Mechanisms Controlling Hypoxia: Integrated Coastal Modeling
Field Year 2010

Survey cruises on R/V Manta

The cruises decribed
Dates of cruises:
14 – 19 June 2010, one-half day mobilization.
1 – 6 August 2010, one-half day mobilization.
Continuous 24-hour operations

Personnel (14 total: 4 crew, 10 scientists)
Chief Scientist: Dr. Steven F. DiMarco
Data Collection/Physical Oceanography: Dr. Matthew Howard
Chemical Oceanography: Dr. Piers Chapman
Biological Oceanography: Dr. Antonietta Quigg (TAMUG)

Acrobat: Ms. Ruth Mullins, Graduate Student
Acrobat: Mr. Li Bo, Graduate Student
Chlorophyll: TBN, TAMUG Graduate Student
CTD/rosette: TBN Graduate Student

Marine/Electronic Technician: Mr. Andrew Dancer (ADCP, Acrobat)
Marine/Electronic Technician: Mr. Eddie Webb (flow-through, CTD)

Four NOAA-FGNMS crew personnel will also participate. TAMU will assume cooking responsibilities; NOAA will provide groceries.

Purpose
To conduct oceanographic research in the northwestern Gulf of Mexico, in summer 2010, to estimate the areal extent and vertical distribution of dissolved oxygen concentration and hydrographic properties.

Objectives
To collect hydrographic, chemical, biological samples using:

a. An undulating towed vehicle, Sea Sciences Acrobat,
b. A shipboard acoustic current velocity profiler, 300-kHz ADCP,
c. Underway surface properties, ship's flowthrough system,
d. Vertical profiles of hydrographic properties: CTD and 3-bottle rosette system.

Figure 1. R/V Manta during sea trials in the Gulf of Mexico. This vessel will be used for two summer surveys of the northern Gulf of Mexico from East Madagorda Bay, TX, to the Southwest Pass, LA.

Cruise summary

We will conduct two shelf-wide surveys of the Texas-Louisiana Shelf to provide an estimate of the spatial extent of hypoxia and the distribution of dissolved oxygen. These cruises will utilize the R/V Manta, a twin-hull vessel operated by NOAA's Flower Garden Banks National Marine Sanctuary (Figure 1) and Texas A&M University at Galveston. The vessels home port in Galveston, TX.. We will use a TAMU-owned SeaSciences Acrobat towfish (http://seasciences.com/acro.htm; undulating towed body, pictured above) that is equipped with a SeaBird SBE43 dissolved oxygen sensor, Seabird CTD, and Wetlabs Fluorometer/Turbidity sensor. The Acrobat will undulate between 1-2 m from bottom and 1-2 m below surface. The cruise plan will follow a jigsaw (or lawnmower) pattern along the northern Gulf of Mexico. Area coverage will be from East Madagorda Bay to the Mississippi Delta at Southwest Pass. The operational tow velocity of the vessel will be about 5 knots. Calibration data will be taken using onboard Winkler titration and a salinometer. To insure proper coverage of the shelf, the ship will not stop except to collect samples for sensor calibrations. The short duration and fast speed of these cruises is also designed so that the survey is done as synoptically as possible. We plan to coordinate the survey cruises with the SEAMAP summer cruises as the SEAMAP can report valuable information such as where the hypoxia is prior to or during the survey cruise. Shipboard flow-through observation of salinity, temperature, and fluorometry, will be taken. Occasionally water samples will be collected for chlorophyll and nutrient concentrations.

Prior to the first survey cruise, we will use outputs from the numerical coupled model to test sampling strategies and cruise plans for the survey cruise to optimize spatial coverage and areal extent of hypoxia.

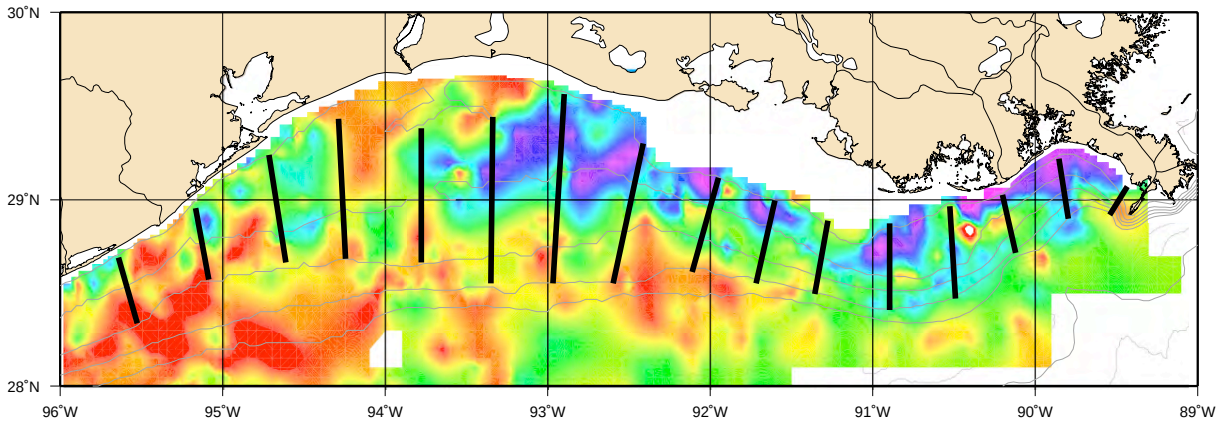

Figure 2. Survey plan for Field Year 2010 cruises. Cross-shelf transects are heavy black lines, bathymetry shown are 10, 20, 30 , 40, 50, 200, and 500 m isobaths. Color contours represent mean near bottom oxygen concentrations (red: high; blue: low) based on NOAA-NMFS SEAMAP summer survey data 2000-2007.

Mobilization will be in Galveston, Texas. After departure from Galveston, we will transit to Texas coast near East Matagorda Bay (EMB). 16 cross-shelf transects (CST) of roughly 30 miles each will be conducted from EMB to SWP. The transects are designed to run roughly across bathymetric lines. Transects are designed with consideration to frequency of occurrence of hypoxia distributions based on mid-summer surveys and NOAA-NMFS SEAMAP survey bottom oxygen climatology (Figure 2). All transects will have a shoreward end near the 10 m isobath (or 5 m if conditions allow). Near the Southwest Pass (east of 89°W), transects will extend seaward to the 50 m isobath, between 90°W and 93°W, transects will extend to the 40 m isobath, west of 93°W, transects will extend to the 30 m isobath.

The Acrobat and shipboard ADCP system will be deployed during each CST. The ship will maintain a constant heading and speed (5 knots) during each CST. The flowthrough system will be run continuously during the cruise. A CTD cast will be performed at the inshore and offshore edges of the CST; water samples from surface, mid-water, and near bottom depths will be collected using the three-bottle rosette sampler. Transits between CSTs will be done at the fastest/safest speed possible; the Acrobat and ADCP systems are not deployed during these transits. A CTD/rosette cast may be done at the mid-point or other location(s) along the transits between CSTs at the discretion of the Chief Scientist.

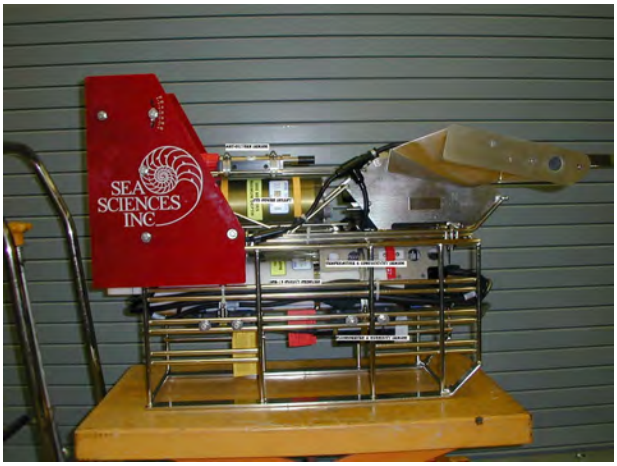

Figure 3. TAMU owned SeaSciences, Inc., Acrobat undulating towed vehicle.

Figure 4. Acrobat vehicle being recovered on R/V Pelican during April 2009 MCH cruise M13.

Ports of Call: to be determined, possibilities include Morgan City or Fourchon, LA. For refueling and to replenish food and water supplies.

Instruments Systems
Sea Sciences Acrobat. Undulating towed body. Sensors: Seabird CTD, SBE43 Oxygen sensor, Wetlabs FLNTB fluorometer and turbidty sensor. A RINKO fast-response oxygen sensor (on loan from Rockland Oceanographic Services) will be integrated into the CTD systems. Winch system, Computer logging system. Tracking pinger, depth finder (optional).

Flow-through system: thermosalinograph, Chelsea fluorometer. Debubbler, associated hoses, clamps, logging computer.

Shipboard ADCP: RDI 300 kHz. Vessel mounted on port side mounting pole. Needed are three-dimensional GPS antennae system.

CTD/rosette. Seabird CTD and three-bottle rosette system, computer, Seabird deckbox, and computer with screen.

Chlorophyll and fluorescence experimental exquipment: provided by Quigg.

Cap'N software and navigation/event logging computer.