Mobile Arthur R. Outlaw
Convention Center
Mobile, Alabama

Sponsored by:

Mobile Bay National Estuary Program
Alabama Center for Estuarine Studies
Mississippi-Alabama Sea Grant Consortium
University of Southern Mississippi

Alabama-Mississippi Bays and Bayous Symposium

Mobile Arthur R. Outlaw Convention Center

One South Water Street
Mobile, AL 36602

General Information

Symposium Registration Desk

The Registration Desk will be located on the Concourse and open during the following times:

Arrival - Monday, November 27, 2006

Desk open	4:00 – 7:00 p.m.
Early Registration	4:00 – 7:00 p.m.

Day 1 – Tuesday, November 28, 2006

Desk open	7:30 a.m. – 4:00 p.m.
Registration & Continental Breakfast	7:30 – 8:30 a.m.

Day 2 – Wednesday, November 29, 2006

Desk open	8:00 – 11:00 a.m.
Registration & Continental Breakfast	8:00 – 9:00 a.m.

All Sessions will be held in Rooms 201 A, B & C. The Registration Desk and Poster Presentation Session will be located on the Concourse. The Continental Breakfast on Day 1 will be in Room 201 D and on Day 2 on the Concourse. Breaks will be held on the Concourse both days. Room 201 D will also be available as a practice room, media room and for storage. Lunches and social will be held in the West Ballroom.

Symposium Featured Lodging

Radisson Admiral Semmes Hotel
251 Government Street, Mobile AL 36602
800-333-3333 or 251-432-8000

Mobile Dining Selections

China Doll. 223 Dauphin Street, Mobile, AL 36602, 251-433-7511, *Located in the heart of downtown Mobile. The China Doll features authentic Chinese cuisine.*
Olivers. 251 Government Street, Mobile, AL 36602, 334-432-8000, *Featuring fine continental cuisine, local seafood favorites, and irresistible homemade desserts in a casual atmosphere.*
Roussos Seafood Restaurant and Catering. 30500 State Highway 181, Mobile, AL 36527, Located in Eastern Shore Centre, Spanish Fort, AL, 251-625-3386, *Featuring fresh Gulf seafood and Grecian style cuisine.*
American Café. 3662-A Airport Boulevard, Mobile, AL 36608, 251-343-2524, *American Cafe's menu consists of a variety of pastas and thin crust gourmet pizzas, along with a variety of grilled entrées and made-from-scratch soups, salads, and sandwiches.*
Gambino Brothers. 873 Hillcrest Road, Mobile, AL 36695, 251-344-8115, *Full-service Italian restaurant offering imported pastas and homemade sauces, delicious baked sandwiches and the freshest salads. A catering menu is also available.*
La Pizzeria. 1455 1/2 Monroe Street, Mobile, AL 36604, 251-473-5003, *Located in the historic Lienkauf neighborhood, La Pizzeria offers traditional and non-traditional Italian fare in a casual yet elegant atmosphere.*
Mikato Japanese Steak House. 364 Azalea Road, Mobile, AL 36609, 251-343-6622, *A unique restaurant where you watch as your food is prepared. Featuring steak, seafood, sushi bar, and children's menu.*
Blue Gill Restaurant. 3775 Battleship Parkway, Mobile, AL 36527, Spanish Fort, 251-625-1998, *Featuring a wide variety of delicious, fresh seafood. Located on Mobile Bay for 52 years.*
Lakeside Lodge Restaurant. 650 Cody Road South, Mobile, AL 36695, 251-343-2211, *"Great local seafood restaurant on the lake." Featuring shrimp, oysters, fish, crab claws, stuffed flounder, steaks, ribs, and many other seafood options cooked the "old fashioned way."*
Mary's Place. 5075 Highway 188 and Bellingrath Road, Mobile, AL 36523-3711, Coden, 251-873-4514, *This seafood and steak restaurant has been around since 1935 serving fresh seafood prepared with a Creole touch.*
Original Oyster House. 1175 Battleship Parkway, Mobile, AL 36527, Spanish Fort, 251-928-2620, *Featuring fresh oysters, delicious steamed seafood, in a unique and casual atmosphere.*
Pillars, The. 1757 Government Street, Mobile, AL 36604, 251-471-3411, *Located near the Government Street and Airport Boulevard split, this restaurant offers fine dining in an elegant atmosphere.*
Riverview Cafe & Grill. 64 South Water Street, Mobile, AL 36602, 251-438-4000, *Featuring a delightful twist to classic regional Gulf Coast cuisine in a casual, relaxing atmosphere. Overlooks beautiful Mobile Bay.*
Wintzell's Oyster House. 605 Dauphin Street, Mobile, AL 36602, 251-432-4605, *Wintzell's has been serving fresh seafood specialties and other Southern favorites in a casual atmosphere for more than 63 years . . . "and still shuckin." Offering "oysters fried, stewed and nude."*
Outback Steakhouse. 901 Montlimar Drive, Mobile, AL 36609, 251-342-3276, *Featuring steaks and prime rib in an "Aussie" atmosphere and a variety of other food such as ribs, burgers, and seafood.*
Ruth's Chris Steak House. 2058 Airport Boulevard at Glenwood Street, Mobile, AL 36606, 251-476-0516, *Featuring American cuisine in your choice of dining rooms. Also offers large dining rooms for banquets.*
Busaba's Thai Cuisine. 203 Dauphin Street, P.O. Box 16572, Mobile, AL 36602, 251-405-0044, *Featuring authentic Thai cuisine in an elegant dining atmosphere. Located in a historic building within walking distance of downtown Mobile.*

Alabama-Mississippi Bays and Bayous Symposium

Agenda

Monday, November 27, 2006

Early Registration – 4:00-7:00 p.m. – Registration Desk – Concourse

Tuesday, November 28, 2006

Registration – 7:30-8:30 a.m. – Registration Desk –Concourse

Continental Breakfast – 7:30-8:30 a.m. – Room 201D

Plenary Presentation – 8:30-9:15 a.m. – West Ballroom

Keynote Speaker: ***Dr. Sylvia Earle – "Sea Change - Subtle Impact"***
Open to the Public, Free of Charge, Book Signing to Follow

Concurrent Sessions - Water Quality and Living Resources

9:30-10:00 a.m. - Opening Talks:

Water Quality: Status and Trends: James McIndoe, Alabama Department of Environmental Management and Jennifer Buchanan, Mississippi Department of Environmental Quality

Living Resources: Status and Trends: Harriet Perry & Ralf Riede, Center for Fisheries Research and Development, Gulf Coast Research Laboratory, University of Southern Mississippi and Leslie Hartman & Stevens Heath Alabama Department of Conservation & Natural Resources, Marine Resources Division

10:00-11:30 a.m. – Concurrent Sessions

11:30 a.m.–1:00 p.m. – Lunch and Guest Presentation – West Ballroom

Guest Speaker: ***Dr. Nancy Rabalais – "Will Science Solve Hypoxia?"***

1:00-2:20 p.m. – Concurrent Sessions Continue

2:20-2:40 p.m. – Break

2:40-4:00 p.m. – Concurrent Sessions Continue

5:00-7:00 p.m. – Poster Presentation Session – Concourse

6:00-8:00 p.m. – Evening Social and Guest Presentation

Guest Speaker: ***Dr. Orrin Pilkey*** **– Discussion on "*Global survey of barrier islands both open ocean and bay barriers"*** *Discussion to begin at 7:00 p.m. and book signing to follow.*

Alabama-Mississippi Bays and Bayous Symposium

Agenda - Continued

Wednesday, November 29, 2006

Registration – 8:00 – 9:00 a.m. – Registration Desk - Concourse

Continental Breakfast – 8:00 – 9:00 a.m. – Concourse

Concurrent Sessions - Water Quality II, Habitat Management, & Natural Hazards and Coastal Development

9:00 – 9:30 a.m. - Opening Talks:

Habitat Management: Status and Trends - La Don Swann, Mississippi-Alabama Sea Grant Consortium & Auburn University, Department of Fisheries and Allied Aquacultures

Natural Hazards and Coastal Development: Status and Trends - Ecosystem-based Management for Hazards Mitigation: Rebecca J. Allee, National Oceanic & Atmospheric Administration, Gulf Coast Services Center

9:00-10:20 a.m. – Concurrent Sessions

10:20-10:40 a.m. – Break

10:40-12:00 noon – Concurrent Sessions Continue

12:00 noon–1:30 p.m. – Lunch and Guest Presentation – West Ballroom

Guest Speaker: ***Dr. Frank Muller-Karger – "Our National Ocean Policy: Past, Present, and a Blueprint for the Future"***

1:30-2:50 p.m. – Concurrent Sessions Continue

2:50-3:10 p.m. – Break

3:10 p.m.–4:00 - Concurrent Sessions Continue

Water Quality Session I

Room 201 A

Tuesday, November 28, 2006

Chairs: Dr. Hugh MacIntyre, Dauphin Island Sea Lab
Mr. James McIndoe, Alabama Department of Environmental Management
Ms. Jennifer Buchanan, Grand Bay National Estuarine Research Reserve
Ms. Barbara Viskup, Mississippi Department of Environmental Quality

Time	Title and Authors
9:30	**Opening Talk - Historical Status and Trends.** *James McIndoe,* Alabama Department of Environmental Management and *Jennifer Buchanan,* Mississippi Department of Environmental Quality
10:00	**Mercury in the Mobile -Alabama River Basin (MARB) and Gulf Island National Park Network (GULN).** Bonzongo, J.-C.[1], K. A. Warner[2] and S. Youn[1]. [1]Department of Environmental Engineering Sciences, PO Box 116450, University of Florida, Gainesville, FL 32611-6450; [2]Oceana, 2501 M Street NW, Suite 300, Washington, DC 20037
10:20	**Benthic Algal Community Structure and Bioaccumulation of Mercury in Fish River, Alabama.** Novoveska, L.[1,3], S. W. Phipps[2] and C. L. Pederson[3]. [1]Dauphin Island Sea Lab and University of South Alabama, Dauphin Island, AL 36528; [2]Weeks Bay National Estuarine Research Reserve, Fairhope, AL 36532; [3]Department of Biological Sciences, Eastern Illinois University, Charleston, IL 61920
10:40	**Nutrient Sources, Transport, and Fate in Coupled Watershed-Estuarine Systems of Coastal Alabama.** Lehrter, J. Ecosystems Dynamics and Effects Branch, Gulf Ecology Division, U.S. Environmental Protection Agency, 1 Sabine Island Drive, Gulf Breeze, FL 32561
11:00	**Has The Environmental Quality Of The Bay Of St. Louis, Mississippi Changed Over The Past 25 Years?** Redalje, D. G., P. A. Sawant, R. L. Schilling, E. A. Rowe, R. J. Pluhar and M. J. Natter. University of Southern Mississippi, Stennis Space Center, MS 39529
11:30	***Lunch and Guest Presentation***
1:00	**Sources and Sinks of Nitrogen in Weeks Bay, AL.** Caffrey, J. M. Center for Environmental Diagnostics and Bioremedation. University of West Florida, 11000 University Parkway, Pensacola, FL 32514

Time	Title and Authors
1:20	**The Effects of Artificial Oyster Reefs on Primary Production and Nutrient Flow in Shallow Coastal Creeks.** Plutchak, R.[1], C. D. Foster[1], A. Anton[1], K. Sheehan[2], J. Goff[3], J. Cebrian[1] and K. Major[2]. [1]University of South Alabama, Marine Sciences, 307 University Boulevard North, Mobile, AL 36688; [2] University of South Alabama, Biological Sciences, Life Sciences Bldg. #124, 307 University Boulevard North, Mobile, AL 36688; [3] Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528
1:40	**Do Environmental Conditions Affect Viral Abundance in the Bay of St. Louis , Mississippi?** Pluhar, R. and D. Redalje. University of Southern Mississippi, Stennis Space Center, MS 39529
2:00	**A Comparison of Nutrients Collected Before and After Hurricane Katrina in Estuarine and Coastal Waterbodies of Mississippi**. Viskup, B. [1], H. Perry[2], C. Trigg[2], J. Anderson[2], F. Mallette[2] and L. Hendon[2]. [1]Mississippi Department of Environmental Quality, Biloxi, MS 39530; [2]Gulf Coast Research Laboratory, University of Southern Mississippi, Ocean Springs, MS 39564
2:20	***Break***
2:40	**Bacterioplankton Abundances in the Bay of St. Louis, MS Relative to Environmental Water Quality Prior to and After Hurricane Katrina**. Mojzis, A. K. and D. G. Redalje. Department of Marine Science, University of Southern Mississippi, Stennis Space Center, MS 39529
3:00	**Short-Term Water Quality Responses of a Microtidal Estuary to Storm Events.** Weston, J.[1,3], M. Slattery[1,2,3] and S. Threlkeld[1,3]. [1]Department of Biology, [2]Department of Pharmacognosy, [3]Environmental Toxicology Research Program, University of Mississippi, University, MS 38677
3:20	**Using PAM Fluorescence to Determine Salinity Tolerance of *Salvinia molesta* (Giant *Salvinia*).** Biber, P. D. University of Southern Mississippi, Gulf Coast Research Laboratory, 703 East Beach Drive, Ocean Springs, MS 39564
3:40	**Discussion**
4:30	**Poster Session Overview**
5:00	**Poster Presentation Session Begins – Concourse**

Living Resources

Room 201 B

Tuesday, November 28, 2006

Chairs: Dr. Rick Wallace, Auburn University Marine Extension and Research
Ms. Harriet Perry, USM Gulf Coast Research Lab
Mr. Steve Heath, Alabama Marine Resources Division
Ms. Traci Floyd, Mississippi Department of Marine Resources

Time	Title and Authors
9:30	**Opening Talk – Historical Status & Trends** – *Harriet Perry* and *Ralf Riede*, Center for Fisheries Research and Development, Gulf Coast Research Laboratory, University of Southern Mississippi; *Stevens Heath* and *Leslie Hartman*, Alabama Department of Conservation and Natural Resources Marine Resources Division
10:00	**Diagnosing the Causes of Biological Impairment in Mobile Bay, Alabama.** Engle, V., J. Kurtz, L. Smith and J. Nestlerode. U.S. Environmental Protection Agency, ORD/NHEERL, Gulf Ecology Division, Gulf Breeze, FL 32563
10:20	**Living Aquatic Resources in The Mobile -Tensaw Delta: Results from a 5-year Study.** Wright, R. A., D. R. DeVries, A. Peer, A. Norris, M. Lowe, D. Glover, T. Farmer, C. Cortemeglia and T. DeVries. Department of Fisheries, Auburn University, Auburn, AL 36849
10:40	**Survey of Diamondback Terrapin (*Malaclemmys terrapin*) Populations in Alabama Salt Marshes.** Coleman, A. T.[1], T. Wibbels[1], K. Marion[1], D. Nelson[2], J. Borden[2], G. Langford[3] and J. Dindo[4]. [1]Department of Biology, University of Alabama at Birmingham, Birmingham, AL 35294-1170; [2]Department of Biology, University of South Alabama, Mobile, AL 36688-0002; [3]Department of Biology, University of Nebraska at Lincoln, Lincoln, NE 68588-0514; [4]Dauphin Island Sea Lab, Dauphin Island, AL 36528
11:00	**Assessment of Alabama's Marine Fishes.** Mareska, J. Alabama Department of Conservation and Natural Resources, Marine Resources Division, PO Box 189, Dauphin Island, AL 36528
11:30	***Lunch and Guest Presentation***
1:00	**Alabama Inshore Recreational Fishing Survey.** Anson, K. J. Alabama Department of Conservation and Natural Resources, Marine Resources Division, PO Drawer 458, Gulf Shores, AL 36547
1:20	**Alabama's Inshore Shrimping Fleet - A Decade of Change.** Hartman, L. D. Alabama Department of Conservation and Natural Resources, Marine Resources Division, Dauphin Island, AL 36528

Time	Title and Authors
1:40	**Fish Consumption Among Coastal Recreational Anglers: Is Methylmercury Poisoning a Significant Risk?** Picou, J. S.[1], L. Swann[2], C. Formichella[1] and F. Woerner[1]. [1]University of South Alabama, Mobile, AL 36688 [2]Mississippi-Alabama Sea Grant Consortium, Gulf Coast Research Lab, Ocean Springs, MS 39564
2:00	**Insights and Implications for Gulf Coast Island Herpetofaunal Communities Gleaned from Hurricane Katrina.** Mohrman, T. J. and C. Qualls. University of Southern Mississippi, Hattiesburg, MS 39406
2:20	***Break***
2:40	**Temporal and Spatial Variation in the Distribution and Abundance of Submerged Aquatic Vegetation in Grand Bay National Estuarine Research Reserve, Mississippi.** May, C.[1] and H. Cho[2]. [1]Grand Bay National Estuarine Research Reserve, 6005 Bayou Heron Road, Moss Point, MS 39562; [2]Department of Biology, Jackson State University, Jackson, MS 39217
3:00	**Effects of Salinity and Herbicide Exposure in Seagrass.** Mintz, M. M.[1], R. D. Sieg[1,2], K. M. Major[1] and A. A. Boettcher[1]. [1]Department of Biological Sciences, University of South Alabama, Mobile, AL 36688; [2]Biology Department, University of Richmond, Richmond, VA 23173
3:20	**System-Integrated Benthic Metabolism Across a Gradient of Human Alteration and Seagrass Abundance in Shallow Coastal Lagoons of the North Central Gulf Of Mexico.** Cebrian, J.[1,2], J. Stutes[1,2], A. L. Stutes[1,2], A. Hunter[1,2] and A. A. Corcoran[1,2]. [1]Dauphin Island Sea Lab, Dauphin Island, AL 36528; [2]Department of Biology, University of South Alabama, Mobile, AL 36688
3:40	**Discussion**
5:00	**Poster Presentation Session Begins – Concourse**

Water Quality Session II

Room 201 A

Wednesday, November 29, 2006

Chairs: Dr. Hugh MacIntyre, Dauphin Island Sea Lab
Mr. James McIndoe, Alabama Department of Environmental Management
Ms. Jennifer Buchanan, Grand Bay National Estuarine Research Reserve
Ms. Barbara Viskup, Mississippi Department of Environmental Quality

Time	Title and Authors
9:00	**Temporal Variability in Summertime Bottom Hypoxia in Shallow Areas of Mobile Bay, Alabama.** Park, K.[1], C.-K. Kim[1] and W. W. Schroeder[2]. [1]Department of Marine Sciences, University of South Alabama, Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528; [2]Marine Science Program, University of Alabama, Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528
9:20	**Hypoxia Recurs in August 2006 Seaward of the Western Mississippi - Alabama Barrier Islands.** Brunner, C. A. and S. D. Howden. Department of Marine Science, University of Southern Mississippi, Stennis Space Center, MS 39529
9:40	**Modeling of Physical Transport in Mobile Bay, Alabama.** Park, K.[1], C.-K. Kim[1], H.-S. Jung[1] and W. W. Schroeder[2]. [1]Department of Marine Sciences, University of South Alabama, Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528; [2]Marine Science Program, University of Alabama, Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528
10:00	**Suspended Sediment Transport in Mobile Bay: Remote Sensing and Numerical Modeling.** Zhao, H. [1], Q. J. Chen[1] and Q. Zheng[2]. [1]Department of Civil and Environmental Engineering, Louisiana State University, Baton Rouge, LA 70803; [2]Department of Meteorology, University of Maryland, College Park, MD 20742-2425
10:20	***Break***
10:40	**Optical Detection and Assessment of Red Tide Events in the Gulf of Mexico.** Lohrenz, S.[1], M. Butterworth[1], S. Craig[2], Z. Lee[3], G. Kirkpatrick[4] and O. Schofield[5]. [1]Department of Marine Science, University of Southern Mississippi, Stennis Space Center, MS 39529; [2]Department of Oceanography, Dalhousie University, 1355 Oxford Street, Halifax, NS B3H 4J1; [3]Naval Research Laboratory, Stennis Space Center, MS 39529; [4]Mote Marine Laboratory, 1600 Ken Thompson Parkway, Sarasota, FL 34236; [5]Institute of Marine and Coastal Science, Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901

Time	Title and Authors
11:00	**Sediment Factors Contribute to High Enterococcal Counts Along the Beaches of the Northern Gulf of Mexico.** Townsend, J.[1], J. Ufnar[1], D. Ufnar[2], S. Wang[1] and R. D. Ellender[1]. [1]University of Southern Mississippi, Department of Biological Sciences, Hattiesburg, MS 39406; [2]University of Southern Mississippi, Department of Geography and Geology, Hattiesburg, MS 39406
11:20	**Tracking Human Pollution in the Aquatic Environment Using Mitochondrial DNA.** White, J. L., J. A. Ufnar, S. Y. Wang and R. D. Ellender. Department of Biological Sciences, University of Southern Mississippi, Hattiesburg, Mississippi 39406
11:40	**Analysis of Fecal Loadings Into Bayous Grande, Chico, and Texar in the Pensacola Bay System, FL.** Snyder, R. Center for Environmental Diagnostics and Bioremediation (CEDB), University of West Florida, Pensacola, FL 32514
12:00	***Lunch and Guest Presentation***
1:30	**Fluorescent Whitening Agents as Facile Anthropogenic Pollution Indicators in Estuarine and Surface Waters.** Cioffi, E. A. Department of Chemistry, University of South Alabama, Mobile, AL 36688
1:50	**Responsiveness of Microbial Biofilms as Indicators of Estuarine Condition.** Snyder[1], R, J. Allison[1], S. Lee[1], J. Lepo[1], J. Moss[1], A. Nocker[2] and M. Wagner[1]. [1]Center for Environmental Diagnostics and Bioremediation (CEDB), University of West Florida, Pensacola, FL 32514; [2]Center for Biofilm Engineering, Montana State University, Boseman, MT 59717
2:10	**A GIS-Based Report Card : An Effective Tool to Monitor and Manage the Changes in the Environmental Quality of the Bay of St. Louis, MS.** Sawant, P. A., D. G. Redalje, E. A. Rowe, M. J. Natter, R. J. Pluhar and E. A. Kirk. Department of Marine Science, University of Southern Mississippi, Stennis Space Center, MS 39529
2:30	**Discussion**

Habitat Management

Room 201 B

Wednesday, November 29, 2006

Chairs: Dr. LaDon Swann, Mississippi-Alabama Sea Grant Consortium
Ms. Leslie Craig, National Oceanic and Atmospheric Administration
Dr. Judy Stout, Mobile County Board of Education
Ms. Nicole Vickey, The Nature Conservancy

Time	Title and Authors
9:00	**Opening Talk - Historical Status & Trends.** *LaDon Swann*, Mississippi-Alabama Sea Grant Consortium and Auburn University Department of Fisheries and Allied Aquacultures
9:30	**The Effect of Eutrophication on the Ecosystem Services Provided by Mixed Seagrass (*Halodule wrightii* and *Ruppia maritima*) Meadows.** Antón, A.[1], J. Cebrián[1] and C. D. Foster[2]. [1]Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528; [2]Santa Barbara Zoological Gardens, 500 Niños Drive, Santa Barbara, CA 93101
9:50	**Fate and Effects of Anthropogenic Chemicals in Seagrass Meadows.** Lewis, M. A. U. S. Environmental Protection Agency, Gulf Ecology Division, Gulf Breeze, FL 32561
10:10	**Measuring Saltmarsh Productivity under Piers.** Biber, P., J. D. Caldwell, G. McCardle and A. Karels. University of Southern Mississippi, Gulf Coast Research Laboratory, 703 East Beach Drive, Ocean Springs, MS 39564
10:30	***Break***
10:50	**Development of Trophic Interactions in Restored Salt Marshes.** Bolt, C. R.[1,2], Moody, R. M.[1,2] and R. B. Aronson[2,1]. [1]University of South Alabama, University Boulevard, Mobile AL 36688; [2]Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island AL 36528
11:10	**Evaluating Indicators of Macrobenthic Community Structure and Function for Tracking Marsh Restoration Success: A Comparison of Created and Reference Marsh Islands within Davis Bay, Mississippi, after 25 Years**. Rakocinski, C. F. and H. J. Ferguson. Department of Coastal Sciences, University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS 39564
11:30	**The Use of Remote Sensing to Evaluate Plant Species Richness on Horn Island, Mississippi.** Lucas, K. L. and G. A. Carter. Department of Coastal Sciences, Gulf Coast Geospatial Center, University of Southern Mississippi, Ocean Springs MS 39564
12:00	***Lunch and Guest Presentation***

Time	Title and Authors
1:30	**Mapping Privately-Protected Lands in the Southeast as a Tool for Resource Protection.** Olsenius, C. Southeast Watershed Forum, Nashville, TN 37228
1:50	**Impacts of the Mobile Bay Causeway on Ecosystem Structure and Function in the Lower Mobile - Tensaw Delta**. Valentine, J. F., S. A. Sklenar, C. Martin and M. Goecker. Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528
2:10	**Using Otolith Microchemistry of Spotted Seatrout to Determine Important Regions of Nursery Habitat Across Coastal Mississippi.** Comyns, B. H.[1], C. F. Rakocinski[1], M. S. Peterson[1] and A. M. Shiller[2]. [1]Department of Coastal Sciences, University of Southern Mississippi, Ocean Springs, MS 39566; [2]Department of Marine Science, University of Southern Mississippi, Stennis Space Center, MS 39529
2:30	**Alabama Fishery Habitat Creation and Restoration**. Duffy, J. J. Alabama Marine Resources Division, PO Box 189, Dauphin Island, AL 36528
2:50	***Break***
3:10	**Conversion of a Manmade Beach to a Natural Beach and Management for 12 Years in Biloxi, MS.** Melby, P. and T. Cathcart. Mississippi State University, Center for Sustainable Design, Mississippi State University, MS 39762
3:30	**Alabama and Mississippi Online Habitat Conservation, Restoration and Enhancement Database.** Swann, R. A.[1], L. Hu[2] and L. Swann[3]. [1]Mobile Bay National Estuary Program, Mobile, AL 36615; [2]Dauphin Island Sea Lab, Dauphin Island, AL 36528; [3] Mississippi-Alabama Sea Grant Consortium, Department of Fisheries and Allied Aquacultures, Auburn University, Ocean Springs, MS 39564
3:50	**The Use of Living Shorelines to Stabilize a 25 Acre Salt Marsh on Dauphin Island, Alabama.** Swann, L. Mississippi-Alabama Sea Grant Consortium, Department of Fisheries and Allied Aquacultures, Auburn University, Ocean Springs, MS 39564
4:10	**Discussion.**

Natural Hazards and Coastal Development

Room 201 C

Wednesday, November 29, 2006

Chairs: Ms. Tina Sanchez, South Alabama Regional Planning Commission
Ms. Tina Shumate, Mississippi Department of Marine Resources
Dr. Rebecca J. Allee, NOAA Coastal Service Center

Time	Title and Authors
9:00	**Opening Talk - Historical Status & Trends.** *Ecosystem-based Management for Hazards Mitigation, Rebecca J. Allee*, National Oceanic & Atmospheric Administration, Gulf Coast Services Center
9:30	**Characteristics and Physical Impacts of Katrina, Rita, and Ivan.** Johnson, D. R.[1], D. S. Ko[2] and W. J. Teague[2]. [1]Gulf Coast Research Lab, University of Southern Mississippi, Ocean Springs, MS 39564; [2]Naval Research Lab, Stennis Space Center, MS 39524
9:50	**Planning & Policy-Making for Sustainable Recovery with Coastal Hazards in Mind.** Miller, J., Department of Marine Resources, Office of Recovery and Renewal, Office of Governor Haley Barbour, 1141 Bayview Avenue, Biloxi, MS 39530
10:10	**NOAA Large Area Surveys of Mobile Bay and Other Nearshore and Bays of Alabama.** Osborn, T. and C. Moegling, NOAA Office of Coast Survey, 646 Cajundome Boulevard, Lafayette, LA 70506
10:30	***Break***
10:50	**Mississippi/Alabama Hurricane Evacuation Study.** Long, B. Department of Homeland Security, Federal Emergency Management Agency
11:10	**FEMA NFIP Flood Mapping Project in Mississippi - Post Katrina Revised Coastal Mapping & Project Initiatives.** Lowe, R. Department of Homeland Security, Federal Emergency Management Agency
11:30	**The Community Growth Readiness Initiative: A Watershed-Friendly Approach to Growth and Development.** Olsenius, C. Southeast Watershed Forum, Nashville, TN 37228
12:00	***Lunch and Guest Presentation***
1:30	**The Impact of Tropical Storms on the Primary Productivity and metabolism of shallow coastal lagoons.** Goff, J.[1], K. Sheehan[1,2], J. Stutes[1], D. Patterson[1], M. Miller[1,2], D. Foster[1] and J. Cebrian[1,2]. [1]Dauphin Island Sea Lab, Dauphin Island, AL 36528; [2]Department of Biology, University of South Alabama, Mobile, AL 36688

Time	Title and Authors
1:50	**Effects of Hurricane Katrina on an Incipient Population of *Salvinia molesta* in the Lower Pascagoula River, Mississippi.** Diaz, D.[1], W. Devers[1], B. Breazeale[1], J. Clark[1], G. Larsen[1] and P. Fuller[2]. [1]Office of Marine Fisheries, Mississippi Department of Marine Resources, Biloxi, MS, 39530; [2]Florida Integrated Science Center, United States Geological Survey, Gainesville, FL 32653
2:10	**Changes in Vegetative Cover on the Mississippi Sound Barrier Islands during Hurricane Katrina.** Carter, G., K. Lucas, E. Otvos and A. Criss. Gulf Coast Geospatial Center and Department of Coastal Sciences, University of Southern Mississippi, Ocean Springs MS, 39564
2:30	**Discussion.**

Poster Presentation Session
Concourse
Tuesday, November 28, 2006

Poster No.	Title and Authors
1	**Water, Weather, and the Coast: An Overview of the National Estuarine Research Reserve System-Wide Monitoring Program.** Woodrey, M.[1,2], S. White[3], S. Phipps[4] and C. Walters[2]. [1]Coastal Research and Extension Center, Mississippi State University, Biloxi, MS 39532; [2]Grand Bay National Estuarine Research Reserve, Moss Point, MS 39562; [3]National Oceanic & Atmospheric Administration, Estuarine Reserves Division, Silver Spring, MD 20910; [4]Weeks Bay National Estuarine Research Reserve, Fairhope, AL 36532
2	**The System-Wide Monitoring Program at Weeks Bay National Estuarine Research Reserve: Monitoring Short-Term Variation and Long-Term Change.** Phipps, S. W. Alabama Department of Conservation and Natural Resources, State Lands Division, Coastal Section, Weeks Bay National Estuarine Research Reserve, 11300 U. S. Highway 98; Fairhope, AL 36532
3	**Assessment of Water Quality and Nutrient Data for the Grand Bay NERR.** Dillon, K. S.[1], C. Walters[2] and M. Woodry[2,3]. [1] University of Southern Mississippi, Gulf Coast Research Lab, [2] Grand Bay National Estuarine Research Reserve; [3]Mississippi State University
4	**Real-Time Hydrographic and Meteorological Monitoring in Mobile Bay for Research and Education.** Dardeau, M. R. Dauphin Island Sea Lab, 101 Bienville Boulevard, Dauphin Island, AL 36528
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Abstracts

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Alabama Inshore Recreational Fishing Survey

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In order to gain a better understanding of recreational angler's impact on important inshore fish species, the Alabama Marine Resources Division has utilized an aerial-roving creel survey. This survey design allows AMRD to gather information on overall fishing effort and characterize inshore recreational catches. Data collected from 2000-2005 was reviewed for angler preferences, estimates of angler effort (trips) and both catch and harvest per unit of effort were calculated for the top four species interviewed anglers were targeting; spotted seatrout *Cynoscion nebulosus*, sand seatrout *Cynoscion arenarius*, red drum *Sciaenops ocellatus*, and southern flounder *Paralichthys lethostigma* .

The Effect of Eutrophication on the Ecosystem Services Provided by Mixed Seagrass *(Halodule wrightii* and *Ruppia maritima*) Meadows

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Seagrass meadows provide important services to the surrounding ecosystem, as they serve as shelter for fauna and provide food for autochthonous and allochthonous consumers. Seagrasses are declining worldwide, in part due to anthropogenic eutrophication. Despite a large number of studies examining the impact of eutrophication on diverse coastal systems, little is known about how eutrophication affects the ecosystem services provided by seagrass meadows. Eutrophication can be expected to alter the structure and function of seagrass communities, and thus, the ecosystem services that they provide. During late spring and summer 2005, we experimentally added nutrients in a mixed seagrass meadow *(Halodule wrightii* and *Ruppia maritima)* in the northern Gulf of Mexico (Sandy Bay, Bayou la Batre, Alabama). A nearby seagrass area (approx. 300 m to the south) was not altered, but examined to allow for comparisons with the nutrient enriched area. Preliminary results reveal a decrease in the amount of shelter provided to fauna by the seagrass community through a decrease in total plant biomass and density. Accordingly we found decreases in the abundance of seagrass-associated epibenthic and semi-demersal fauna (mainly fish, shrimp and crab) in the nutrient-added plots. A plausible cause for the reduction of seagrass and associated fauna abundance in the nutrient enriched area seems to be the toxic effect of the experimentally elevated nitrogen concentration on seagrass physiology and growth. Most of the negative impacts of anthropogenic eutrophication on seagrass systems reported in the literature occurred through the indirect effect of an increase in nutrients (the appearance of algal blooms and the resulting decrease in light and oxygen availability). However, our results indicate that eutrophication can have a direct negative effect (nitrogen toxicity) on seagrass meadows and can dramatically alter the functioning and services of seagrass systems.

Worldwide Phylogeography of the Invasive Jellyfish *Phyllorhiza punctata*

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The so-called 'Australian spotted jellyfish', *Phyllorhiza punctata*, drew wide-spread attention when it appeared suddenly and in spectacular numbers in the northern Gulf of Mexico during the summer of 2000. Since then, regional spreading has occurred into Texas and Florida, and a permanent population appears established in southern Louisiana. *Phyllorhiza punctata* was first described from Pt. Jackson, Australia, and, presumably due to its large medusa phase, has a relatively well-documented history of invading tropical and subtropical environments around the globe over the past 200 years. This well-documented history of invasion may make *P. punctata* a particularly instructive model for understanding invasions of jellyfish in particular, and of invasive marine species in general. The potential ecological and economic impacts of *P. punctata* were judged as high, and it was feared that the ecology of the northern Gulf of Mexico would be altered permanently, along with the valuable fishing industry that depends on it. These fears were fueled by the costs of *P. punctata* to the shrimp industry -- for Mississippi alone, these have been estimated to be US $ 10 million for 2000.

The occurrence of the very large population estimated at 10×10^6 medusae across the north-central Gulf of Mexico (Alabama, Mississippi, and Louisiana) in the summer of 2000 was unexpected, as the species had never been documented north of the Caribbean Sea. The timing of the occurrence was coincident with the incursion of tropical water from the Caribbean into the Gulf of Mexico suggesting that medusae were transported out of the Caribbean Sea by the northward-flowing Loop Current in the Gulf of Mexico. The question of invasive history and translocation was addressed through a series of studies funded primarily by the Mississippi-Alabama Sea Grant Consortium.

In order to examine the invasion pathway of this jellyfish, we collected and analyzed morphological and genetic data for animals from various geographic regions across the native and introduced range of *P. punctata.* Morphological comparisons between populations showed that jellyfish in the Gulf of Mexico were more similar to the invasive population of southern California and native populations of southern Australia. However, the Puerto Rico population, presumably a source for the Gulf invasion, was morphologically dissimilar from Gulf invaders. All genetic data indicate that no invasive jellyfish came from the sampled 'type-locality' of Pt. Jackson, Australia. Moreover, DNA sequence data indicate that two distantly related taxa (possibly different species) exist and have hybridized at some point (either pre- or post-invasion). Interestingly, mitochondrial DNA sequences indicate that all historical invasions were independent of each other, and each invasion was accompanied by extreme founder effects, as evidenced by each region possessing a single haplotype. In summary, *Phyllorhiza punctata* has proven to be an interesting marine bioinvader in that it appears to have invasive tendencies that confound current models of translocation across and within ocean basins.

Identification and Analysis of a Phage-displayed Novel Peptide for the Detection of *Vibrio* spp. in shellfish Using FACS

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A novel 7-mer phage-displayed peptide, which is capable of targeting clinically important *Vibrio* spp. was identified in shellfish using the NEB Ph.D. 7 phage library. The selected peptide, exhibiting the consensus sequence, was labeled with Alexa Fluor® 488 fluorescent dye and an "intact cell"-based detection assay using the fluorescence-activated cell sorting (FACS) method was developed. This peptide was shown to be specific for the detection of seven disease-causing clinically important *Vibrio* spp. Non-*Vibrio* bacterial species did not exhibit binding to this phage-displayed peptide. Detection of artificially contaminated *Vibrio* spp. with an initial inoculum of 10 CFU per gram of oyster tissue was achieved following overnight enrichment. Currently, there are no specific guidelines for the minimum level of detection of some of the pathogenic *Vibrio* spp. in shellfish. However, an increase in the number of disease incidents caused by marine *Vibrio* spp. other than *V. cholerae*, *V. parahaemolyticus*, and *V. vulnificus*, heightens the need for a comprehensive detection strategy for monitoring pathogenic *Vibrio* spp. in shellfish, thereby helping to protect consumer health, and the shellfish industry from financial losses.

Using PAM Fluorescence to Determine Salinity Tolerance of *Salvinia molesta* (Giant *Salvinia*)

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Aquatic plants can be grouped into 3 types: emergent, floating, and submerged. Some of the most successful invasive aquatic plants are in the floating group (e.g., *Eichhornia crassipes* and *Salvinia molesta*). These plants exhibit rapid growth rates, rapid nutrient uptake rates, and are released from competition with other plants for space. The degree of impact of these species on a freshwater body can be illustrated by *Salvinia molesta*, which can grow from 1 plant to 67 MILLION plants in just 2 months! (MS DMR, 2006). *Salvinia molesta*, one of top ten worst invasive aquatic weeds in the world, was discovered in the lower Pascagoula Delta in 2005. Evidence suggests that this species is spreading into the northern Gulf of Mexico (GoM). Distributional observations by the MS DMR suggest that *S. molesta* is able to survive in salinities of up to 7 ppt in the lower Pascagoula Delta. This is a higher salinity tolerance than has been reported in the past, and has implications for the use of the biological control agent (weevil) on this infestation.

We tested the response of plants of *S. molesta* plants collected from the Pascagoula Delta to three salinity levels: 0, 5, 10 ppt. Plants were allowed to recovery from field collecting and transport for 10 days prior to starting the experiment, most plants by this time were producing new leaves. Using PAM fluorescence we measured the health of the plants over the period of one month, using a decreasing series of observation intensity (hourly, daily, weekly). Plant responses indicated an acute salinity effect after about 4-6 hours and then a gradual chronic decline. Only plants in the control (0 ppt) treatment showed significant new growth. Plants in 5 ppt appeared to be maintaining themselves, but plants at 10 ppt all exhibited signs of severe stress and loss of color, turgor, and tissue viability after about 10 days. Pros and cons of use of PAM fluorescence in salinity tolerance trials will be discussed.

Measuring Saltmarsh Productivity under Piers

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We are measuring photosynthetically available radiation (PAR) under pier structures to determine the amount of saltmarsh plant shading piers cause. Shading by piers is a major concern for agencies tasked with protecting coastal wetlands. Regulations frequently require a minimum pier height and board spacing to ensure light reaches plants under the pier. In Mississippi (MS), and in many states nationwide, this requirement is set at 4ft above the marsh or plant canopy height +1 ft, and board spacing of 0.75", with a recommended pier width of 4 ft over marsh. These regulations are not based on a scientific assessment of shading impacts. We have sampled 30 piers in coastal MS for a total of 63 perpendicular PAR profiles under these piers. Shading was routinely greater than 90% of incident sunlight. Since July we have been measuring light under selected pier combinations to determine the difference that structure height, width, and board spacing have. More research will be needed to investigate minimum light requirements of *Juncus* (Black Needle Rush) and *Spartina* (Smooth Cordgrass), two of the most common species in MS

Measuring Ecosystem Development in Restored Salt Marshes on the Gulf Coast

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Salt-marsh restoration projects, which are routinely constrained by logistical and financial considerations, generally go no further than the mere replanting of marsh grasses. But does replanting by itself guarantee that natural patterns and processes will ensue, and on what time scale? We are examining the successional trajectories of restored *Spartina alterniflora* marshes along the Gulf Coast to determine if and when created habitats converge on natural habitats in terms of ecosystem function. We are comparing community structure (i.e., biomass, species diversity and species evenness) between restored and reference marshes using 1) flume nets and pit traps to study the mobile epifauna and 2) sediment cores to study the infauna. We are evaluating energy flux using gut-content and fecal analyses of the predatory blue crab, *Callinectes sapidus*. Finally, we are comparing the critical predator-prey relationship between *Callinectes* and the marsh periwinkle *Littoraria irrorata* between created and reference marshes. This combination of static and dynamic measures suggests that some approximation of normal ecosystem function is re-established on a decadal time scale.

Mercury in the Mobile-Alabama River Basin (MARB) and Gulf Island National Park Network (GULN)

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In the past decade, mercury (Hg) concentrations above levels that could pose human health risks have been measured in predatory fish from many rivers and reservoirs in the southeastern region of the United States. This study focused on the MARB and water bodies found in the GULN. In the MARB, Total mercury (THg) and methyl-mercury (MeHg) levels in water, sediment, and largemouth bass (*Micropterus salmonides*) samples were collected from several sites where: (1) nutrient loading from certain land-use activities and increased sedimentation above water impoundments develop conditions favorable for MeHg production, (2) increased sulfate loading from energy resource extraction operations result in increased MeHg production, (3) abundant wetlands within the MARB contribute to MeHg loads downstream and in fish, and (4) fish tissue levels of Hg are related to levels of Hg in river waters and to net rates of MeHg production in sediments. We found that aqueous THg was positively associated with Fe-rich suspended particles and highest in catchments impacted by agriculture. Sediment THg was positively associated with sediment organic matter and iron content, with the highest levels observed in smaller catchments influenced by wetlands, followed by those by agriculture or mixed forest, agriculture, and wetlands. The lowest sediment THg levels were observed in main river channels, except for reaches impacted by coal mining. Sediment MeHg levels were a positive function of sediment THg, organic matter, and aqueous nutrient levels. The highest levels occurred in agricultural catchments and in those impacted by elevated sulfate levels associated with coal mining. Aqueous MeHg concentrations in main river channels were as high as those in smaller catchments impacted by agriculture or wetlands suggesting these areas were sources to wetlands. Elevated THg levels in some largemouth bass specimen were observed across all types of land use and land cover, but factors such as shallow water depth, large wetland catchment surface area, and high chlorophyll *a* concentrations were associated with higher Hg burdens, particularly in the Coastal Plain Region. In Gulf Island National Park Network (GULN), the study was designed to assess both the levels and the extent of Hg contamination in different environmental compartments of selected park units and to determine the potential of sediments in these parks to produce and accumulate MeHg. The obtained results show low THg and MeHg levels in both water and sediment collected from most of the park units, which can be considered non-polluted based on background values reported in the literature. In addition, the ability of sampled sediments to produce and accumulate MeHg appears to be low as they tend to favor the degradation of MeHg over its production.

The Alabama-Mississippi Clean Marina Program

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Traditional coastal economies were once dominated by shipping, commercial fishing, defense and manufacturing. The coastal population has increased in recent years, yielding a shift in economic dominance from the production sectors to service sectors such as recreational boating, tourism, property development and marine service trades. With this shift comes the potential increase of stormwater pollution, and in a coastal economy, water quality is an essential part of a successful equation.

The Alabama-Mississippi Clean Marina Program was established in June, 2004. Part of a national initiative to combat nonpoint source pollution, this voluntary, non-regulatory program promotes marinas that use best management practices to minimize potential pollution sources within their business. Over time, the Clean Marina program will help to encourage marina operators to use more responsible practices, inform boaters of environmentally sensitive practices, and create better communication of existing laws by offering recognition for creative and proactive marina operators implementing these practices.

Despite two challenging hurricane seasons, Alabama has so far designated three marinas as Clean Marinas: Zeke's Landing Marina in Orange Beach, Dog River Marina in Mobile and Harbor Pointe Marina in Dadeville. There are several more marinas in Alabama pledged to work towards becoming a Clean Marina. Likewise, Mississippi has also designated four marinas: the Beau Rivage Marina, Palace Casino Marina, Point Cadet Marina in Biloxi, and Columbus Marina in Columbus. Mississippi lost almost 70% of their slips along the coast due to Hurricane Katrina, and three of the four Clean Marinas were destroyed. Over 90% of coastal MS marinas surveyed have said they will be rebuilding with Clean Marina standards in mind.

Hypoxia Recurs in August 2006 Seaward of the Western Mississippi-Alabama Barrier Islands

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Seasonal hypoxia is a recurrent problem on many continental shelves and is well known, in particular, on the Louisiana shelf. Less well known is its incidence in the Mississippi bight. Recent evidence confirms that hypoxia recurred during at least two years on the shelf seaward of the western Mississippi-Alabama barrier islands. Anecdotal reports from several decades have suggested that hypoxia recurs sporadically in this area, and in 2004 the Mississippi Department of Marine Resources measured hypoxia in 3 casts in late July to late August at Fish Haven 2 (FH-2) south of Horn Island as part of a year-long monthly monitoring effort in 2003-2004. Geologic evidence also points toward a hotspot of hypoxic activity in the vicinity of FH-2, based on foraminifer assemblages in surface sediment samples collected during the 1950s.

In August of 2006, a grid of 22 sites was occupied seaward of Ship, Horn, and Petit Bois Islands along the 10-m and 20-m isobaths. At most sites, weather permitting, the following were collected: (1) casts for conductivity, temperature, depth, dissolved oxygen, turbidity, current direction, and current speed; and (2) water samples to calibrate the casts for oxygen, turbidity, and salinity. Oxygen was measured using a YSI 6030 probe, a Sea-Bird SBE 43 probe and Winkler analyses of bottom and surface water samples to calibrate the oxygen probes.

Results clearly showed a discrete region of bottom-water hypoxia and the physical conditions associated with shelf hypoxia. Bottom water at 11 sites had values <3.0 mg/L, and bottom waters were unarguably hypoxic (<2.0 mg/L) at 7 sites, 4 of which were confirmed by Winkler analyses of water samples and the remaining 3 sites had water-sample values <2.8 mg/L. The hypoxic "hotspot" (<2.0 mg/L) extended seaward to ~20 m water depth near FH-2 and extended along the 10-m isobath from Ship Island to Petit Bois Pass, where bottom-water oxygenation increased to ~3 mg/L. The water column was highly stratified throughout the region, consistent with isolation of deep waters from atmospheric refreshment.

Sources and Sinks of Nitrogen in Weeks Bay, AL

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Weeks Bay is an agricultural watershed being converted to suburban developments. NO_{3-} concentrations in Weeks Bay responded to runoff events. An *in situ* NO_{3-} analyzer was deployed at the head of Weeks Bay. Hourly NO_{3-} concentrations were measured between January and March 2001, June and July 2001 and in November 2001. Following rainfall events, NO3- concentrations at the head of Weeks Bay ranged between 0 and 80 µM over a tidal cycle as high salinity, low NO_{3-} water entered the Bay on flood tides and low salinity, high NO_{3-} water entered the Bay on ebb tides. Concentrations were generally higher in winter and spring compared with the summer. A negative relationship between NO_{3-} concentration and salinity was evident during all deployments demonstrating a tight linkage between river flow and NO_{3-} input to Weeks Bay. NO_{3-} was the dominant form of DIN in Weeks Bay, with NH_{4+} concentrations representing less than 1% of DIN. Diurnal changes in dissolved oxygen concentration were used to estimate rates of primary production and respiration. In the lower Fish River and at the mouth, primary production was enhanced following runoff events. In 2004 and 2005, we measured porewater ammonium, phosphate and sulfide, solid phase iron and sediment CNP content at sites in mid Weeks Bay and the lower Fish River next to the NERR SWMP sites. Potential nitrification, benthic fluxes and denitrification were also measured at these locations. The sediment organic content averaged 2.4% and 7.3% (LOI) at Fish and mid sites respectively. Porewater NH_{4+} and DIP concentrations were higher in mid Bay than in the Fish River. Potential nitrification rates ranged from almost 0 to 1.6 µmol/g/d with higher rates in the Fish River than in mid Bay. The Fish River site also had higher NO_{3-} fluxes into the sediment and denitrification rates than at the mid Bay site, probably due to the higher NO_{3-} concentrations in the River compared to the Bay.

Hourly-to-Monthly Variability in Environmental Forcing Factors and the Response of Phytoplankton in Weeks Bay, Alabama

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With projected increases in nutrient loading into Weeks Bay, it is essential to understand the effects of increased nutrient loading on phytoplankton productivity. It is well understood that the dynamics of phytoplankton productivity in turbid estuaries are driven by short-term (hours and days) variability in the availability of light and nutrients. We compared short-term (hours and days) and long-term (seasonal) variability in the factors that determine productivity in Weeks Bay, Alabama. Short-term variability in biomass, spectral light attenuation, and nitrate was determined hourly at a fixed station using in-water optical sensors during two fixed-station monitoring periods. Monthly transects were used to account for long-term variability in phytoplankton biomass, light attenuation and nitrogen loading. Our results show that the variability of environmental forcing and phytoplankton response is comparable between short and long-term timescales. The implication of the results is that high frequency (hourly to daily) monitoring is needed in turbid estuaries to accurately quantify phytoplankton productivity.

Changes in Vegetative Cover on the Mississippi Sound Barrier Islands during Hurricane Katrina

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The Mississippi Sound barrier islands, which from west-to-east include Cat, West Ship, East Ship, Horn, Petit Bois and Dauphin, insulate the mainland coast, 13-20 km to the north, from the higher wave energies of the open Gulf of Mexico. This role of barrier islands is particularly critical during tropical storms and hurricanes. However, the protective capacity of the Mississippi Sound islands was overwhelmed dramatically by the force of Hurricane Katrina on August 29, 2005. As Katrina passed due west of the islands along its northerly path (lat. 30.2 deg. N., long. 89.6 deg. W.), minimum distance from the eye of the storm to island center ranged from 48 km (Cat) to 133 km (Dauphin). Consequently, the westernmost islands were subjected to greater wind speed, storm tide depth and wave energy. Approximate ranges in maximum sustained wind speed and tide depth were 200 to 140 km/h and 7 to 2 m for Cat and Dauphin, respectively. Satellite image data acquired for each island before and one week after Katrina were compared to determine immediate storm impact on total vegetative cover. Analyses based on the normalized difference vegetation index (NDVI) indicated losses in vegetative cover of 0, 6, 2, 114, 46 and 39 ha (0, 8, 17, 16, 27 and 51 percent of pre-storm cover) on Cat, West Ship, East Ship, Horn, Petit Bois and West Dauphin, respectively. Thus, percentage loss in vegetative cover increased with distance from storm center, contrary to expected results. This was likely a consequence of the greater tidal depths and thus more extensive island submersion nearer the storm center which apparently reduced the scouring of vegetation by waves and currents during the period of maximum storm energy.

System-Integrated Benthic Metabolism across a Gradient of Human Alteration and Seagrass Abundance in Shallow Coastal Lagoons of the North Central Gulf of Mexico

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Seagrasses are being lost worldwide at alarming rates, most often due to anthropogenic effects, but few reports have examined how seagrass loss affects the metabolism of coastal systems. Here we contribute to this question by comparing both areal and system-integrated benthic metabolism rates across three lagoons in the North Central Gulf of Mexico that display varying levels of shoalgrass (*Halodule wrightii*) abundance (i.e., from 64% of the bottom covered with shoalgrass to 4% to 0%) partially due to contrasting anthropogenic pressure. When the two lagoons with shoalgrass were compared, shoalgrass patches featured higher areal rates of gross primary production and respiration, and, to a lesser extent, higher rates of net production, than did bare sediment. These results were robust despite across-lagoon differences in shoalgrass cover and areal biomass of shoalgrass and benthic microalgae (i.e., the lagoon with less cover had also lower areal shoalgrass biomass in the patches and higher areal microalgal biomass in the sediment). We did not find any consistent differences in the metabolic rates of bare sediment across the three lagoons, despite the fact that areal microalgal biomass in bare sediment increased as shoalgrass abundance decreased across the three lagoons. System-integrated rates of benthic gross primary production and respiration were higher in the lagoon with the highest shoalgrass cover when compared with the lagoons with little or no shoalgrass but, surprisingly, system-integrated rates of benthic net production did not differ significantly across lagoons. This result suggests that the large decrease in shoalgrass abundance across the lagoons examined does not affect greatly the lagoon's potential capacity for accumulation and/or export of organic carbon. It also underlines the importance of deriving system-integrated estimates to properly understand how decreasing seagrass abundance can alter the metabolism of coastal systems.

Fluorescent Whitening Agents as Facile Anthropogenic Pollution Indicators in Estuarine and Surface Waters

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Virtually all-major brands of laundry detergents contain one or more fluorescent whitening agents (FWAs). FWAs are anthropogenic, are not biodegradable, and reach receiving waters through wastewater. The feasibility of utilizing FWAs as a facile anthropogenic pollution indicator in estuarine and surface waters has been investigated. To field verify the overall method, control studies were performed within two WWTFs and their receiving waters. Spectral analyses of the FWAs investigated were initially performed on a spectrometer to determine the optimum excitation source and filter ranges for a portable field fluorometer. Environmental samples were filtered using 0.45 micron glass fiber filters to remove potentially interfering bioluminescent organisms and particulate matter. FWAs were extracted from the filtered samples and pre-concentrated using solid phase extraction (SPE)

tubes and eluted with an ion pairing reagent. Background fluorescence measured in environmental samples did not change before and after filtration, thus interference due bioluminescent organisms and particulate matter was considered negligible. Background fluorescence measured prior to solid phase extraction in unpolluted freshwater [< 0.5 ppt (parts-per-thousand) salinity] was approximately 71 - 79% higher than background fluorescence measured in estuarine water [25 - 30 ppt (parts-per-thousand) salinity] and marine water [> 30 ppt (parts-per-thousand) salinity], respectively. Subsequently, after SPE, background fluorescence in unpolluted freshwater, estuarine water, and marine were found very comparable (< 4.0% relative standard deviation). In addition, after SPE, the "apparent pH" (non-aqueous media) as well as conductivity were also comparable (1.6% and 11.3% relative standard deviation, respectively) indicating that environmental samples are comparable after SPE *regardless* of the sample matrix. Overall, the background fluorescence in environmental samples was lowered approximately 86% in freshwater, 50% in estuarine water, and 34% in marine water, and thus the overall limits of detection were dramatically lowered due to the reduction in background as well as the pre-concentration of the FWAs. The field fluorometer instrument detection level (IDL) was less than 0. 04 ppb (parts-per-billion), and the lower level of detection (LLD) of FWAs was less than 0.30 ppb (parts-per-billion). The SPE recoveries in environmental samples ranged from 71% to 124%, and the precision of the SPE method ranged from 0.4% to 5.4% (relative standard deviation). FWA concentrations were found to range from 95.1 to 128 ppb (parts-per-billion) in wastewater treatment facility (WWTF) influent and 78.2 to 98.1 ppb (parts-per-billion) in WWTF effluent during field verification studies performed at two facilities. FWA concentrations in estuarine and freshwater receiving waters ranged from 10.6 to 1.1 ppb and 72 to 0.7 ppb, respectively. In future studies, this validated method may be applied to help locate failing riverside or shoreline septic systems, or illicit connections to stormdrains.

Survey of Diamondback Terrapin (*Malaclemmys terrapin)* populations in Alabama Salt Marshes

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The demography and ecology of *Malaclemmys terrapin pileata* were studied in the salt marshes of southwestern Alabama during 2004–2006. A variety of methodologies were utilized in an attempt to obtain information on population density and nesting activity. This included head surveys and modified crab traps in salt marshes, depredated nest surveys and drift fences with pitfall traps on nesting beaches, and radio tracking of reproductive females. In 2004, twenty-four heads were spotted in eleven total surveys of Cedar Point Marsh, Airport Marsh, Mon Louis Creek, and Little Dauphin Island. Seventy-four depredated nests were found on the nesting beaches surrounding these marshes. In 2005, twenty-five heads were seen in seven surveys of the four marshes. However, only fifteen depredated nests were observed that year (primarily due to overwash of nesting areas due to a series of storms). In 2006, forty heads were observed in thirteen surveys, although these head surveys were completed only in Cedar Point and Jemison's Marsh. The nest surveys were concentrated on the beaches surrounding Cedar Point Marsh, where 109 depredated nests were found. Seven adult females were captured in the pitfall traps, and two females were captured while nesting. Seventeen terrapins were caught in the modified crab traps: two in Jemison's Marsh and fifteen in Cedar Point Marsh. All turtles were PIT tagged and their shells notched. A suite of morphological measurements as well as blood samples were collected. The blood samples will be used in both genetic and hormone studies of this population. The results suggest that limited populations of terrapins exist in the salt marshes of Alabama with the largest detected nesting aggregation occurring near Cedar Point. The stability and threats to the conservation of these populations are currently being examined in order to assess optimal management strategies.

Sediment Heavy Metal Concentrations and Associated Land Usage in Halls Mill Creek, Mobile, Alabama

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The Dog River Watershed is responsible for the drainage of the majority of the city of Mobile, AL into Mobile Bay. Halls Mill Creek and its tributaries cover the western portion of the watershed and flow through wetlands, forested, residential, and commercial areas. This portion is of particular interest for potential anthropogenic pollution due to increasing residential and commercial development throughout West Mobile. Stream characteristics and priority heavy metal concentrations in sediment samples were measured at ten sites on Halls Mill, Milkhouse and Second Creeks. Lead, copper and cadmium were analyzed by graphite furnace atomic absorption spectroscopy and zinc by flame atomic absorption spectroscopy. Heavy metal concentrations were found to vary throughout the stream's courses based on stream flow, sediment characteristics and to a larger extent land usage. Sites with enriched levels of metals did not exceed the EPA's chronic toxicity concentrations. Anthropogenic metal enrichment was attributed to storm water runoff from construction sites, impervious surfaces and roadways as well as recreational stream use and marine antifouling agents.

Using Otolith Microchemistry of Spotted Seatrout to Determine Important Regions of Nursery Habitat Across Coastal Mississippi

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Early juvenile spotted seatrout, *Cynoscion nebulosus* (n=199), were collected during late summer and autumn 2001 from shoreline habitats in nine coastal regions bordering Mississippi Sound in the north-central Gulf of Mexico to assess spatial patterns in otolith microchemistry as a tool for inferring where adults developed as juveniles. Left otoliths

were assayed from individual fish for trace element/Ca ratios of Ba, Li, Mg, Mn, and Sr, and right otoliths for 13C and 18O. A significant difference was found between concentrations of trace elements from the otoliths of fish collected in the nine regions (MANOVA, $P < 0.001$), and subsequent univariate ANOVAs showed that all seven otolith variables varied significantly among the nine regions ($P < 0.001$). Thus all seven otolith variables were potentially useful for regional classification within a Canonical Discriminant Function Analysis (CDFA). The first three of seven discriminant functions accounted for 97.5% of the cumulative variance in the seven otolith variables: 73.5% for CFD 1, 16.7% for CDF 2, and 7.3% for CDF 3. CDF 1 was influenced primarily by 18O and Li, CDF 2 by Mn and 13C, and CDF 3 by Ba and Mg. Considerable separation of the nine regional groups was illustrated by a plot of the 197 juvenile spotted seatrout along with regional centroids within the first two CDFA dimensions. The arrangement of group centroids along CDF 1 likely reflected differences in discharge regimes rather than geographical affinity, with Chandeleur Island specimens showing the strongest separation at the high end of the CDF 1 axis. Thus, otoliths of specimens from high salinity locations generally had higher 18O and lower Li concentrations. The overall percent of cases correctly classified was 93.4% when all 197 specimens were included within the CDFA. Classification success ranged from 83.3 to 100% among regions. During a subsequent phase of this study, adult spotted seatrout were collected in 2002 and 2003 from the same region.

Presenting Environmental Data Online Using a Customized ArcIMS® Map Viewer

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The ability to easily share geographical and associated environmental data among researchers, managers, planners, and the concerned public is an important and powerful tool. Data on water quality was collected during 2003-2004 by the Center for Fisheries Research & Development, The University of Southern Mississippi, as part of a larger series of studies to establish numerical criteria for nutrients in the State's coastal waters. The water quality study was made accessible using an interactive online Geographic Information System. The first step in the creation of the website was the development of a custom ArcIMS® DHTML viewer. The ArcIMS DHTML viewer is a collection of HTML and JavaScript files that dynamically generate map images of a specified Map Service based upon user interaction. The custom viewer maintains the uniform appearance of web pages in the website and its more efficient page layout provides more area for map images. The custom viewer becomes a template to generate all subsequent websites, allowing rapid deployment of new Map Services. (A Map Service is a process that runs on one or more ArcIMS® Spatial Servers.) Map Services are based on instructions written in ArcXML that specify the data sources to be used in the map and how to symbolize the different data layers.

Dispersion of Reef Fish around Two Artificial Reef Habitat Types in the Northern Gulf of Mexico

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The dispersion of reef fish was investigated between two types of commonly used material (Barge and Concrete Rubble) utilized for artificial reef habitat on Mississippi Fish Haven Two (FH-2). Fish traps were used to assess the dispersion around the habitat types. Six fish traps were used for each habitat, one on the material and five set out systematically at 20-meter distances away from the habitat types out to 100-meters on randomly selected cardinal compass points. Total catch shows a statistically significant difference between the habitat types. A total of 797 fish were caught (including recaptures). Five hundred and sixty three were caught on the concrete rubble habitat and 234 on the barge habitat. Traps fished on the concrete rubble, 20-meter, 40-meter, 80-meter and 100-meter distances caught greater numbers of fish than traps fished off the same distances from the Barge. Both red snapper and triggerfish catch show no statistically significant difference between the two habitat types. Red snapper show a statistically significant relationship between size vs. distance on both habitat types. Triggerfish show no statistically significant relationship between size vs. distance on both habitat types. Management implications on reef spacing and material performance are discussed.

Real-Time Hydrographic and Meteorological Monitoring in Mobile Bay for Research and Education

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The value of coastal observing systems is recognized by the U.S. Congress, the National Ocean Partnership Program, the Environmental Protection Agency, and the National Ocean and Atmospheric Administration. Recent reports by the Pew Oceans Commission and U.S. Commission on Ocean Policy have decried the lack of information from near coastal waters on which to base management decisions and recommended monitoring programs linked to strong research. Reasons for continuous, real-time observations of meteorological and hydrographic parameters include (1) continuous characterization of spatial and temporal patterns of change in water quality, (2) development of a permanent record of significant and human caused changes in environmental indicators over time and (3) support for research activities through the availability of consistent, scientifically valid data. An additional benefit of real-time observation is the potential for the public to track and learn about water quality conditions. Many coastal dwellers are uninformed about conditions in nearby estuaries because they do not have access to current information about parameters such as water temperature, salinity, dissolved oxygen levels and water level and they may fail to appreciate the complexity of interactions in estuarine ecosystems.

Dauphin Island Sea Lab and the Mobile Bay National Estuary Program have partnered with the University of South Alabama, Weeks Bay National Estuarine Research Reserve, the Alabama Department of Conservation, State Land Division, Coastal Program and the Alabama Lighthouse Association to provide real-time data on wind speed, wind direction, air temperature, barometric pressure, photosynthetically active radiation, precipitation, water temperature, dissolved oxygen, water height, and salinity at four sites located throughout Mobile Bay. These up to the minute data are available in a user-friendly format at www.mymobilebay.com. Informative pop-ups describe each parameter and graphs of each may be displayed by the visitor to the website. Researchers may upload the data in a spreadsheet format for further analysis.

Managing Alabama's Commercial Fisheries: The Alabama Trip Ticket Program

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Commercial seafood landings statistics are a primary tool of any fisheries manager. Landings play a vital role in stock assessments, quota monitoring, and assessing environmental and anthropogenic effects on those fisheries. In Alabama, a commercial trip ticket system, employed August 1, 2000, is used to capture this data. The trip ticket system is part of a Gulf-wide program aimed at collecting more precise landings and effort data. Unlike earlier data collection programs whose data were limited to monthly summaries, the trip ticket system collects these data elements at the trip level, allowing managers to identify catch rates and fishing pressures in a given area. Data elements collected consist of the primary area of harvest, primary gear used (including gear quantities and sizes), fishing and trip times, individual fisherman and vessel, and the landings of each species by landing condition and market count.

Alabama Water Watch - 14 Years of Community-Based Water Monitoring and Action

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Alabama Water Watch (AWW) is a citizen volunteer, water quality monitoring program that began in 1992 with primary funding from the Alabama Department of Environmental Management and the U.S. Environmental Protection Agency. The AWW Program is coordinated from Auburn University and provides training resources, technical backstopping, data management, outreach publications and monitor coordination. A nonprofit AWW Association advocates improved water quality and policy, and provides funding through grants and gifts for publishing AWW Waterbody Reports, supporting workshops and other monitoring activities. About 4,000 citizens have been AWW-certified to monitor physical, chemical and biological conditions of water using EPA-approved protocols. The AWW office has received more than 40,000 data records from 1,800 sites on 700 waterbodies statewide. Data records are submitted (about 80% online) to a customized database that allows volunteers to analyze, graph and access their information in a variety of ways. Long-term AWW water quality data sets containing several years of continuous monitoring appear comparable to professional data and have been used to identify pollution, take corrective actions and develop scientifically-based watershed management plans. AWW training materials and field protocols for stream biological monitoring have been adapted to the Alabama Course of Study Objectives to create a curriculum for grades 6-12, called *Living Streams*. Other environmental education initiatives are underway. AWW is at a crossroads, facing decreasing core funding, coincident with a decline in participating groups and data submission. Both the Program and Association are analyzing group dynamics and program potential, optimistically strategizing to sustain and grow a nationally-recognized water monitoring effort.

Effects of Hurricane Katrina on an Incipient Population of *Salvinia molesta* in the Lower Pascagoula River, Mississippi

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A population of the invasive aquatic plant, *Salvinia molesta*, commonly known as giant *Salvinia* was discovered in June 2005 in the Lower Pascagoula River in coastal Mississippi. By the time this infestation was first reported, the salinity intolerant weed had already spread to numerous waterways within the Pascagoula River and eradication by using herbicides was not practical. On August 18 2005, prior to Hurricane Katrina, Australian *Salvinia* weevils, *Cyrtobagous salviniae*, were introduced, as a control measure, at three sites in an effort to hinder the spread of giant *Salvinia*. Preventing the spread of giant *Salvinia* is extremely important as it is classified as one of the worst invasive aquatic weeds in the world. Under ideal conditions giant *Salvinia* can double its biomass in less than four days, clogging waterways with dense mats of vegetation. More troubling, is that this plant can out-compete native vegetation. It can cause a reduction in oxygen content rendering waterways uninhabitable by most fish species. Therefore, control measures are necessary.

The objective of this cooperative project between Mississippi Department of Marine Resources and the United States Geological Survey began May 1, 2006 to assess the impact of Hurricane Katrina on the distribution of giant *Salvinia* in the Lower Pascagoula River system in Mississippi. The river system is a large waterway which consists of hundreds of miles of rivers, bayous, canals, lakes and ponds. Two separate field surveys are being conducted. The initial survey was completed on August 9, 2006 and mapped the presence/absence of giant *Salvinia* and other identifiable aquatic invasive plants on approximately 300 miles of waterways in the lower Pascagoula River System. This survey found that the giant *Salvinia* population substantially decreased from pre-Hurricane Katrina levels. When populations of giant *Salvinia* were discovered the infested areas were sprayed with herbicides. A second survey will be conducted in October 2006 to monitor areas previously treated. In conjunction with the mapping project, water temperature and salinity measurements were taken at all sampling points.

Assessment of Water Quality and Nutrient Data for the Grand Bay NERR

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The annual tidal range of water levels at Grand Bay stations is approximately 1 meter throughout the year. Larger variations during the summer months can be caused by tropical systems. Unlike most estuarine systems, the GBNERR has no major freshwater inflow hence the rapid variations in salinity are due to local runoff. Salinities in the GBNERR can range from near zero to approximately 25 psu at the more landward stations, Bayou Heron (BH) and Bayou Cumbest (BC), to values of 10 to near 30 psu at the more seaward stations, Bangs Lake (BL), Crooked Bayou (CR) and Point Aux Chenes (PC). The lowest salinities are found during the summer wet season where salinities of 0 to approximately 10 psu can persist for two months throughout the system. Shorter depressions in salinities also occur due to winter storms. The pH of upland creeks (BH) decreases from 7 to 5 with the lowest values associated with rain events and resultant runoff from the marshes and uplands. Other stations' pHs ranged from 7 to 8 over a tidal cycle and appears to be due to tidal movement of marine water in and out of the system. Water temperatures ranged from 7 to 15 ºC during the winter to near 35 ºC during the summer. Daily fluctuations at any one station were typically 4-5 ºC. Dissolved oxygen concentrations were negatively correlated with temperature with the highest concentrations during the winter months (DO = 10-14 mg/L). Low DO concentrations during the summer were common in smaller creeks and bayous often becoming anoxic (0-2 mg O/L) for prolonged periods (days to weeks) due to higher temperatures and restricted water exchange. More seaward stations had daily DO minimums and maximum of 3-4 mg/L and of 6-8 mg/L, respectively, during the summer.

Measured nutrient (NH_4, NO_3, NO_2, and PO_4) concentrations of surface waters in the Grand Bay Reserve are typically low or undetectable. NH_4 is the dominant form of inorganic nitrogen with concentration range of 0-24 µM (0- 0.34 ppm) throughout the system although typical concentrations are <5 µM (0.07 ppm). NO_3 concentrations in the estuary were rarely greater than 2µM although a maximum concentration of 10µM was observed in December 2005 in Bayou Heron which is located at the mouth of a small creek that is greatly influenced by marsh runoff. Dillon (in prep) has shown that dissolved organic nitrogen (DON) concentrations in Grand Bay can be much greater then those of dissolved inorganic nitrogen (DIN) species. During October and November 2003, total dissolved nitrogen concentrations were 20-30 µM throughout the estuary while DIN concentrations were near or below the limits of detection. This suggests that monitoring only the inorganic nitrogen species ignores the dominant nitrogen pool in the system. Future SWMP monitoring at the GBNERR should include total nitrogen measurements to adequately characterize the nitrogen dynamics within the GBNERR.

During April 2005, there was a large amount of PO_4 introduced to Bangs Lake from a neighboring gypsum stack. This spill greatly reduced the pH of surface waters in Bang's Lake and increased PO_4 concentrations to 144µM (4.7 ppm). Concentrations fell to approximately 20 µM in May 2005 and remained between 10 and 20µM until September when concentrations dropped to <2µM. An increase of PO_4 was observed during November 2005 in Bangs Lake likely due to residual gypsum runoff that was washed into Bangs Lake by precipitation.

Alabama Fishery Habitat Creation and Restoration

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The Alabama Marine Resources Division has been involved in fishery habitat restoration and creation since the 1950s. Offshore, our agency has built the largest and most active reef system in the country, and in the past ten years, has overseen and participated in the deployment of over 1,000 individual reefs per year. Inshore, the rehabilitation and creation of oyster reef habitat and sport fish habitat has boomed, with such programs as the wildly popular Roads to Reefs effort, and annual oyster cultch plantings. Collectively, these programs have resulted in excellent and sustainable fisheries for sport fish and shellfish, and have garnered the attention and appreciation of conservation groups and management agencies across the Gulf of Mexico and throughout the world.

Diagnosing the Causes of Biological Impairment in Mobile Bay, Alabama

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Mobile Bay is the fourth largest estuary in the conterminous U.S. with a watershed of more than 43,000 square miles. Biological condition in Mobile Bay has been assessed annually since 2000 through the National Coastal Assessment, a monitoring collaboration between US EPA and Alabama Department of Environmental Management (ADEM) and prior to 2000 through ADEM's ALAMAP. Several other sources of biological data are available as well from institutions such as Dauphin Island Sea Lab and Mobile Bay National Estuary Program. Benthic macroinvertebrate communities provide ideal biological indicators for estuaries because they reflect both short-term and long-term changes in environmental condition. A benthic index, developed for Gulf of Mexico estuaries, was applied to benthic macroinvertebrate community data to assess biological condition in Mobile Bay. The benthic index showed that up to 56% of Alabama estuaries were in poor biological condition from 2000 to 2004 and that Alabama estuaries received a poor ranking for biological condition every year since 2000. State environmental managers need tools to understand the potential causes of poor biological condition in order to restore the estuary to a desired environmental condition. We applied a tool developed by US EPA (CADDIS – Causal Analysis/Diagnosis Decision Information System) to evaluate the causes of poor biological condition in Mobile Bay. Potential environmental stressors that affect benthic macroinvertebrate communities include low dissolved oxygen, sediment contaminants, sediment toxicity, organic enrichment, nutrients, turbidity, sedimentation, changes in salinity, habitat alterations and disturbance. We present a case study for Mobile Bay that follows the steps recommended by CADDIS to define biological impairment, list candidate causes of that impairment, and evaluate data from the case and elsewhere to identify the most probable cause(s) of biological impairment.

Coastal Alabama Beach Monitoring

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In June of 1999, the Alabama Department of Environmental Management (ADEM), in cooperation with the Alabama Department of Public Health (ADPH), initiated a program to routinely monitor bacterial levels at five public recreational beaches along the Gulf Coast. The effort was later expanded to include six additional sites along the Gulf Coast and Mobile Bay. In October of 2000, the federal Beaches Environmental Assessment and Coastal Health (BEACH) Act was signed into law. This Act mandates the monitoring and assessing of coastal recreational waters and the prompt notification of the public when applicable water quality standards are not being met. The Act also authorizes EPA to award grants to help governments implement monitoring and notification programs consistent with the published EPA guidance and criteria. The ADEM was designated as the State's lead agency and was awarded grant money to carry out this program. Through the BEACH Act, the ADEM and the ADPH expanded and enhanced monitoring and notification efforts for Alabama's public recreational waters. The goal of this program is to increase public awareness and provide water quality information to help the public make more informed decisions concerning their recreational use of Alabama's natural coastal waters.

The monitoring program now involves the routine collection of water samples from 25 high use and/or potentially high-risk public recreational sites from Perdido Bay to Dauphin Island. The selection of sites and the frequency of sampling have been determined using a risk-based evaluation and ranking process. This process considers a number of factors for a given site, most importantly the amount of use and the potential risk. Depending on the site rankings, samples are collected twice per week, once per week, or once every other week during the swimming season (June through September), and once per month during the cooler months (October through May). Samples are analyzed for the indicator bacteria *Enterococci*. *Enterococci* bacteria are endemic to the guts of warm-blooded creatures. These bacteria, by themselves, are not considered harmful to humans but often occur in the presence of potential human pathogens. The indicator bacteria used and the threshold concentration, which triggers an advisory, are based on recommendations provided by the EPA in documents Ambient Water Quality Criteria for Bacteria (1986) and Water Quality Standards Handbook, second edition (1983). ADPH Laboratory using EPA Standard Method 1600 performs all *Enterococci* analysis. EPA Method 1600 provides a direct count of bacteria in the water based on the development of colonies on the surface of the membrane filter. ADPH and EPA Whole Body Water Contact Standard for *Enterococci* = 104 col/100 ml (single sample max).

Dog River Clearwater Revival: Monitoring Water Quality in an Urban Stream

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Dog River is an urban stream that drains a 95 square mile area of urban and suburban Mobile, Alabama. Like all such streams, it suffers from water quality degradation related to the loss of natural systems within the watershed. Dog River Clearwater Revival is a non-profit organization dedicated to improving water quality in the river through outreach, education, water related activities, and water quality monitoring. Water quality monitoring is in conjunction with Alabama Water Watch, and several streams have data that goes back for seven years. This long term data makes before and after comparisons possible as well as provides a means of examining long term trends.

A common problem for urban streams is development and the proliferation of impermeable surfaces in the watershed. This insidious process increases sediment availability as land is cleared, it decreases groundwater recharge, and it increases surface runoff. Streams rise faster, carry higher discharges, and transport sediment and litter easily following rainfall events. In Dog River, urban sprawl in the watershed has led to high levels of turbidity and trash in the water following rainfall events. The lack of groundwater recharge and base flow into tributaries leads to an increasing number of intermittent channels that only carry water during rainfall events. This process allows saltwater to penetrate farther upstream during dry periods because there is no opposing freshwater flow.

Eslava Creek is the most degraded of Dog River's tributaries. Deprived of its headwaters in the 1960s by the construction of Interstate 65, the creek now has dissolved oxygen levels below 5 ppm for most of the summer. The Alabama Department of Environmental Management considers such low levels problematical. This Dog River tributary is on the 303d list of impaired streams due to organic enrichment, low dissolved oxygen, and pathogens. Other streams in the Dog River watershed are impacted by channelization projects that not only change hydrology, but also alter water chemistry. These projects, intended to remove water quickly and prevent flooding, increase the velocity of flow and contribute to high levels of turbidity and trash in Dog River following rainfall events. Additionally, Spring Creek's pH, alkalinity, and hardness all changed noticeably after channelization and the installation of gabions in 2001.

Dog River Clearwater Revival and Alabama Water Watch have used data collected by volunteers in educational presentations to the general public and in producing the Dog River Watershed Report, which highlights the group's water quality data in an easily readable and visually pleasing format that is accessible in schools, public libraries, and on the internet. The data itself is also available from Alabama Water Watch for use by anyone doing research that involves the monitored streams.

New Insight to Fundamental Questions in Coastal Ecology Using the Power of Genomics

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In light of unprecedented rates of environmental change, marine ecologists have a pressing need to understand factors that determine present and future patterns of organismal distribution and abundance so that we can predict responses to change for both basic biological knowledge and to enable conservation and management strategies. Genome-enabled technologies can provide comprehensive information about systems-level structure and functioning within this context. Over 65 marine species now have structural or functional genomic resources available and the ease with which these can be developed and applied more broadly is rapidly advancing. Here, I highlight application of both basic and advanced approaches for genomics-based physiological "fingerprinting" of response to change that provide both diagnostic response markers as well as insight to mechanism in studies employing non-model species to address "real-world" questions in the field. The expanded application of genomics in interdisciplinary studies of coastal ecology may help address current questions across the organism to ecosystem levels.

The Impact of Tropical Storms on the Primary Productivity and Metabolism of Shallow Coastal Lagoons

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Coastal lagoons are key components of land-ocean fringe ecosystems in view of their ubiquity and the important ecological roles they play, such as the provision of food and shelter for many organisms, the filtration of land-derived nutrients and the prevention of shoreline erosion. Over the past five years, we have been monitoring a number of ecological variables in three shallow coastal lagoons in Big Lagoon Sound (Perdido Bay, Florida) that are indicative of the important services the lagoons offer to wildlife and human-kind. Those variables include the abundance of flora and fauna, primary productivity and metabolism, as well as the dynamics of carbon and nutrients within the lagoons. In addition, during the five years we have been carrying out our survey, several major tropical weather disturbances, including Hurricane Ivan, Tropical Storm Arlene, Hurricane Cindy, Hurricane Dennis, and Hurricane Katrina, have landed at close, albeit variable, proximity to the lagoons. Here, we examine the impacts of those disturbances on the primary productivity and metabolism of the lagoons. The disturbances appear to have some transient effects depending on their intensity, duration and proximity to the lagoon, but the overarching conclusion is that, whenever there was a noticeable effect, it was small and short-lived. These results can be explained by the morphology of the lagoons examined, which offers them substantial protection against tropical storms and hurricanes. Specifically, the lagoons are relatively small and have reduced water surface area through which wind induce shear and turbulence (i.e., fetch), are surrounded by

maritime vegetation that substantially baffles wind energy, and are connected to the open sound through a narrow mouth that protects the lagoons against wave energy. If these morphological characteristics apply to most shallow coastal lagoons in the Northern Gulf of Mexico, our results suggest that intense tropical weather disturbances generally have a modest influence on the ecological functioning, and resulting services to wildlife and humankind, of those lagoons.

Alabama's Inshore Shrimping Fleet - A Decade of Change

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Historically, the shrimp fishery is economically the most important commercial fishery in Alabama. The past decade was a decade of significant change that has resulted in reduced significance of the shrimp industry. These extensive changes are the result of increased global trade, a changing economic landscape and natural disasters. An overview of the status of the inshore shrimping fleet, past and present, is presented. The inshore shrimping effort revolves around three commercially important shrimp, brown shrimp, *Farfantepenaeus aztecus*, white shrimp, *Litopenaeus setiferus* and pink shrimp, *Farfantepenaeus duorarum* with incidental catches of rearback / roughneck shrimp, *Trachypenaeus* spp, rock shrimp, *Sicyonia* spp and seabobs, *Xiphopenaeus kroyeri*. Management of the inshore fleet is the responsibility of the Alabama Marine Resources Division and is regulated based on overall size of the shrimp. The seasonal distribution of the brown and white shrimp drives management decisions for openings and closings. As fleet size and market share decrease, the applicability of the current management plan will need to be reviewed.

Alabama’s Blue Crab Industry – A Manager’s Perspective

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Blue crab (*Callinectes sapidus*) harvest in Alabama has been recorded in Alabama since the 1800’s and is believed to have helped sustain pre-historic Indian populations. This fishery has an extensive history and has increased in importance since the 1950’s with the advent of the wire crab trap. The use of this gear has helped increase the marketability of the blue crab. Early stages of blue crabs require available marsh edge for growth, prey items and protection. As climate and population growth change the coastal habitat, a resulting impact on blue crab populations may occur. Currently, the Alabama blue crab fishery is one of the most stable fisheries in Alabama both in pounds landed and in number of licenses sold. In recent years, changes in amount of gear deployed have affected the individual catch per trap. Regulation of this industry is minimal, although concerns about bycatch and user conflict abound. The Alabama Marine Resources Division monitors this population through both fishery dependent and fishery independent data and strive to ensure the population remains viable.

Harmful Algal Blooms in Mobile Bay and the Mississippi Sound: A One Year Comparison of Remote Sensing and *In situ* Data

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Harmful algal blooms (HABs) are comprised of phytoplankton accumulating at biomass levels that negatively affect co-occurring organisms and the food web. Some HAB species produce toxins that may harm or kill shellfish, fish, birds, marine mammals and humans, while others create anoxic or other conditions leading to stress of co-occurring organisms in the environment. To date, 8 toxin-producing HAB species have been detected in coastal waters of the northern Gulf of Mexico. These include the diatoms *Pseudo-nitzschia* spp. and the dinoflagellates *Karenia brevis, K. mikimotoi,* and 5 members of the genus *Prorocentrum*. This study investigates the use of satellite remote sensing (MODIS Aqua sensor) to detect and predict environmental conditions leading to the formation of HABs in the turbid coastal waters along the Mississippi and Alabama shores. Phytoplankton populations and water quality were monitored at 3 to 6 week intervals at 17 locations in Mobile Bay and the Mississippi Sound beginning in July, 2005 and continuing through June, 2006. *In situ* and satellite-derived water properties included surface temperature, salinity, concentrations of chlorophyll-*a* (CHL*a*), colored dissolved organic matter (CDOM), total suspended solids (TSS), and nutrient levels (combined Nitrates and Nitrites). Simple curvilinear regressions determined relationships between phytoplankton cell count and water properties (both measured and satellite-derived). In general, counts of dinoflagellates, chlorophytes, and cryptophytes correlated positively with temperature (r-squared = 0.37 to 0.92) and CHL*a*, TSS and CDOM (r-squared = 0.42 to 0.63) while diatoms exhibited inverse relationships with salinity, temperature, and CHL*a*. These preliminary results are being used to develop a prediction model for HABs in coastal waters of the northern Gulf of Mexico based on daily to weekly satellite observations.

National Coastal Assessment Alabama 2000-2004

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Alabama estuaries cover an area of 610 square miles, including Mobile Bay, the fourth largest estuary on the North American continent. Mobile Bay drains a watershed of approximately 43,662 square miles, receiving an average of 460,000 gallons per second of freshwater.

The U.S. EPA's National Coastal Assessment (NCA) is a multi-year partnership with EPA's Office of Research and Development (ORD), EPA's Regional office, all coastal states, and selected territories. Alabama entered the program in 2000 and sampled through 2004. Samples were collected to determine water quality, sediment quality, and biota at fifty sampling locations, each to be revisited on a yearly basis. The NCA program is based on EPA's Environmental Monitoring and Assessment Program

(EMAP), using a compatible probabilistic program and a common set of environmental indicators to survey each state's estuaries and assess their condition. These estimates can then be aggregated to assess conditions at EPA's regional, biogeographical, and national levels.

The goal of NCA is to make statistically unbiased estimates of ecological condition with known confidence. To approach this goal, a probabilistic sampling framework was established among the overall estuarine areas along the Alabama coast. Under this design, each sampling point is a statistically valid probability sample. Thus, percentages of estuarine area with values of selected indicators differing from established environmental guidelines can be estimated based on the conditions observed at the individual sampling locations. Statistical confidence intervals around these estimates also can be calculated. Moreover, these estimates can be combined with estimates from other states or regions that were sampled in a consistent manner to yield national estimates of estuarine condition.

Alabama's sampling design for the base sites consisted of partitioning the estuaries and rivers of the coastal area into hexagonal quadrats. Each hexagon covered 55.2 square kilometers and the grid was placed randomly over a map of the estuaries of the State of Alabama. Computer iterations were then performed to randomly select at least one site in each quadrat. This was repeated until all sampling locations were at a water location (some quadrats were only partially over the water).

Characteristics and Physical Impacts of Katrina, Rita and Ivan

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Using satellite images, in-situ physical oceanographic measurements and numerical models, we present the time histories of several recent hurricanes impacting the Northern Gulf of Mexico Coast. Katrina (2005), Rita (2005) and Ivan (2004) blew up rapidly in the western Atlantic, increased in strength over the Loop Current and severely impacted the continental shelf and inshore waters of Louisiana, Mississippi and Alabama. Movie loops of surface winds and currents from numerical models show the dramatic sweeping effect on continental shelf waters. In-situ measurements under Ivan give credence to the model results and demonstrate the relatively short duration but intense amplification of currents and wind driven surge. Effects on bottom communities and larval dispersion are discussed.

A Comparison of Fungal Decay Communities in Natural and Created Saltmarshes, with Implications for Coastal Restoration

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Coastal saltmarshes are declining worldwide. In the northern Gulf of Mexico, saltmarshes provide nursery habitats for commercially important fish and invertebrates; as well, they buffer shorelines against erosion and hurricane damage while improving water quality. Coastal restoration projects are underway in southern Mississippi and Alabama, but the current success rate is only 50%. Saprophytic fungi are the dominant saltmarsh plant decomposers and thus perform a vital role in these ecosystems. This study assessed the role of saprophytic marine fungi as indicators of coastal saltmarsh ecosystem health. Created saltmarshes were compared with natural saltmarshes using the following parameters: fungal species richness, abundance and belowground biomass. Fungal species on decaying *Spartina alterniflora* and *Juncus roemerianus* were inventoried using morphological and molecular techniques (ITS sequencing, T-RFLP analysis), and site-specific fungal community fingerprints were generated. Belowground fungal biomass was measured using the index biochemical ergosterol. Results and implications for coastal restoration are discussed.

Effect of Environmental Estrogens on the Reproductive Fitness of the Gulf Pipefish, *Syngnathus scovelli*

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Over the past twenty years a number of synthetic compounds have been shown to exhibit estrogen-like activity causing a disruption to specific endocrine pathways. Therefore, these compounds posses the potential to have a major impact on organisms' fitness. The long-term goal of this research is to determine if endocrine disruptors can disrupt sexual selection mechanisms and optimal mate choice behaviors in natural populations. The model system used in this experiment is the Gulf pipefish due to its reversal of sex roles concerning mating behavior. Female competition over access to mates has led to secondary sexual characteristics that are used as visual signals by males to determine female quality. Because these sexual character traits appear to be estrogen regulated, the manipulation of perceived mate quality through exposure to a synthetic estrogen (17a-ethinylestradiol, EE_2) can be achieved. This study will therefore allow us to determine the effect of estrogenic exposure on general health and mate recognition. Initial studies focused on the effects of EE_2 on gonadosomatic and hepatosomatic indices, testes structure, protein expression, and pigmentation patterns. All of these factors are significantly affected by estrogen exposure. In addition, preliminary results suggest that exposure may disrupt optimal mate choice mechanisms. Therefore, environmental estrogens can significantly impact the mating success of Gulf pipefish.

Nutrient Sources, Transport, and Fate in Coupled Watershed-Estuarine Systems of Coastal Alabama

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The processes regulating sources, transport, and fate of nutrients were studied in 3 coupled watershed-estuarine systems that varied mainly by differences in the dominant land use-land cover (LULC), i.e., Weeks Bay -- agriculture, Dog River -- urban, and Fowl River -- forest. Measurements and modeling of watershed nutrient loads, estuarine hydrodynamics, and estuarine biogeochemical processes were used to describe spatial and temporal variation in carbon (C), nitrogen (N), and phosphorus (P) concentrations in the tidal river and open-estuarine regions of the three systems. The results of this comparative study directly link watershed LULC to estuarine biogeochemical process rates and eutrophication.

The percentage of a watershed LULC in row crop and urban/suburban land-use complexes was directly correlated to nutrient concentrations in waterways draining the study watersheds. The Weeks Bay Estuary watershed, being predominately agricultural, received by far the largest loads of N and P. In contrast the Fowl River Estuary is mainly forested and received the largest load of organic carbon (OC). Consistent with the cause-effect relationship observed in many other aquatic ecosystems whereby elevated nutrient loading results in elevated primary production, Weeks Bay had the largest system-wide primary production rates. Hydrodynamics also exerted control on primary production as large residence times in portions of Dog River covaried with phytoplankton biomass accumulation and very high rates of primary production.

The fates of N, P, and OC in these estuaries differed. Denitrification removed 31-72% of the incoming N loads to these 3 systems with the highest percentage of load removed in regions with the longest residence times. Thus these estuaries were a sink for N. On the contrary, during the study period, it appears these systems were a net source of P and thus were net exporters of P to Mobile Bay. Net ecosystem metabolism (NEM = primary production – respiration) is a measure used to evaluate whether a system is a net source or net sink of OC and may be used as a relative indicator of eutrophication. Stongly positive NEM implies eutrophication is likely and that this system is an OC source, while strongly negative NEM implies that eutrophication is not likely and that the system is a sink for OC. NEM was positive in the Weeks Bay Estuary, near zero in Dog River, and strongly negative in Fowl River. Loading of dissolve inorganic N and OC from the watersheds were shown to be strong regulators of NEM in these systems. Eutrophication symptoms such as high phytoplankton biomass and low bottom-water oxygen concentrations were observed in the Dog River and Weeks Bay estuaries.

Fate and Effects of Anthropogenic Chemicals in Seagrass Meadows

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Excessive nutrients are thought to be the major anthropogenic cause of seagrass declines in the Gulf of Mexico (GOM). However, toxic chemicals have also been considered a factor, but published information describing their fate and effects in seagrass meadows is less available than that for accelerated eutrophication. Consequently, their impact, either alone or in combination with other stressors, is also unknown, but important to know since the GOM receives more point and non-point source contaminants than other U.S. coastal zones. The objective of this presentation is to summarize the current knowledge concerning the fate and effects of trace metals, pesticides, oil dispersants and antifoulants in grass bed-associated surface waters, sediments and plant tissues. Contaminant fate information is more available for sediments than surface water and for trace metals than other anthropogenic chemicals. Reported pesticide concentrations in seagrass meadow-associated media are uncommon. Laboratory toxicity results derived in short-term and aqueous exposures are available for 12 seagrass species, most of which are not common to the Gulf of Mexico. Toxicity effect levels are available for several metals, pesticides, oil dispersants and, anti-foulants. Toxicity effect levels derived for chemical mixtures and single chemicals in sediment matrices have not been published for any species. Chemical accumulation by seagrasses has been investigated frequently. Residues of trace metals and pesticides have been reported in above and below substrate tissues of 20 grass species, several indigenous to the Gulf of Mexico. Contaminant residue concentrations typically have exceeded environmental levels; however, the biological significance of most residues is uncertain due to the lack of a residue-effects data base. Experimental conditions have varied considerably in seagrass contaminant research and interspecific differences for tissue residues and toxic effect levels are common which limits data generalizations and extra

Nutrient Changes and Shifts in Microalgal Community Structure in Little Lagoon, AL

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Little Lagoon, Alabama, was examined as a potential site for harmful algal bloom (HAB) formation in the Mobile Bay area. Historical data was examined in order to identify patterns of abundance of harmful algae, in particular *Pseudo-nitzschia* spp., in Little Lagoon, and adjacent sites. The nutrient availability in the sediment and surface water of Little Lagoon were also examined through field studies. In addition, a mesocosm experiment was conducted in Little Lagoon in order to examine the effects of different nutrient pulses on the structure of the microalgal community. Historical data showed a greater frequency of high-density *Pseudo-nitzschia* events as compared to the rest of the Mobile Bay area. Little Lagoon is more nutrient-rich and has a lower N:P ratio than waters of similar salinity in Mobile Bay and the coastal Gulf of Mexico. The sediment of

Little Lagoon is a large, phosphorus-rich pool of nutrients. In the mesocosm studies, a shift in the microalgal community was observed after the addition of three different nutrient types. The proportion of cryptophytes and diatoms increased while the dominant chlorophytes decreased. Within the diatom community, the potentially-toxic *Pseudo-nitzschia* sp. had lower net growth rates than other diatoms, but still showed appreciable growth despite seasonal temperature constraints.

Optical Detection and Assessment of Red Tide Events in the Gulf of Mexico

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Harmful algal blooms or "red tides" represent a significant and expanding threat to human health and fisheries resources, particularly in ocean margin waters. Despite their potential to negatively impact public health, local tourism, and fisheries, abilities to detect, monitor and mitigate red tide phenomena have been limited. Recent advances in understanding of the optical signatures of blooms are encouraging for efforts to utilize *in situ* instrumentation and remote sensing approaches for monitoring and assessment of blooms. An organism commonly associated with red tide events in the Gulf of Mexico is the dinoflagellate species, *Karenia brevi*s. Here, we highlight evidence that populations of *K. brevis* give rise to distinct and identifiable optical signatures in inherent optical properties and remote sensing reflectance. Results from both in water and remotely sensed observations support the view that *K. brevis* exhibits distinct optical signatures that can be used to detect and monitor bloom events. Similarity index analyses of fourth derivative spectra of measurements of absorption showed significant correlations with population cell densities using a variety of methods. The utility of hyperspectral remote sensing reflectance, *Rr*s, to detect *K. brevis* blooms has also been demonstrated. Analysis of *Rrs* was accomplished by a two step process. First, a quasi-analytical algorithm was used to invert *Rrs* to derive phytoplankton absorption spectra, af (?). Second, the fourth derivatives of the af (?) spectra were compared to the fourth derivative of a reference *K. brevis* absorption spectrum by means of a similarity index analysis. Results suggest that detection and mapping of *K. brevis* blooms based on hyperspectral measurements of *Rrs* and *in situ* optical properties are feasible.

The Use of Remote Sensing to Evaluate Plant Species Richness on Horn Island, Mississippi

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Mississippi's barrier islands are protected from development but remain vulnerable to pollution, species invasions and the impacts of climate change. These influences may alter barrier island landscapes, water quality, and ecosystem processes and may substantially impact biodiversity. Remote sensing is increasingly important in providing rapid assessments of biodiversity owing in part to difficulties involved in ground sampling. This study determined the extent to which the species richness of vascular plants on Horn Island, Mississippi, might be estimated using airborne imaging spectrometry. A 124-band data cube acquired in October 2003 by the Hymap imaging spectroradiometer provided coverage of Horn Island throughout the 450-2500 nm spectrum at a ground sample distance of 3 m and a spectral resolution of approximately 15 nm. To correspond with the image data, plant species richness was sampled for 95, 15-m transects that were established at random locations. For a given transect, mean spectral reflectance was computed along with spectral coefficient of variation (CV), an indicator of spatial variability in surface reflectance. Within habitat-type, richness was significantly related ($p=0.05$) to reflectance band ratios and CV, as well as some first and second spectral derivative band ratios, when near- and mid-infrared bands were utilized. Species richness in the same 95 transects was re-sampled following hurricane Katrina. Initial results indicate an average 23 percent decrease in apparent richness, mostly due to burial or scouring during the storm. Richness in 10 transects actually increased. Ongoing research will compare present results with those obtained from multispectral satellite imagery and quantify post-Katrina vegetation recovery on Horn Island.

Estimating Microalgal Abundance and Productivity in Estuarine Waters from 2-D Bio-Optical Mapping

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Estuarine environments are highly variable on both temporal and spatial scales. Accounting for this variability is critical to describing the population dynamics of microalgae and to assessing the importance of nutrient and suspended sediment loads on their abundance, type and productivity. Continuous boat-based measurements of temperature, salinity, fluorescence by chlorophyll and chromophoric dissolved organic material, spectral absorption and scattering, and nitrate concentration can be converted to 2-D maps. These maps can be cast in terms of microalgal abundance, taxonomic group and productivity; water clarity; suspended sediment load etc., using models based on calibration of the optical data against discrete samples. These show the spatial variation in these parameters with higher spatial resolution than is possible using discrete sampling and indicate areas where potential problems (e.g., harmful blooms) are most likely to occur.

Wolf Bay Watershed Watch Mission and Goals

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The primary purpose of the Wolf Bay Watershed Watch is to promote the conservation, protection, and improvement of the natural resources within the Wolf Bay Watershed with the following goals:

1. Serve as advocates for improving and protecting water quality within the Wolf Bay Watershed to meet or exceed state water quality criteria for swimming and for fish and wildlife.
2. Establish and maintain a water quality monitoring system.
3. Provide watershed residents with water quality trend data and other pertinent watershed environmental information.
4. Serve as an advocate for Wolf Bay through education, legislation and individual effort.
5. Secure funding for the organization through donations and grant applications.
6. Expand, educate and involve members within the Wolf Bay Watershed.

Assessment of Alabama's Marine Fishes

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The Marine Resources Division began a sampling program in 2000 for adult fishes to answer management concerns for numerous species. The program has undergone several changes in order to meet those demands. Gear consists of two multiple-panel monofilament gillnets. Panels include mesh sizes of 2 to 4-inch stretch by half-inch increments in the first net. The second net has panels of 4.5 to 6-inch stretch mesh by half-inch increments. Collection of selected species has allowed for growth and abundance estimates as well as other parameters necessary for management. In addition to monitoring the marine species, the program has also captured several freshwater species utilizing the estuary. Currently, we believe we have a design that will allow the division to perform stock assessments on estuarine dependent species such as spotted seatrout and escapement estimates for red drum.

Effects of Invasive Eurasian Milfoil (*Myriophyllum spicatum*) on Trophic Interactions and Community Structure of Estuarine and Freshwater Fishes in the Mobile-Tensaw Delta

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While biological invasions have been shown to trigger significant changes in the structure and function of many estuarine ecosystems, the impacts of these invaders within the Mobile Bay estuary remain unstudied. Since its first reported occurrence, Eurasian milfoil (*Myriophyllum spicatum*), has consistently been found to be one of the most abundant of

species of submerged aquatic vegetation (SAV) in the Mobile-Tensaw Delta (MTD). Moreover, milfoil has been widely reported to have competitively displaced native SAV from the area which in turn may have triggered a major reorganization of ecosystem structure. To test this hypothesis, we compared the composition and density of fish and epibenthic macroinvertebrates collected within milfoil habitats with those of two other habitat-forming native grasses, wild celery (*Vallisneria neotropicalis*) and water stargrass (*Heteranthera dubia*). Since milfoil forms a dense structurally complex habitat, conventional sampling techniques were ineffective. Thus, a $1m^2$ throw trap was used to document relative abundances of smaller fishes and invertebrates within these habitats. In addition, we used gill nets, composed of multiple mesh sizes, to catch larger predatory fishes moving through these SAV habitats.

Analysis of Similarity (ANOSIM) showed that while the composition of smaller fishes and macroinvertebrates in the milfoil and stargrass habitats were not significantly from one another (p=0.292), they were both significantly different from faunal composition within the wild celery habitat (p=0.055 and p=0.009, respectively). These differences seem best explained by greater abundances rainwater killifish (*Lucania parva*), redspotted sunfish (*Lepomis miniatus*), and grass shrimp (*Palemonetes pugio*) within the milfoil and stargrass habitats. In contrast, significantly greater abundances of freshwater gobies (p=0.043), gulf pipefish (*Syngnathus scovelli*) (p=0.036), and brown shrimp (*Penaeus aztecus*) (p=0.092) were found in wild celery. Of note was the unanticipated presence of high density of very small blue crabs (*Callinectes sapidus*) (<35cm CW) in wild celery (p=0.067). No such differences in large predator density or composition were noted among the three SAV species. Based on the results of this ongoing study, we conclude that if Eurasian milfoil competitively displaces native *V. neotropicalis* habitats in the MTD, then it is likely that the spread of this invasive species has also significantly altered community structure. Acknowledging that this sampling has been conducted during extremely dry years, some caution should be used in generalizing our current findings. Future studies will be conducted to determine the extent to which top down factors (habitat preference, predator's choice of prey, and foraging efficiency) influence this observed difference in the community structure of prey in the wild.

Temporal and Spatial Variation in the Distribution and Abundance of Submerged Aquatic Vegetation in Grand Bay National Estuarine Research Reserve, Mississippi

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Studies have reported a nearly 50% decline of seagrass beds in Mississippi Sound since 1967. The reports also described the complete or significant loss of *Thalassia testudinum*, *Syringodium filiforme*, and *Halophilia engelmannii*. As a result, *Halodule beaudettei* and *Ruppia maritima* became the two dominant submerged aquatic vegetation (SAV) species in Mississippi Sound. These species primarily occur in sheltered bays, bayous, and the leeside of barrier islands. The decline has been attributed to a variety of sources including storm events, erosion, and anthropogenic impacts. We have surveyed SAV in the vicinity of Grand Bay National Estuarine Research Reserve (NERR) to track temporal and spatial changes in this important habitat type. Since 2003, we have used remote sensing and field surveys (snorkeling, raking from boats) to map annual occurrence of SAV beds in the vicinity of Grand Bay NERR. Since 2005, we have surveyed for SAV depth distribution and species composition using fixed transects at four to six sites during the spring, summer, and fall of each year. We also have monitored surface and underwater Photosynthetically Active Radiation (PAR) biweekly at three sites since September 2005. Annual variation in SAV coverage across GBNERR has been high, ranging from 146 ha during 2003 to 300 ha during 2006. Along transects, the abundance of both species significantly varied seasonally and spatially. *Ruppia maritima* growth peaked and flowered in May-June, then declined in late summer. Compared to the summer 2005 data, the total SAV cover was significantly reduced by October 2005 mainly due to a significant decline of *R. maritima*. *H. beaudettei* abundance was not different between summer and fall 2005. Both species significantly increased in summer 2006. Due to the seasonal changes in relative abundance of the two species, the mean transect coverage ratio of *R. maritima* and *H. beaudettei* varied considerably: 21:4 in summer 2005, 3:17 in fall 2005, and 17:8 in summer 2006. Although water clarity (derived from PAR data) was significantly higher over sandy substrates compared to muddy substrates, the overall seasonal trend in water clarity condition was not different among sites (season x site). The temporal and spatial variation in the abundance and species composition of SAV beds should be considered for assessment of long-term changes in seagrass beds. Our observations show that the coverage of SAV beds can decline rapidly during 2-3 week periods; this has potential implication for the assessment of this resource based on annual surveys, which capture a snapshot in time and may miss the peak biomass production.

Conversion of a Manmade Beach to a Natural Beach and Management for 12 Years in Biloxi, MS

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The conversion of an intensely maintained 1000 foot long section of manmade beach along the Mississippi Coast began in 1995 as a joint project with the Biloxi Bay Chamber of Commerce. As the project progressed support funding came from the Tidelands Trust Fund and the Mississippi-Alabama Sea Grant Consortium. Investigators learned how intense management of beaches by machinery can cause sand loss to rain runoff and wind. Investigators based sand acretion plantings and beach management processes on natural cycles and natural beach forms. The resultant natural beach landscape and maritime forest now acretes sand and grows in elevation. There is no blowing sand that has to be removed from adjacent Highway 90. Beach aesthetics has increased and management is limited to hand pickup of litter and regular planting of native beach plant materials. The establishment of 58 native plants on the 3 acre site has been documented in a booklet. Current research is seeking to establish emergent *Spartina alterniflora* along the beachfront. The impact of Hurricane Katrina on the experimental beach landscape will be shared.

Effects of Salinity and Herbicide Exposure in Seagrass

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Seagrasses constitute a group of aquatic angiosperms with a worldwide distribution among estuarine and shallow marine ecosystems. Thus, these plants occupy nearshore environments that are often affected by anthropogenic disturbance, including exposure to high nutrient loads and agricultural herbicides. Because seagrasses represent a threatened habitat, the potential impact of chemical exposure coincident with other environmental stressors (e.g., high salt, low light, high nutrients, etc.) could be severe. This study examined how well *Thalassia testudinum* (turtlegrass), a marine species, and *Vallisneria americana* (tape grass), an estuarine species, tolerate increased salinity and herbicide (dichlorophenyl dimethylurea - DCMU) exposure using Chlorophyll-*a* (Chl-*a*) fluorescence and pigment content as indicators of plant health. Measurements of fluorescence yield (Fv/Fm) indicated that herbicide exposure resulted in low photosynthetic efficiency in both *T. testudinum* and *V. americana*; Fv/Fm ratios were 53% lower in herbicide exposed plants. High salinity (25 ppt) also had a significant negative effect on *V. americana*. Low fluorescence yields were attributed to 1) damage to PSII as indicated by high values for initial fluorescence (Fo) upon DCMU exposure and 2) reduction in pigment content due to increased salinity. Values for Fm did not vary as a function of salinity or herbicide. Preliminary data suggest that increased salinity, when combined with herbicide exposure, acts synergistically to negatively impact photosynthetic efficiency in *Thalassia* and *Vallisneria*. In conjunction with photosynthetic measurements, future experiments will examine the roles of heat shock protein (HSP) 70 and antioxidant enzymes (SOD) as they relate to stress in aquatic plants.

Planning & Policy-Making for Sustainable Recovery with Coastal Hazards in Mind

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In the wake of Hurricane Katrina the Mississippi Gulf Coast is experiencing an unprecedented opportunity to redevelop large tracts of land along its coasts and inland bayous. Since Katrina we have engage in the largest planning effort the state has ever known, adopted building codes, smart codes and higher base flood elevations, began a master regional wastewater plan and have linked individual grants to complying with more restrictive regulations. Still we are asking, is it enough?

Mississippi's efforts to recovery from the worst natural disaster in America's history has simultaneously provided the most difficult challenges and hopeful opportunities for more sustainable redevelopment by avoiding coastal hazards and protecting sensitive coastal environments. As Mississippi moves forward in recovery and rebuilding we continue to focus on our greatest asset, the people. Housing, jobs, education, public safety and

human services are just a few of the major challenges still facing us one year after Katrina. But perhaps our biggest challenge is meeting our needs in a way that will ensure that we are less vulnerable the next time nature comes calling. Building Codes, Smart Codes, higher base flood elevations, better infrastructure planning and creating incentives and requirements for compliance when receiving State and Federal assistance are some of the strategies Mississippi is currently utilizing.

Insights and Implications for Gulf Coast Island Herpetofaunal Communities Gleaned from Hurricane Katrina

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Since January 2004 the Herpetology Lab at the University of Southern Mississippi has conducted extensive field, literature and museum surveys of the Mississippi Gulf Islands herpetofaunal (amphibian and reptile) communities. A comparison between historic herpetofaunal records and current community composition show that these communities have undergone significant composition changes in the past 50 years. Through the impacts of Hurricane Katrina, we have observed first hand the changes that extremely severe storms bring to island faunal communities, i.e., loss of freshwater habitat from saltwater inundation, loss of refugia, mortality of individuals during the storm, etc.

Though our post-Katrina surveys show an expected reduction in overall species richness, observations also include the appearance of new species not documented before the storm and an increase in the abundance the salt marsh snake *Nerodia clarkii*. Based on these observations and historical data, we suspect hurricanes and other large storms are impart responsible for the dynamic nature of island herpetofaunal communities in the Gulf Islands.

Bacterioplankton Abundances in the Bay of St. Louis, Mississippi Relative to Environmental Water Quality Prior to and After Hurricane Katrina

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The Bay of St. Louis is an important shallow (average depth 4 ft) estuary for the communities in Hancock and Harrison Counties, including Bay St. Louis, Diamondhead, DeLisle, and Pass Christian. The Hollywood casino in Bay St. Louis rests on the shore of the bay, near the mouth of the Jourdan River. The DuPont titanium dioxide plant and 4 sewage treatment plants on the shoreline, including a large plant near Bayou Portage, also contribute to the poor water quality nearest their effluent pipes. Pollutants, chemicals, and sewage can be washed into the bay during heavy rains. Polluted water can seep into groundwater from the land and then leak into the bay. In the case of Hurricane Katrina, storm surges exceeded 30 feet in this area. The objective of this study was to determine the effects of Hurricane Katrina on water quality in the Bay of St. Louis by measuring bacterioplankton concentrations throughout the bay. A total of nine stations were sampled to determine the water quality at the mouths of the Jourdan and Wolf Rivers, the Bayou Portage, and how the water quality changed as water emptied out of the Bay of St. Louis. Preliminary results (June and July 2006) have shown that bacterioplankton abundances were highest at the mouths of the Jourdan and Wolf Rivers, as well as near Bayou Portage and offshore of the DuPont plant. Bacterioplankton abundances were lower in the mid-bay stations and the lowest at the Mississippi Sound station. Sampling at these nine stations will continue through 2007 to document seasonal (temporal) changes. Further work includes measuring chlorophyll *a* levels, nutrient concentrations (ammonia, nitrite, nitrate, and phosphate), dissolved organic carbon (DOC), and trace metal concentrations at each station to determine possible relationships between these parameters and bacterioplankton concentrations.

Development of Trophic Interactions in Restored Salt Marshes

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Marsh restoration along the Atlantic and Gulf Coasts involves replanting smooth cordgrass, *Spartina alterniflora*. The underlying assumption is that natural ecosystem function will follow the provision of structure, but this assumption has not generally been corroborated. The blue crab, *Callinectes sapidus*, is the primary predator of the marsh periwinkle, *Littoraria irrorata*, an abundant herbivore in *Spartina* marshes. *Callinectes* controls *Littoraria* populations, with cascading effects that can prevent the snails from overgrazing *Spartina*. We characterized the trophic linkage between *Callinectes* and *Littoraria* from the perspective of the gastropod prey, using: 1) tethering experiments, 2) estimates of the frequency of sublethal injury (repaired shell cracks) and 3) multivariate descriptions of antipredatory shell morphologies. Field and laboratory studies confirmed that among-site variations in shell morphology resulted from predator-induced plasticity by *Callinectes*. These metrics revealed the existence of distinct predation regimes over small spatial scales, which correlated with the abundance of the predatory crabs and persisted over multiple years. Although *Callinectes* and many of its prey species rapidly colonize restored marsh habitats, it is unclear whether or when quasi-natural trophic relationships become established. Conventional approaches to measuring ecosystem development, which are rarely applied, rely on indirect measures of biotic interactions that are costly and time-intensive. Metrics of the predator–prey relationship between *Callinectes* and *Littoraria* have the potential to provide inexpensive and time-efficient proxies for assessing the development of marsh function.

Using Geographic Information Systems to Model the Environmental Quality of St. Louis Bay, Mississippi.

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The Bay of St. Louis estuary is an important economical and ecological resource for the State of Mississippi. Any negative water quality impacts could affect the commercial industries in addition to tourism and recreational activities associated with the Bay. Geographical information systems (GIS) were used to model the environmental parameters in Bay of St. Louis to predict water quality, which illustrates the current or potential problems to scientists and managers. The main objective of this study was to examine water quality using GIS in the Bay of St. Louis that has become an ongoing process to determine whether GIS can accurately display the changes in environmental parameters. The seasonal variation of environmental parameters, such as the concentration of individual nutrients, ratio of nitrogen to phosphorous, and the ratio of carbon to nitrogen of the particulate organic matter, has been examined and compared. This comparison was used to determine whether the water quality in Bay of St. Louis exhibits long term variations or remains relative stable. The 2003-2004 Coastal Impact Assistance Program (CIAP) Bay of St. Louis data was entered into a Microsoft Excel spreadsheet and converted into an extension applicable for the Environmental Systems Research Institute (ESRI) ArcView program. The watershed boundaries were defined by using the United States Geological Survey (USGS) Digital Elevation Model (DEM) data. The landuse/landcover (LU/LC) was determined using the USGS GIRAS images of coastal Mississippi at a scale of 1: 250,000. Once the base layers were established, the nine sampling stations were identified using GPS (Global Positioning System) coordinates. The environmental parameters associated with each sampling station have been added to ArcView as attributes that could potentially impact water quality. Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) was used to combine the GIS (Geographic Information Systems) referenced physical data and the HSPF (Hydrological Simulation Program – FORTRAN) model to predict the future quality of water within this watershed.

Benthic Algal Community Structure and Bioaccumulation of Mercury in Fish River, Alabama

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Largemouth bass in the Fish River watershed of coastal Alabama are known to contain relatively high concentrations of mercury, the source of which is unknown. We used benthic microalgal assemblages in an effort to describe spatial distribution of mercury in the Fish River and its tributaries. Artificial substrates were deployed for 3-week exposure periods at 13 sites on 4 separate occasions. When analyzed by cold vapor atomic absorption spectroscopy, mercury concentrations in periphyton ranged from 0.066 μg/g

(Pensacola Branch) to 0.493 µg/g (Barner Branch). Principal Components Analysis indicated that physical and chemical heterogeneity exists throughout the watershed and is correlated with agricultural and urban land use categories. Physical and chemical heterogeneity of stream sites, variability in land use/land cover, and mercury content of periphyton all are reflected in the diatom assemblages characterizing each site. Further sampling of Barner Branch revealed high abundance of diatom *Brachysira vitrea* which may be associated with elevated mercury levels.

Mapping Privately-Protected Lands in the Southeast as a Tool for Resource Protection

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The Southeast Watershed Forum developed the Partnership for Land & Water Protection in cooperation with the Land Trust Alliance and Southeast Aquatic Resources Partnership to encourage greater regional cooperation and coordination among land trusts, watershed groups, and state agency staff for aquatic habitat protection. A key component of the Partnership was an effort to survey and map the location of privately-protected lands in the southeastern United States.

The need is critical as the Southeastern region is the center of aquatic biodiversity for North America. Now unprecedented pressures from growth, development and urban sprawl are changing land use patterns and threatening water quality and aquatic habitat.

The Partnership for Land and Water Protection has six goals:

1. To encourage more habitat protection & collaborative planning/management,
2. To improve the overall management of public and private lands by coordinating activities among groups involved in land protection,
3. To encourage communities to protect habitat as part of comprehensive plans,
4. To build public support for habitat protection,
5. To provide a baseline to measure growth or reduction in land protection efforts over time, and
6. To provide a source of land/habitat protection data as a regional model.

In an effort to document land protection activity in an 8-state region, the Southeast Watershed Forum has surveyed over 100 land trusts and watershed groups to date. Additional data is being secured through the end of 2006. The GIS coordinates from these land protection surveys are being combined with state and federal lands data. The USGS will assist in mapping the data on a county, state and regional basis. The maps can be cross-referenced with other resource data, like state wildlife action plans or impaired streams to identify any correlations.

The maps generated from this project will be available online in 2007. They will assess "gaps" in land protection that identify future areas requiring protection. The online database that is evolving from this project will identify public-private partnerships for leveraging limited dollars to maximize future land preservation initiatives.

The Forum will use the maps with its Community Growth Readiness workshops to assist local officials and community planners in; 1) understanding the role that protected lands and open space play in preserving local water quality, 2) encouraging local planners to include habitat protection in their comprehensive planning process, and 3) identifying new partners to assist communities in land protection efforts. The downloadable maps will be available as a tool for communities, agencies and organizations to use in their natural resource planning and management.

The Community Growth Readiness Initiative: A Watershed-Friendly Approach to Growth & Development

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Between 1992 and 1997, 3.6 million acres of forests, farms and open space were lost to urban sprawl in the Southeast. Such rapid transformation in land cover places natural resources at risk, increase stormwater and local flooding, and jeopardizes both water supplies and water quality. The costs of unplanned growth can create future burdens that will stress local community finances and jeopardize future growth.

To address this issue, the Southeast Watershed Forum worked with the University of Tennessee and the Tennessee Valley Authority to pilot a "southern" approach to quality growth, called Community Growth Readiness. The program was designed to:

1) highlight the economic costs from poor land use practices;
2) demonstrate ways to reduce the cost of services,
3) showcases the long term impact of changing land use practices on local communities,
4) demonstrate model development principles that provide watershed-friendly growth and development,
5) assist communities in evaluating if current land use practices will protect their quality of life at current growth rates, and
6) train communities in building local consensus for changing land use.

Over 200 communities have received Growth Readiness training and over 40 are actively involved in changing land use ordinances.

Now agencies in Virginia, Georgia and Kentucky have asked to be trained in the Community Growth Readiness approach and long-term programs are underway. In addition, the Forum staff has worked with individual communities in Louisiana, Alabama, Georgia and Florida.

The Forum has been sharing this approach with NEMO coordinators and NOAA, EPA and other agencies concerned about maintaining the unique natural resources of the region in the face of continuing growth pressures.

In a region culturally averse to land use change, more than technical data and education is needed. A process to enable consensus-building among diverse local stakeholders is essential to building support for and overcoming political indifference against land use practices that will lead to quality growth in the region. The Community Growth Readiness approach offers a valuable tool for Gulf-coast communities to build more sustainable communities.

NOAA Large Areas Surveys of Mobile Bay and Other Nearshore and Bays of Alabama

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Hurricane Katrina created significant damage to Alabama coastal areas. Significant debris and hazards have accumulated in nearshore and bay areas in state waters.

In order to address and possibly remove these hazards, NOAA has been funded and tasked with the sidescan surveying of fishing grounds found in Alabama, Mississippi, and Louisiana state waters.

In collaboration with Alabama DCNR Marine Resources, NOAA has developed plans to survey over 300 square miles of Alabama waters using sidescan coverage of 100% of the water bottom. This imagery and analysis of the sidescan surveys will generate data on the hazards and debris found in the water as well as provide important information on the bottom habitats.

Surveying will start in 2006 and continue into 2007. NOAA will provide an overview on the survey project, the areas to be surveyed and the type of data and survey results to be provided to Alabama state authorities and others.

Modeling of Physical Transport in Mobile Bay, Alabama

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Water quality (WQ) modeling has been extensively employed to study and manage WQ conditions in aquatic systems. The fate of pollutants, once introduced into a system, is affected by both physical transport and material-specific biogeochemical transformation processes, and thus WQ modeling involves modeling of both processes. A three-dimensional hydrodynamic model has been developed for Mobile Bay, Alabama, to simulate physical transport processes. The modeling domain is about 80 km wide in the east-west direction (88°30′-87°41′W) and 110 km long in the north-south direction (30°07′-31°05′N), including tidal rivers, eastern Mississippi Sound, and the adjoining coastal regions of northern Gulf of Mexico. An orthogonal, curvilinear grid that follows the ship channel was generated, with a varying size grid with a minimum of ~58 m to resolve the narrow ship channel and complex geometry in the Mobile-Tensaw Delta. The model gives a good reproduction of prototype behavior under various conditions of tide, freshwater discharge, and wind. The model results agree well with the observed surface elevation at seven stations throughout the modeling domain, not only for tidal fluctuations but for subtidal variations. The model also gives a reasonably good reproduction of current velocity and distribution of salinity and temperature. The model is currently being employed to study characteristics of physical transport in Mobile Bay and to develop an oyster larval transport model. We will discuss in this presentation the characteristics of the transport through five distributaries (Mobile, Raft, Tensaw, Apalachee, and Blakeley rivers) and the exchange processes through Main Pass and Pass aux Herons.

Temporal Variability in Summertime Bottom Hypoxia in Shallow Areas of Mobile Bay, Alabama

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This paper addresses temporal variability in bottom hypoxia in broad shallow areas of Mobile Bay, Alabama. Time-series data collected in the summer of 2004 from one station (mean depth of ~4 m) exhibit bottom DO variations associated with various time scales of hours to days. Despite a large velocity shear, stratification was strong enough to suppress vertical mixing most of the time. Bottom DO was closely related to the vertical salinity gradient, ? S. Hypoxia seldom occurred when .S (over 2.5 m) < 2 psu and occurred almost all the time when ? S > 8 psu in the absence of extreme events like hurricanes. Oxygen balance between vertical mixing and total oxygen demand was considered for bottom water from which oxygen demand and diffusive oxygen flux were estimated. The estimated decay rates of kd20 ranging between 0.175- 0.322 d^{-1} and the corresponding oxygen consumption as large as 7.4 g O_2 m -2 d^{-1} fall at the upper limit of the previously reported ranges. The diffusive oxygen flux and the corresponding vertical diffusivity estimated for well-mixed conditions range between 8.6-9.5 g O_2 m^{-2} d^{-1} and 2.6-2.9 m^2 d^{-1}, respectively. Mobile Bay hypoxia is likely to be associated with a large oxygen demand, supported by both water column and sediment oxygen demands, so that oxygen supply from surface water during destratification events would be quickly exhausted to return to hypoxic conditions within a few hours to days after destratification events are terminated. This paper presents the analysis of bottom DO variations associated with time scales on the order of days, but cannot explain the variations with shorter time scales (hours), for which a more complete analysis, probably including horizontal transport processes, may be required.

The System-Wide Monitoring Program at Weeks Bay National Estuarine Research Reserve: Monitoring Short-Term Variation and Long-Term Change.

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The National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Research Reserve System (NERRS) was established by the Coastal Zone Management Act of 1972. There are currently 27 reserves in the United States. The Coastal Zone Management Act created reserves to protect estuarine areas, promote and conduct estuarine research and monitoring, provide education opportunities, and transfer relevant information to coastal managers. In 1995, the NERRS established a System-Wide Monitoring Program (SWMP). The SWMP was designed to track short-term variability and long-term changes in estuarine waters to understand how human activities and natural events can change ecosystems. The SWMP began at the Weeks Bay National Estuarine Research Reserve (WBNERR) with the deployment of water quality dataloggers at 2 stations in October 1995. In 2001, a weather

station was added and in 2003, 2 more water quality stations were added bringing the total to 4 active stations. Monthly aquatic nutrient determinations were added in 2002 at the 4 water quality stations. Nutrients are measured over a complete tidal cycle at one site monthly as well. These data are available at the Centralized Data Management Office, found online at: http://cdmo.baruch.sc.edu/ . These data show a great deal of short-term variation at the WBNERR. Nitrate availability varies seasonally and tidally. Dissolved oxygen concentration often varies from hypoxic to super saturation within a diel cycle. The Bay is shallow and wind events can cause dramatic increases in turbidity. Tropical storm events occur frequently with wide range changes in most measured parameters. Some data parameters have been measured for a decade, making long-term trend analysis feasible and these determinations are ongoing.

Fish Consumption Among Coastal Recreational Anglers: Is Methylmercury Poisoning a Significant Risk?*

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Fish consumption is an important part of the diet of most Americans. USDA has strongly recommended the inclusion of fish in the U.S. public's diet due to numerous health benefits, including the intake of Omega-3 fatty acids for reducing incidences of coronary heart disease and stroke. Recently, fish consumers have been made aware of potential health risks associated with the consumption of some species of offshore fish due to high levels of methylmercury. Methylmercury is a dangerous neurotoxin that can impair nervous system development in unborn fetuses and young children. The primary objective of this research was an evaluation of marine fish consumption among recreational fishers in the coastal counties of Mississippi and Alabama. Survey data were collected by a telephone poll of 1,230 respondents. Our results indicate that recreational fishers consume more pounds of fish per year than recommendations set by USDA, FDA and EPA (32.6, males; 16.6, females). Furthermore, males, non-whites and younger adults consume more than their counterparts. Several scales of "high-mercury" fish species were developed to assess the pounds per year of fish consumed that may have associated health risks. On average, only 4.4 pounds of these "risky" combinations of fish species were consumed per year, suggesting that the risks associated with methylmercury poisoning are rather low for coastal recreational fishers in Mississippi and Alabama. Suggestions for future research are provided.

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Do Environmental Conditions Affect Viral Abundance in the Bay of St. Louis, Mississippi?

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The Bay of St. Louis, Mississippi is a shallow vertically mixed, lagoonal-type estuary which is impacted by several point and nonpoint sources of nutrients and pollution. The environmental quality of the bay was evaluated by enumerating free and attached marine viruses using epifluorescence microscopy and the nucleic acid stain SYBR Gold. Eight stations along the coastline of the bay were sampled during outgoing tidal regimes for a 10 month period in 2004 and 2005. In addition, shorter sampling periods (days and hours) were conducted to determine the variability of viral abundance. The environmental quality was evaluated by monitoring how the viral abundance changed temporally and spatially. In addition, the effectiveness of a newly seeded oyster reef to clean the water of viruses and other pollutants was evaluated by examining the difference in free and attached viral abundance between stations. Results suggest that the free viral abundance was similar to the quantity found in other estuaries around the Gulf of Mexico (10^{10} to 10^{11} viruses$\cdot L^{-1}$). The free and attached viral abundances were similar. The abundances of viruses were different significantly ($p < 0.05$) between seasons where greater numbers of viruses were present in autumn. Autumn conditions consisting of greater salinity, lower pH, lower primary production, and reduced turbidity impacted viral abundance positively. Viral abundances were different significantly ($p < 0.01$) on shorter time scales suggesting that viral abundance was highly variable on all three sampling periods. Free and attached viruses were correlated significantly to various parameters; however, a majority of these correlations were more likely due to these parameters affecting the virus's host organism. Parameters correlated significantly to free viruses that had a direct effect on their abundances were turbidity ($r = -0.285$, $p < 0.05$, $n = 71$) and salinity ($r = 0.752$, $p < 0.01$, $n = 71$). Attached viruses were also correlated significantly to turbidity ($r = 0.379$, $p < 0.01$, $n = 70$) and salinity ($r = -0.362$, $p < 0.05$, $n = 70$). The Bay of St. Louis was moderately impacted by the sources of pollution and has the potential to become heavily impacted a few days after rainfall in the region directly around the bay. There was no significant difference in free or attached viruses between stations up current or down current of the oyster reef.

The Effects of Artificial Oyster Reefs on Primary Production and Nutrient Flow in Shallow Coastal Creeks

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A concerted effort has been made to restore and/or rehabilitate habitats lost to the negative impacts of human activities on estuarine and coastal ecosystems. To date, the success or failure of oyster reef restoration efforts has been primarily based upon assessments of “animal” abundance (i.e., recruitment success of oysters, crabs and economically important finfish), water quality and/or productivity of surrounding grass beds. Herein, we report preliminary results from year two of a novel, interdisciplinary project designed to evaluate artificial oyster reef function. Study sites are located in six tidal creeks around Dauphin Island and Little Dauphin Island, AL; each of three experimental sites (cultch + oysters) is paired with a control site (no cultch – no oysters). Coincident with samplings for infauna, invertebrates and fish, estimates of microphytobenthic community structure, abundance and productivity are collected from the water column, sediments and in association with artificial oyster reef structures. Together with biological data, we are also monitoring changes in temperature, irradiance, attenuation, salinity, pH, dissolved oxygen and both inorganic and organic nutrient levels. Our first estimates indicate that the benthic community is very productive relative to that of the water column throughout much of the year, achieving net photosynthetic rates of 0.50 cf. 0.15 mg O_2 L^{-1} h^{-1}, respectively. Furthermore, the algal communities, characteristic of these tidal creeks, exhibit an impressive resilience and are able to rapidly recover (i.e., within days to weeks) from acute environmental disturbances (e.g., the major hurricane events, Ivan and Katrina).

Change Detection of Coastal Alabama Marshes: Mon Luis Island Model

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The purpose of this research is to develop a digital change detection algorithm capable of visualizing and supporting the scientific evidence of alterations in coastal marshes. Aerial photography and digital imagery collected in multiple years were utilized to document ecological change in the coastal marshes of Mon Louis Island, Alabama. Two change detection methods were combined to analyze the vegetative, land use and geomorphic alterations of Mon Louis Island over time. A difference map of grayscale imagery was performed with 1940’s and 1980’s aerial photography. Additionally, a difference map of classification images derived from 2002 Army Corps of Engineers CASI hyperspectral imagery and 1972 U. S. Geological Survey Digital Ortho Quad Imagery was performed. Statistical analysis on class changes using the Environment for Visualizing Images (ENVI) software provided quantitative differences between classes. Future research will include computer aided change detection models that will enhance our understanding of natural versus anthropogenic impacts on marshes and assist decision makers in the development of coastal restoration and enhancement projects.

Evaluating Indicators of Macrobenthic Community Structure and Function for Tracking Marsh Restoration Success: A Comparison of Created and Reference Marsh Islands within Davis Bay, Mississippi, after 25 Years

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In order to counteract extensive coastal habitat losses, marsh restoration efforts have increased dramatically in recent years. Former studies of infaunal communities indicate that newly created *Spartina alterniflora* marsh does not function as well as natural marsh. The objectives of this study were (1) to compare macrobenthic indicators between a set of created marsh islands that have been established for 27 years and a set of nearby reference marsh islands within Davis Bay, Mississippi; and (2) to appraise indicators of macrobenthic community structure and function for tracking marsh restoration success. A total of 40 stations comprising both intertidal *Spartina* and adjacent subtidal habitats were sampled in May, 2005. Indicators of macrobenthic function included total abundance, production potential, community turnover-time, mean body-size, and residual intercepts from the linearized Biomass Size-Spectrum (BSS). Community-structure metrics included taxonomic diversity, evenness, and dominance, as well as Bray-Curtis community similarity. Using PRIMER 6 software, Non-metric Multidimensional Scaling (NMDS) ordination, ANOSIM, and SIMPER discerned differences in community structure. Total abundance, production potential, and BSS residual intercepts differed significantly between created and natural marshes as well as between intertidal and subtidal habitats. Mean body size differed significantly between habitats, but not between created and natural marshes. Community turnover-time did not differ with respect to either marsh status or habitat. Taxonomic diversity, evenness, and dominance were non-significant between created and natural marshes; however these metrics were all significant with respect to habitat. Community composition differed significantly between habitats and between created and natural marshes. Macrobenthic indicator values compared favorably with values from similar habitats in the region, suggesting functional equivalence.

Has the Environmental Quality of the Bay of St. Louis, Mississippi Changed Over the Past 25 Years?

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The Bay of St. Louis is a shallow, vertically-mixed estuary along the Mississippi Gulf of Mexico coastline. Freshwater enters via two rivers, Jourdan and Wolf rivers, numerous bayous, and runoff. Nutrients enter from sewage treatment plants, septic systems and agricultural, industrial or commercial activities in the watershed. Development in the watershed over the past 25 years has increased. Bay uses include recreational activities and limited oyster harvesting. We conducted studies in 1995/1996, 1997/1998, and 2003/2004. We compare our results with a 1977/1978 study. Data sets span three decadal climate regimes based on the Southern Oscillation Index (SOI): 1977/1978 – 1989, 1989 – 1998/1999, and 1999 – 2004. Measured parameters include dissolved

inorganic nutrients, pigments, POM, O_2, temperature and salinity at up to 25 stations. The bay acts as a single system with environmental quality varying similarly at all stations. Numbers of indicator bacteria have increased over time, but nutrient concentrations have not varied significantly since 1978. However, N:P was significantly greater than the Redfield ratio during La Nina events, significantly below the Redfield ratio during El Nino events and only approached Redfield proportions during normal years. About half of the variability in the bay can be linked to shifts in decadal climate regimes.

Factors Influencing the Distribution and Abundance of Marsh Birds in Mississippi's Tidal Marshes

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Despite the rapid loss of tidal marsh along the Gulf Coast of the United States, little is known about the marsh birds that inhabit this ecosystem. Specifically, how these species may be responding to loss of habitat and stochastic events such as tropical storms and hurricanes remains largely unknown. During the summer of 2005 and 2006 we conducted call-broadcast surveys for these secretive species, and used GIS to identify factors that influence the distribution and abundance of Least Bitterns (*Ixobrychus exilis*), Clapper Rails (*Rallus longirostris*), Common Moorhens (*Gallinula chloropus*), Marsh Wrens (*Cistothorus palustris*), Seaside Sparrows (*Ammodramus maritimus*), Red-winged Blackbirds (*Agelaius phoeniceus*), and Boat-tailed Grackles (*Quiscalus major*) in Mississippi's tidal marshes. Additionally, during the summer of 2006 we applied radio-telemetry to monitor movement and habitat use by Clapper Rails within these tidal systems. Results from the analysis of call-broadcast survey data indicate that Clapper Rails are more common and Least Bitterns less common in salt marshes experiencing greater salinity regimes. Examination of macrohabitat variables in relation to the density of marsh birds at survey points suggests that the density of Common Moorhens, Boat-tailed Grackles and Red-winged Blackbirds may be positively related to the linear distance of a survey point to marsh-upland interface while the density of Seaside Sparrows showed a negative relationship. Estimates of home range size for Clapper Rails during 2006, as determined using radio-telemetry, were similar to estimates derived from call-broadcast surveys. In addition radio telemetry revealed that in the tidal systems of coastal Mississippi Clapper Rails undergo little intra-seasonal movement, a fidelity that may continue through the post-breeding period. Comparison of density estimates for Clapper Rails as derived from surveys conducted during the summer of 2005 and 2006 suggest that site specific population size for this species may have increased.

A GIS-Based Report Card: An Effective Tool to Monitor and Manage the Changes in the Environmental Quality of the Bay of St. Louis, MS

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The environmental quality of the Bay of St. Louis was monitored regularly for a period of fourteen months during 2003- 2004. Several parameters including dissolved inorganic nitrogen (DIN), dissolved inorganic phosphates (DIP), dissolved oxygen (mg/L) (DO), chlorophyll *a*, and turbidity were measured at ten different stations. These parameters were used as indicators of environmental quality. We identified five management objectives for the bay. An environmental quality index was then established based on our objectives and on the data collected over the fourteen months. The reference values selected for this estuary were representative of a subtropical pristine environment. A report card was developed based on the environmental quality index with a rank scale of 0 to 10, 0 being "Impaired conditions" and 10 representing "Good conditions" for the bay. Environmental quality at every location in this estuary was determined using spatial analysis. Seasonal variability was observed in all indicator parameters. Significant spatial variability was, however, observed only in nutrient concentrations. The indicator parameters varied in relation to the physical forcing factors such as wind speed, precipitation, river discharge and tides. Seasonally averaged DIN concentrations exceeded the threshold values during summer 2003 and spring 2004, both periods of high river discharge. DIP concentrations varied throughout the year in relation to salinity, wind speed, and gage height. Chlorophyll a concentrations were higher than the reference values during summer. Turbidity in the bay exceeded the acceptable levels in spring, summer, and winter. Dissolved Oxygen concentrations in the bay were always higher than the required values. Although the environmental quality of the bay was impaired at certain times of the year, the overall environmental quality score for the entire period of fourteen months was 7.6 out of 10, which ranked as "Good" on our index.

Baldwin County Grasses in Classes Program

Sedlecky, M. H. Weeks Bay National Estuarine Research Reserve, Fairhope, Al 36532

The poster will outline the goals and objects of the Baldwin County Grasses in Classes (BCGIC) Program. This unique program gives high school students meaningful hands-on experiences that provide investigative and problem-solving opportunities. Students learn about coastal habitats and gain technical skills, while working along side conservation agency staff to implement restoration projects which have a direct impact on the health of Alabama's coastal habitats.

Assessment of Phytoplankton Community Composition and Species Succession in the Bay of St. Louis, Mississippi

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Phytoplankton are acutely susceptible to environmental factors which can prompt rapid species succession and create dynamic communities. Phytoplankton have a fundamental role in aquatic ecosystems therefore an understanding of how these communities respond to environmental changes is crucial. A phytoplankton community was examined in the Bay of St. Louis, Mississippi, to determine how the community responds to environmental variability. The Bay of St. Louis is a shallow water estuary connected to the Mississippi Sound by a narrow opening and influenced by two rivers (the Jourdan and the Wolfe), multiple bayous, four sewage treatment plants, a casino, and a titanium dioxide plant. For this study samples were collected at 10 stations, twice monthly during incoming and outgoing tides, from April 2003 to May 2004. Then a High Performance Liquid Chromatography (HPLC) method was coupled with Chemical Taxonomy (CHEMTAX), a pigment classification program, to determine the phylogenetic composition of the community. The phytoplankton community in the Bay of St. Louis is expected to exhibit seasonal species succession without spatial variability. In addition, it is predicted that species composition will remain relatively stable over time, with each group contributing equal amounts to total chlorophyll *a*.

Effects of Nutrient-Rich Water on the Parasitism of the Common Grass Shrimp, *Palaeomonetes pugio* on Gaillard Island, AL

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The effects of direct and indirect nutrient loading and toxic compound accumulation on a dredge spoil island is being investigated in relation to the prevalence and infection success of a trematode parasite, *Microphallus turgidus,* which infects the common grass shrimp *Palaeomonetes pugio*. Trematode prevalence within the *P. pugio* population on Gaillard Island, AL has been observed to be relatively low (0-13%) when compared to a population of *P. pugio* on the mainland (74-89%). The high parasitism observed at the mainland site could be related to the potential presence of chemical compounds released from neighboring industries. The source for nutrients on Gaillard Island is the large population of nesting Brown pelicans, *Pelecanus occidentalis*. Tons of bird guano are deposited around the thousands of roosts on the island each nesting season. In addition, dredge material is dumped each year when nesting birds are not present. With the dredge spoils it is possible that chemical species and heavy metals are deposited onto the island. The island is engineered to reduce the amount of harmful runoff from entering the Mobile Bay. The presence of the birds and the first intermediate host of the parasite on the island suggests there should be infected shrimp present. The ongoing survey is designed to investigate and record the prevalence of parasites in Gaillard Island *P. pugio* populations

and to follow and quantify nutrients as they move from roosting sites and dredge dumping sites to the Mobile Bay. Laboratory experiments are also being conducted to determine the effects of known quantities of nitrogen and phosphorus species on the infective success of *M. turgidus*, as well as the resistance of the host. This study may help to evaluate the effectiveness of dredge spoil island engineering, and the *M. turgidus- P. pugio* association as a possible bioindicator of habitat disturbance.

Estimating the Areal Extent of Suitable Habitat for Post-Larval and Juvenile Brown Shrimp (*Farfantepenaeus aztecus*) in Mobile Bay National Estuary

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Extensive research has demonstrated a strong correlation between wetlands and productivity of shrimp fisheries in the Gulf of Mexico. Unfortunately, the Gulf coast has the highest rate of wetland loss in the U.S. Quantifying suitable habitat for post-larval and juvenile shrimp in Gulf estuaries is vital to sustainable fisheries. The extent of suitable habitat determines best management practices and restoration activities. We present the results from the application of an existing Habitat Suitability Index (HSI) model for northern Gulf of Mexico brown shrimp (*Farfantepenaeus aztecus*) using National Wetlands Inventory (NWI) wetland and submerged aquatic vegetation coverages and EPA National Coastal Assessment (NCA) data for water quality and sediment characterization for Mobile Bay, Alabama. These results will serve as a baseline for the areal extent of suitable brown shrimp habitat within the Mobile Bay National Estuary Program (MBNEP) boundaries. Estuarine habitat protection, conservation and restoration goals have been outlined in MBNEP's Comprehensive Coastal Management Plan. This information could be used to evaluate and support those management goals. The integration of NCA data and vegetated habitat coverage data allows for an estimate of suitable habitat as percent cumulative area. This approach may also provide an estimate of the extent of suitable brown shrimp habitat Gulf-wide.

Harmful Bloom-Forming Microalgae in Alabama Waters

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Several species of microalgae in Alabama waters are capable of forming toxic blooms that can result in fish-kills and may necessitate closure of commercial fisheries. Samples collected by the Alabama Department of Environmental Management, Dauphin Island Sea Lab, Baldwin County Health Department, Alabama Department of Conservation, and Alabama Department of Public Health are analyzed by the Alabama Department of Public Health's Mobile Division Laboratory for the presence and abundance of these microalgae. These data are maintained in a database along with sampling information and water-quality data. In the event of potential human health risks, the numbers are transmitted to the appropriate state and federal agencies to ensure timely management of living resources. In recent years, there have been toxic blooms of the red-tide dinoflagellate *Karenia brevis*, *Alexandrium monilatum*, and the diatom *Pseudo-nitzschia pseudodelicatissima*, predominantly along the Gulf of Mexico beaches. A bloom of the dinoflagellate *Heterocaps triquetra* near Fairhope caused a fish-kill through nocturnal hypoxia (a "jubilee"). The potentially-toxic dinoflagellaate *Prorocentrum minimum* and the raphidophyte *Chattonella* sp. have both bloomed in local bays but have not been associated with fish-kills or other deleterious effects. Other potentially-toxic species that are detected in low numbers include the dinoflagellates *Karenia mikimotoi*, *Dinophysis acuta* and *D. caudata* and the cyanobacterium *Lyngbia sp*. None has formed a known bloom to date.

Analysis of Fecal Loadings into Bayous Grande, Chico, and Texar in the Pensacola Bay System, FL

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Chronic fecal contamination of waterways within the Pensacola Bay, FL system represents both a public health and environmental problem. This report summarizes the findings of a multi-year study to identify sources of fecal contamination within the urban bayous of Pensacola, FL: Bayou Grande, Bayou Chico, and Bayou Texar. The design of the study was fundamentally different than typical monitoring programs. Stations within the bayous were selected to coincide with storm water drainages, perennial streams, and areas of likely groundwater discharge indicated by topography and freshwater wetland plants in salt water areas. Spatially explicit loading to all three systems was apparent. The intensity of this geographic variability (as variance in system-wide data) increased with moderate rainfall (up to 1.6" within the past 48 hours), but higher levels of rainfall resulted homogenization of the system and loss of both lower and higher count records. Analysis of station-specific data for rainfall effects on contamination indicated some stations with high loading rates at zero rainfall, presumably from groundwater loadings, and others with more dependence on rain, presumably as storm water inputs and enhanced groundwater discharge. In Bayou Grande, the residential areas of the northern and western drainages, and not the Naval Air Station along the southern shore, appeared to be the major source areas of chronic fecal contamination to the system. In Bayou Chico, loading of nitrogen and fecal bacteria decreased along the salinity gradient of the system as a general trend, indicating the three freshwater and residential areas of the bayou as sources to the system, as opposed to the industrial and commercial marina areas along the main part of the bayou. In Bayou Texar, nitrogen and fecal bacteria also decreased along the salinity gradient of the system as a general trend, indicating the Carpenters Creek drainage area as the primary groundwater sources to the system, with the main bayou area served by residential sewer being affected mainly by rainfall. By focusing sampling effort on potential loading points into the systems, areas of concern could be identified for remedial action, and the spatial distributions distinguishing between storm water and chronic inputs could be made in many cases.

Responsiveness of Microbial Biofilms as Indicators of Estuarine Condition

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Microbial biofilms are complex communities that can be comprised of bacteria, protozoa, microalgae, and micrometazoa existing in an extracellular polysaccharide matrix. Their development is affected by biotic and abiotic characteristics of the milieu and is therefore integrative of environmental conditions. The tremendous surface area available within estuaries makes the contribution of natural biofilms to estuarine ecosystem function significant. As a fixed point growth assay, biofilms would be indicative of nutrient bioavailability, light and oxygen within the complexity of estuarine circulation. Biofilms were grown for seven days on acrylic plates held in PVC racks with floats for the surface, concrete anchors for the benthos, or a harness to suspend them as a vertical array in the water column. Additionally, water column samples were collected during deployment and retrieval of samplers to characterize ambient physico-chemical parameters. The method also appears to be sensitive to hypoxia when deployed as a water column profiling microalgal growth assay, or with artificial substrates deployed over the benthos. This allows determination of microalgal production at fixed points within the system, unlike phytoplankton biomass distributions which may be decoupled from growth by hydrodynamic constraints on biomass accumulation. Indeed, periphyton growth responses over a multiyear period do not match the spatial distributions of phytoplankton but show the locations of bioavailable nutrients and the conditions that constrain microalgal growth. Perhaps counter-intuitively, water chemistry, and not light availability, has been most limiting to estuarine microalgal production for this assay. Comparisons to shallow water benthic production and respiration with *in situ* chambers indicate that these biofilms, even when deployed over the benthos, are reflecting water column conditions and not microphytobenthos dynamics. Analysis of the prokaryotic portion of this biological sensor has also been addressed by extraction of DNA and developing DNA fingerprints of community structure by TRFLPs and sequencing of 16s rRNA genes from shotgun cloning. These studies have illustrated spatial and temporal patterns of diversity and responses of biofilm prokayotes. Oyster reefs appear to have a unique microbial community as compared to adjacent sand/mud benthos. Seagrasses and adjacent bare sand bottom do not show differences. At a single location, community structure was found to be relatively stable during summer months despite fluctuations in salinity and oxygen and was replaced by a cold water community in the winter. Prokaryotes engaged in sulfur cycling (reduction, oxidation) appear to be responsive to both organic loading and hypoxia. In microcosms, N-cycling prokaryotes appear responsive to differences in nitrogen loading treatments. While more work needs to be done to formalize the responses of biofilms as indicators of estuarine status and condition, they are highly responsive, integrative biological sensors of ambient estuarine conditions.

The Use of Living Shorelines to Stabilize a 25 Acre Salt Marsh on Dauphin Island, Alabama

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Dauphin Island, Alabama is a barrier island located at the western side of the mouth of Mobile Bay. Fort Gaines Harbor serves as one of the Island's two primary access points for recreational boats to the Gulf of Mexico. Pilot Boats for the Mobile Ship Channel, ExxonMobil Crew Boats, and the Mobile Bay Ferry navigating between Dauphin Island and Fort Morgan dock at Alonzo Landing in the harbor. The Dauphin Island Sea Lab and the U.S. Coast Guard also have docking/mooring facilities within Fort Gaines Harbor. Although there is a no-wake zone in Fort Gaines Harbor, this area of high boat traffic coupled with easterly winds, has led to erosion of Saw Grass Point Salt Marsh; immediately West of the ferry landing. This saline tidal marsh, one of only two on Dauphin Island, consists of 25.12 acres of wetlands bordered to the south by 2.68 acres of pine savannah. In 2004 the Gulf of Mexico Foundation funded a community-based restoration project to protect and restore the eastern edge of the marsh through the use of wave attenuation devices. In March 2005 182 wave attenuation devices were emplaced along the eastern perimeter of the marsh. These living shoreline structures serve the dual roles of protecting the marsh and providing habitat for a wide array of marine organisms. In June, the Dauphin Island Boy Scouts planted 1,200 *Spartina* plants along the edge of the Marsh. The primary positive impacts from the project were that the devices are allowing sediment accretion shoreward and provide very good substrate for oyster spat. The downside of implement the project was the high cost of the wave attenuation devices and the extremely cumbersome permitting process.

Alabama and Mississippi Online Habitat Conservation, Restoration and Enhancement Database

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Habitat conservation and restoration activities are imperative to the long-term sustainability of regional ecosystems, including fishery resources and the habitats that support them, and to a host of societal benefits derived from productive coastal and estuarine habitats. In Mississippi and Alabama, both public and private organizations have undertaken habitat conservation and restoration activities, however, there is no mechanism that currently exists to track these activities, provide for technology transfer, and evaluate the effectiveness of these protection efforts. During the summer of 2005, the Mississippi-Alabama Sea Grant Consortium contracted with the Dauphin Island Sea Lab to develop an online habitat conservation, restoration, and enhancement database to track habitat conservation activities in the 11 coastal counties of Mississippi and Alabama; thereby establishing a mechanism for collecting data such as 1) habitat projects planned, in progress or completed along the northern Gulf of Mexico, 2) types of habitat conserved, 3) conservation techniques employed, 4) the variety of funding sources used, and 5) the locations of such projects. Cold Fusion, a scripting language for internet applications, was used to develop the web page interface and these pages reside on a Cold Fusion server. The database itself resides on a Microsoft SQL server managed by the DISL. The interactive map was created using ArcIMS, an online mapping software produced by ESRI (Environmental Systems Research Institute, Inc.). This database, which was recently put online for Mississippi and Alabama agency access, will allow resource practitioners to calculate the number of acres of habitat by type being restored and provide a basis for long term monitoring of activities and data that will shed light on most effective restoration techniques over the long term. Managed by the Mobile Bay National Estuary Program, it is robust yet simple to use in that registered users may add or modify projects

Assessment of Toxicants within the Mobile/Tensaw Watershed in Mobile and Baldwin Counties, Alabama

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The Mobile/Tensaw Delta is one of the largest deltas in the United States. The watershed comprises 2/3 of the state of Alabama and portions of Georgia, Mississippi and Tennessee. Activities such as agriculture, forestry and urbanization contribute to a large amount of non-point source pollution entering the watershed. The purpose of this study was to assess the organic and inorganic toxicants in the watershed of the Mobile/Tensaw Delta in Mobile and Baldwin Counties. Abiotic and biotic samples were analyzed for metals, mercury and organic toxicants. Hellgrammites (Megaloptera) were chosen as the biotic sampling unit.

Sediment Factors Contribute to High Enterococcal Counts along the Beaches of the Northern Gulf of Mexico

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Enumeration of enterococci (EN) bacteria in water is an USEPA approved indicator of fecal pollution and the possible presence of enteric pathogens. Along the northern Gulf of Mexico, the water is shallow with a high organic and particulate load because of the Mississippi River discharge. Disturbance of coastal sediments caused either by weather or human activities may increase bacterial counts as a result of increased EN persistence in the water column and/or resuspension of EN from the sediment. The goals of this project were to determine the relationship between organic content and EN counts in the sediment and to determine whether bacterial resuspension from sediment contributes to elevated EN counts. We found that EN counts in the water correlate with calm and rough wave conditions at seven sites along the Mississippi Gulf Coast. Bacterial counts during calm conditions expressed low EN levels in water with higher counts in sediment; the

reverse was observed during rough wave conditions. EN counts were positively correlated with organic content of the sediment. Wave activity to keep EN in suspension was apparently critical for high counts. EN counts decreased by 50% in 4 hr with the absence of resuspension. EN in the sediment are not stationary as genetic fingerprinting using REP-PCR showed low persistence of specific isolates over time. Jackknife analysis revealed low similarity among EN isolates from the water and sediment collected on the same day and site during calm wave conditions. This indicates that EN does not persist for long periods in the same area but instead are resuspended and redistributed along the coast. Results from this study provided evidence that high organic content and resuspension of isolates from the sediment during periods of strong wave action contribute to high EN counts. Current research on the survival of EN in estuarine habitats will provide further insight into the environmental persistence and the source of fecal pollution causing high EN counts along the beaches of the north?

Is Heat Shock Protein 70 a Useful Biomarker for Environmental Stresses in the Eastern Oyster, *Crassostrea virginica*?

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It is thought that Eastern oyster, *Crassostrea virginica*, populations have been declining along the coasts of the eastern United States and Gulf of Mexico. Anthropogenic disturbances are thought to be the main cause of these declines, with changes in abiotic environmental conditions, either in conjunction with, or independent of these anthropogenic factors contributing to increased mortality in specific areas. For successful restoration, understanding the responses of oysters to environmental stressors and developing simple biomarkers for detecting their effects is critical. As a part of the Alabama Oyster Reef Restoration Program, we have been examining the usefulness of heat shock protein 70 (HSP 70) expression as a biomarker of environmental stress in *C. virginica*. Heat shock protein 70 is a molecular chaperone known to play a role in cellular defense mechanisms. It has been used as a biomarker to detect environmental stress for a variety of species because of increasing expression in response to environmental stresses. Although three isoforms of HSP 70, two constitutive (77 and 72 kDa) and one inducible (69 kDa), have been identified in *C. virginica*, it is not known how different environmental stresses impact the expression of these three isoforms. This study examined differences in expression of HSP70 isoforms in *C. virginica* based on both type of environmental stress (salinity, temperature, and dissolved oxygen) and age of the oyster. Levels of environmental stress, type of stress, and age of the oyster all impact on HSP 70 expression. Clarifying how these factors interact will allow for a better evaluation of the effectiveness of HSP 70 as a biomarker.

Impacts of the Mobile Bay Causeway on Ecosystem Structure and Function in the Lower Mobile-Tensaw Delta

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Habitat alteration is among the most pervasive consequences of man's encroachment into coastal ecosystems. Locally, concern has been expressed about the impacts of one such large-scale alteration on the Mobile Bay ecosystem. Specifically, the Mobile Bay Causeway has been hypothesized to have reduced the free exchange of salty tidal waters between Mobile Bay and the lower reaches of the Mobile-Tensaw Delta. Here, we report on the findings of two years of study that have sought to determine if in fact the causeway has altered the ecology of this delta.

Dramatic differences in sediment grain size composition and community structure were found to exist on each side of the causeway during Year I. Sediments north of causeway were dominated by silts and clays indicative of quiescent waters. Sediments south of the causeway were sandy and indicative of a more erosional environment. While no differences in invertebrate density or species diversity were found, Analysis of similarity (ANOSIM) detected significant differences in benthic composition to exist north and south of the causeway. The benthos north of the causeway was dominated by insects. To the south, it was dominated by bivalves and amphipods. In Year II, the passage four successive hurricanes homogenized the distributional patterns of the sediments, and fauna of the area. In fact, few clear impacts were identified in Year II. Of these, the most noticeable impact was the persistence of hypoxia in semi enclosed bays north of the causeway following the landfall of each hurricane and the wide spread dominance of polychaetes at most study sites.

Also of note was that traditional, static, measures of nutrient concentration underestimated differences in nutrient availability above and below the causeway. Nutrient concentrations on each side of the causeway were statistically indistinguishable from one another, yet time integrated measures of nutrient availability (e.g., Carbon: Nitrogen: Phosphorus ratios in plants, and stable nitrogen isotope signatures in plants and fishes) detected significant differences to exist on each side of the causeway. Because of the concerns expressed above, their clear need for a third year of assessment which includes time integrated measures of ecosystem productivity. Even so, our results tend to support the hypothesis that the causeway has impacted the structure and function of the Mobile Tensaw Delta.

Lead Assessment within the Soil, Water, Vegetation, and Organisms in the Live Oak Rifle and Pistol Range at the Grand Bay National Estuarine Research Reserve

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The Grand Bay National Estuary Research Reserve was established in 1999 by NOAA and is maintained by the Mississippi Department of Marine Resources. The reserve is located in Jackson County, Mississippi between Pascagoula and the Alabama state line.

The abandoned Live Oak Rifle and Pistol Range lie within the boundaries of the NERR and is the main study site. The Live Oak Rifle and Pistol Range ecosystem consists of forested areas, seasonal wetlands, and a permanent pond. This project addresses the amount of lead present in the Live Oak Rifle and Pistol Range. Four collection sites were chosen throughout the range, and included: a short-range target, a long-range target, a pond behind the range, and the shooting area. The water that lies within the ditch and the boat dock were sampled to serve as reference sites. The soil samples were extracted using a small core, water was collected in amber plastic bottles, and vegetation was pulled from the roots and placed in plastic bags. All samples were kept in a cooler during transport and chilled or frozen upon arrival in the lab. The organisms collected at these sites were mosquito fish, dragonfly nymphs, crawfish, and tadpoles. Dip nets and seines were used to collect these organisms, put into plastic containers, kept in a cooler during transport, and frozen upon arrival at the lab. All samples were processed through microwave-assisted digestion and analyzed using GFAA. The lead levels for the soil samples ranged from 19.57 µg/g to 137,835.9 µg/g. Lead levels for the vegetation samples ranged from 2.66 µg/g to 2290.37 µg/g. Lead levels in water samples ranged from 0.45 µg/L to 557.4 µg/L; some of these samples were above EPA acceptable limits. These values were comparable to levels reported from other shooting ranges. The initial results for water, soil, and vegetation indicate possible lead contamination within this estuary reserve. However, the initial results for the organisms do not indicate lead contamination within the food web of the estuary reserve.

A Comparison of Nutrients Collected Before and After Hurricane Katrina in Estuarine and Coastal Waterbodies of Mississippi

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From spring 2003 through fall 2004 water quality samples were collected and physical/chemical parameters measured across the Mississippi Gulf Coast as part of a program to establish numerical criteria for nutrients in Mississippi's coastal waters. Twenty eight sites (8 were wadeable beach sites) were sampled quarterly over a two year period. The nutrients measured were total ammonia, total Kjeldahl nitrogen, total nitrate/nitrite, total phosphate, and total suspended solids. After Hurricane Katrina struck the Mississippi Gulf Coast on August 29, 2005, these 28 sites were re-sampled and compared to data collected prior to the storm. Physical/chemical parameters were similar in both studies. For most sites, there was little or no difference between the samples collected before and after the storm. Total suspended solids were lower at most sites in the fall 2005 samples. Post-hurricane concentrations of total phosphate and total Kjeldahl nitrogen were elevated in Bayou Casotte in eastern Jackson County.

Short-Term Water Quality Responses of a Microtidal Estuary to Storm Events

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In 2005, there were 3 heavy rain events, 1 tropical storm and 4 hurricanes, Hurricane Katrina being the largest, in the northern Gulf of Mexico. Data logged every 30 min at three sites within the Grand Bay National Estuarine Research Reserve, Mississippi, were used to assess water quality (depth, temperature, salinity, turbidity, pH and dissolved oxygen) responses to the eight events. Measurements during each storm event, defined by the period of continuous precipitation, were compared to tidally-normalized periods before and after each event. Water depth increased and temperature decreased during and after each event, but not in relation to either the duration of the storm event or the total precipitation from the event. Turbidity increased during and after each event. Salinity changed little during most of the events, but decreased in proportion to the total event precipitation in the post-event period. Responses in pH were similar to those in salinity, and suggest that pH was acting as a conservative tracer of the water mass rather than being responsive to biological activity in the storm and post-event period. Of the water quality parameters evaluated dissolved oxygen responses were most variable and least related to storm events. The resiliency of water quality measures could not be fully evaluated with these data, with each parameter having a return time longer than 3-event period equivalents. The spatial scale of variation in water quality responses was not addressed.

Tracking Human Pollution in the Aquatic Environment Using Mitochondrial DNA

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A PCR based method for the detection of human mitochondrial DNA (mtDNA) was developed to identify human waste as a source of contamination in coastal watersheds. Primers were designed for human mitochondrial DNA and tested against DNA fecal extracts from humans, deer, cows, pigs, dogs, chickens, sheep, horses and goats, untreated sewage and extracts of individual bacterial isolates. The PCR protocol was designed to detect human mtDNA in sources containing 10-20ng/ì L of DNA in 10 ì L PCR reactions. The presence of mtDNA was found in 117 of 120 human fecal samples. 188 samples from animal feces other than human showed no amplification of the DNA product. Sewage from lift stations in Hattiesburg, MS showed the presence of human mtDNA in 19 of 30 (63%) samples tested; the DNA from eight sewage samples collected from aerobic lagoons showed no amplification. Further, human mtDNA was detected in only one of eight environmental samples from coastal waters, river and creeks in south Mississippi. Results of this investigation show that human mtDNA is detectable in 97.5% of human feces, but not in all sewage samples. This indicates the possible presence of an inhibiting factor or the deterioration of mtDNA in human sewage or in the environment. If the PCR protocol can be modified to detect the signal in a larger percentage of lift station samples, the method could to be useful as an indicator of a recent human contamination.

Water, Weather and the Coast: An Overview of the National Estuarine Research Reserve System-Wide Monitoring Program

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The National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Research Reserve System (NERRS) was established by the Coastal Zone Management Act of 1972. There are 27 reserves protecting over one million acres of estuarine waters and adjoining lands across the continental United States, Alaska, and Puerto Rico. The Coastal Zone Management Act created reserves to protect estuarine areas, promote and conduct estuarine research and monitoring, provide education opportunities, and transfer relevant information to coastal managers. In 1995, the NERRS established a System-Wide Monitoring Program (SWMP) with three ecosystem foci: 1) abiotic water and weather parameters, 2) biological monitoring including biodiversity and habitat characteristics, and 3) watershed habitat land use classifications. The SWMP was designed to track short-term variability and long-term changes in estuarine waters to understand how human activities and natural events can change ecosystems. Currently, each reserve deploys a minimum of four water quality dataloggers and one weather station to record abiotic water conditions and track weather conditions, respectively, Recent SWMP developments include near real-time availability of abiotic data via the Centralized Data Management Office website (http://cdmo.baruch.sc.edu/) and expansion into the bio-monitoring phase through the development of protocols for collecting baseline data for emergent and submerged aquatic vegetation across the reserves for habitat change analysis. Reserve monitoring efforts are integrated with coastal training and education programs to provide timely scientific data to users who influence coastal resource decisions. Local education, training and management applications of the SWMP abiotic and biological monitoring data are powerful examples of integrating coastal science and technology to address coastal management needs. The reserves provide a framework for how systematic monitoring efforts that are well integrated with management needs and end user products can inform local and national coastal management policy and priorities.

Living Aquatic Resources in the Mobile-Tensaw Delta: Results from a 5-year Study

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The Mobile-Tensaw River Delta extends from the confluence of the Tombigbee and Alabama rivers to the head of Mobile Bay and constitutes one of the largest delta systems in North America. Its discharge (est. 2,000 m /sec) is among the greatest in North America generating one 3 of the highest ratios of freshwater inflow to estuary area of estuaries in the United States comparable only to Sabine Lake, Louisiana along the Gulf Coast. This presentation will highlight the results of 5 years of monthly sampling in the

Mobile-Tensaw River Delta focused on fishes, but includes physical, chemical, and zooplankton components. Salinity is typically 0 ppt throughout the Mobile-Tensaw River Delta in winter and spring, increases during the summer in the lower areas of the Delta reaching peak values of 12 ppt at sites near the Causeway which forms the southern boundary of the Delta while remaining entirely fresh upstream near I-65. Daily tides and unpredictable tropical storms/hurricanes introduce additional variability to these salinity patterns. Our zooplankton sampling revealed an expanding population of a large non-native zooplanker, *Daphnia lumholtzi*; its potential influence is not yet clear. Our electrofishing sampling has yielded more than 100 fish species, including one Federally Threatened species (blackmouth shiner, *Notropis melanostomus*). We focused specific effort on the Delta population of largemouth bass *(Micropterus salmoides*), which is both ecologically and economically important in the Delta as an abundant piscivore that supports a tremendous sportfishery. This freshwater fish tolerates fluctuations in salinity in the Delta from 0 ppt to over 10 ppt annually. Evidence from tagging studies, tracking of fish implanted with sonic transmitters, and microelemental analyses of otoliths all suggest that largemouth bass move little to avoid higher salinities. Our results suggest that largemouth bass in the Delta may differ significantly from strictly freshwater populations in life history, growth, diet, and perhaps even genetics. As such, much of what we know about this well-studied species from freshwater systems may not apply to these coastal populations. Our ongoing work also addresses recruitment processes and behavior of fishes such as southern flounder *(Paralicthys lethostigma*) and several freshwater sunfishes. While southern flounder is thought to be entirely a marine spawner, otolith microelement signatures suggest that a significant fraction of their eggs hatch in the freshwater of the Delta. We are also exploring bioenergetics and foodweb linkages to better understand bioaccumulation of mercury and the movement of material and energy between the Delta and other coastal systems. The results of these continuing research efforts address two important needs by: 1) describing the biology and ecology of important sport and commercial fishes in the Delta and 2) generating data necessary to evaluate impacts on the ecosystem due to alteration of water flow, watershed development, and potential future alteration of the Causeway.

Suspended Sediment Transport in Mobile Bay: Remote Sensing and Numerical Modeling

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The watershed of the Mobile Bay estuary is vast and diverse. The Mobile River Basin is the sixth largest in the nation. On average, the Mobile River system discharges 62,000 cubic feet per second of fresh water inflow into the estuary, the fourth largest in the U.S. The runoff from the local and regional watersheds carries a large amount of sediment and nutrients, which is susceptive to human activities, such as agriculture, dam construction and urban sprawl. The turbidity and salinity in the water column influence the production of many marine species in the estuary. As one of the water quality indicators, the high suspended solids concentration in an estuary has important scientific, engineering and ecological implications. The study demonstrates the feasibility of integrating state-of-the-art technologies in remote sensing, numerical modeling and in-situ monitoring to assess the turbidity variability in the Mobile Bay Estuary. We have inferred total suspended solids (TSS) from satellite imagery of the estuary surface and coupled a three-dimensional circulation model with a sediment transport model to simulate the dynamics of turbidity in Mobile Bay. The output of the numerical model includes spatial and temporal variations of suspended sediment concentrations. An integration of the suspended sediment concentrations over the water column gives the total sediment solids, which allow for direct comparison with the inferred TSS from remotely sensed MODIS (MODerate resolution Imaging Spectroradiometer) data. A statistic-thermodynamic model developed by Zheng et al. (2006) for the dissolved organic matter (DOM) degradation in estuaries is employed to explain the correlation of salinity and DOM in the estuary. It is concluded that the inelastic collision between the terrestrial DOM molecules and dissolved salt ions in seawater is a dominating mechanism for the degradation of terrestrial DOM. The research has been funded by the Alabama Center for Estuary Studies (ACES).

Notes

Notes

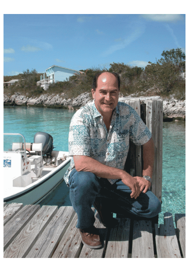
__Our keynote speaker__ for the conference on Tuesday morning is the **renowned Marine Biologist, Dr. Sylvia A. Earle.** She will be discussing the impact we are having on our oceans, from heightened mercury levels in the fish we eat to tsunami devastation in coastal areas once protected by corals and mangroves. Dr. Earle—sometimes known as "Her Royal Deepness" or the "Sturgeon General"—has been an Explorer-in-Residence at the National Geographic Society since 1998, the year *Time* magazine named her their first "hero for the planet." Earle has pioneered research on marine ecosystems and has led more than 50 expeditions totaling more than 6,000 hours underwater. She holds numerous diving records, including setting the women's depth record for solo diving at 3,300 feet (1,000 meters). Since 1990 Earle has held a variety of important posts, including chief scientist of the U.S. National Oceanic and Atmospheric Administration. She describes the ocean as the cornerstone of Earth's life-support system, vital for the survival and well-being of humankind. As Earle says, the ocean has no borders and we must all focus our energies on critical conservation.

NATIONAL GEOGRAPHIC LIVE!

Photo By:
Natalie Forbes

Dr. Orrin Pilkey, Professor Emeritus, Duke University will present a lively discussion on his life's work on barrier islands, beach processes, and coastal development. Dr. Pilkey's research centers on both basic and applied coastal geology, focusing primarily on barrier island coasts. Dr. Pilkey's applied studies are carried out under the auspices of the Program for the Study of Developed Shorelines (PSDS). Such studies have included a review of the national beach replenishment experience on all 3 U.S. coasts and analysis of the validity of replenished beach engineering design parameters. The PSDS group is currently exploring, from a geologic viewpoint, methods for mitigating hurricane damage on barrier islands. The PSDS is also critically analyzing the numerical models used by geologists and engineers to predict coastal and especially beach behavior and finds them wanting. Known for his outspoken candor, Dr. Pilkey will be available for a book signing during the evening event.

Dr. Nancy Rabalais will present the latest information on hypoxia studies in the Northern Gulf of Mexico during lunch on Wednesday. Currently Director of the Louisiana Universities Marine Consortium, Dr. Rabalais brought national attention to the problem of Gulf of Mexico hypoxia (oxygen depleted waters) related to excess nutrients, particularly nitrogen. As a result of White House action, a scientific assessment of the hypoxia issue and the linkages with nutrient loadings of the Mississippi River was conducted and a Mississippi River/Gulf of Mexico Watershed Nutrient Task Force is now implementing a Gulf Hypoxia Action Plan to coordinate and support nutrient management and hypoxia related activities in the watershed and Gulf. She gives seminars and presentations concerning the hypoxia and nutrient overload issues across the U.S., and globally, and has testified at Senate and House Committee hearings.



Dr. Frank Muller-Karger is a biological oceanographer, where he directs the Institute for Marine Remote Sensing. Muller-Karger was appointed by President George W. Bush to serve on the U.S. Commission on Ocean Policy. The results of this Commission's deliberations are far-reaching and urgent. The impacts of human activity in the coastal zone and our lack of information with which to develop comprehensive management strategies are both timely and revealing. On Wednesday, Dr. Muller-Karger will discuss the signal results of this committee's deliberations and sound a renewed call for action that is particularly important for the Gulf states. Muller-Karger conducts research on marine primary production using satellite remote sensing, large data sets, networking, and high-speed computing. This research helps in the location and monitoring of large-scale phenomena, understanding climate control and climate change, and in the interpretation of numerical models of the ocean.

Alabama-Mississippi Bays and Bayous Symposium

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