Eytan, R.K. Cooper, and J.F. La Peyre 2010. Cv-lysozyme 3 suggests an evolutionary pathway from host defense to digestion in the eastern oyster, *Crassostrea virginica.* BMC **Evolutionary Biology** 10: 213.
La Peyre, J.F., Q.-G. Xue, N. Itoh, Y. Li, and R.K. Cooper 2010. Serine protease inhibitor cvSI-1 potential role in the eastern oyster host defense against the protozoan parasite *Perkinsus marinus*. **Developmental and Comparative Immunology** 34:84-92.
La Peyre M.K., S.M. Casas, A. Villalba, and J.F. La Peyre 2008. Determining the effects of temperature on two *Perkinsus* species viability, metabolic activity and proliferation and its significance to understanding seasonal cycles of perkinsosis. **Parasitology** 135: 505-519.

Synergistic activities

Development and optimization of an in vitro culture system for propagating the oyster parasite *Perkinsus marinus* (dermo)
Optimized methodology to maintain primary cultures of oyster somatic cells including hemocytes
Serve as mentor to numerous undergraduate students funded through federal agencies and Undergraduate Research Opportunities Program of Louisiana Sea Grant College Program
Session organizer 'In vitro culture systems for shellfish research'. Aquaculture 2001,Orlando, FL, January 21-25, 2001.
Member of organizing committee for the 4th International Symposium on Aquatic Animal Health, New Orleans, Louisiana, September 1-5, 2002.

Collaborators over the last 48 months

*Collaborator*s:
La Peyre M (USGS), Schey (Vanderbilt University), Itoh (Tohoku University), Cooper (LSU Ag Center), Supan (LSU), Walton (Auburn University), Janes (LSU Ag Center), Losso (LSU Ag Center), Jenkins (USGS), Reece (Virginia Institute of Marine Science), Moss (VIMS), Audemard (VIMS), Villalba (Conselleria de Pesca e Asuntos Maritimos, Galicia, Spain), Aswani Volety (FGCU)

Graduate advisors and postdoctoral sponsors:
Chu (Virginia Institute of Marine Sciences), Faisal (Virginia Institute of Marine Sciences), Cooper (LSU Ag Center)

Thesis Advisor and postgraduate-scholar sponsor:
Nickens (NOAA Center for Sponsored Coastal Ocean Research), Jimenez (University of Texas Medical School), Xue (LSU Ag Center), Itoh (Tohoku University, Japan), Casas (LSU).

Martin Scott Miles June 2011
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Education

B.S. 2011 Louisiana State University, Civil & Environmental Engineering
M.S. 1994 Louisiana State University**,** Environmental Science (Environmental Chemistry and Toxicology
B.S. 1987 Southeastern Louisiana University, Biology,

Professional Experience

Research Associate V, Louisiana State University 1999 - Present
Lead Scientist, ABC Chemical, Inc. 1997-1998
Research Associate IV, Louisiana State University 1994 - 1996
Research Associate III, Louisiana State University 1990-1993
Laboratory Supervisor, Environmental Testing & Certification, Inc. 1983-1989
Research Associate V, Louisiana State University 1999 - Present
Lead Scientist, ABC Chemical, Inc. 1997-1998
Research Associate IV, Louisiana State University 1994 - 1996
Research Associate III, Louisiana State University 1990-1993
Laboratory Supervisor, Environmental Testing & Certification, Inc. 1983-1989

Five publications most relevant to the proposed activities

Barbee, G.C, M.S. Miles, O. Umejuru, S.G. Hall 2010. Acute toxicity (LC50) of south Louisiana crude oil, mineral oil and peanut oil to the red swamp crayfish *Procambarus clarkia*. **Freshwater Crayfish** 17: 227-233.

Overton, E.B, M.S. Miles, B.M. Ashton, and R.L. Wong 2008. Determination of the net flux of reactive volatile organic compounds at the air-water interface in the Gulf of Mexico. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA, **OCS Study**, In Review.

Qianxin, L., I.A. Mendelssohn, K. Carney, M.S. Miles, N.P. Bryner, and W.D. Walton 2005. In-situ burning of oil in coastal marshes. 2. Oil spill cleanup efficacy as a function of oil type, marsh type, and water depth. **Environ. Sci. Technol.** 39: 1855-860.

Overton, E.B., B.M. Ashton, and M.S. Miles 2004. Historical polycyclic aromatic and petrogenic hydrocarbon loading in the Northern Central Gulf of Mexico shelf sediments. **Marine Pollution Bulletin** 49: 557-563.

Five other significant publications

Overton, E.B., M.S. Miles, and B.M. Ashton 2003. Chapter 2 - Organics analysis in historical reconstruction of the contaminant loading and biological responses in the central Gulf of Mexico. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA, **OCS Study**, MMS 2003-063.

Miles, M.S. and J. Sansalone 2003. Coagulation-flocculation treatability study of bilge and barge wastewater applying ferric chloride and cationic polymers. **Water Environment**

Federation 2003 Conference Proceedings.
Michel, J., Z. Nixon, M.S. Miles, and H. Hinkledey 2002. Recovery of four oiled wetlands Subjected to In Situ Burning. **API Publ. No., American Petroleum Institute**, Washington, D.C., 71 pp.
Miles, M.S., E.B. Overton, and B.M. Ashton 2002. Re-evaluation of soils from In-situ and phytoremediation studies for onshore oil spills. Louisiana Oil Spill Research and Development Program.
Ashton, B.M., R.S. East, M.M. Walsh, M.S. Miles, and E.B. Overton 2000. Studying and verifying the use of chemical biomarkers for identifying and quantitating oil residues in the environment. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA, **OCS Study**, MMS 2000-086.

Synergistic activities : Working Group on In-situ Fluorescence: 2008-present; SMART Advisory Team Member: 2001- present

Collaborators over the last 48 months: La Peyre J (Louisiana State University), Thibodaux (Louisiana State University), Lee K (Bedford Institute of Oceanography), Foil L (LSU Ag Center), Supan J (LSU Sea Grant), Roza L (NOAA NMF), Whitehead A (Louisiana State University), Henry C(NOAA), Wood M (NOAA), Mullin J (BOEMRE), Carney R (Louisiana State University), Shigenaka G (NOAA), Coble R (University of South Florida), Conmy R (USEPA), Mearns A (NOAA)

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Education
Ph.D. 1970 University of Alabama, Chemistry
B.S. 1965 University of Alabama, Chemistry
1961-63 Spring Hill College

Experience
Designated Professor & Clairborne Chair, Department of Environmental Sciences, LSU
Adjunct Professor, Department of Chemistry, LSU 2008-2009
Professor Department of Environmental Sciences, LSU 1984-2008
Research Associate, Center for BioOrganic Studies, UNO, 1976-1984
Assist Professor, Northeast Louisiana University, 1970-1976

Selected Publications:
Iqbal, J., E.B. Overton, and D. Gisclair 2008. Polycyclic aromatic hydrocarbons in Louisiana Rivers and coastal environments: Source fingerprinting and forensic analysis. **Environmental Forensics** 9: 63-74.

Iqbal, J., E.B. Overton, and D. Gisclair 2008. PAH sources in Louisiana rivers and coastal environments: Principal component analysis. **Environmental Forensics** 9: 310-319.

Dorman, F.L., E.B. Overton, J.J. Whiting, J.W. Cochran, and J. Gardea-Torresdey 2008. Gas chromatography. **Anal. Chem**. 80: 4487-4497.

Eiceman, G.A., J. G. Torresdey, F. Dorman, E.B. Overton, A. Bhushan, and H.P. Dharmasena 2006. Gas chromatography. **Anal. Chem**. 78: 3985–3996.

Overton, E.B., B.M Ashton, and M.S. Miles 2004. Historical polycyclic and petroleum hydrocarbon loading in the Northern Central Gulf of Mexico shelf sediments. **Marine Pollution Bulletin** 49: 557-563.

Overton, E.B., M.S. Miles, and B.M. Ashton 2003. Organic analysis, Chapter 2 in Historical Reconstruction of the Contaminant Loading and Biological Responses in the Central Gulf of Mexico. US Dept of Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA OCS Study, MMS 2003-063

Significant Early Oil Spill Publications:
Overton, E.B., J.A. McFall, S.W. Mascarella, C.F. Steele, S.A. Antoine, I.R. Politezer, and J.L. Laseter 1981. Petroleum residue source identification following a fire and oil spill. 1981 Oil Spill Conference, Atlanta, GA, pp. 541-546.

Overton, E.B., L.V. McCarthy, S.W. Mascarella, M.A. Maberry, S.R. Antoine, J.W. Farrington, and J.L. Laseter 1980. Detailed chemical analysis of IXTOC I crude oil and selected environmental samples from the Researcher and Pierce Cruises. Proc. of Researcher/Pierce IXTOC I Symposium, pp. 439-495.

Overton, E.B., J.L. Laseter, S.W. Mascarella, C. Raschke, I. Nuiry, and J.W. Farrington 1980. Photochemical oxidation of IXTOC I oil. Proc. of Researcher/Pierce IXTOC I Symposium, pp.

341-383.
Laseter, J.L., G.C. Lawler, E.B. Overton, J.R. Patel, J.P. Holmes, M.I. Shield, and M.A. Maberry 1980. Characterization of aliphatic and aromatic hydrocarbons in flat and Japanese yype oysters and adjacent sediments collected from L'Aber Wrach following the Amoco Cadiz oil spill. Proc. of International Symposium on the Amoco Cadiz: Fates and Effects of the Oil Spill, Breast, France, pp. 633-644.
Overton, E.B., J.R. Patel, and J.L Laseter 1979. Chemical characterization of mousse and selected Eevironmental samples from the Amoco Cadiz oil spill. Proceedings of 1979 Oil Spill Conference, Los Angeles, CA, pp. 169-174.

Areas of Specialization

Since 1984, Dr. Overton has been the lead chemist and Principal Investigator on a contract with NOAA's Office of Response and Restoration's Emergency Response Division with primary responsibility for providing, evaluating and interpreting analytical, chemical, and physical data during oil and hazardous material spill incidents in all marine environments under U.S. jurisdiction. His present role as NOAA's lead response chemist involves: participation in evaluating data from chemical spill incidents; coordinating chemical information with trajectory modeling for chemical incidents; recommending appropriate analytical techniques for use during specific incidents; designing sample and analysis programs for damage assessment studies; interpretation of chemical-analytical data from chemical spill incidents; and education of NOAA and USCG chemical response team personnel on the various aspects of chemical support. Dr. Overton and his group have been involved in studying the fate and effects of oil spills since the 1978 blowout at the US Strategic Petroleum Reserve facility at West Hackberry Louisiana, as well as most major oil spills since that time, including the Amoco Cadiz, IXTOC-1, Exxon Valdez and Persian Gulf spills. Further, his research group has been developing field deployable analytical instrumentation designed to detect and identify volatile and semivolatile chemicals at toxic levels. Dr. Overton and his group first developed the forensic capability to fingerprint oils and identify the source of oil spills even as oil weathers in the environment following the SPR Cavern #6 and IXTOC spills. During the Deepwater Horizon Oil Spill, Dr. Overton provided facts-based public outreach information about the oil spill that was accurate and reliable through hundreds of live interviews with virtually all major print, radio, and broadcast new outlets around the world including an appearance on the Late Show with David Letterman. He has also been an invited speaker at dozens of national and international scientific meetings and seminars on topics associated with the Oil Spill.

Dr. Overton held the Clairborne Chair in Environmental Toxicology and Air Quality prior to his retirement, and was honored as an LSU Distinguished Faculty in 2008, the Louisiana Communicator of the Year in 2010, and was the 1996 Louisiana Technologist of the Year.

Collaborators:

Drs. Bill Lehr, Jim Farr, Mr. Charlie Henry, NOAA Seattle
Drs. Ralph Portier, Gene Turner, Irv Mendelssohn, LSU
Dr. Abhinav Bhushan, UC Davis
Drs. Joshua Whiting, Joe Simonson, Sandia National lab

Michael Lewis Parsons June 2011
Department of Marine and Ecological Sciences, and, Coastal Watershed Institute
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Education

Ph.D. 1996 Louisiana State University (Biological Oceanography)
B.S. 1990 University of Rochester, Rochester, New York (Biology-Geology)

Professional Experience

Director, Coastal Watershed Institute, Florida Gulf Coast University, 2010 - present.
Professor, Department of Marine and Ecological Sciences, Florida Gulf Coast University, 2010 - present.
Co-Director, Coastal Watershed Institute, Florida Gulf Coast University, 2009 - 2010.
Acting Director, Coastal Watershed Institute, Florida Gulf Coast University, 2007 - 2009.
Associate Professor, Department of Marine and Ecological Sciences, Florida Gulf Coast University, 2007 - 2010.
Assistant Director, Tropical Conservation Biology and Environmental Science Masters Program, 2004 - 2006.
Associate Professor, Marine Science Department, University of Hawaii at Hilo, 2004 - 2006.
Assistant Professor, Marine Science Department, University of Hawaii at Hilo, 1999 - 2004.
Post-doctoral Fellow, Louisiana Universities Marine Consortium, 1996 - 1999.

Five publications most relevant to the proposed activities

Parsons, M.L., C.J. Settelmier, and P.K. Bienfang 2010. A simple model capable of simulating the population dynamics of *Gambierdiscus*, the benthic dinoflagellate responsible for ciguatera fish poisoning. **Harmful Algae** 10: 71-80.

Parsons, M.L., Q. Dortch, R.E. Turner, and N.N. Rabalais 2006. Reconstructing the development of eutrophication in Louisiana salt marshes. **Limnology Oceanography** 51: 534-544.

Rabalais, N.N., R.E. Turner, B.K. Sen Gupta, E. Platon, and M.L. Parsons 2007. Sediments Tell the History of Eutrophication and Hypoxia in the Northern Gulf of Mexico. **Ecological Applications** 17(5) Supplement: S129-S143.

Parsons, M.L., Q. Dortch and R.E. Turne 2002. Sedimentological evidence for an increase in *Pseudo-nitzschia* (Bacillariophyceae) abundance in response to coastal eutrophication. **Limnology Oceanography** 47: 551-558.

Parsons, M.L., C.A. Scholin, P.E. Miller, G.J. Doucette, C.L. Powell, G.A. Fryxell, Q. Dortch, and T.M. Soniat 1999. *Pseudo-nitzschia* in Louisiana coastal waters: molecular probe field trials, genetic variability, and domoic acid analyses. **J. Phycology** 35: 1368-1378.

Five other significant publications

Parsons, M.L., C.J. Settelmier, and J.M. Ballauer In press. An examination of the epiphytic nature of Gambierdiscus toxicus, a dinoflagellate involved in ciguatera fish poisoning. **Harmful Algae**.

Parsons, M.L., W.J. Walsh, C.J. Settlemier, D.J. White, J.M. Ballauer, P.M. Ayotte, K.M. Osada, and B. Carman 2008. A multivariate assessment of the coral ecosystem health of two

embayments on the lee of the island of Hawai‘i. **Marine Pollution Bulletin** 56: 1138-1149.
Parsons, M.L. and L.B. Preskitt 2007. A survey of epiphytic dinoflagellates from the coastal waters of the island of Hawai‘i. **Harmful Algae** 6: 658-669.
Thessen, A.E., Q. Dortch, M.L. Parsons, and W. Morrison 2005. Effect of salinity on *Pseudo-nitzschia* species (Bacillariophyceae) growth and distribution. **J. Phycology** 41: 21-29.
Parsons, M.L., Q. Dortch, R.E. Turner, and N.N. Rabalais 1999. Salinity history of coastal marshes reconstructed from diatom remains. **Estuaries** 22: 961-972.

Recent Synergistic Activities
Member, National Harmful Algal Bloom Committee, July 2009-June 2012; Board Member, Solutions To Avoid Red Tide (START), November 2007-present; University Science Day, Veteran’s Memorial Elementary School, June 2009, 2010, 2011; Estuary Conservation Association Guardian Committee Member, June 2009-2010; Instructor, Gulf of Mexico Harmful Algal Bloom Workshop, St. Petersburg, FL, June 1-5, 2009; Member, Steering Committee, Red Tide Control and Mitigation Workshop, February 9-11, 2010, Mote Marine Laboratory, Sarasota, FL.

Collaborators over the last 48 months:
Don Anderson (WHOI), Paul Bienfang (University of Hawaii), Larry Brand (U. Miami), Loren Coen (SCCF), Clinton Dawes (USF), Quay Dortch (NOAA NOS), Greg Doucette (NOAA Marine Biotoxins Program), Deana Erdner (UTMSI), Ray Grizzle (U. NH), Cindy Heil (FWRI), Ai Ning Loh (FGCU), Eric Milbrandt (SCCF), Steve Morton (Marine Biotoxins Program), Yuri Okolodkov (U. Veracruz), Ernst Peebles (USF), Nancy Rabalais (Louisiana Universities Marine Consortium), Bernard Riegl (Nova SE), Alison Robertson (FDA GCSL), Darren Rumbold (FGCU), S. Gregory Tolley (FGCU), R. Eugene Turner (Louisiana State University), Tracy Villareal (UTMSI), Aswani Volety (FGCU).

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Education

Ph.D. 1983 University of Texas at Austin, Zoology (Minor: Marine Studies)
M.S. 1975 Texas A&I University, Biology (Minor: Psychology)
B.S. 1972 Texas A&I University, Kingsville, Biology (summa cum laude)

Professional Experience

Professor, Louisiana Universities Marine Consortium
Louisiana State Univ., Dept of Oceanography & Coastal Sciences, Adjunct, Graduate Faculty
Nicholls State University, Department of Biological Sciences, Adjunct
2005-present Executive Director, Louisiana Universities Marine Consortium
1997-present Professor, Louisiana Universities Marine Consortium
1991-1997 Associate Professor, Louisiana Universities Marine Consortium
1984-91 Assistant Professor, Louisiana Universities Marine Consortium
1985-90 Summer Program Director, Louisiana Universities Marine Consortium
1983-84 Research Associate, Louisiana Universities Marine Consortium

Five publications most relevant to the proposed activities

Rabalais, N.N., R.J. Díaz, L.A. Levin, R.E. Turner, D. Gilbert, and J. Zhang 2010. Dynamics and distribution of natural and human-caused coastal hypoxia. **Biogeosciences** 7: 585-619.

Quiñones-Rivera, Z.J., B. Wissel, N.N. Rabalais, and D. Justić 2010. Effects of biological and physical factors on seasonal oxygen dynamics in a stratified, eutrophic coastal ecosystem. **Limnology Oceanography** 55: 289–304.

Rabalais, N.N., R.E. Turner, D. Justić, and R.J. Díaz 2009. Global change and eutrophication of coastal waters. **ICES Journal of Marine Science** 66: 1528-1537.

Rabalais, N.N., R.E. Turner, B.K. Sen Gupta, D.F. Boesch, P. Chapman, and M.C. Murrell 2007**.** Characterization and long-term trends of hypoxia in the northern Gulf of Mexico: Does the science support the Action Plan? **Estuaries and Coasts** 30(5): 753-772.

Rabalais, N.N., R.E. Turner, B.K. Sen Gupta, E. Platon, and M.L. Parsons 2007. Sediments tell the history of eutrophication and hypoxia in the northern Gulf of Mexico. **Ecological Applications** 17(5) Supplement: S129-S143. [Special Issue, Nutrient Enrichment of Estuarine and Coastal Marine Environments]

Five other significant publications

Rabalais, N.N. and R.E. Turner 2011. 11.5 Management Case Study: Mississippi River In: Kremer, H. and J. Pinckney (eds.), Volume 11. Integrated Management of Estuaries and Coasts, *In*: Wolansky, E. and D.S. McLusky (eds.), Treatise on Estuarine and Coastal Science. Elsevier. In press

Rabalais, N.N. and R.E. Turner (eds.) 2001. *Coastal Hypoxia: Consequences for Living Resources and Ecosystems*. Coastal and Estuarine Studies 58, American Geophysical Union, Washington, D.C., with authorship or co-authorship in six chapters.

Gilbert, D., N. N. Rabalais, R. J. Diaz, and J. Zhang 2010. Evidence for greater oxygen decline rates in the coastal ocean than in the open ocean. **Biogeosciences** 7: 2283–2296.
Levin, L. A., W. Ekau, A. Gooday, F. Jorrisen, J. Middelburg, W. Naqvi, C. Neira, N. N. Rabalais and J. Zhang 2009. Effects of natural and human-induced hypoxia on coastal benthos. **Biogeosciences** 6: 2063-2098.
Ren, L., N. N. Rabalais, W. Morrison, W. Mendenhall, and R. E. Turner 2009. Nutrient limitation on phytoplankton growth in upper Barataria Basin, Louisiana: Microcosm bioassays. **Estuaries and Coasts** 32: 958-974.

Recent Synergistic Activities

25 Graduate students; 3 Postdoctoral advisees
Member, SCOR Working Group #128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas, 2006-2010.
Member, National Sea Grant Advisory Board, 2008-present, currently Vice Chair
President- Elect, former Member-at-Large, Executive Board, Southern Association of Marine Laboratories, 2007-present
Member-at-Large for UNOLS Council, University-Naval Oceanographic Laboratory System, 2007-present
Inside Trustee, Consortium for Ocean Leadership, 2008-present
President Elect, Southern Assn. of Marine Laboratories, 2007-present.
Chair, Trustee Nominating Committee, Consortium for Ocean Leadership, 2008-2010
Advisory Committee Member, NSF Environmental Research and Education directorate, 2007-10
Member, Board of Directors, GCOOS, Gulf of Mexico Regional Association, 2005-present
Co-Chair, Gulf of Mexico Coastal Ocean Observing System-RA, HABIOS working group, 2007-present
Representative, National Federation of Regional Associations, IOOS, 2008-present
Member, National Research Council, Committee on the Impacts of the Deepwater Horizon Oil Spill on Ecosystem Services, 2010-present.
Member, National Research Council, Committee on Applying the Clean Water Act across the Mississippi River Basin, 2009-present
Representative, National Federation of Regional Associations, IOOS, 2008-present.
Co-Chair, Scientific Steering Committee, Land Ocean Interactions in the Coastal Zone, International Geosphere Biosphere Programme, 2006-2009; member 2002-2005.
Member, National Research Council, 5 Committees, 2005-present.

Selected Honors, Awards and Distinctions

12th Annual Roger Revelle Commemorative Lecture, Ocean Studies Board, The National Academies, March 2011.
Louisiana Environmental Education Commission, 2009-present
Clarke Prize, National Water Resources Institute, July 2008
Ruth Patrick Award, ASLO, American Society of Limnology and Oceanography, 2008
Second Most Cited paper in *Estuaries* 1985-2005
Chair, Ocean Studies Board, National Research Council, 2002-2005
B. K. Ketchum award, Woods Hole Oceanographic Institution, 2002
National Associate, National Academies of Science, awarded December 2001, lifetime
Blasker Award for Environmental Science and Engineering, 1999, shared with R. E. Turner
Aldo Leopold Leadership Program Fellow, 1999-present
Fellow, American Association for the Advancement of Science, 1995

Brian Joseph Roberts
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Education:
Ph.D. 2004 Cornell University, Ecology and Evolutionary Biology
M.A. 1996 Boston University (MBL), Biology (specialization in Marine Science)
B.S. 1995 College of William and Mary, Biology and Philosophy

Professional experience:
Assistant professor, Louisiana Universities Marine Consortium 2007-present
Adjunct Assistant Professor, Dept. of Oceanography & Coastal Science, LSU, 2008-present
Adjunct Assistant Professor, Dept. of Biology, Nicholls State University, 2008-present
Adjunct Assistant Professor, Dept of Ecology & Evolutionary Bio, Tulane Univ. 2010-present
Postdoctoral Research Associate, ESD, ORNL, supervisor: Patrick Mulholland. 2003-2007
Research assistant, Marine Biological Laboratory, supervisor: Ivan Valiela 1996-1997
Research intern, Ecosystems Center, MBL, supervisor: Anne Giblin 1997
Undergraduate Research Assist., William & Mary, advisor: Gregory Capelli 1994-1995

Five publications most relevant to current proposal:
Roberts, B.J., P.J. Mulholland 2007. In-stream biotic control on nutrient biogeochemistry in a forested headwater stream, West Fork of Walker Branch. **Journal of Geophysical Research (Biogeosciences)** 112, G04002, doi: 10.1029/2007JG000422.
Roberts, B.J., P.J. Mulholland, and W.R. Hill 2007. Multiple scales of temporal variability in ecosystem metabolism rates: results from two years of continuous monitoring in a forested headwater stream. **Ecosystems** 10(4): 588-606. (*Received Hynes award)
Roberts, B.J. and R.W. Howarth 2006. Nutrient and light availability regulate the relative contribution of autotrophs and heterotrophs to respiration in freshwater pelagic ecosystems. **Limnology Oceanography** 51(1): 288-298.
Roberts, B.J., M.E. Russ, and N.E. Ostrom 2000. Rapid and precise determination of d18O of dissolved and gaseous di-oxygen via gas chromatography-isotope ratio mass spectrometry. **Environmental Science and Technology** 34: 2337-2341.
Lee, R.Y., S.B. Joye, B.J. Roberts, and I. Valiela 1997. Release of N2 and N2O from salt marsh sediments subject to different land-derived nitrogen loads. **Biological Bulletin** 193: 292-293.

Five other significant publications
Roberts, B.J., P.J. Mulholland, and J.N. Houser 2007. Effects of upland disturbance and in-strea restorations on hydrodynamics and ammonium uptake in headwater streams. **Journal of the North American Benthological Society** 26(1): 120-135.
Roberts, B.J., B.J. Roberts, W.R. Hill, and J.G. Smith 2009. Stream ecosystem responses to the 2007 spring freeze in the Southeastern United States: Unexpected effects of climate change. **Global Change Biology** 15: 1767–1776.
Hill, W.R., S.E. Fanta, and B.J. Roberts 2009. Combined effects of phosphorus and light on

stream algae: implications for establishing stream nutrient criteria. **Limnology Oceanography** 54(1): 368-380.
Lutz, B.D., E.E. Bernhardt, B.J. Roberts, and P.J. Mulholland 2011. Examining the coupling of carbon and nitrogen cycles in Southern Appalachian streams: Understanding the role of dissolved organic nitrogen. **Ecology** 92(3): 720-732.
Roberts, B.J., P.J. Mulholland, and J.N. Houser JN. *In press*. Response of ecosystem metabolism to instream restorations along a catchment disturbance gradient. **Ecological Applications**.

Awards:
Hynes Award for New Investigators, North American Benthological Society, 2009
ORNL ESD Distinguished Achievement Award for Post-Graduate Research, 2005
DIALOG VI Symposium, 2004
NSF RTG Fellowship, 1997-1999, 2000-2001

Recent Synergistic Activities
LUMCON REU Program Director, 2011-present
ASLO Early Career Committee Member, 2007-present
LUMCON Environmental Monitoring Committee, 2007-present
DIALOG VI Symposium participant, Dauphin Island Marine Lab, 30 Oct-6 Nov 2004
Invited workshop participant: "Oxygen isotopes as a tracer of global O2, CO2, and H2O cycles" BASIN/SIBAE Workshop, Marconi Conference Center (2004); "Dissolved Organic Matter in Aquatic Ecosystems" workshop, Institute of Ecosystems Studies (2000)
Reviewer: Journals— Biogeochemistry, Ecology, L & O, L&O Methods, Geochimica et Cosmochimica Acta, Marine and Freshwater Research, Restoration Ecology, Aquatic Botany, Aquatic Sciences, ECSS, JNABS, Fundamental and Applied Limnology, Ecosystems, Forest Ecology & Management, Aquatic Sciences, CJFAS, Freshwater Biology.
Proposals—NSF Biological Oceanography, Hydrologic Science.
Member of advisory committee for Cornell University/Boyce Thompson Institute for Plant Research Stable Isotope Laboratory (CoBSIL), 2001-2003

Current Courses Taught
Changing Coastal Oceans (LUMCON team taught course each spring; 2008-present); Marine Field Ecology (2008; will be taught on even years thereafter)
Previous Teaching Experience (Cornell University):
Introductory Biology Laboratory Instructor (Fall 1999-Spring 2000); Plant Physiological Ecology (Spring 2003): TA & guest lecturer; Introductory Ecology (Fall 2002): TA & guest lecturer; Ecosystem Ecology (Guest Lecturer in Spring 2003)
Postdoctoral Research Advisor:
Patrick Mulholland, Environmental Sciences Division, Oak Ridge National Laboratory
Graduate Advisors:
Ph.D.: Robert W. Howarth, Department of Ecology & Evolutionary Biology, Cornell University
M.A.: Ivan Valiela, Boston University Marine Program, Marine Biological Laboratory
Graduate Advisees:
Chair of Committee (1): S. Doty, MS, Marine & Environmental Biology, NSU (August 2010);
Committee Member (2): J. West, Ph.D., Dept. of Renewable Natural Resources, LSU (expected 2012); T. Pasco, Ph.D., Dept of Oceanography & Coastal Sciences, LSU (expected 2013)

Geoffrey A. Sinclair June 2011
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Education

Ph.D. 2008 North Carolina State University, Raleigh, North Carolina
M.S. 2005 North Carolina State University, Raleigh, North Carolina
B.A. 1998 University of Virginia, Charlottesville, Virginia

Professional Experience

Adjunct Assistant Professor, Louisiana State University 2011-present
Assistant Professor, Louisiana Universities Marine Consortium2008-present
Adjunct Assistant Professor, North Carolina State University 2008-present
US Peace Corps Volunteer, Benin, West Africa 1998-2000

Five publications most relevant to the proposed activities

Sinclair, G.A., D. Kamykowski, P.M. Glibert 2009. Growth, uptake and assimilation of ammonium, nitrate, and urea, by three strains of *Karenia brevis* grown under low light. **Harmful Algae** 8: 770-780

Sinclair, G.A. D. Kamykowski 2008. Benthic-pelagic coupling in sediment associated populations of *Karenia brevis.* **J. Plankton Research** 30(7): 829-838

Sinclair, G.A. D. Kamykowski 2006. The effects of physiology and behavior on the near-bottom distributions of *Karenia brevis* on the West Florida shelf: a numerical study. **African Journal of Marine Science** 28(2): 361-364

Sinclair, G.A., D. Kamykowski, E. Milligan, and B. Schaeffer 2006. Nitrate uptake by *Karenia brevis*. I. Influences of prior environmental exposure and biochemical state on diel uptake of nitrate. **Marine Ecology Progress Series** 328: 117-124

Sinclair, G.A., D. Kamykowski, E. Milligan, and B. Schaeffer 2006. Nitrate uptake by *Karenia brevis*. II. Behavior and uptake physiology in a nitrate-depleted mesocosm with a bottom nutrient source. **Marine Ecology Progress Series** 328: 125-131

Five other significant publications

Schaeffer, B.A., D. Kamykowski, G.A. Sinclair, L. McKay, E.J. Milligan 2009. Diel vertical migration thresholds of *Karenia brevis* (Dinophyceae). **Harmful Algae** 8(5): 692-698

McKay, L.D., D. Kamykowski, E.J. Milligan, B. Schaeffer, and G.A. Sinclair 2006. Comparison of swimming speed and photophysiological responses to different external conditions among three *Karenia brevis* strains. **Harmful Algae** 5(6): 623-636

Schaeffer, B.A., D. Kamykowski, L. Mckay, G.A. Sinclair, and Milligan 2009. Lipid class, carotenoid and toxin dynamics of *Karenia brevis* (Dinophyceae) during diel vertical migration. **J. Phycol.** 45**:** 154-163.

Schaeffer, B.A., D. Kamykowski, L. McKay, G.A. Sinclair, and E. Milligan 2009. A comparison of photoresponse among ten different *Karenia brevis (Dinophyceae)* isolates. **J. Phycology** 43(4) 702-714

Schaeffer, B.A., G.A. Sinclair, J.C. Lehrter, M.C. Murrell, J.C. Kurtz, R.W. Gould, and D.F. Yates[1]. *(accepted)* An analysis of diffuse attenuation in the northern Gulf of Mexico hypoxic zone using the SeaWiFS satellite data record. **Journal of Remote Sensing**

Recent Synergistic Activities

Participant in Louisiana's Race to the Tope Science, Technology Engineering and Mathematics (STEM) Initiative, Graduate Student Mentor (ASLO/AGU Ocean Sciences Feb 2010), Terrebonne Parish Science Fair Judge, Participant in Gulf of Mexico Alliances Water Quality Team, Participant in the Gulf of Mexico Alliances Harmful Algae Team, Reviewer for PNAS, Reviewer for Rhode Island Seagrant, Reviewer for U.S. EPA, Invited Speaker to NOAA Biotoxins Program, Charleston S.C. (2008), Invited Speaker to Oceans and Human Health Gordon Conference (2008), Co-wrote Coastal Processes course at NCSU as part of Preparing Professoriate Program, Participant in Instructional Technologies Access Program (ITAP) (2006), Graduate Student President for MEAS department at NCSU (2005), North Carolina Ocean Science Bowl Volunteer (Annually since 2003), Earth Day (2003, 2004) Economic and Ecological Impacts of Red Tide, Bayou Side Classroom Participant (LUMCON's K-12 education program), Member of Environmental Monitoring Committee (LUMCON)

Collaborators over the last 48 months

D. Kamykowski (NCSU), J. Morrison (UNCW), G. Kirkpatrick (Mote), P. Glibert (UMCES), N. Rabalais (LUMCON), B. Roberts (LUMCON), E. Turner (LSU), D. Justic (LSU), B. Fry, C. LI (LSU), B. Schaeffer (EPA)

Philip C. Stouffer July 2011
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Education
Ph.D. 1989 Rutgers University, New Brunswick, NJ (Ecology)
B.S. 1983 Bucknell University, Lewisburg, PA (Biology)

Professional experience
Professor, Louisiana State University/LSU AgCenter, 2011-present
Associate Professor, Louisiana State University/LSU AgCenter, 2003-2011
Associate Professor, Southeastern Louisiana University (SLU), 1998-2003
Graduate Coordinator, Department of Biological Sciences, SLU, 1998-2003
Assistant Professor, Southeastern Louisiana University, 1993-1998
Post-doctoral Researcher, Smithsonian Institution, 1991-1993

Five publications most relevant to the proposed activities
Johnson, E.I., J.K. DiMiceli, P.C. Stouffer, and M.E. Brooks 2011. Habitat use does not reflect quality for Henslow's Sparrows wintering in fire-managed longleaf pine savannas. **The Auk**, in press.
Brooks, M.E. and P.C. Stouffer 2010. Effects of Hurricane Katrina and salvage logging on Bachman's Sparrows. **Condor** 112: 744-753. 10.1525/cond.2010.100019
Fox, D.M., P.C. Stouffer, W.E. Kelso, D.A. Rutherford, and M. LaPeyre 2007. Impact of a freshwater diversion on wildlife and fisheries in the Maurepas Swamp, Louisiana. Report to Environmental Protection Agency, Dallas.
DiMiceli, J.K., P.C. Stouffer, E.I. Johnson, C. Leonardi, and E.B. Moser 2007. Seed preferences of wintering Henslow's Sparrows. **Condor** 109: 595-604.
Stouffer, P.C. 2006. Density, territory size, and long-term spatial dynamics of a guild of terrestrial insectivorous birds near Manaus, Brazil. **The Auk** 124: 292-306.

Five other significant publications
Stouffer, P.C., E.I. Johnson, R.O. Bierregaard, Jr., and T.E. Lovejoy 2011. Understory bird communities in Amazonian rainforest fragments: Species turnover through 25 years post-isolation in recovering landscapes. **PLoS One**, in press.
Stouffer, P.C., C. Strong, and L.N. Naka 2009. Twenty years of understory bird extinctions from Amazonian rainforest fragments: Consistent trends and landscape-mediated dynamics. **Diversity and Distributions** 15: 88-97.
Ferraz, G., J.D. Nichols, J.E. Hines, P.C. Stouffer, R.O. Bierregaard, Jr., and T.E. Lovejoy 2007. A large-scale deforestation experiment: Effects of patch area and isolation on Amazon birds. **Science** 315: 238-241.
Stouffer, P.C., R.O. Bierregaard, Jr., C. Strong, and T.E. Lovejoy 2006. Long-term landscape change and bird abundance in Amazonian rainforest fragments. **Conservation Biology** 20: 1212-1223.

Ferraz, G., G. J. Russell, P.C. Stouffer, R. O. Bierregaard, Jr, S. Pimm, and T.E. Lovejoy 2003. Rates of species loss from Amazonian forest fragments. **Proceedings of the National Academy of Sciences** 100: 14069-14073.

Recent synergistic activities

Invited participant, Society for Ecological Restoration symposium on faunal recovery, 2011
Book review editor, *Journal of Field Ornithology,* 2010-present
NSF Population and community ecology review panel, Fall 2007, Spring 2010
Louisiana Important Bird Areas Committee, 2006-present
Associate Editor, *The Auk* (journal of the American Ornithologists' Union), 2002-present
Invited participant, USFWS Henslow's Sparrow Conservation Planning Workshop, 2007
Associate Editor, *Biotropica*, 2006-2008
Assigning Editor, *Conservation Biology*, 2006
Scientific Program Chair, 2002 North American Ornithological Congress (organized >800 presentations)

Collaborators over the past 48 months

Erik Johnson, National Audubon Society; Rob Bierregaard, University of North Carolina, Charlotte; Thomas Lovejoy, Heinz Center; Jennifer DiMiceli, Portland State University; Matthew Brooks, Albuquerque, NM; William Laurance, James Cook University, Australia; Regina Luizão, Instituto Nacional De Pesquisas da Amazônia (INPA), Brazil; José Camargo, INPA; Susan Laurance, James Cook University; Stuart Pimm, Duke University; Emilio Bruna, University of Florida; Claudier Vargas, INPA; Cheryl Strong, USFWS; Luciano Naka, LSU; Mario Cohn-Haft, INPA; Curtis Marantz, Cornell University; Andrew Whittaker, Manaus, Brazil; Claudia Leonardi, LSU; E. Barry Moser (deceased), LSU; James Nichols, USFWS; James Hines, USFWS; Gonçalo Ferraz, INPA; Antonio Celis-Murillo, University of Illinois; Marina Anciães, INPA

Annette Summers Engel
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Education

Ph.D. 2004 U Texas-Austin, TX, Geological Sciences (Advisor: PC Bennett)
M.S. 1999 U Cincinnati, OH, Biological Sciences (Advisor: BK Kinkle)
M.S. 1997 U Cincinnati, OH, Geology (Advisor: W Huff)
B.A. 1995 Wittenberg U, Springfield, OH, Geology (Advisor: JR Ritter)

Professional Experience

Jones Associate Professor of Aqueous Geochemistry, U Tennessee at Knoxville 2011-present
Associate Professor. Louisiana State University (LSU), Depts. Geology & Geophysics and Biological Sciences (joint appointment) 2010-July 31, 2011
Assistant Professor. LSU, Dept. Geology & Geophysics and Dept. Biological Sciences (joint appointment) 2004-2010

Five publications most relevant to the proposed activities

Engel, A.S., D.B. Meisinger, M.L. Porter, R. Payne, R., M. Schmid, L.A. Stern, K.-H. Schleifer, and N.M. Lee 2010. Linking phylogenetic and functional diversity to nutrient spiraling in microbial mats from Lower Kane Cave (USA). **The ISME Journal**. 4: 98–110.

Birdwell, J.E. and A.S. Engel 2010. Characterization of dissolved organic matter in cave and spring waters using UV-Vis absorbance and fluorescence spectroscopies. **Organic Geochemistry** 41: 270-280.

Porter, M.L.*, A.S. Engel, B.K. Kinkle, T.C. Kane + 2009. Diversity-productivity relationships from chemolithoautotrophically based sulfidic karst systems. **International Journal of Speleology** 38(1): 27-40 (*equal contribution; +deceased).

Engel, A.S.**,** H. Lichtenberg, A. Prange, and J. Hormes 2007. Speciation of sulfur from naturally-occurring, filamentous microbial mats from sulfidic cave springs using x-ray absorption near edge spectroscopy. **FEMS Microbiology Letters.** 269(1): 54-62.

Campbell, B.*, A.S. Engel,*, M.L. Porter, and K. Takai 2006. The versatile ε-proteobacteria: Key players in sulphidic habitats. 4:4 58-468. **Nature Reviews Microbiol.** *equal contribution

Five other significant publications

Engel, A.S. and A.M. Green Garcia (IN REVIEW) *Thalassia testudinum* meadow siliciclastic sediment bacterial diversity and its implications to *Lucinisca nassula* endosymbiont diversity. **Environmental Microbiology.**

Engel, A.S. and K. Randall 2011. Experimental evidence for microbially-mediated carbonate dissolution from the saline water zone of the Edwards Aquifer, Central Texas. **Geomicrobiology J.** 28(3): 313-327

Engel, A.S. 2010. Incorporating the *Deepwater Horizon* oil spill into geomicrobiology courses. **National Association of Geoscience Teachers e-News Magazine**. http://nagt.org/nagt/enews/sep10/summers.html

Landrum, J.T., P.C. Bennett, A.S. Engel, M. Alsina, P. Pastén, and K. Milliken 2009. Partitioning geochemistry of arsenic and antimony, El Tatio Geyser Field, Chile. **Applied Geochemistry** 24: 664-676.

Porter, M.L. and A.S. Engel 2008. Diversity of uncultured *Epsilonproteobacteria* from terrestrial sulfidic caves and springs. **Applied Environ. Microbiol.** 74(15): 4973-4977.

Synergistic Activities

Professional Societies & Service: Editorial Board of Frontiers in Evolutionary and Genomic Microbiology, Associate Editor, J. Sedimentary Research; Vice President of Communications, Karst Waters Institute, a 501(c)3 (since March 2009); Board of Director, Karst Waters Institute (since 2005); co-organizer for KWI conferences ("2008 Future Research Directions in Karst" & 2011 "Carbonate Geochemistry"), and sessions (Geol. Soc. America, Nat. Speleological Society, Goldschmidt). Served on NSF Geobiology & Low Temperature Geochemistry and Systematic Biology & Biodiversity Inventories Cluster review panels, NASA Exobiology Panel, 2011 Committee of Visitors for the Surface Processes Section of EAR at NSF

Outreach and Honors: Oil spill-related research was feature by the NSF, Press Release 10-142, Aug., 16, 2010 "Gulf Oil Spill: NSF Awards Grant to Study Effects of Oil and Dispersants on Louisiana Salt Marsh Ecosystem", including photographs <*http://www.nsf.gov/ news/news_summ.jsp?cntn_id=117498&org= NSF&from=news*>, and I was interviewed for CNN, WKRG Mobile News, "Oil hits Alabama, Mississippi barrier islands, Tarballs on Dauphin Island;" Posted June 1, 2010 <*http://www.cnn. com/2010/US/06/01/oil.spill.alabama/ index.html; http://www.wkrg.com/gulf_oil_spill/article/tarballs-on-dauphin-island/892429/ Jun-01-2010_10-51-pm/*>. I was honored (with 9 other faculty) at the LSU vs. MS State football game (92,000+ in attendance) for oil spill research response, LSU Office of the Vice Chancellor for Research and Economic Development, Sept. 18, 2010 <h*ttp://www.lsu.edu/ur/ ocur/lsunews/MediaCenter/ News/2010/09/item19517.html*>. In 2011, I was an invited speaker at the 1st World Congress of Marine Biotechnology conference, Dalian, China (April 26, 2011).

Collaborators over the last 48 months

Carol Wicks (LSU); Laurie Anderson (LSU/SD Sch Mines); Huiming Bao (LSU); Barbara Campbell (U Delaware); Josef Hormes (U Bonn; CAMD); Natuschka Lee (TU-Munich, Germany); Diana Northup (U New Mexico); Maurizio Paoletti (U Padova, Italy); Pablo Pastén (U Catolíca, Chile); Alexander Prange (U Bonn, Germany; CAMD)

Advisees

(i) Former Post-doctoral and Research Associates: (partially funded on projects) Justin Birdwell (USGS Mendenhall Fellow, Boulder, CO); Janez Mulec (Karst Research Institute, Slovenia); Megan Porter (U Maryland-Baltimore Co.)

(ii) Current Graduate Students: Kathleen Brannen (PhD, to begin 2011-present); Teresa Brown (PhD, 2010-present); Sarah Keenan (PhD, 2009-present); Brendan Headd (PhD 2009-present); Audrey Paterson (MS 2010-present); Axita Gupta (MS 2010-present); Chang Liu (MS 2009-present). I have also served as the main thesis advisor for six completed MS student theses (2006-present) and two undergraduate senior theses (2011).

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Education
Ph.D. 2006 University of Otago, New Zealand (Zoology)
M.Sc. 2000 Dalhousie University, Canada (Biology)
B.Sc. 1995 (Hons. First Class) University of Victoria, Canada (Biology)

Professional experience
Assistant Professor, Louisiana State University & Agricultural Center, March 2009 - present
NSERC Post-Doctoral Fellow, University of British Columbia, July 2007-March 2009

Five publications most relevant to the proposed activities
Taylor, S.S., R. Sardell, J.M. Reid, T. Bucher, N.G. Taylor, P.A. Arcese, L.K. Keller 2010. Inbreeding coefficient and heterozygosity-fitness correlations in unhatched and hatched song sparrow nestmates. **Molecular Ecology** 19: 4454-4461.
Taylor, S.S., S. Boessenkool, and I.G. Jamieson 2008. Genetic monogamy in two long-lived New Zealand passerines. **J. Avian Biology** 39: 579-583.
Taylor, S.S. and I.G. Jamieson 2008. No evidence for loss of genetic variation following sequential translocations in extant populations of a genetically depauperate species. **Molecular Ecology** 17:545-556.
Taylor, S.S., I.G. Jamieson, and G.P. Wallis 2007. Historical and contemporary levels of genetic variation in two New Zealand passerines with different histories of decline. **J. Evolutionary Biology** 20: 2035–2047.
Boessenkool, S., S.S. Taylor, C.K. Tepolt, J. Komdeur, and I.G. Jamieson 2007. Large mainland populations of South Island robins retain greater genetic diversity than offshore island refuges. **Conservation Genetics** 8:705-714.

Five other significant publications
Lim, H.-C., F, Zou, S.S. Taylor, B.D. Marks, R.G. Moyle, G. Voelker, and F.H. Sheldon 2010. Phylogeny of Magpie-Robins and Shamas (Aves: Turdidae: *Copsychus* and *Trichixos*): implications for island biogeography in Southeast Asia. **J. Biogeography** 37: 1894-1906.
Jamieson, I.G., S.S. Taylor, L. Hegg, D.P. Armstrong, H. Kokko 2009. Why some species of birds do not avoid inbreeding: data and new theory from New Zealand robins and saddlebacks. **Behavioural Ecology** 20:575-584.
Taylor, S.S. and I.G. Jamieson 2007. Factors affecting the survival of founding individuals in translocated New Zealand saddlebacks. **Ibis** 149: 783–791.
Taylor, S.S., I.G. Jamieson, and D. Armstrong 2005. Successful island reintroductions of New Zealand robins and saddlebacks with small numbers of founders. **Animal Conservation** 8:415-420.
Taylor, S.S., M.L. Leonard, D.J. Boness, and P. Majluf 2002. Foraging in Humboldt penguins (*Spheniscus humboldti*) during the chick-rearing period: general patterns, sex differences, and recommendations to reduce incidental catches in fishing nets. **Canadian J. Zoology** 80:700-707.

Recent Synergistic Activities

As an assistant professor, I mentor undergraduate students who work in my lab, graduate students in my Department, and graduate students at the LSU Museum who use my ancient DNA lab. I have developed an undergraduate course in conservation genetics that integrates my research with education. I also volunteer for AgMagic, an educational event for K-12 students at the LSU AgCenter, 4-H College, and for the Louisiana Young Ag Producer's workshop where I introduce high school students to basic genetic lab techniques. Other synergistic activities include serving as a reviewer for scholarly journals (Molecular Ecology, Behavioral Ecology and Sociobiology, Conservation Genetics, Fisheries, Journal of Avian Biology, Journal of Wildlife Management, and Southeast Naturalist), serving as a judge at the Louisiana Region VII Science and Engineering Fair (2010 & 2011) and Halifax Regional Science Fair (1998 & 1999) and volunteer fund-raising for the Nova Scotia Nature Trust (2002 & 2003).

Collaborators over the last 48 months:

Collaborators and co-authors
Peter Arcese (University of British Columbia), Doug Armstrong (Massey University), Sanne Boessenkool (University of Oslo), Thomas Bucher (University of Zurich), Robert Fleischer (Smithsonian Institution), Lisa Hegg (University of Otago), Ian Jamieson (University of Otago), Lukas Keller, (University of Zurich), Hanna Kokko (University of Helsinki), Jan Komdeur (University of Groningen), Haw-Chuan Lim (Louisiana State University), Ben Marks (Dept. of Wildlife & Fisheries Sciences and Texas Cooperative Wildlife Collections), Rob Moyle (University of Kansas), Jane Reid (University of Aberdeen), Rebecca Sardell (University of Aberdeen), Fred Sheldon (Louisiana State University), Nathan Taylor (University of British Columbia), Carolyn Tepolt (Stanford University), Gary Voelker (Dept. of Wildlife & Fisheries Sciences and Texas Cooperative Wildlife Collections), Graham Wallis (University of Otago), Amy Wilson (Smithsonian Institution), Fasheng Zou (South China Institute of Endangered Animals)

Graduate advisors and post-doctoral sponsors
Peter Arcese (Post-doctoral advisor), University of British Columbia
Daryl Boness (M.Sc. advisor), retired, formerly with the Smithsonian Institution
Ian Jamieson (Ph.D. advisor), University of Otago
Marty Leonard (M.Sc. advisor), Dalhousie University
Graham Wallis (Ph.D. advisor), University of Otago

Graduate Students and Post-doctoral Fellows
Stefan Woltmann, Post-doctoral Fellow (June 2011-June 2012)
Kristin Brzeski, Ph.D. student (August 2010-present)
Blain Cerame, MSc student (August 2010-present)
Jean Elbers, Ph.D. student (starts August 2011)

Robert Eugene Turner
Department of Oceanography and Coastal Sciences, and, Coastal Ecology Institute
School of the Coast and Environment
Louisiana State University
Baton Rouge, Louisiana 70803
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Education
Ph.D. 1974 University of Georgia, Athens, Georgia (Zoology)
M.A. 1969 Drake University, Des Moines, Iowa (Zoology)
B. A. 1967 Monmouth College, Monmouth, Illinois (Zoology)

Professional Experience
Director, Coastal Ecology Institute, Louisiana State University 1997 - 2001
Interim Director, Coastal Ecology Institute, Louisiana State University 1996 - 1997
Interim Chairman, Department of Oceanography and Coastal Sciences, Louisiana State University, 1990-1992;
Chairman, Department of Marine Sciences, Louisiana State University, 1989 - 1990
Professor, Louisiana State University, 1983-present; Chaired in various ways since 2002
Associate Professor, Louisiana State University, 1978 – 1983
Assistant Professor, Louisiana State University, 1975-1978

Five publications most relevant to the proposed research
Turner, R. E. 2011. Beneath the wetland canopy: Loss of soil marsh strength with increasing nutrient load. **Estuaries and Coasts** 33: DOI: 10.1007/s12237-010-9341-y
Turner, R. E., B. L. Howes, J. M. Teal, C. S. Milan, E. M. Swenson, and D. Goehringer-Toner 2009. Salt marshes and eutrophication: An unsustainable outcome. **Limnol. Oceanogr.** 54: 1634-1642.
Turner, R. E., J. J. Baustian, E. M. Swenson and J. S. Spicer 2006. Wetland sedimentation from hurricanes Katrina and Rita. **Science** 314: 449-452.
Turner, R. E. and B. Streever 2002. Approaches to Coastal Wetland Restoration: Northern Gulf of Mexico. SPB Academic Publishing, Den Hague, Netherlands. 147 pp.
National Research Council (Panel Member) 2001. Compensating for Wetland Losses Under the Clean Water Act. National Research Council. National Academy Press, Washington, D.C. 322 pp.

Five other significant publications
Kearney, M.S., A. Riter, and R.E. Turner 2011. Freshwater diversions for marsh restoration in Louisiana: Twenty-six years of change in vegetation coverage and marsh area in three diversions. **Geophysical Research Letters** in revision
Baustian, J., R.E. Turner, N.F. Walters, and D. Muth 2009. Restoration of dredged canals in wetlands: A comparison of methods. **Wetlands Ecology Management** 17: 445-453.
Turner, R.E., E.M. Swenson, C.S. Milan, and J.M. Lee 2007. Hurricane signals in salt marsh sediments: Inorganic sources and soil volume. **Limnol. Oceanogr.** 52: 1231-1238.
Darby, F.A. and R.E. Turner 2008. Effects of eutrophication to salt marsh roots, rhizomes, and soils. **Marine Ecology Progress Series** 363: 63-70.

Darby, F.A. and R.E. Turner 2008. Below- and aboveground *Spartina alterniflora* production in a Louisiana salt marsh. **Estuaries and Coasts** 31: 223-231.

Recent Synergistic Activities

International Association for Ecology (INTECOL): Executive Board Member: 1998-present; Working Group on Wetlands, 1979 -; Chairperson 1984 -to present; Organizer of Inernational Wetland Symposium every 4 years;

Panel Member, U.S. EPA, Board of Scientific Counselors (BOSC), Ecological Research Subcommittee Review of ORD's Ecological Research Program Feb. - April 2006; 2007.

Editorial Board Wetlands Ecology and Management (1988 - present); Editor-in-Chief (1992-1999); Honorary Editor-in-Chief (2000-present)

Environmental Law Institute, Project on Performance Standards for Wetland Mitigation 2005

Committee Member, Monitoring Design and Inventory Workgroup, of the National Water Quality Monitoring Council (NWQMC). Feb. 2005-May 2006.

American Society of Limnology and Oceanography, Professional Ethics Committee 2002-04.

Travel for 10+ off-campus invited lectures annually in recent years

Collaborators, projects & publications, last 48 months:

R.B. Alexander (USGS); D. Baltz (LSU); R.T. Bianci (Tex. A&M), D.F. Boesch (U. Maryland), G. Boody (MN); D. Braud (LSU); W. Broussard (LSU); J. Cable (LSU); P. Chapman (Texas A&M); M.J. Dagg (LUMCON); F.Q. Dortch (NOAA, COP), S. Farber (U. Pittsburgh); B. Fry (LSU); J. D. Glover (Land Inst.); S. Guang-You (Changchu, China); R.W. Howarth (Cornell); M. Inoue (LSU); N. Jordan (MN); D. Justic' (LSU), D. Keeney (Iowa State U); J. Lee (LSU); R.R. Lewis (consultant, Fla).; S.E. Lohrenz (U MS); M. McClain (RSMAS-MGG, U. Miami); B. H. McCowan (Wisc.); G. McIsaac (ILL); T.P. Meyers (NOAA/ATDD, Oak Ridge, TN); C.S. Milan (LSU); W.J. Mitsch (Ohio State U.); J. Marisco (Melaque, Mexico); J. Morris (USC); M. Muller (MN); H. Murray (MN.); M.C. Murrell (USEPA FLA); J. Neal, (Iowa State);), N.H. Oh (Yale); L. Osterman (USGS); C. Pansing (Minn.); M. Parson (FLA); H.W. Paerl (U.N.C.); N.N. Rabalais (LUMCON, LA), D.G. Redalje (U. So. Miss.); P.A. Redmond (Yale); D. Reed (UNO-LA); G.T. Rowe (Tx. A&M), D. Scavia (U. Mich.); B. Sen Gupta (LSU), B. Streever (BP, Alaska); P.W. Swarzenski (USGS); J. Teal (WHOI, Mass.); R. Twilley (LSU); K.D. Warner (U CA-Santa Cruz); M. Weinstein (Monclair State U.); W.J. Wiseman, Jr. (NSF); B. Wissel (U. Regina); D.L. Wyse (U. MN); J. Zedler and P. Zedler (U. WI.)

Graduate Students, Postdoctoral Associates

Bass, A. (Baton Rouge); J. Baustian (LSU); M. Boyer (U. AK); W. Broussard (LSU); J. Cowan (LSU); F. Darby (Baton Rouge); S. Duke (unknown); J. Kastler, LUMCON; R. Kaswadji (IPB, Indonesia); M. Koch (Florida); R. Miller (NASA); L.N. May, Jr. (US NMFS, Bay St. Louis); R. Miller (Stennis Space Center); P. Payonk (US COE, North Carolina); S. Rissotto (DC area); P. Roberts (NSF Palmer Station); W. Scaife (unknown); F.H. Sklar (S. Fla. Water Management District); J. Spicer (Univ. SC); Underwood, S.G. (USCOE, Wilmington, N.C.); D. West (D.C.)

External Awards

2010 Marine Pollution Bulletin: "Top-50 most cited articles" 2005-2009

2009 Environmental Science & Technology Top Paper Award – Science (for 2008)

2004 "Thanks" INTECOL Wetland Working Group

1999 Blasker Award for Environmental Science and Engineering, shared with N. N. Rabalais

1998 National Wetlands Award, Science Research, Environmental Law Institute et al.

8b. List of Partner Institutions and Project Personnel

Organizational affiliations	Project personnel
Lead Institution	
LUMCON	Rabalais, Roberts, Sinclair
Collaborating Institutions	
Brigham Young University	Bracken-Grissom, Crandall
Connecticut College	Bernhard
Florida Gulf Coast University	Parsons
Louisiana State University AgCenter	Brown, Hooper-Biu, LaPeyre, Stouffer, Taylor
Louisiana State University	Fry, Justic, Miles, Overton, Turner
Marine Biological Laboratory (Woods Hole)	Giblin
Rutgers, The State University	Able, Fodrie, Jensen
University of Louisiana at Lafayette	Felder, Fredericq
University of Maryland	Kearney
University of Tennessee	Summers-Engel
Virginia Institute of Marine Science	Diaz

8c. List of External Advisory Committee Members appointed and their affiliations.

The following have *accepted* an invitation to serve on the Advisory Committee:

Craig W. Osenberg	Department of Biology, University of Florida, Gainesville, FL
Lisa Levin	Scripps Inst. Oceanography, La Jolla, CA
Linda Deegan	Ecosystems Center, Marine Biological Lab., Woods Hole, MA
Jim Morris	Dept. Biology, Univ. South Carolina, Columbia, S.C.
Bob Christian	Biology Department, East Carolina University, Greenville, NC