CENTER FOR MARINE RESOURCES AND ENVIRONMENTAL TECHNOLOGY and SEABED TECHNOLOGY REASERCH CENTER
UNIVERSITY OF MISSISSIPPI

ACTIVITIES REPORT FOR THE CRUISE GOM03-11, ABOARD THE R/V *ACADIANA*

ST. BERNARD SHOALS AND
MISSISSIPPI RIVER BIRDSFOOT DELTA
NORTHERN GULF OF MEXICO

MAY 30 – JUNE 2, 2011

OPERATIONS REPORT AND EVENT LOG OF CORING OPERATIONS AND COLLECTION OF SEDIMENT AND HYDROGRAPHIC DATA RELATING TO THE MISSISSIPPI RIVER FLOOD OF 2011

By
Leonardo Macelloni, Marco D'Emidio, and Carol B. Lutken

Center for Marine Resources and Environmental Technology
Seabed Technology Research Center
111 Brevard Hall
University of Mississippi
University, MS 38677

Scientific Staff:

CMRET/STRC	Leonardo Macelloni– Chief Scientist
	Carol Lutken - Scientist
	Marco D'Emidio – Scientist/Navigator and GIS expert
	Matt Lowe – Research Systems Specialist
	Brian Noakes – Research Systems Specialist
Pelican crew:	Max Wike – Captain
	Carl Sevin – Mate
	John Klingler – Marine Technician

INTRODUCTION

A two-part scientific research cruise was undertaken to St. Bernard Shoals and to the passes of the Mississippi River Birdsfoot Delta (Fig. 1) May 30 – June 2, 2011, aboard the R/V *Acadiana*. The objectives of this cruise were to: 1. Collect sediment cores from target areas of the St. Bernard Shoals in support of the Bureau of Ocean Energy Management's (BOEM) beach sand replenishment efforts; 2. Quantify and characterize in "near real-time" the flood/sediment plume emanating from the main passes of the Mississippi River during peak-flow of the historic 2011 flood. This second objective was accomplished via satellite updates delivered every four hours that impacted/revised the sample targets. Figure 1 shows the area where sampling activities – sediment, water and hydrographic data collection - were focused. Figure 1 includes preliminary targets

and transects that were revised continuously during operations at sea as the flooding event evolved. Revisions were possible because the field team maintained close, near-constant, communications with the University of Pennsylvania's satellite imagery monitoring and analysis team. Transects rationale and sampling operations are listed below:

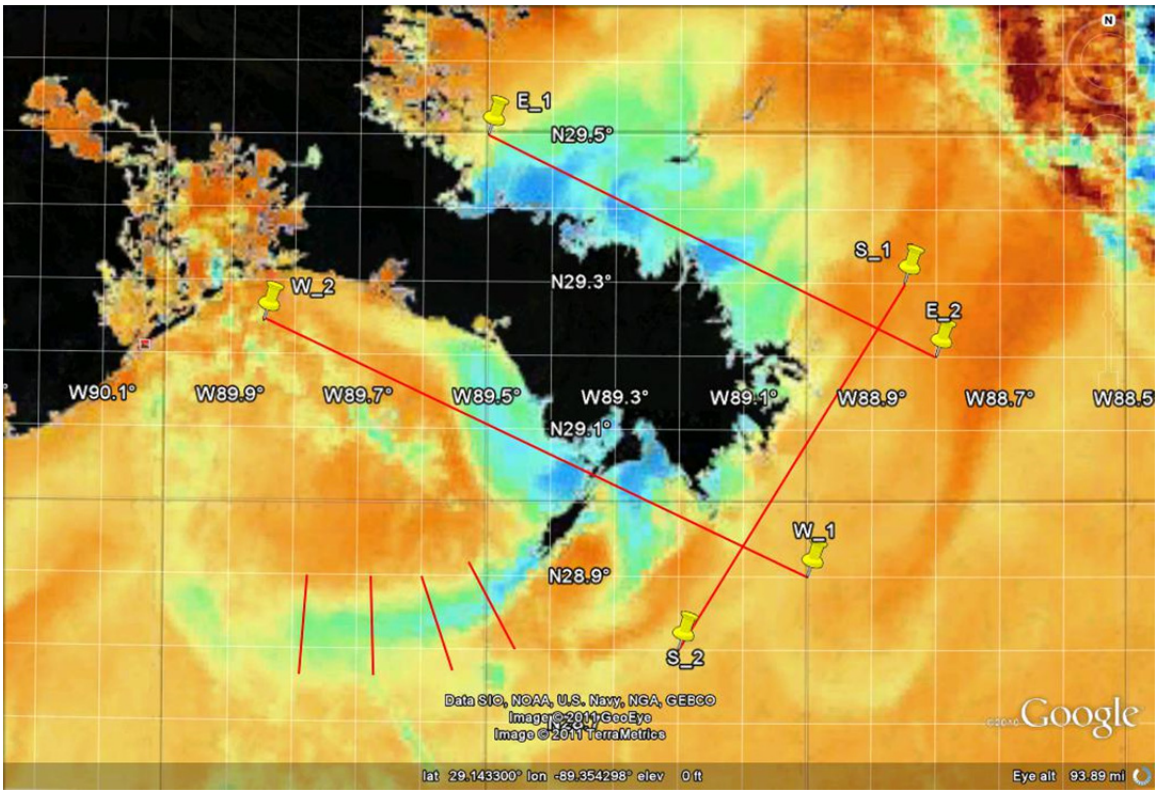

Figure 1. Locations of the target transects for data-collection, Mississippi River Delta.

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BACKGROUND

During the spring of 2011, the Mississippi River system experienced record high-water along much of its extent. The dates of arrival of peak floodwaters were predicted with great accuracy throughout the River's length. At about six weeks prior to the arrival of the floodwaters at the River's mouth(s), geoscientists at the University of Pennsylvania contacted colleagues at the University of Mississippi to discuss the possibility of a collaboration that would "catch" the flood's peak as it exited the River's effluents into the Gulf of Mexico. The exit of waters was monitored via satellite by the University of Pennsylvania team while the University of Mississippi prepared the field component of the study – collection of *in situ* sediment, water (suspended sediment) and hydrographic parameters – in key areas as determined by the satellite data. The work was supported by a 5-institution NSF Rapid Response grant: NSF EAR 1140269; $49,000; 07/11-7/12. "RAPID: Connecting the historic 2011 Mississippi River flood to marsh sedimentation on the Delta", designed to show how the largest-ever Mississippi flood did or did not

contribute to coastal wetland sedimentation in Louisiana and how river-mouth dynamics controlled the fate of sediment.

OBJECTIVES

1) Collect 15-20 cores from St. Bernard Shoals using the SDI vibracorer;
2) Collect data that will enable researchers to track sediment transport and volume along the shoreline of the major effluents of the Mississippi River (MR) Bird's Foot Delta during an extreme flooding event, including the following:
   a. Suspended Sediment Concentration (SSC);
   b. seawater velocity;
   c. conductivity (salinity), temperature and depth;
   d. seawater samples;
   e. seafloor samples.

Cruise activities at St. Bernard Shoals

Survey rationale and sampling strategy for the BOEM project were carried out according to priorities set by the BOEM. Target sites for core recovery had been selected from areas of the St. Bernard Shoals suspected – based upon bathymetry and shallow subsurface profiles from the area - to host significant volumes of sand.

Strong currents and limited length of vibracore hose (~ 12 m) allowed us to recover just 3 cores, with fair recovery (27", 33" and 37") from water depths ranging from 6m to 11m (Table 1, Figure 2). (See 5/31/11 of the Cruise Event Log).

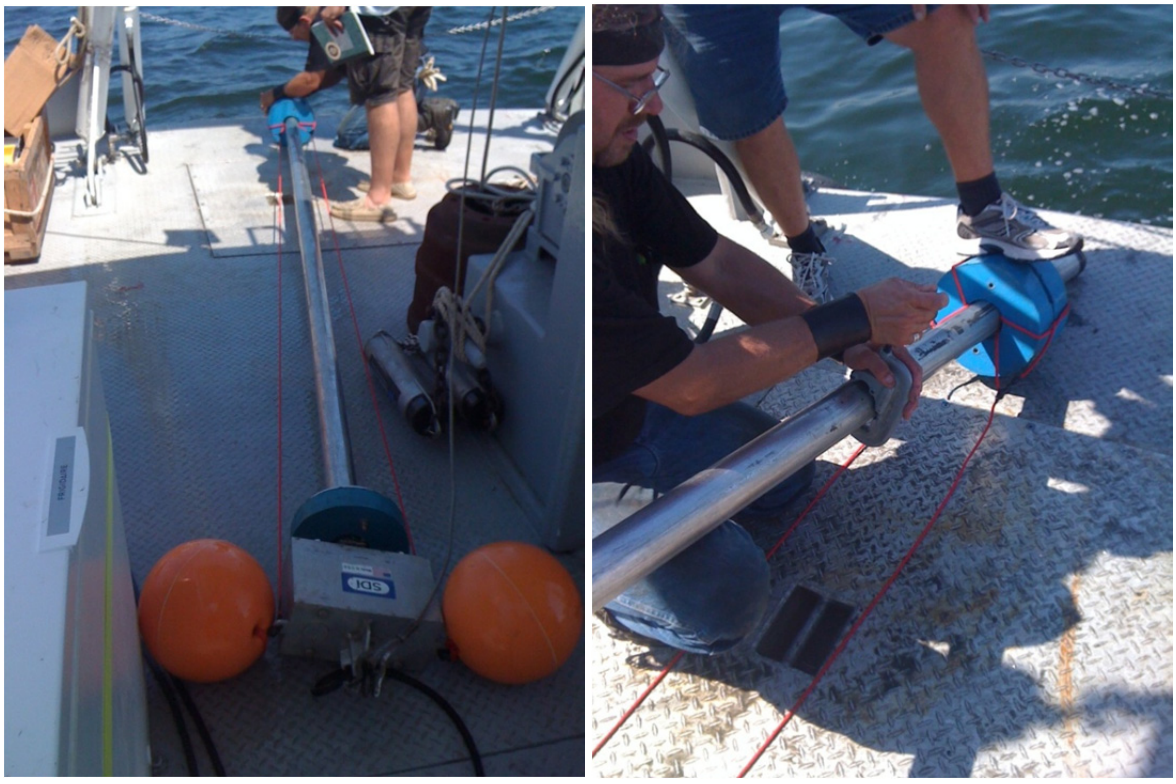

Figure 2. Vibracoring at St. Bernard Shoals. The small core barrel produced good recovery of clean sands in this area of rough seas. The rig is held upright by means of floats (right). Recovery is quick and possible in rougher seas than with a larger rig (left).

Table1: Cores at St. Bernard Shoals

Core ID	Longitude	Latitude	Depth	Recovery
SBS-10-01	88.79855752° W	29.75636304° N	-6m	33" (~83.82cm)
SBS-10-02	88.79006182° W	29.74967633° N	-6m	37" (~93.98cm)
SBS-10-1_Real	88.78698365° W	29.76800786° N	-11m	27" (~68.58cm)

Cruise Activities at effluents of the Mississippi River, 2011 Flood

At-sea operations for this project were conducted by the Mississippi Mineral Resources Institute at University of Mississippi. Surveys and sampling were carried out between May 30-June 2 from the R/V *Acadiana*, a Louisiana University Marine Consortium (LUMCON) research vessel outfitted to support research activities in coastal bays and nearshore waters.

Survey rationale and sampling strategy for the Mississippi River flood portion of the research, in accordance with the scientific hypotheses presented in the proposal, were designed to quantify and characterize in "near real-time" the flood/sediment plume. Figure 1 shows the area where sampling targets were focused. All operations at sea remained flexible throughout the study and were conducted in close connection with the UPenn. team, who modified transect locations, as satellite imagery revealed the evolution of the flooding event. Transects and sampling rationale that were actually executed are plotted in Figure 3 and were as follows:

Transect NE, Fig. 3 (North-East); E1_E2 of Figure 1. This transect was designed to measure Suspended Sediment Concentration (SSC) (turbidity meter), seawater velocity (Acoustic Doppler Current Profiler, or ADCP), conductivity (salinity), temperature and depth (CTD), seawater samples (Niskin bottles), and seafloor samples (Ponar) along the northeast shoreline of the Mississippi River (MR) Bird's Foot Delta.

Endpoints: 29.5N/89.5W; 29.2N/88.8W. Length: ~ 40 Nautical Miles**.**

Transect SE, Fig. 3 (South-East); S1_S2 of Figure 1. This transect was designed to measure the SSC (turbidity meter), seawater velocity (ADCP), conductivity (salinity), temperature and salinity (CTD), seawater samples (Niskin bottles), and seafloor samples along the southeast shoreline of the MR Bird's Foot Delta.

Endpoints: 29.3N/88.85W ; 28.8N/89.2W. Length: ~ 35 Nautical Miles**.**

Transect SW, Fig. 3 (South-West); W1_W2 of Figure 1. This transect was designed to measure the SSC (turbidity meter), seawater velocity (ADCP), conductivity (salinity), temperature and salinity (CTD), seawater samples (Niskin bottles), and seafloor samples along the southwest shoreline of the MR Bird's Foot Delta.

Endpoints: 28.9N/89.0W ; 29.25N/89.85W. Length: ~ 50 Nautical Miles.

Transect SWp_1, Fig. 3 (Southwest Pass 1). This transect was designed to measure the fine structure of SSC (turbidity meter), seawater velocity (ADCP), conductivity (salinity), temperature and salinity (CTD), seawater samples (Niskin bottles), and seafloor samples across the MR plume flowing out from the Southwest pass.

Endpoints: 28.91N/89.52W ; 28.80N/89.45W. Length: ~ 8 Nautical Miles**.**

Transect SWp_2, Fig. 3 (Southwest Pass 2). This transect was designed to measure the fine structure of SSC (turbidity meter), seawater velocity (ADCP), conductivity (salinity), temperature and salinity (CTD), seawater samples (Niskin bottles), and seafloor samples across the MR plume flowing out from the Southwest Pass.
Endpoints: 28.78N/89.55W ; 28.90N/89.60W. Length: ~8 Nautical Miles.

Transect SWp_3, Fig. 3 (Southwest Pass 3). This transect was designed to measure the fine structure of SSC (turbidity meter), seawater velocity (ADCP), conductivity (salinity), temperature and salinity (CTD), seawater samples (Niskin bottles), and seafloor samples across the MR plume flowing out from the Southwest Pass.
Endpoints: 28.90N/89.68W ; 28.76N/89.67W. Length: ~ 8 Nautical Miles**.**

Transect SWp_4, Fig. 3 (Southwest Pass 4). This transect was designed to measure the fine structure of SSC (turbidity meter), seawater velocity (ADCP), temperature and salinity (CTD), seafloor bathymetry, seawater samples (Niskin bottles), and seafloor samples across the MR plume flowing out from the Southwest pass.
Endpoints: 28.76N/89.79W ; 28.90N/89.78W**.** Length: ~ 8 Nautical Miles**.**

Stations were spaced ~ 2 nautical miles apart**.** Niskin bottles were used to collect two water samples from each station (Figure 4), using a rosette: one at the sea surface and one at the benthic layer.

CTD data were collected using SBE Seasave v.7 software in a .hex (hexadecimal) file format, editable using SBE win 32 data processing software. A total of twenty two (22) CTD casts were made in depths of 3-100 meters of water using an SBE 19 plus v. 2 configured with an SBE 55 ECO water sampler carousel.

Sediment sample recovery was achieved using a ponar grab sampler (Figure 4). This method worked especially well at sites of strongest current as minimal bottom time was required to retrieve good samples. Grab samples were subsampled and the sediment stored in glass bottles and Zip-lock bags and placed in coolers for transport to lab facilities.

Acoustic Doppler Current Profiling methods were employed to recover current magnitude and direction both from a moored station and from a pole-mounted (to the vessel) instrument (Figure 5). Acquisition was monitored throughout the study (Figure 6) and plotted via WinRiver II, software from Teledyne RD Instruments.

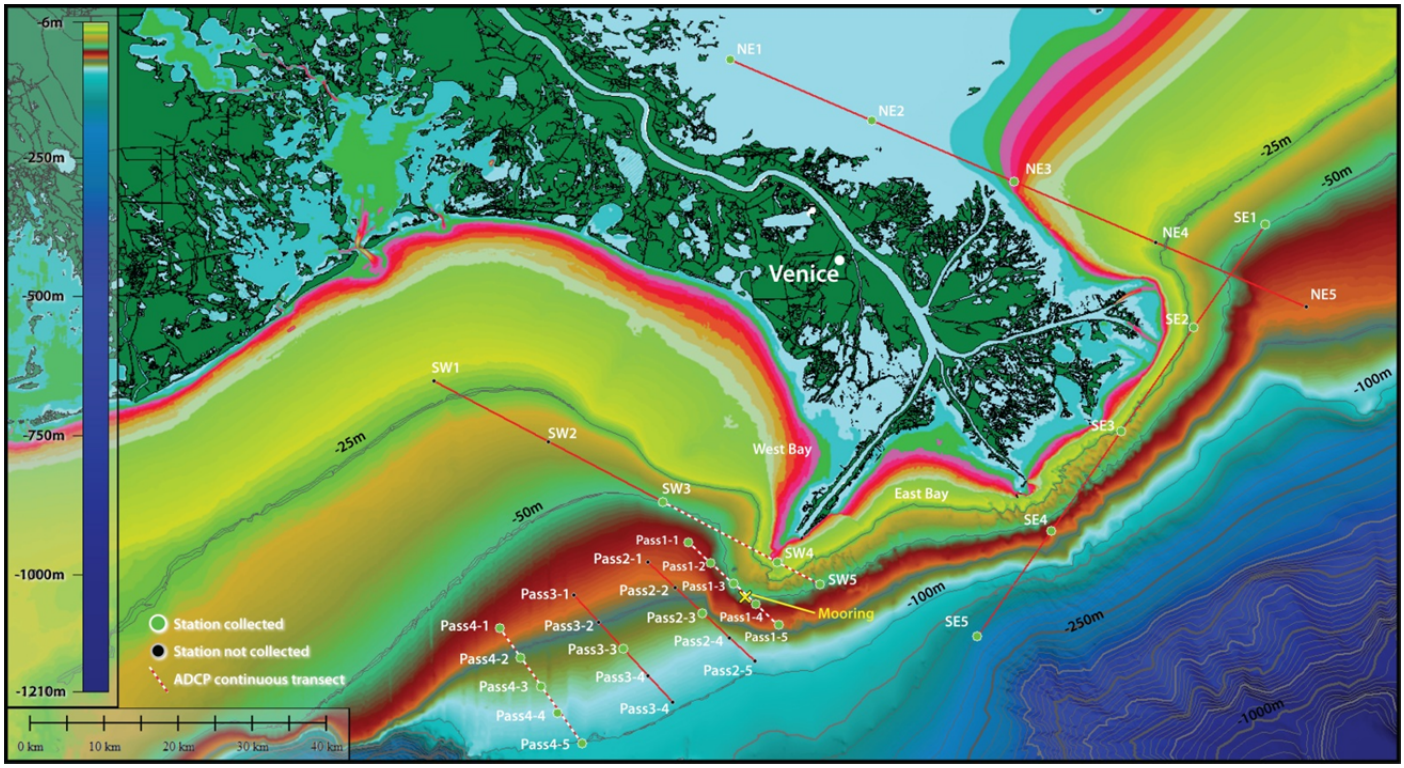

Figure 3. Locations of transects and stations where data were actually collected, Mississippi River Birdsfoot Delta.

Figure 4. Water sampling (left), Ponar grab sampling (right).

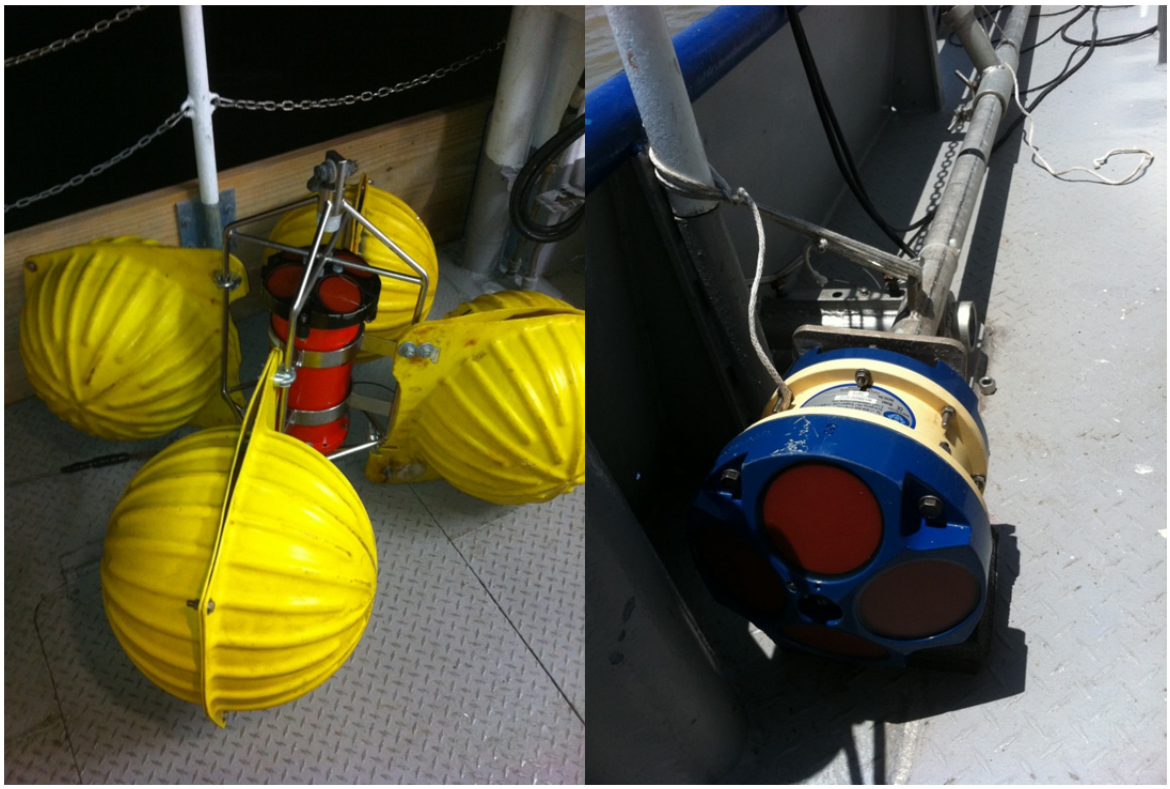

Figure 5. Mooring ADCP (left), Pole mounted ADCP(right).

Figure 6. Real time ADCP acquisition station (left), Nav station (right).

Event Log
MRSB 2011Cruise on R/V *Acadiana*
May 30 – June 2, 2011

05/30/11 – Venice Marina, transit Venice Marina to NE transect

09:30 – Marco and Leo arrive at Venice Marina, met with Matt, Max, John, Kenny, Carl. Start to load the equipment.
10:30 – Finish loading the vessel.
11:00 – Briefing with Matt and Max about survey strategy.
11:20 – Leaving Venice Marina. Survey strategy: start with NE transect and then move to St. Bernard Shoals to core.
14:10 – We reach the NE1 station (NE transect).
14:15 - ADCP pole in the water.
14:20 – Rosette in the water.
14:25 – Rosette on deck (1 Bottom, 2 Top).
14:30 – Grab sample.
15:45 – Reach NE2.
15:50 – ADCP pole in the water.
15:52 – Rosette in the water.
15:58 – Grab sample.
16:10 – We finish the ADCP half mile transect and we move to NE3.
16:40 – Max, the captain, asked if we can go back to Venice. He needs to disembark to run some important personal business. I agree because he told me that Joe would return the 6 hours we might lose taking him back.
18:30 – Back to Venice Marina dock.

05/31/11 – Venice Marina, transit Venice Marina to NE transect (NE3)

05:00 – Leave Venice Marina. Present on board Leonardo, Matt, Marco, John, Kenny, Carl.
07:40 – Reached station NE3 – Rosette in the water.
07:30 – Rosette on the deck (maybe it touched the bottom).
07:48 – Grab sample done.
07:59 – Finish to acquire the ADCP, we leave the NE transect and direct to St. Bernard Shoals for the coring job.
08:20 – MMRI GPS crashed, no way to recover it so Hypack is not working. We are going to use the ship's navigation system.
11:55 – Reached the St. Bernard Shoals. SBS 10_13 (the cores names are from Marco's project using the MMS shape file).
12:50 – Attempt to core SBS 10_13. Seabed is too deep (~20 m). The VibeCore doesn't have enough cable.
13:45 – Reached SBS 10_03 located in the north part, the water depth is 13m. We start to core. No recovery. The seabed is 16m (from the ADCP).
14:22 – We reached SBS 10_01 (depth 6 m). The point has been plotted on Global Mapper as SBS 10_01_real. The depth is 11 m (from ADCP). Recovered 27".
15:07 – We direct to SBS 10_01.
15:18 – Core in the water. The water depth is 6 m (from ADCP is 10 m). Recovered 33".
15:41 – We reached SBS 10_02.

15:49 – Core in the water.
15:58 - Core on the deck. Recovered 37”.
16:00 – Directing to SE transect (SE1 station).
18:50 – Reached SE1.
18:55 – Rosette in the water, ADCP pole in the water (water depth is 47.55 m)
19:10 – Grab sample.
19:25 – Moving to SE2 station.
20:10 – Reached SE2; ADCP pole in the water.
20:20 – Rosette in the water (weird spike of OX and Salinity at 17 m).
20:20 – Rosette on deck (maybe it touched the bottom).
20:25 – Grab sample.
20:40 – Moving to SE3 station.
21:10 – ADCP in the water.
21:27 - Reached SE3 (water depth from ADCP is 27 m).
21:29 – Rosette in the water.
21:37 – Grab sample. Failed.
21:48 - 2nd attempt grab sample. Successful.
22:45 – Reached SE4. ADCP stopped working.
22:49 – Rosette in the water.
23:10 – Grab sample.
23:15 – We move to SE5. ADCP is still not working, we have lost the data on the screen, it seems does not receive GPS signal.

06/01/11 – SE transect, SW transect.

00:10 – We reach SE5. The water depth is 178 m. The ADCP is not working (probably the depth is too high). The CTD is rated for just 100 m, so we can get just reach up to 100 m depth.
00:18 – Rosette in the water.
00:40 – We ended the operations. The captain wants to have some time of rest.
07:00 – Off from the anchor point sailing to SW5 station on the SW transect.
08:10 – Reached SW5 station. Started test on ADCP. The ADCP is now working.
08:27 – Rosette in the water. The water depth is 51.75 m.
08:37 – Rosette on deck. Start grab sample.
08:45 – Grab sample completed.
08:49 – Moving to SW4 station with ADCP on survey along the SW transect (we are sailing toward NW, from SW5 to SW4). We changed ADCP acquisition range. It was up to 20 m. We put up to 100 m. Now ADCP will record during all of SW transect. The vessel speed is about 4/5 knots.
09:35 – Reached SW4 station. The water depth is about 9 m. (depth from ADCP is 8.35 m). We drifted too much (about 400 m south with the rosette in the water. So we are getting back to SW4 original position.
10:00 – Rosette in the water.
10:05 – Rosette on the deck. Grab sample.
10:10 – Moving to SW3, ADCP still running.
12:07 – Reached SW3.
12:10 – Rosette in the water (depth is 48 m).
12:20 – Rosette on the deck. Stat grab sampling.
12:24 – Grab sample on the deck.

12:25 – We finish at SW3 and go back to the Venice Marina because we are running out of fuel. The ADCP transect ended as well.
15:05 – Arrived at Venice Marina. We got fuel and cokes for Matt.
15:55 - Left the Marina heading PASS 1 transect.
18:15 – Reached Pass1-1 station. We had to move ½ mile south this transect (from the original Federico's (UPenn) transect position) because a rig was in the middle. ADCP running all transect.
18:20 – Rosette in the water.
18:33 – Rosette on the deck. Grab sample in the water.
18:40 – Finished the operations at this station. Move to Pass1-2 station.
19:08 – We are at Pass1-2 station. The water depth from the ADCP is about 47 m.
19:10 – Rosette in the water.
19:20 – Rosette back on the deck but cast aborted when was at 43 m depth. The signal became crazy (maybe cable problems).
19:30 – Test on the Rosette trying a new cable. Test ok. Grab sample.
20:10 – Reached Pass1-3 station. The water depth is 42 m (ADCP). Rosette in the water (max depth reached with the new cable is 28 m).
20:20 – Rosette on the deck. Grab in the water.
20:25 – Grab sample on the deck.
20:30 – Done. Move to the Mooring site.
20:50 – Mooring deployed (89.4817° W – 28.8481° N). Water direction is 265° and water speed is 0.2 m/s.
21:10 – Reached Pass1-4 station.
21:13 – Rosette in the water. The water depth from ADCP is 53 m. Bottom bottle fired at 50 m depth.
21:20 – Rosette on the deck.
21:25 – Grab sample.
21:58 – Reached Pass 1-5. Rosette is in the water.
22:06 – Rosette on the deck.
22:20 – ADCP transect ended. Day activities ended as well. We head to Venice Marina.

06/02/2011 – Pass4, Pass3 and Pass2 transects – Mooring recovery.
01:35 – Reached Venice Marina.
06:07 – Start the day with Carol, Brian and Gwyneth joining us on board. We head to Pass4-5 station.
09:49 – Reached Pass4-5. ADCP pole is in the water.
09:53 – Rosette in the water (the water depth from ADCP is 99 m). 96 m reached.
10:10 – Rosette on the deck. No grab sample. It didn't reach the bottom.
11:13 – We reached Pass4-4 station but the captain missed the point so we went a little bit forward. The new point is called Pass4-4_new. All the samples will refer to this location. We turned off the ADCP because the sea was rough and we had to tighten and lash the ADCP pole to the boat railing.
11:29 - Rosette on the deck.
12:06 – Pass4-3 station. Rosette is in the water. The water depth from ADCP is 83 m.
12:21 – Rosette on the deck. No grab sample (The seafloor is too deep).
12:51 – At Pass4-2 station. Rosette is in the water.
13:05 – Rosette on the deck. Grab sample in the water.

13:18 – Grab sample back on the deck but empty. We are able to get just a little bit from the ponar side (Bottle sample C).
13:52 – Pass4-1 station. Rosette is in the water. Up cast up to 37.35 m (cable problems again). We had to leave because a boat was operating a survey.
15:16 – We reached Pass3-3 station. ADCP run for a short time. Rosette is in the water. The water depth from ADCP is 81 m.
15:30 – Rosette on board. CTD failed at 24 m in the up cast. Down cast is good. No grab sample (too deep). We do only Pass3-3 for this transect because we do not have time.
16:16 – Reached Pass2-3 station.
16:24 – ADCP profile start. Rosette is in the water. CTD aborted. Rosette is not working. So we go to recover the Mooring.
17:00 – We do (Matt) different attempts to release the Mooring. We had to be on top of the point to be able to talk with the Mooring.
17:20 – Mooring on the surface.
17:30 – Mooring on the deck.
17:35 – Heading back to Venice Marina.
20:35 – Arrive at Venice Marina.

TABLE 2. Core collection from The Mississippi River Bird's Foot Delta, northern Gulf of Mexico

LABEL	LONGITUDE W	LATITUDE N	ELEV mt	Elev ADCP mt	DATE	Done	CTD	Turbidity	GRAB (ABC=replicants)	WATER (ABC=replicants)
NE1	89.5	29.5	0	-3	5/30/2011	x	x	x	x(NE1_GRAB) (ABC)	NE1_W_top-bottom (ABC)
NE2	89.33	29.43	0	-4.5	5/30/2011	x	x	x	x(NE2_GRAB) (ABC)	NE2_W_top-bottom (ABC)
NE3	89.16	29.35	-4.01	-4.5	5/31/2011	x	x	x	x(NE3_GRAB) (ABC)	NE3_W_top-bottom (ABC)
NE4	88.98	29.28	-23.04							
NE5	88.8	29.2	-69.75							
SE1	88.85	29.3	-49.31	-47.55	5/31/2011	x	x	x	x(SE1_GRAB) (ABC)	SE1_W_top-bottom (ABC)
SE2	88.94	29.17	-29.55	-22.8	5/31/2011	x	x	x	x(SE2_GRAB) (ABC)	SE2_W_top-bottom (ABC)
SE3	89.03	29.05	-26.43	-26	5/31/2011	x	x	x	x(SE3_GRAB) (ABC)	SE3_W_top-bottom (ABC)
SE4	89.11	28.93	-66.14	?	5/31/2011	x	x	x	x(SE4_GRAB) (ABC)	SE4_W_top-bottom (ABC)
SE5	89.2	28.8	-176.96	?	5/31/2011	x	x (-100m)	x (-100m)	no	SE5_W_top-bottom (ABC)
SE5(PE11-33Lutken)Cast4	-89.2	28.8	-176.96	-167	6/28/2011	x	x	x	x	x
SW1	89.86	29.11	-21.12							
SW2	89.7208	29.0367	-36							
SW3	89.5819	28.9636	-48.23	-48.1	6/1/2011	x	x	x	x(SW3_GRAB) (ABC)	SW3_W_top-bottom (ABC)
SW4	89.443	28.8905	-8.75	-8.2	6/1/2011	x	x	x	x(SW4_GRAB) (ABC)	SW4_W_top-bottom (ABC)
SW5	89.3911	28.8632	-51.8	-51.75	6/1/2011	0	x	x	x(SW5_GRAB) (ABC)	SW5_W_top-bottom (ABC)
SW6(PE11-33Lutken)Cast5	89° 26.45773' W	28° 48.88555' N	-89.185	-90	6/28/2011	x	x	x	x	x
Mooring deployed	89.4817943	28.84811977	-53.5	-47		x				
Pass1-1	89.5509621	28.91475916	-61.961	-61	6/1/2011	x	x	x	x(Pass1-1_grab) (ABC)	Pass1-1_W_top-bottom (ABC)
Pass1-2	89.52344222	28.88976754	-57.787	-48.5	6/1/2011	x	x	x	x(Pass1-2_grab) (ABC)	Pass1-2_W_top-bottom (ABC)
Pass1-3	89.49593561	28.86477033	-48.661	-40	6/1/2011	x	x (-28m)	x (-28m)	x(Pass1-3_grab) (ABC)	Pass1-3_W_top-bottom (ABC)
Pass1-4	89.46844224	28.83976753	-57.881	-53.62	6/1/2011	x	x (-50m)	x (-50m)	x(Pass1-4_grab) (ABC)	Pass1-4_W_top-bottom (ABC)
Pass1-5	89.4409621	28.81475916	-69.431	-72	6/1/2011	x	x (-49m)	x (-49m)	x(Pass1-5_grab) (ABC)	Pass1-5_W_top-bottom (ABC)
Pass1-5(PE11-33Lutken)Cast6	89.44096210° W	28.81475916° N	-69.431	-72	6/29/2011	x	x	x	x	x
Pass2-1	89.6	28.89	-68.001							
Pass2-2	89.56671677	28.85927702	-71.994							
Pass2-3	89.53372258	28.82882084	-79.86	?	6/2/2011	x	no	no	no	Pass2-3_Wtop (bucket) (ABC)
Pass2-4	89.50096772	28.79858559	-86.784							
Pass2-5	89.47	28.77	-94.303							
Pass2-5(PE11-33Lutken)Cast7	89.47000000° W	28.77000000° N	-94.303	-90	6/29/2011	x	x	x	x	x
Pass3-1	89.69	28.85	-67.33							
Pass3-2	89.66008193	28.81758876	-74.986							
Pass3-3	89.63011593	28.78512559	-82.629	-80	6/2/2011	x	x (notes)	x (notes)	no	Pass3-3_Wtop-bottom (ABC)
Pass3-4	89.59993667	28.75243139	-89.981							
Pass3-5	89.57	28.72	-98.007							
Pass3-5(PE11-33Lutken)Cast8	89.57000000° W	28.72000000° N	-98.007	-97	6/29/2011	x	x	x	x	x
Pass4-1	89.78	28.81	-65.337	-64.55	6/2/2011	x	x (notes)	x (notes)	no	Pass4-1_W_top-bottom (ABC)
Pass4-2	89.75466855	28.77453597	-78.03	-76.6	6/2/2011	x	x	x	x(Pass4-2_grab) (C)	Pass4-2_W_top-bottom (ABC)
Pass4-3	89.7293991	28.73915874	-84.314	-83.3	6/2/2011	x	x	x	no	Pass4-3_W_top-bottom (ABC)
Pass4-4new	89.70977599	28.70724147	-91	-90	6/2/2011	x	x	x	no	Pass4-4_W_top-bottom (ABC)
Pass4-5	89.68	28.67	-100.721	-99	6/2/2011	x	x (-96m)	x (-96m)	no	Pass4-5_W_top-bottom (ABC)
Pass4-5(PE11-33Lutken)Cast9	89.68000000° W	28.67000000° N	-100.721	-99	6/29/2011	x	x	x	x	x