CRUISE REPORT

DEEPWATER HORIZON CRUISE – RAPID GULF SURVEY
R/V *WALTON SMITH* Cruise – WS1010A

Prepared by: Michelle Wood, NOAA/OAR/AOML

RSMAS CRUISE #: WS1010A
SHIP NAME: R/V *Walton Smith*
CRUISE DATES: June 6 - 10, 2010
CHIEF SCIENTIST: Michelle Wood
                    NOAA/OAR/AOML
                    4301 Rickenbacker Causeway
                    Miami, FL 33149
                    305-361-4374; 541-914-8394 (cell)
                    Michelle.Wood@noaa.gov
PORT OF EMBARKATION: Gulfport, MS
PORT OF DISEMBARKATION: Miami, FL

CRUISE SUMMARY: The primary goal of this cruise was to collect observational data regarding the presence or absence of oil and/or tar balls in offshore regions where connectivity to the Loop Current might enable transport of these materials to South Florida and out of the Gulf of Mexico. The cruise took advantage of flexibility in transit time during the R/V *Walton Smith* return from Gulfport, MS to Miami, FL after an NSF-funded study that ended on June 6. The cruise track is shown in Figure 1. Ship-time was provided at no cost to NOAA by the University of Miami and the National Science Foundation. NOAA scientists had identified the "Tiger Tail," a long filament of oil sheen and discolored water extending to the southeast of the well site that was observable by satellite and aircraft, as a possible mechanism for transport of oil offshore. At the time, NOAA's Office of Response and Restoration (OR&R) predicted limited presence of oil, sheens, and/or tar balls offshore but did not have observational confirmation (Fig. 2). Additionally, several satellite products and model results being circulated by academic and commercial sources predicted substantial penetration of oil into the Loop Current (LC) and Florida Current (Fig. 1).   Thus, there was considerable demand for observational research in the far field, away from the well site, and in regions where connectivity between the spill area and Florida Current might exist. The condition of the LC and associated features as interpreted by NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) at the time of the cruise is shown in Figure 3.

The specific goals of the cruise were:
1) To survey regions of likely accumulation of oil in the LC and associated features insofar as possible, given the available ship time, 2) collect samples of petroleum sheen, tar balls, or oil-in-water - if encountered - for fingerprinting by the Response and Chemical Assessment Team at Louisiana State University (RCAT), 3) observe condition and abundance of birds and other vertebrates along the cruise track, 4)

collect neuston tows for tar balls and assessment of the identity and condition of larval fish and invertebrates in the water, 5) observe water column properties using ship-board underway system and deck-mounted CTD, 6) support modeling efforts for the response by deploying XBTs every hour and serving the data in near-real-time to the AOML ftp site and GTS, and 7) deploy 12 drifters in the LC and associated eddies along the cruise track to provide information about direction and potential rate of transport of floating material in surface waters.

The cruise track and sampling plan were closely coordinated with the Unified Area Command and specific sites identified by OR&R were sampled whenever possible. The cruise track was also guided by information supplied by Roffer's Ocean Fishing Forecasting Service (ROFFS™) and by data obtained from the XBTs and hull-mounted ADCP to maximize encounter with convergent flow that would concentrate floating material (e.g., weathered oil and tar balls). On June 8, the USCG and OR&R provided C-130 aircraft support. Observers on the aircraft identified a suspicious region of "glossy" water located between 26° 48.4'N, 86° 05.1'W and 26° 42.3'N, 85° 58.1'W which was reported to the R/V *Walton Smith*. The feature was about 0.25 miles wide and 6.0 miles long. Upon arrival in the area at approximately 1300 local time, orange flocculent material similar to that seen close to the wellhead was observed in the water. Floating "tar balls" or soft pads of aggregated material were also present. As observed from the deck, these tar balls ranged in size from a few centimeters in diameter to the size of a small dinner plate (e.g. 18-20 cm or approximately 6-8"). Abundance was difficult to assess from the bridge watch, but five or six "tar balls" would pass the ship within 25' every few minutes.   A 30-minute neuston tow recovered one large tar ball and one small one. The large one was collected by scraping a Teflon sheen net over the neuston net; a total of three sheen nets were required to collect all of the material from the single tar ball. Analysis by the RCAT confirmed that this sample was a match to MC-252 oil ("Swipe" sample in Figs. 4 and 5).

Drifters deployed in the tar ball feature traveled into Eddy Franklin and had not entered the Florida Current as of July 1 (Fig. 6). Model results provided by AOML/PhOD based on release of simulated tar balls with the properties of water molecules (e.g. neutrally buoyant and infinite lifespan) indicate that the most probable fate for the actual tar balls would be entrainment into Eddy Franklin (George Halliwell, AOML, pers. comm.).

Nine water samples and 14 sheen samples were collected at intervals along the cruise track. Only two contained more than trace amounts of polyaromatic hydrocarbons (M. Scott. Miles, LSU, pers. comm.).   One of these two was the previously mentioned tar ball sample; the other was a surface water sample collected close to the wellhead (28° 52.5'N, 88° 0.53'W) at a location where oil was visibly present. Both of these samples provided sufficient material for chemical fingerprinting and both matched MC-252 source oil based on GC/MS analysis (Figs. 4 & 5).

Observations for birds and other vertebrates were conducted during daylight hours by a trained observer, assisted by the ship's crew. Most noteworthy was the low number of species and individuals encountered.   No turtles were observed on the cruise. Bottle-nosed dolphins were encountered once and spotted dolphins twice; none showed signs of oil contamination. Birds observed included adult Brown Boobies, Sooty Terns, Sooty Shearwaters and Laughing Gulls; repeated observations of Band-Rumped Storm Petrels were especially noteworthy as sightings of these rare birds are unusual. Band-Rumped Storm Petrels were found exclusively at or near the convergence between Eddy Franklin and a large cyclonic frontal eddy northeast of Eddy Franklin; other bird observations were too sparse to link to any surface features. Birds in flight were checked for oil contamination, and none was found.

Thirty-minute neuston tows were conducted at four locations: 1) 27° 45.39' N, 86° 47.97' W, 2) 27° 9.029' N, 85° 58.53' W, 3) 26° 45.85' N, 86° 03.65' W, and 4) 24 28.08' N, 81° 30.13' W. Larval organisms were abundant in two of these. Approximately 1000 crab megalopa were recovered in Sample 1, the tow conducted closest to the spill area, and a high abundance of larval fish was recovered from Sample 4, which was collected off the Florida Keys. Included in Sample 4 were several hundred larval file fish (Monocanthidae) and several hundred larval puffer fish (Tetradontidae). None of the larvae showed visible signs of oil contamination. Compared to the results of these tows, the tow that recovered tar balls (Sample 3) contained few larvae, other fish, or invertebrates. Sample 2, while containing more invertebrates than Sample 3, was also relatively sparse compared to Samples 1 and 4.

Forty five XBTs were deployed on the cruise (Fig. 7) with all XBT data posted to the GTS and AOML ftp site during the cruise; 12 drifters were deployed, two at each of six locations (Fig. 6).   XBT data are described at http://www.nodc.noaa.gov/General/deepwater_oceanprofile.html#walton and temperature sections can be obtained at http://www.aoml.noaa.gov/phod/dhos/xbt_ctd.php.

R/V *Walton Smith* Rapid Response Cruise (WS1010A)

EMBARKED SCIENTIFIC PERSONNEL:

Dr. Michelle Wood	NOAA/OAR/AOML	Chief Scientist
Dr. Tom Lee	CIMAS /RSMAS	Physical Oceanography Lead
Nelson Melo	NOAA/OAR/AOML CIMAS	Physical Oceanographer
Charles Featherstone	NOAA/OAR/AOML	Chemical Oceanographer
Dr. David Lee	The Tortoise Reserve North Carolina St. Museum	Ornithologist

OTHER CONTRIBUTORS:

Shailer Cummings	NOAA/OAR/AOML	(Cruise preparation)
Dr. Rick Lumpkin	NOAA/OAR/AOML	(Drifter support and data analysis)
Joaquin Trinanes	NOAA/OAR/AOML	(XBT analysis, web support)
Francis Bringas	NOAA/OAR/AOML	(XBT analysis, web support)
David Lindo	NOAA/OAR/AOML	(XBT analysis, web support)
Ryan Smith	NOAA/OAR/AOML	(Cruise preparation and web support)
Sean Doake	NOAA/OAR/AOML	(Cruise preparation)
Dr. Chris Kelble	NOAA/OAR/AOML	(Cruise preparation)
Dr. Gustavo Goni	NOAA/OAR/AOML	(Altimetry analysis)
Dr George Halliwell	NOAA/OAR/AOML	(Modeling results)
Dr. Debbie Payton	NOAA/NOS/ORR	(Cruise track guidance)
Dr. Jim Jeansonne	NOAA/NOS/ORR	(Cruise track guidance)
Dr. Scott Miles	LSU	(Hydrocarbon analysis)
Dr. Chris Haney	Defenders of Wildlife	(Data analysis, pelagic birds)
Dr. Peter Ortner	CIMAS/RSMAS	(Cruise preparation and planning)
Dr. Robert Cowan	CIMAS/RSMAS	(Larval fish identification)
Dr. Mitchell Roffer	Roffers Ocean Fish Forecasting Service	(Near real-time satellite support)
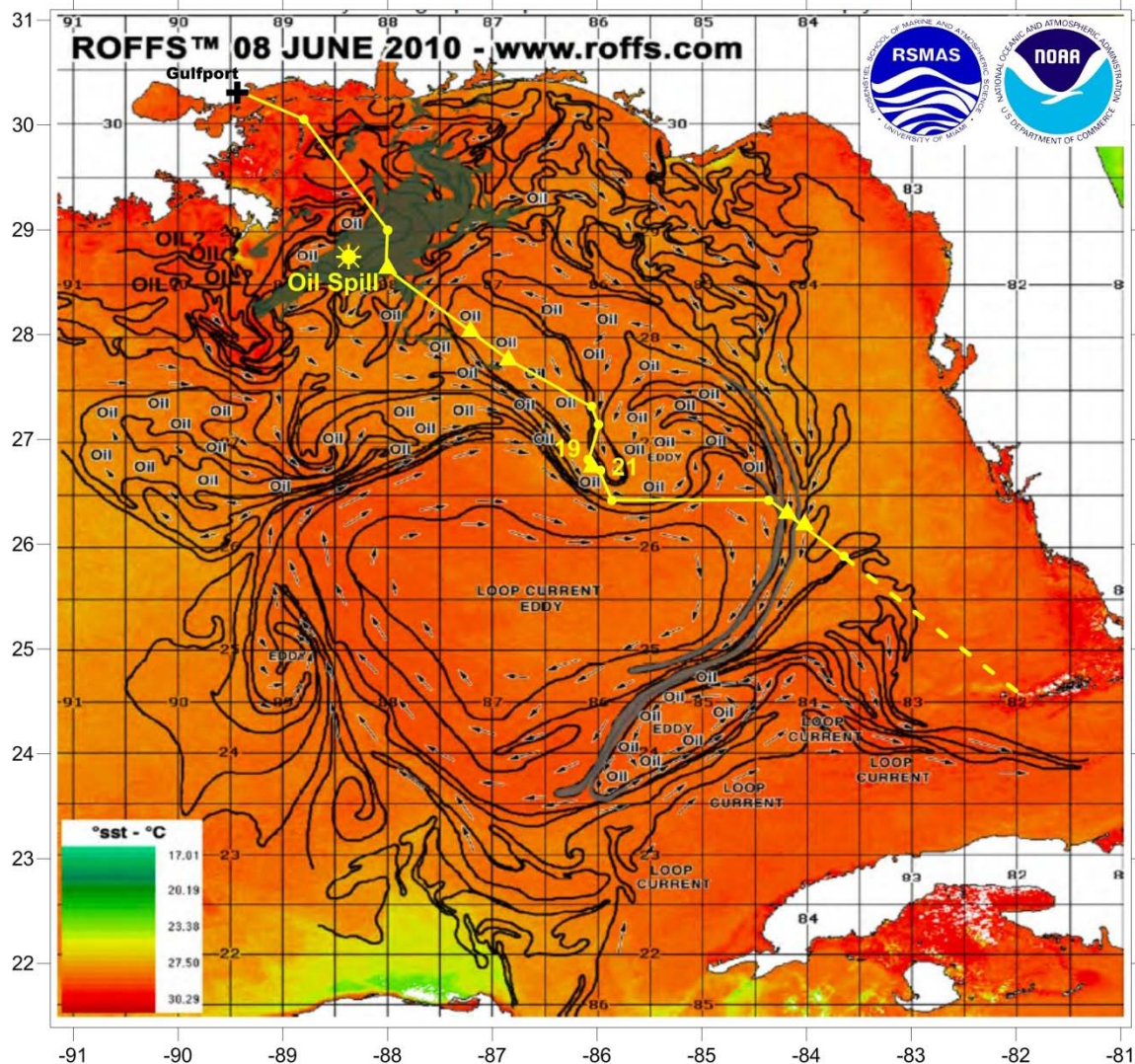
Cruise track given with yellow line.
Turning points given with yellow dots.
Stations with drifter releases given with solid yellow triangles.
Oil plume surveyed between stations 19 and 21.
XBT stations made every 10 nautical miles between the Deepwater Horizon spill site (yellow star) and the east end of the survey.

Figure 1. **ROFFS[TM] oil projection for June 8 with WS1010A cruise track shown in yellow and the position of drifter deployments shown in yellow triangles.** The tar ball sample described in the fingerprint analysis shown in Figs. 4 and 5 was collected between stations 19 and 21. ROFFS[TM] projections from this period of the spill use solid olive-green to denote areas where surface oil was observed using synthetic aperture radar (SAR) and data from RGB channels on the MODIS sensors on NASA's Terra and Aqua satellites. Areas labeled 'oil' and shown in solid gray represent water masses that were tracked continuously in time as they moved away from the well head using SAR and MODIS data by ROFFS[TM]. Other areas marked with "oil" are water masses predicted to contain oil from the spill but which were not continuously monitored as they moved away from the well head because of cloud interference. All interpretation relating to oil and its distribution presented in this figure was made by ROFFS[TM].
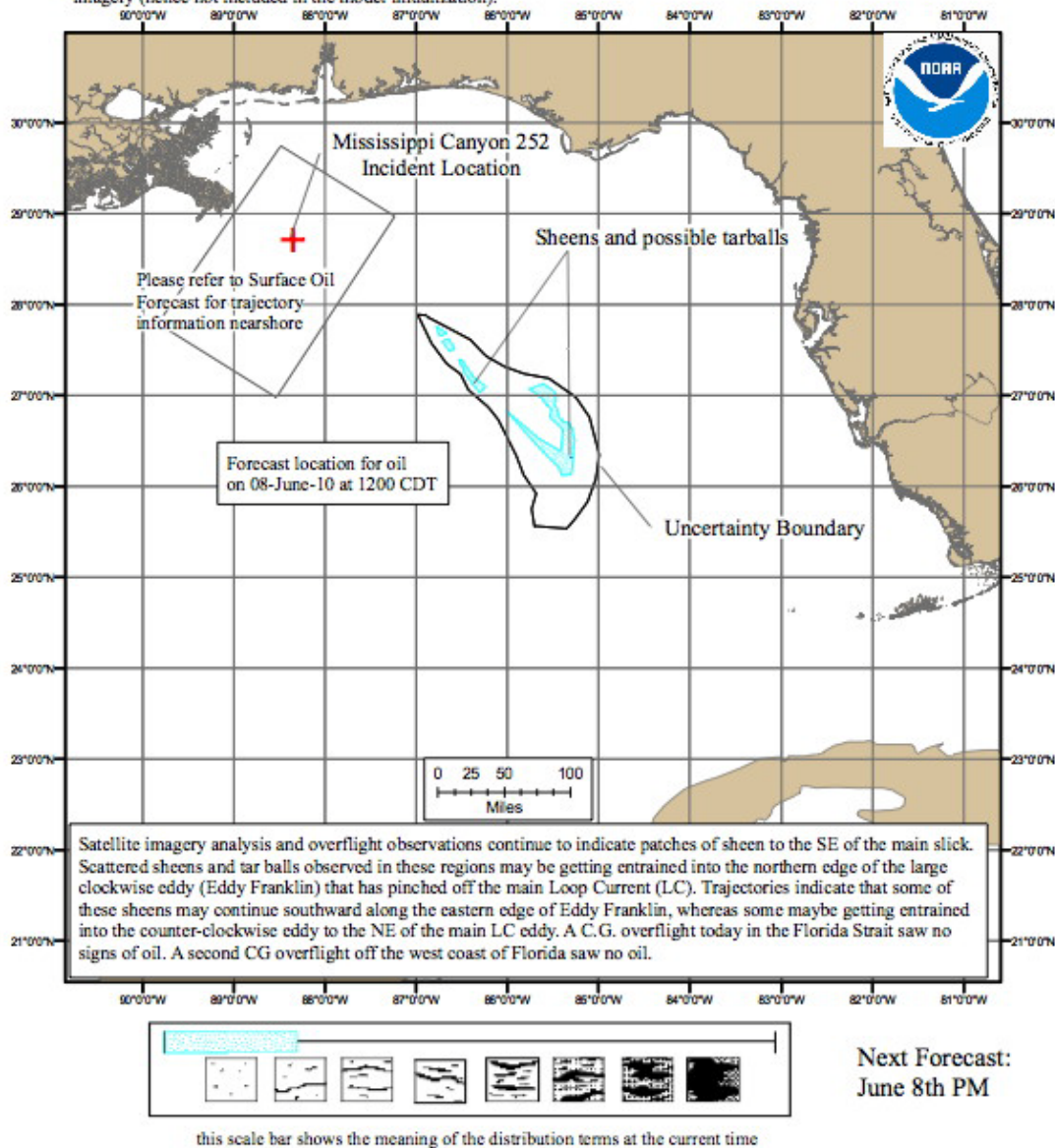
Figure 2. OR&R Offshore Surface Oil Forecast for June 8. The tar ball field sampled on June 8 was located SE of the sheens and possible tar balls projected in blue near 27° N and 86 °W, but within the uncertainty boundary of the model prediction.
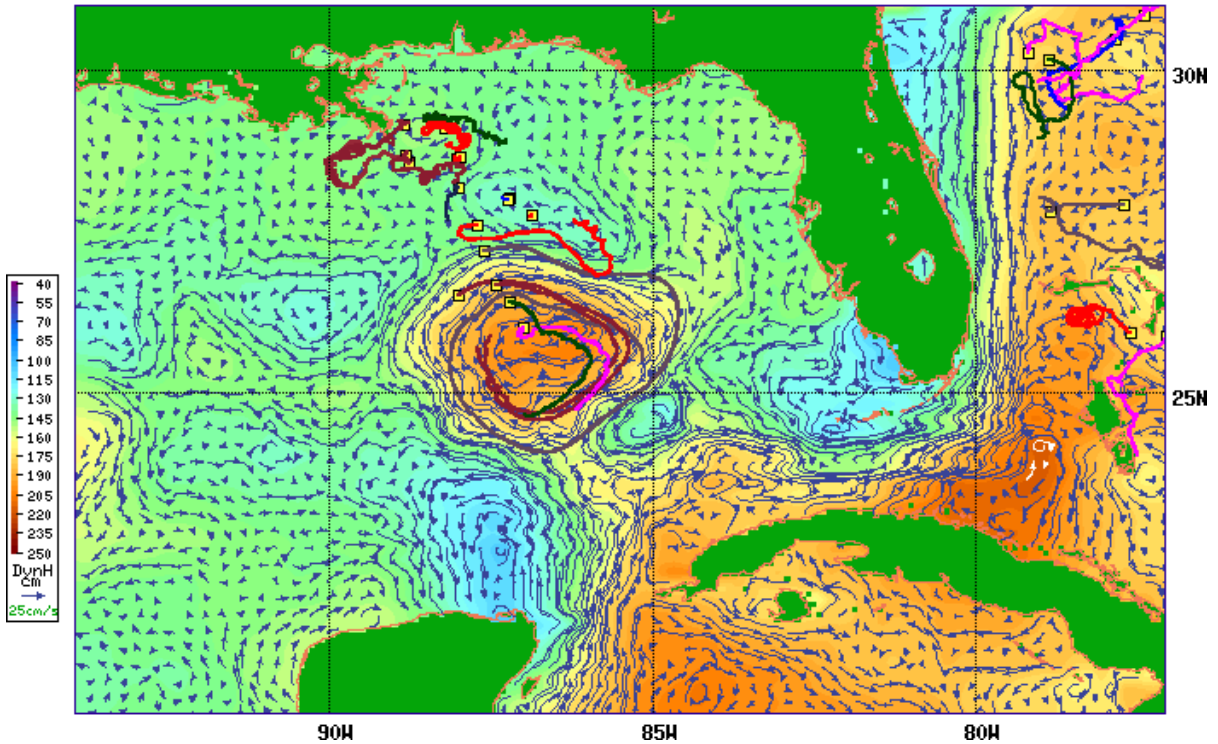
Figure 3. AOML altimetry-derived circulation for the Gulf of Mexico on June 8, 2010. Eddy Franklin is the large anticyclonic eddy located at about 25° N, 86° W; convergence along its boundary with the cyclonic eddy to the NE provides a mechanism for concentrating weathered oil, *Sargassum*, and ichthyoplankton. Band-Rumped Storm Petrels were observed exclusively in this frontal area. Solid lines are fifteen-day drifter tracks; the yellow squares show the position of the drifters on May 23.
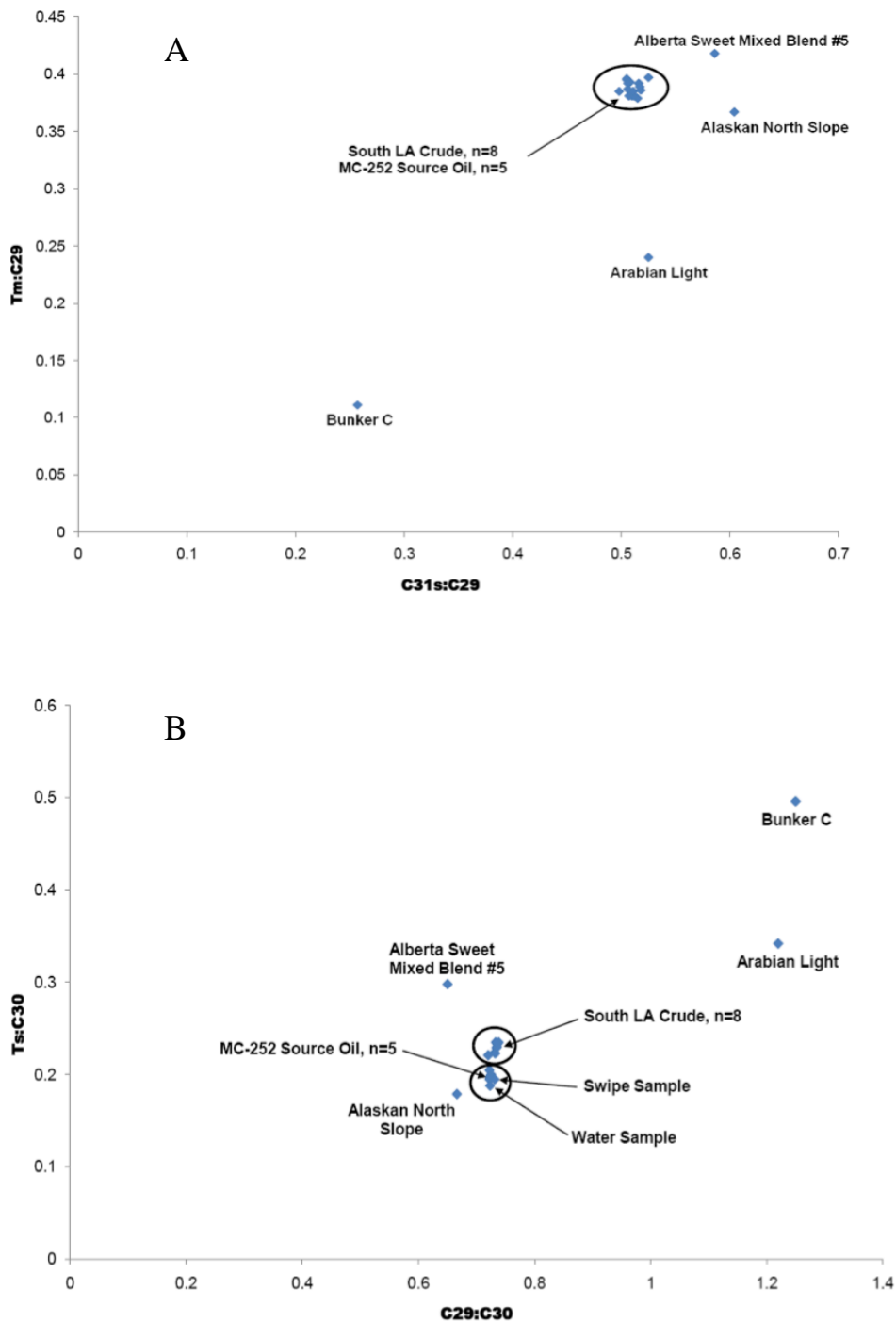
http://www.aoml.noaa.gov/phod/dhos/altimetry.php
http://www.aoml.noaa.gov/phod/dhos/index.php

Figure 4. Results from GC/MS fingerprinting. **A**: Cross-plot of the double ratios of Peak C31s:C29 versus Tm:C29 for crude oils and refined fuel oil; all reference oils are essentially 'unweathered'. The circle indicates related samples from the same origin. **B:** Cross-plot of the double ratios of Peak C29:C30 versus Ts:C30 for crude oils and refined fuel oil. Each oil series from Louisiana sources produced a tight cluster. The samples from the *Walton Smith* cruise are clearly included within the MC-252 cluster. The "swipe" sample is the tar ball sample collected on the *Walton Smith* at 26° 45.85'N, 86° 03.65'W on June 8, 2010. The "water" sample is a surface sample collected on June 7, 2010 at 28° 52.50' N and 88° 0.53' W, relatively close to the well site. Data provided by M. Scott Miles, Louisiana State University.
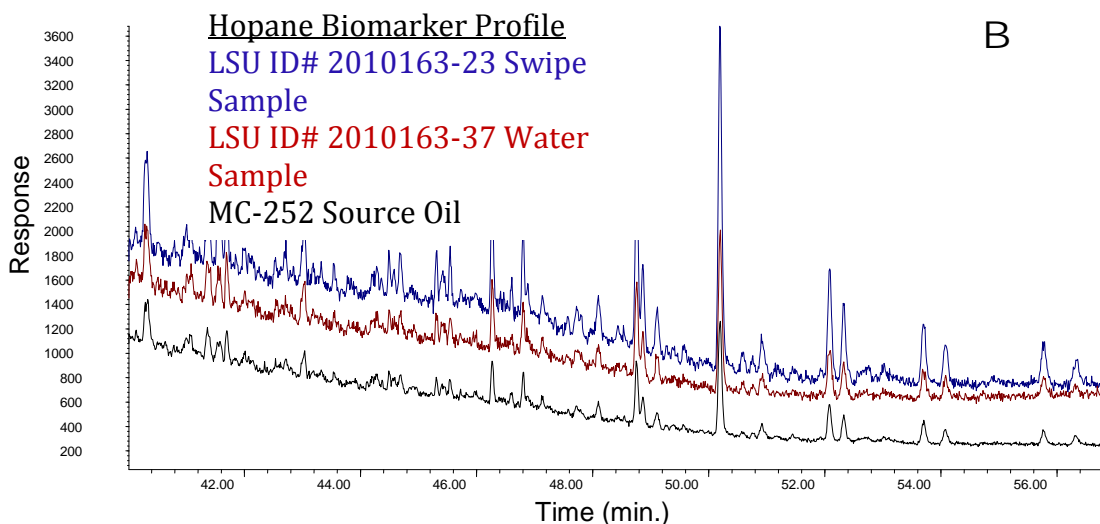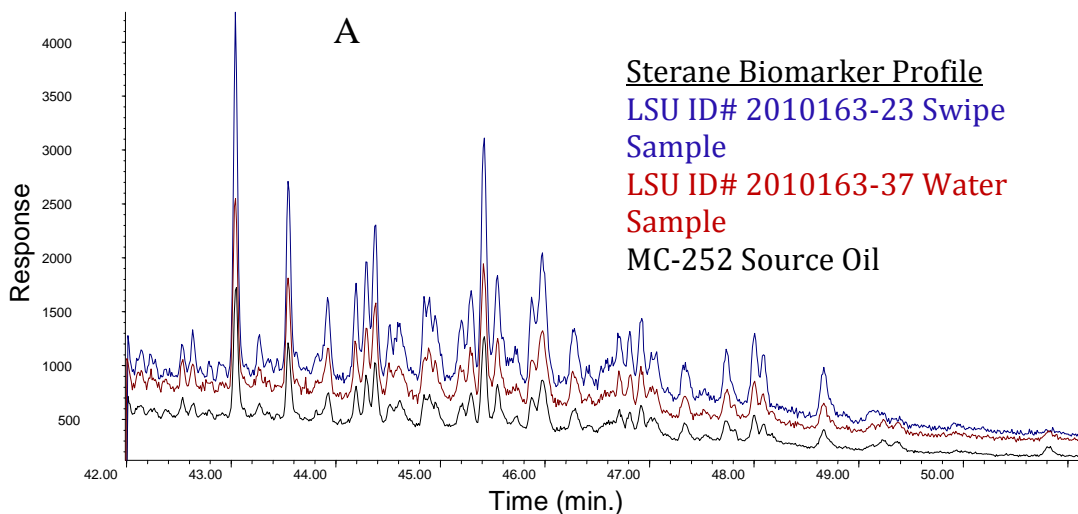
Figure 5. Results from GC/MS fingerprinting. A: Overlay of *m/z* 217 chromatograms from MC-252 source oil and *Walton Smith* cruise samples. **B:** Overlay of *m/z* 191 chromatograms from MC-252 source oil and *Walton Smith* cruise samples. The overlays of biomarker chromatograms represent a "positive" match between the MC-252 source oil and the two *Walton Smith* cruise samples. "Swipe" and "Water" samples are as described in Figure 3. Data provided by M. Scott Miles, Louisiana State University.
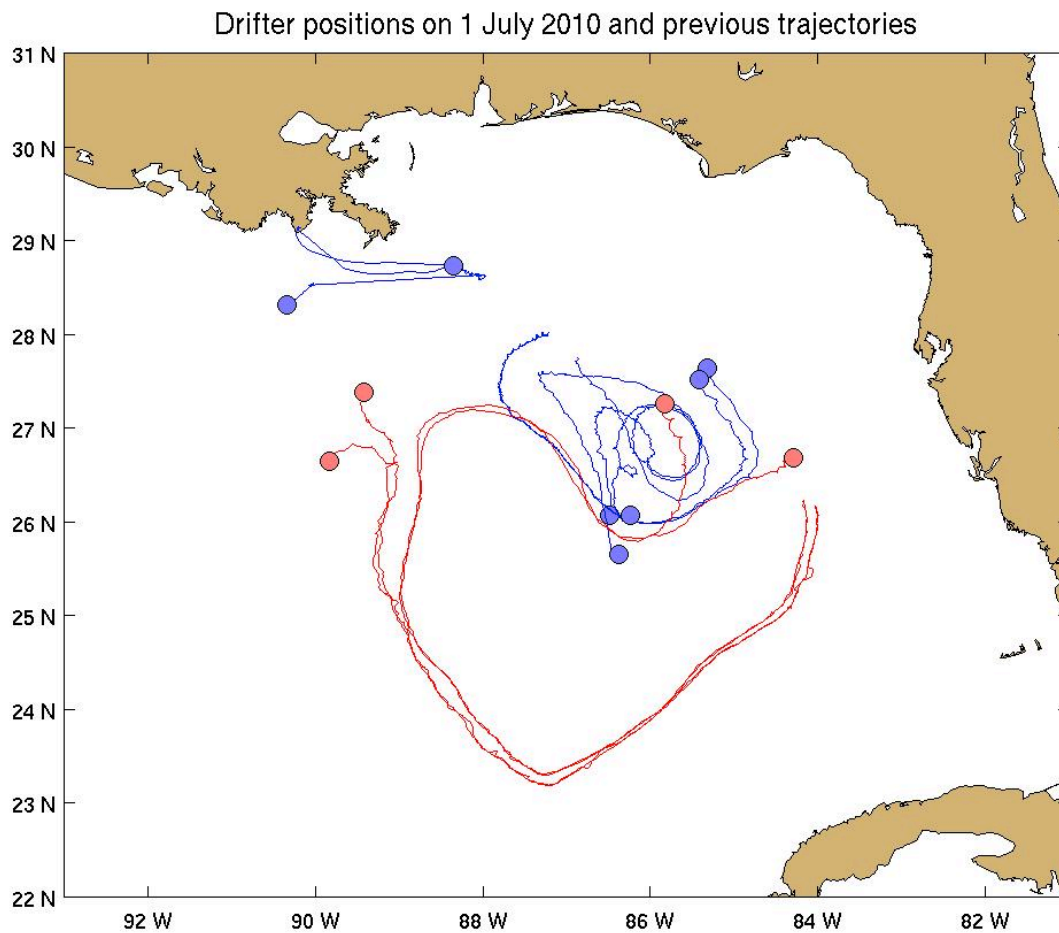
Figure 6. Position tracks for Argos drifters released during WS1010A cruise; location on July 1 shown with circles. Six pairs of drifters were released along the cruise track. One failed to deploy and one released in the northern portion of the study area was picked up by a vessel and taken to shore, then re-released. Track and position shown in red describe the behavior of drifters released in region of suspected oil and where tar balls were collected.
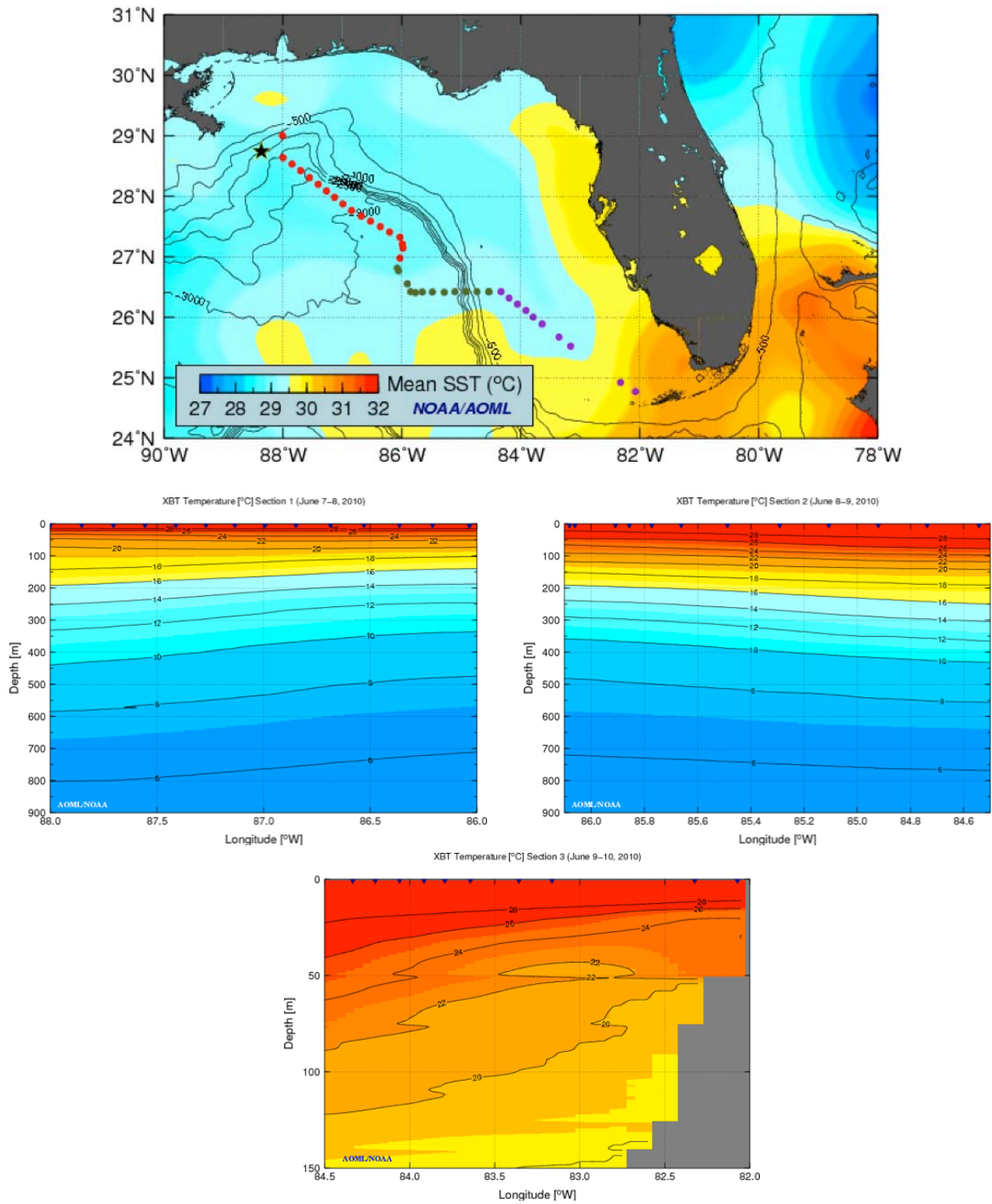
Figure 7. XBT deployments and profiles in the Gulf of Mexico. Top: position of XBT deployments from WS1010A cruise. Section 1, 2, and 3 contours were interpolated using data collected from positions marked with red, green, and purple circles, respectively. The color scale is the same for all panels.