Ryan Chouest Cruise 5 Summary Report

Period covered: 2231 hrs 06/24/2010- 1756 hrs 06/28/2010

636.343 - Cruise 5 Cummulative nautical miles covered

Vessel science party:

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Cruise notes:

During this cruise, we have successfully monitored the inferred hydrocarbon concentrations for over 630 nautical miles off the coast of Florida and Alabama and farther offshore to the sites of interest including the Deepwater Horizon Incident site. We sailed the ship track for cruise 5 shown in Figure 1 from 2231hrs 06/24/2010 to 1756 hrs 06/28/2010. During Cruise 5, we decided to deviate from our planned trajectory and head south and sample surface waters around the Deepwater Horizon incident site. This was to test the fluorometry sensors ability to detect high range values of dissolved oil in the surface layer. The cruise track for 6/28 (blue on Figure 1) differs from the planned course because unusually strong swells and currents pushed the ship towards the southeast. We attempted to continue on the cruise track originally planned until both pumps failed at approximately 1700 hrs on 6/28. After this occurred, we removed the pump and sailed directly back to port.

Science results and preliminary interpretation:

Fluorometry results

Cruise 5 General Observations:

All three fluorometers show higher responses in areas covered with oil slicks and gradually decreased responses as the survey track approached the water south of Panama City. All three fluorometry sensors yield very consistent results over the yellow cruise track (see Figure 1) as shown in Figures 2-4: Sensor readings are very low and near baseline values on the region of the track outside of the potential oiling fingerprint and increase to their highest values NW of the Deepwater Horizon incident site. The sensor responses from close to the incident represent the highest values thus far on the Ryan Chouest scientific expedition. Although the fluorometers detected their highest values close to the spill site, they did not

detect TPHg concentration at levels exceeding 0.5ppm based on our previous sensor calibration using SPE extraction followed by GCMS analysis.

*MapRescaling: Please note that t*he fluorometry data shown on the maps in Figures 2-4 were rescaled to better illustrate the hidden detail in the sensor readings.

<u>Surface Observations</u>

Sea surface oil slick observations include convergence lines with dense patches of seaweed and surface sheens (Photographs 1). The surface sheens observed included light and rainbow sheens, which were often time very subtle and could be discerned only with careful examination of calm water (Photograph 2). We also observed streamers of orange mousse with dense patches of mousse (Photographs 3-5).

A relatively active zone with diverse oil slicks was observed between 29 ^{o} 30'-30 ^{o}N and 86 30'-87° 15'W. Brown oil, orange pancakes, and streamers were mostly observed in this region, but these were observed at night and we were unable to photograph them.

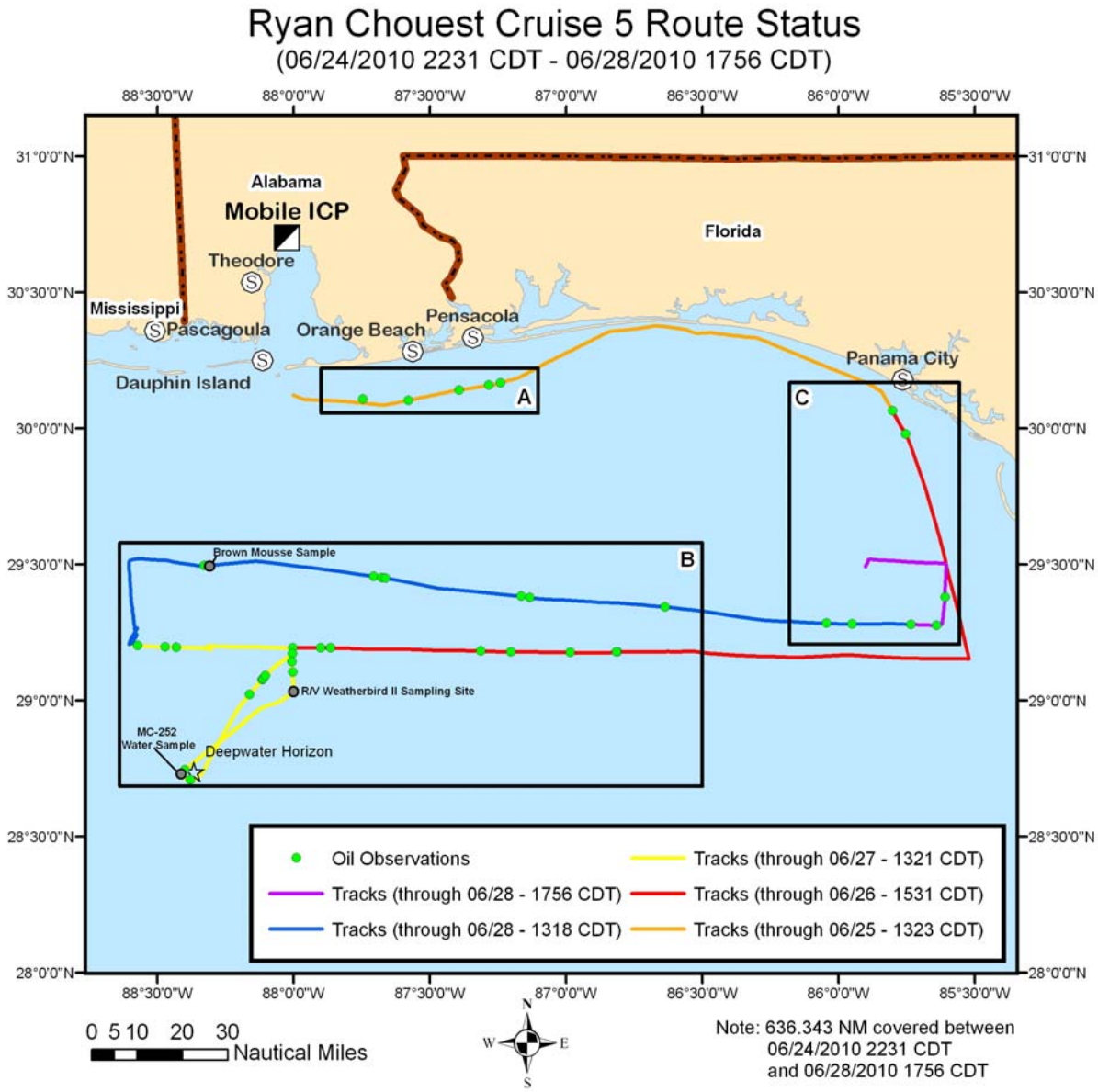

Figure 1: Total oil slick observations plotted between 06/24/2010 –06/28/2010.

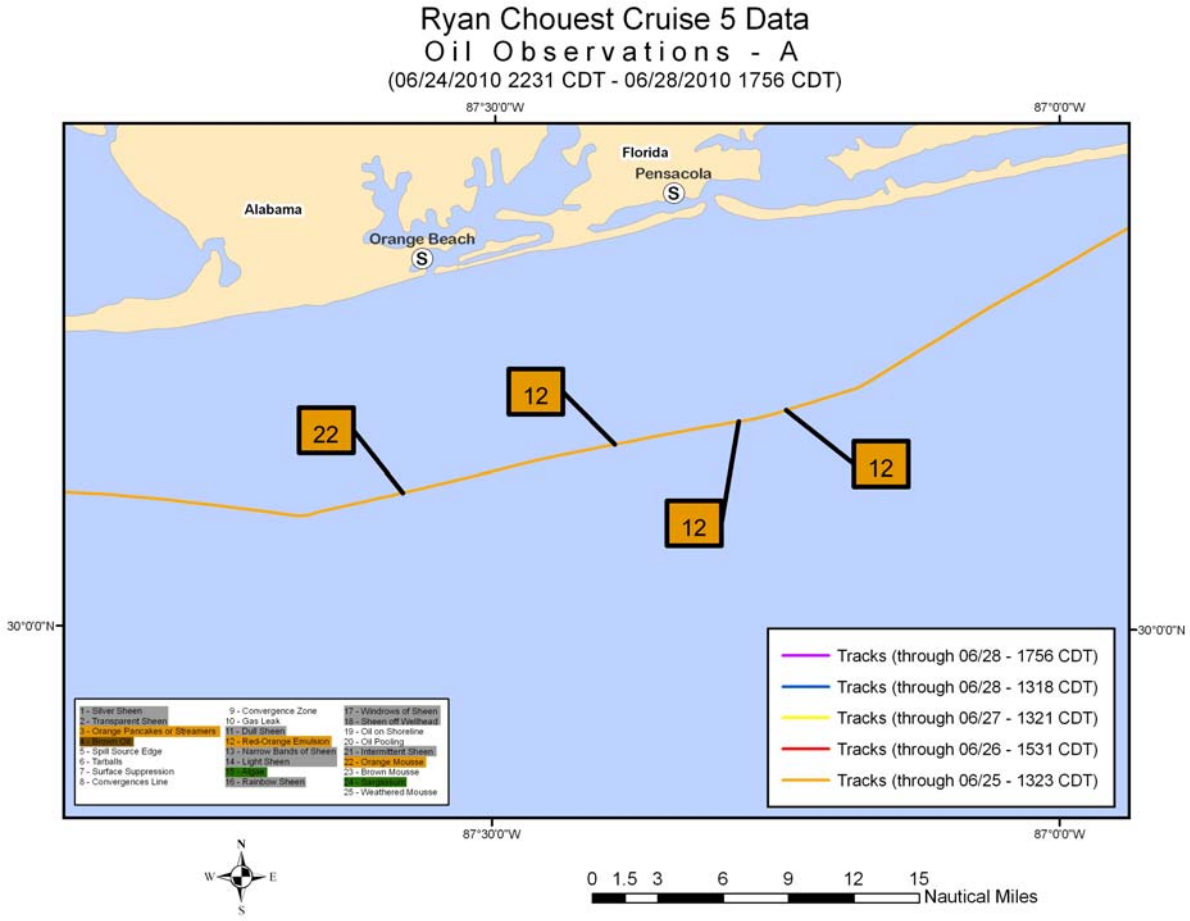

Figure 1A. Large scale map of region A in Figure 1 showing oil slick observations. See also Photographs 9-10.

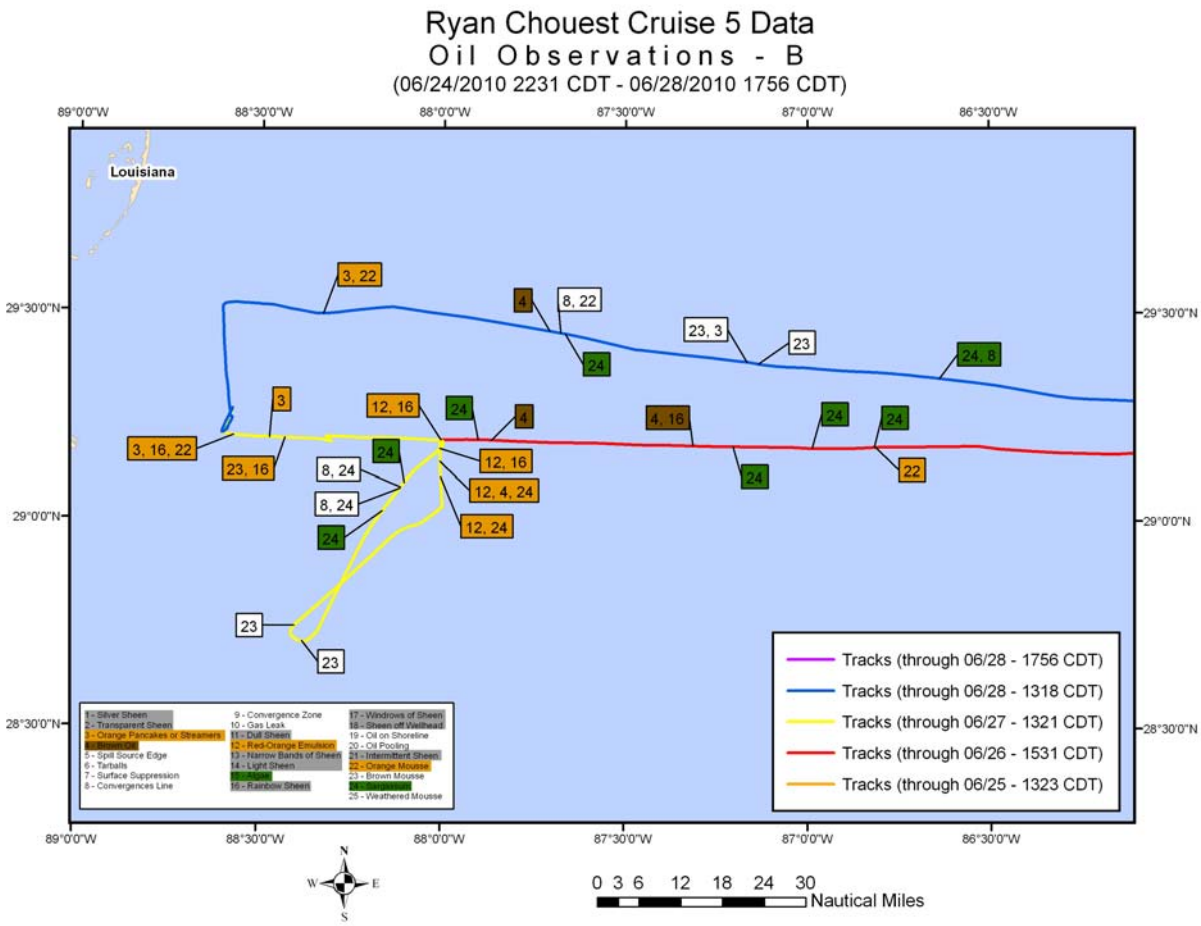

Figure 1B. Large scale map of region B in Figure 1 showing oil slick observations. See also Photographs 4-8.

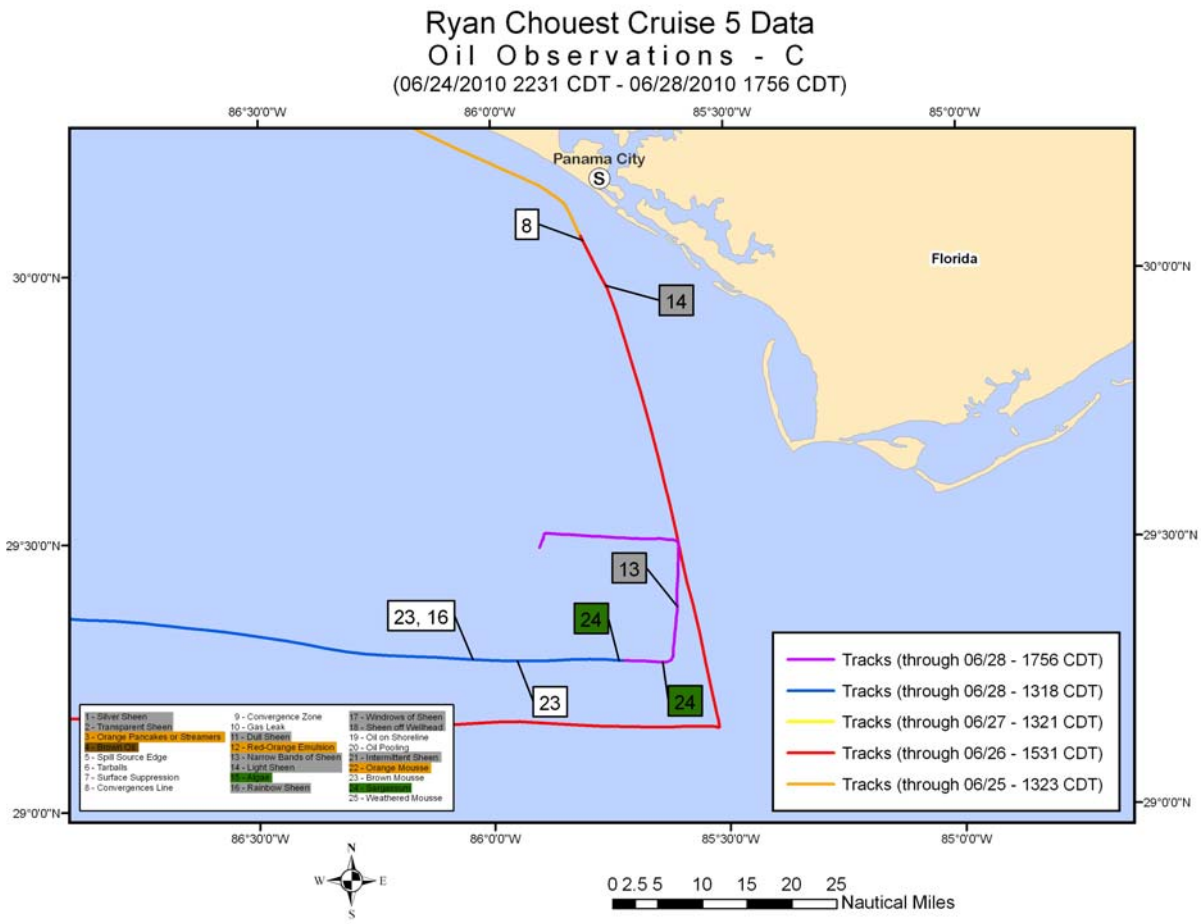

Figure 1C. Large-scale map of region C in Figure 1 showing oil slick observations. See also Photographs 1-3.

<u>Geochemistry</u>

Water sample near the R/V Weatherbird II site 29° 01.9788' N 88° 00.0008' W

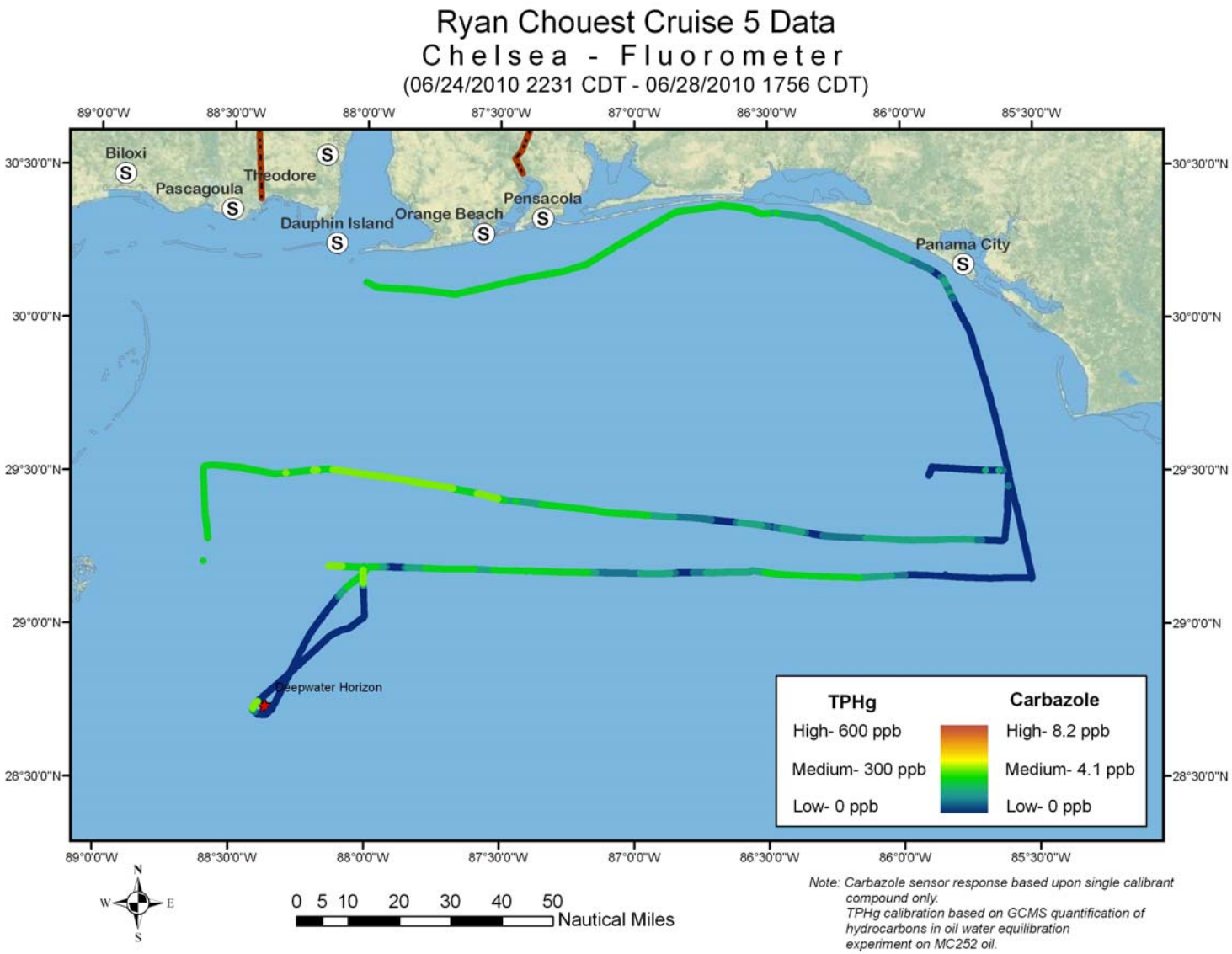

Figure 2. Chelsea fluorometer results plotted with location on cruise 5 track. Breaks in data occur when either data quality is poor or the systems were turned off due to pump problems.

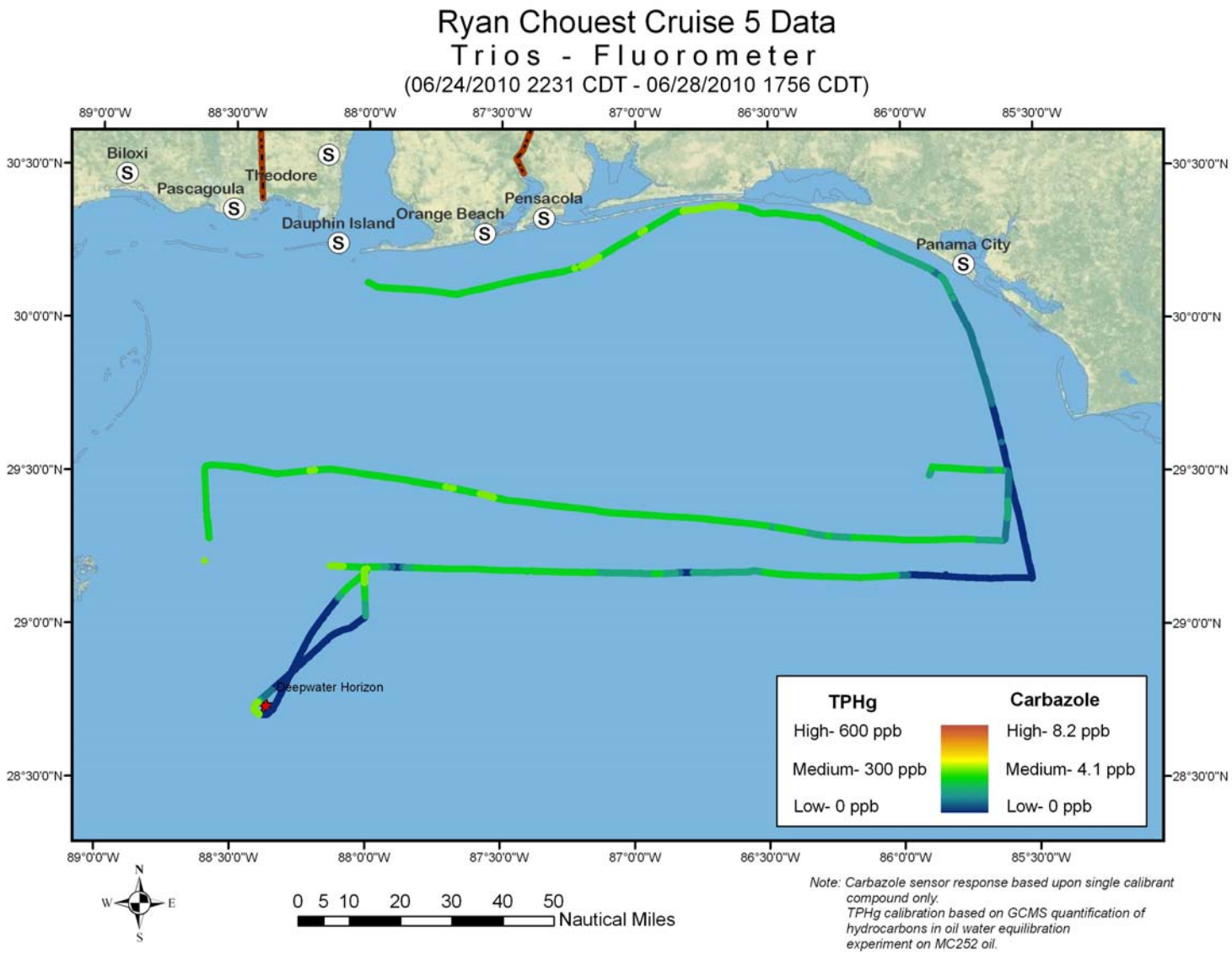

Figure 3. Trios fluorometer results plotted with location on cruise 5 track. Breaks in data occur when either data quality is poor or the systems were turned off due to pump problems.

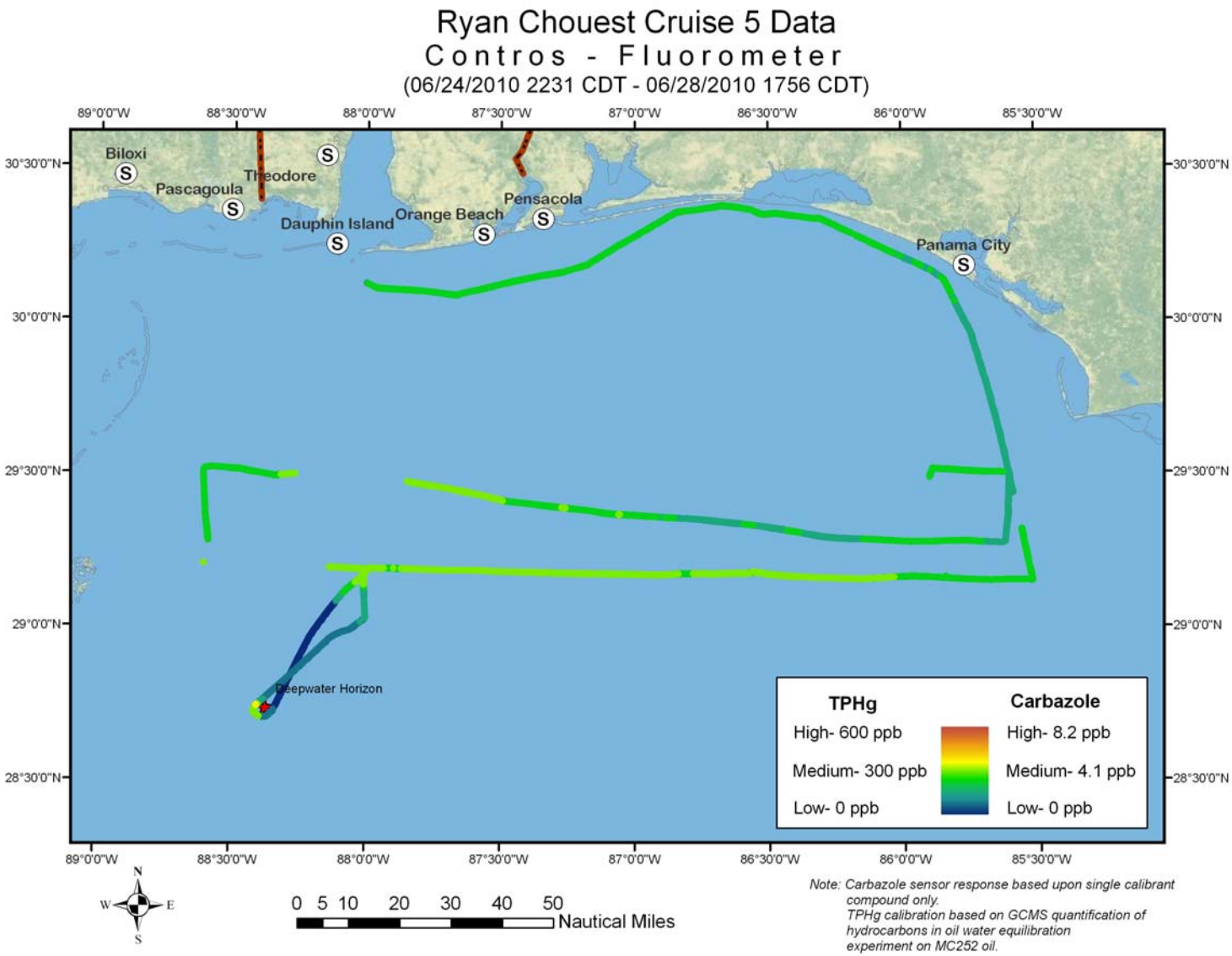

Figure 4. Contros fluorometer results plotted with location on cruise 5 track. Breaks in data occur when either data quality is poor or the systems were turned off due to pump problems.

Chemistry

A 90m vertical cast was performed at the R/V Weatherbird site (29 ° 1.9788 N, 88° 0.0008 W). Three sea water samples were collected at 5m, 70m and 90m water depth respectively. The three samples were pretreated with liquid/liquid extraction and then analyzed with GCMS analysis. Figure 6 and figure 7 show their TIC region with low molecular weight range of compounds from 6min to 20min and with high molecular weight range of compounds from 20-55min. There is little difference between the samples except for the water sample collected at 70m an abundance of tetrachloroethane has been detected.

Surface seawater samples were collected at the Deepwater Horizon spill site (28° 44.74 N, 88° 24.04 W). Liquid extraction TIC of the water sample shows higher concentration of tetrachloroethane (figure 8). This is unusual as tetrachloroethane is not a compound normally associated with oils but it is found in a few of the water samples collected so far. The oil has low abundance of toluene and naphthalenes and trimethylbenzenes but higher relative abundance of methyl naphthalene. The profile of the oil is similar to the profile of the mousse collected at sea only with higher contribution from the *n*C13-17 alkanes.

The Chromatogram (figure 9) of oil mousse collected on surface sea waterter at (29° 29.83 N, 88° 18.24 W) shows absence of light molecular weight compound which could be due to the evaporation of the volatile components over time.

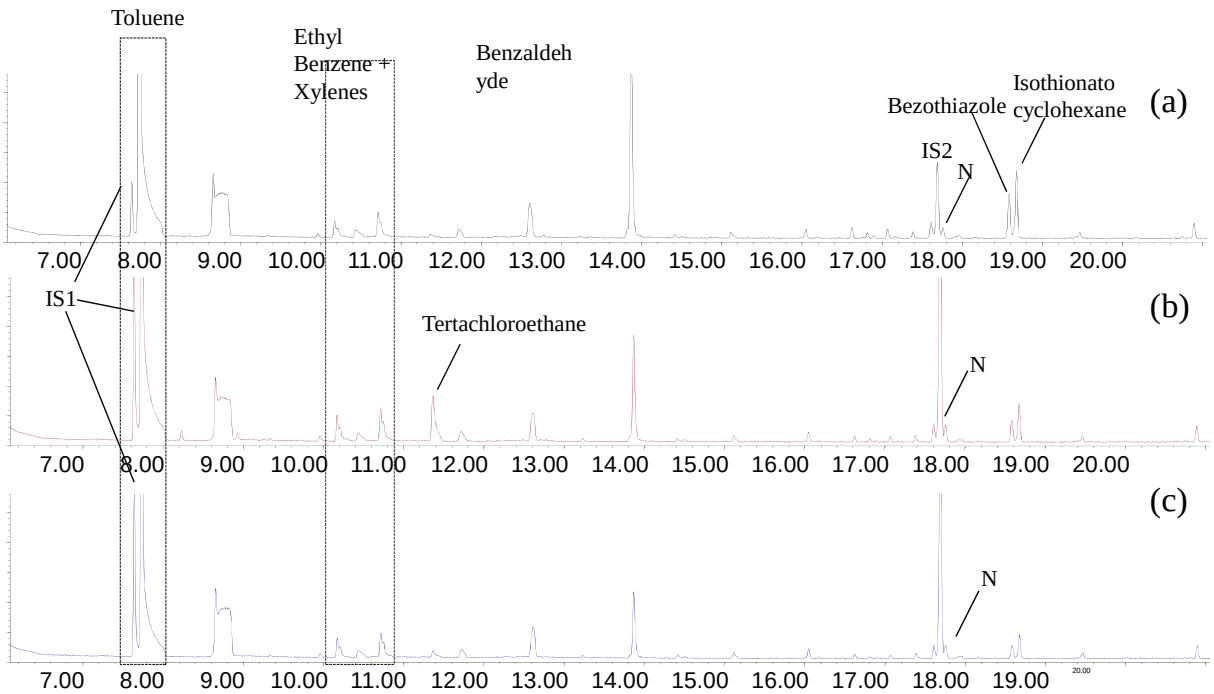

Figure 6. Liquid extraction of (a) surface seawater (5 m) (b) at 70m depth seawater showing the light molecular weight range. (c) at 90m at the R/V Weatherbird site (29 ° 1.9788 N, 88° 0.0008 W) showing the TIC region with low molecular weight range of compounds from 6 minutes to 21 minutes. IS1= d-toluene, IS2= d-Naphthalene. *indicated that the peak is not the same as found in the corresponding chromatogram.

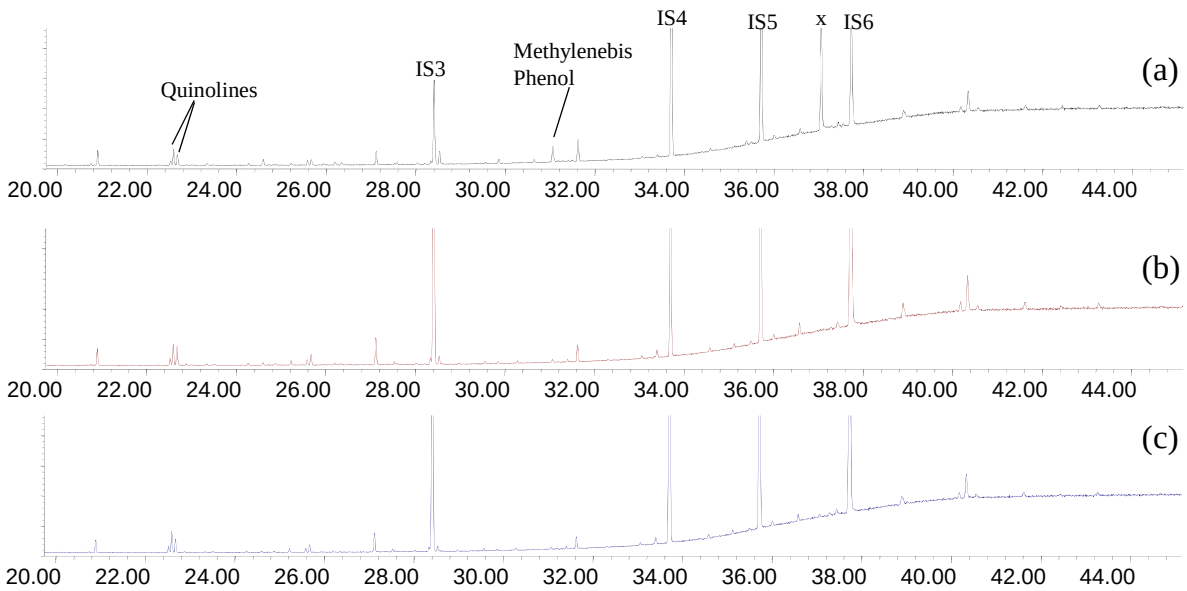

Figure 7. Liquid extraction of (a) surface seawater (5 m) (b) at 70m depth seawater showing the high molecular weight range. (c) at 90m at the R/V Weatherbird site (29 ° 1.9788 N, 88° 0.0008 W) showing the TIC region of high molecular weight range of compounds from 20 to 55 minutes. IS3= d-anthracene, IS4=p-terpthenyl, IS5= 1,1-Binaphthyl, IS6= squalane. X indicate contamination peaks associated with phthalates.

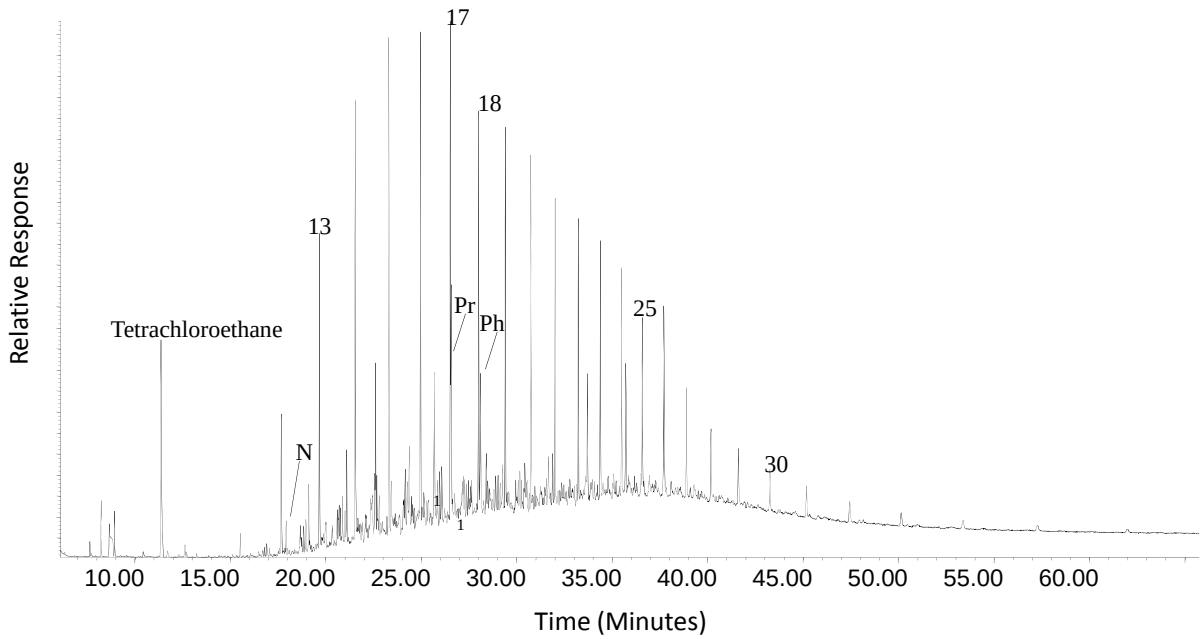

Figure 8. Liquid extraction TIC of surface seawater collected near the Deepwater Horizon spill site (28° 44.74 N, 88° 24.04 W). Numbers refer to the aliphatic carbon chain length, N= Naphthalene, MN= Methyl Naphthalenes, Pr = Pristane, Ph= Phytane.

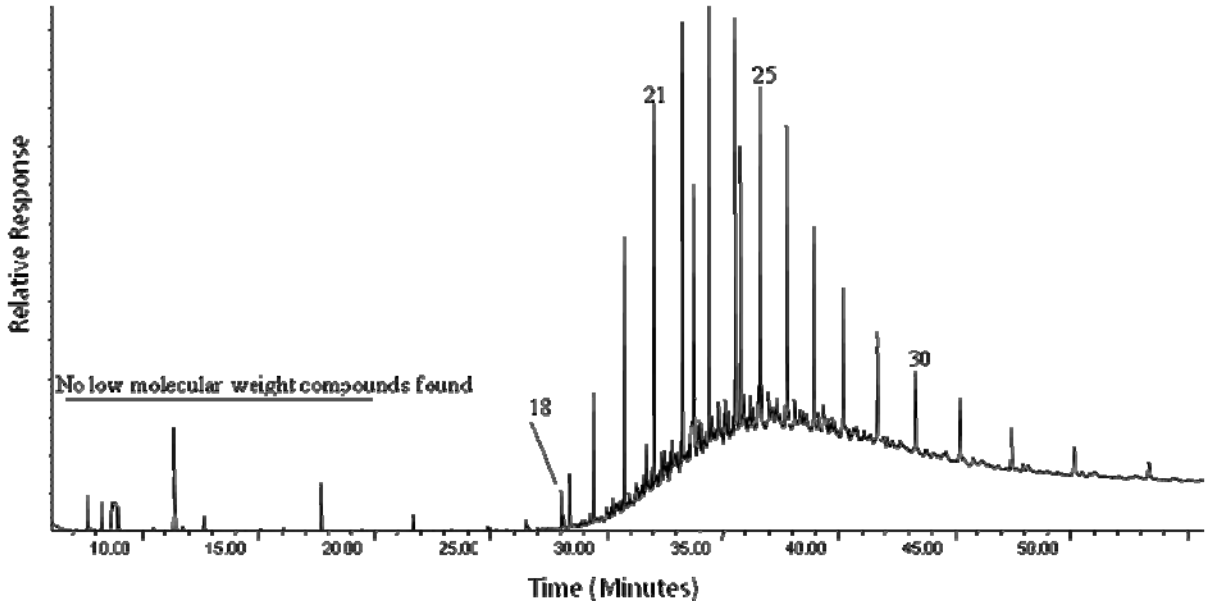

Figure 9. TIC of extracted mousse (29° 29.83 N, 88° 18.24 W) sample prepared by dissolved in DCM. Numbered peaks equate to the aliphatic *n*-alkane chain length. Note the absence of low molecular weight compounds. Numbers refer to Aliphatic carbon chain length, Pr = Pristane, Ph= Phytane

Vessel science operations:

We logged fluorometer measurements, observed sea-surface conditions, and continued to perform liquid-liquid extractions on seawater samples and analyze with the GCMS. We decided to deviate from our cruise trajectory and head south to sample surface waters around the Deepwater Horizon incident site. This was to test the fluorometry sensors ability to detect high end-member values of dissolved oil in the surface layer. We also visited the previous R/V Weatherbird II CTD site (29° 02 N, 88° W) to perform a surface and deep fluorometry cast. Fluorometer measurements were logged for the remainder of the cruise until the underway water pump failed. Without a spare, we sailed straight to port for repairs and crew change thus ending cruise 5.

Problems/operational issues:

(Includes items up to report submission time)

We have repaired the underway submersible water pump. The new office container was onloaded and the plans to fix the jib crane wheel blocks were given to the machinists. The relief crew has also arrived and will stay onboard tonight. The Stratos communications technician will arrive at 0600 hrs to set up a phone/ethernet ports in the new container and increase the bandwidth of the internet communications.

Planned activities for next 24 hours:

We will remain in port for approximately 24 hours while new equipment is connected, personnel are changed, groceries are delivered, and equipment repairs are tested. Weather delays are uncertain at this time but may be expected if Tropical Storm Alex continues to churn in the southwestern GoM.

Planned Route for Cruise 6:

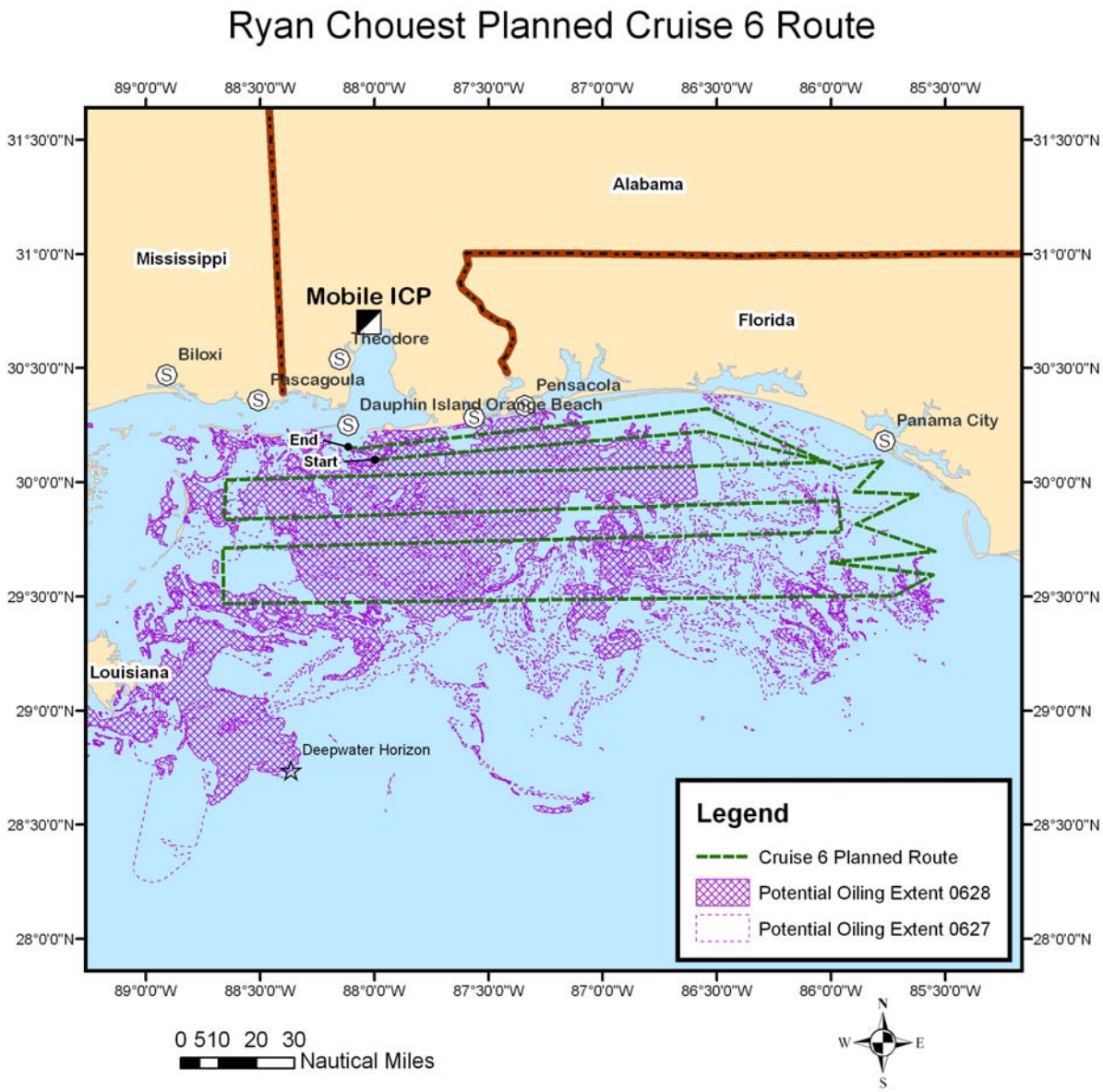

Figure 11. Planned trajectory for cruise 6.

Selected Photos:

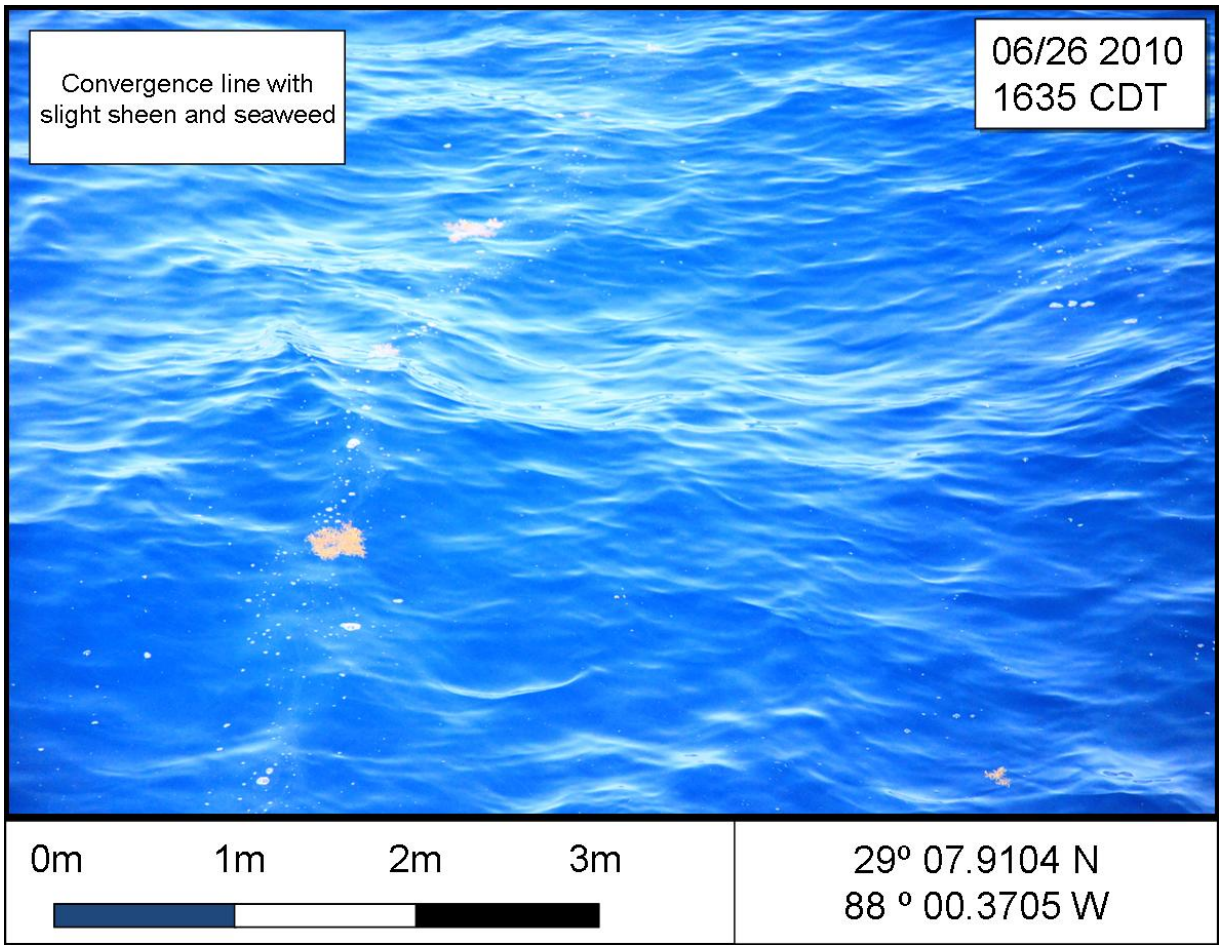

Photo 1. Convergence line characterized by seaweed and slight surface sheen.

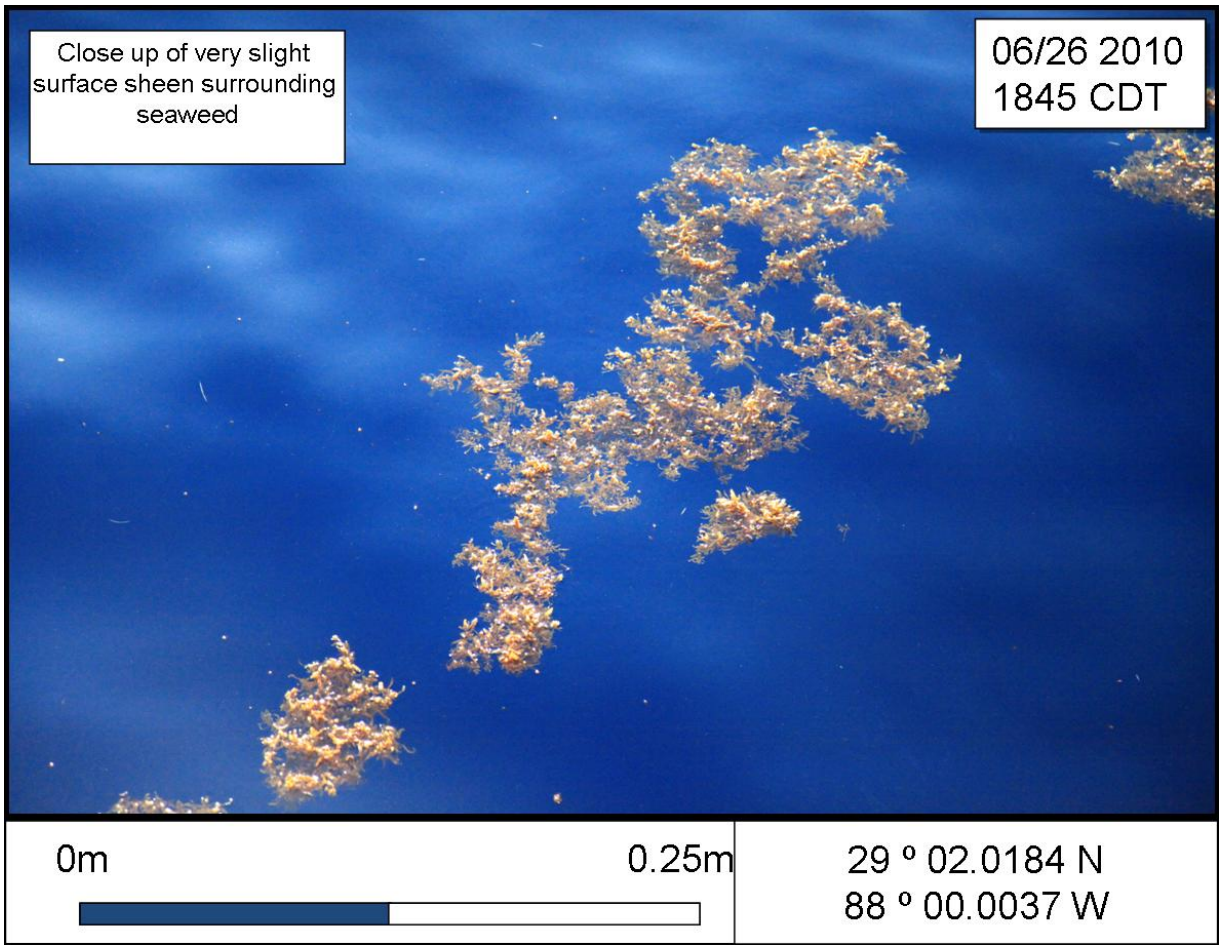

Photo 2. Close-up of seaweed that is surrounded by subtle wavy lines of surface sheen.

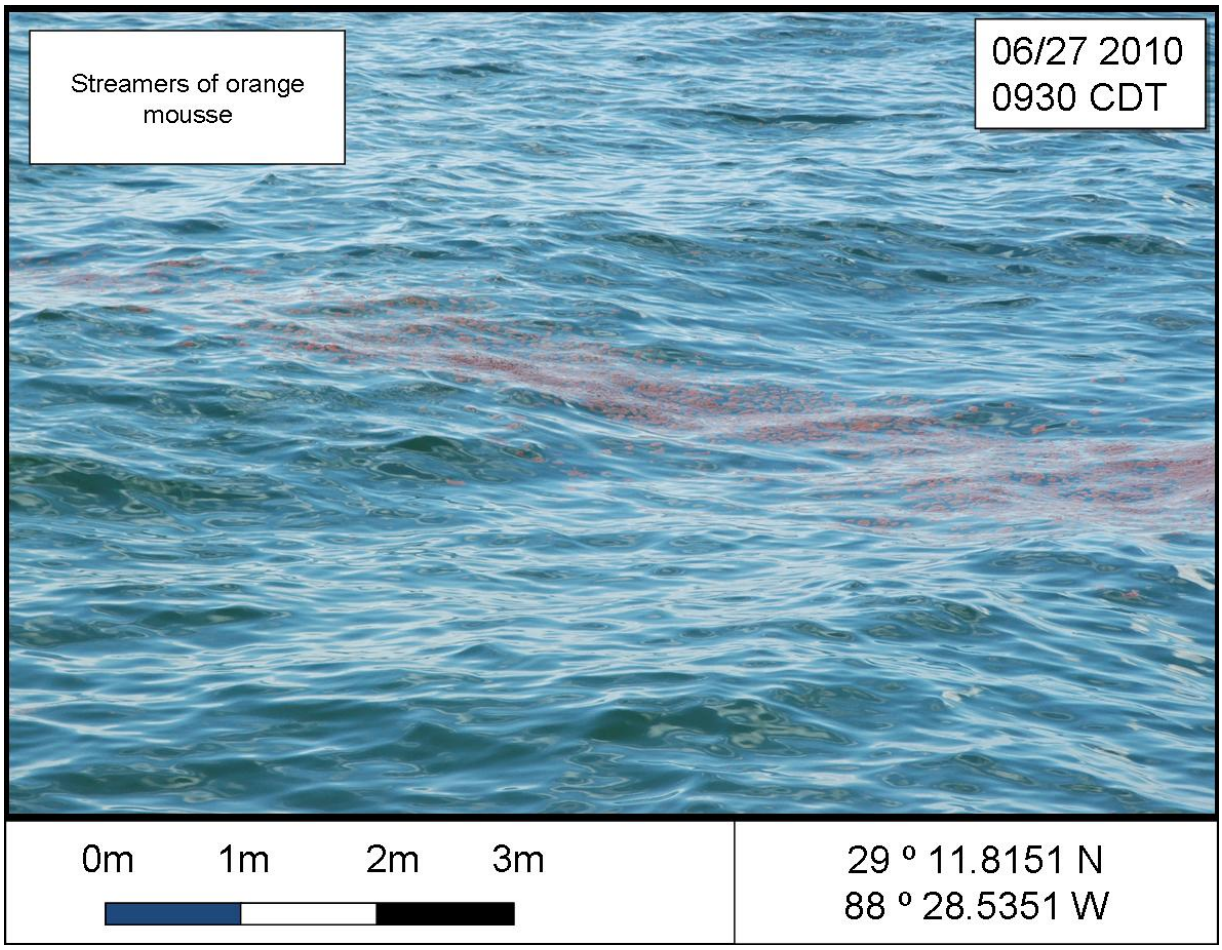

Photo 3. Streamers of dense orange mousse.

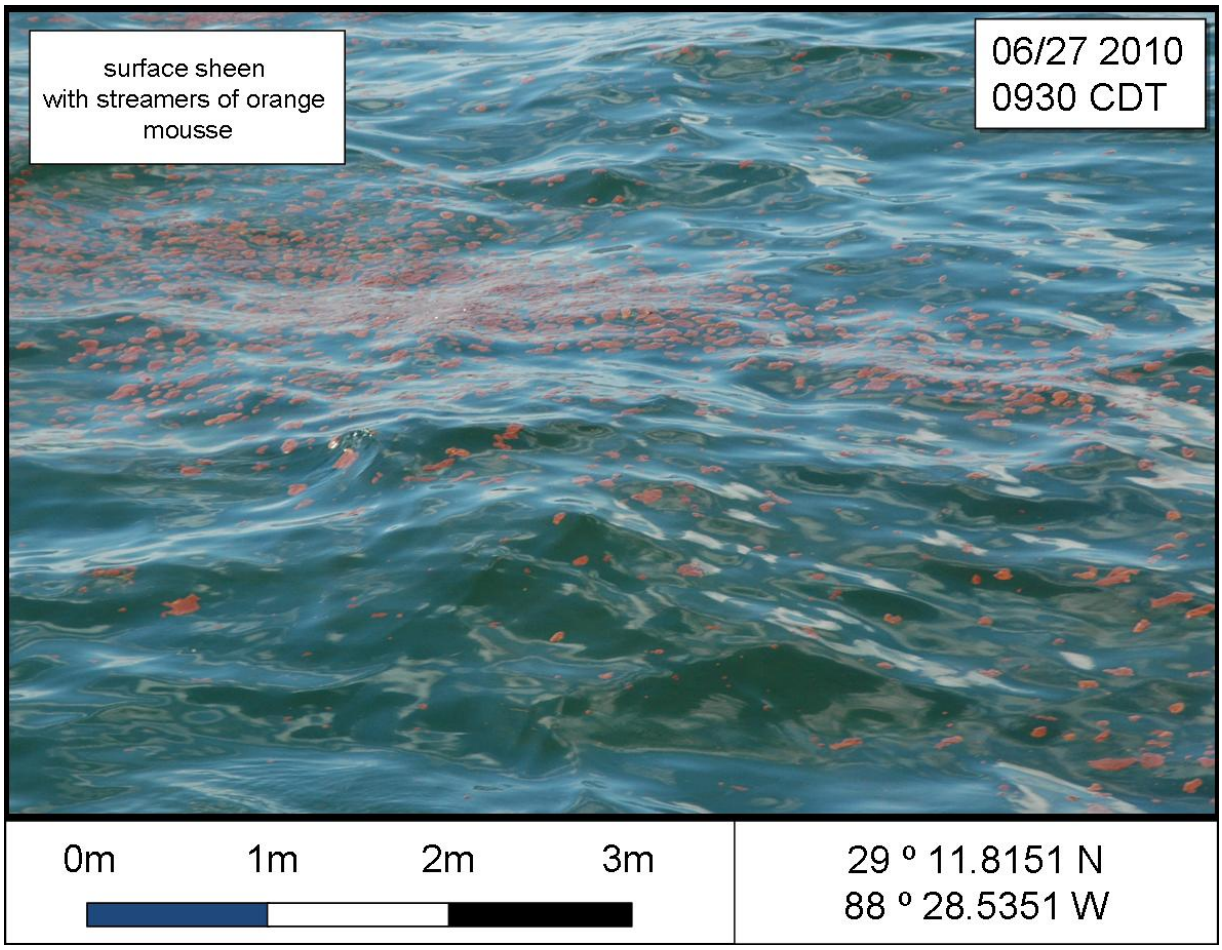

Photo 4. Streamers of relatively dense orange mousse and surrounded by a surface sheen.

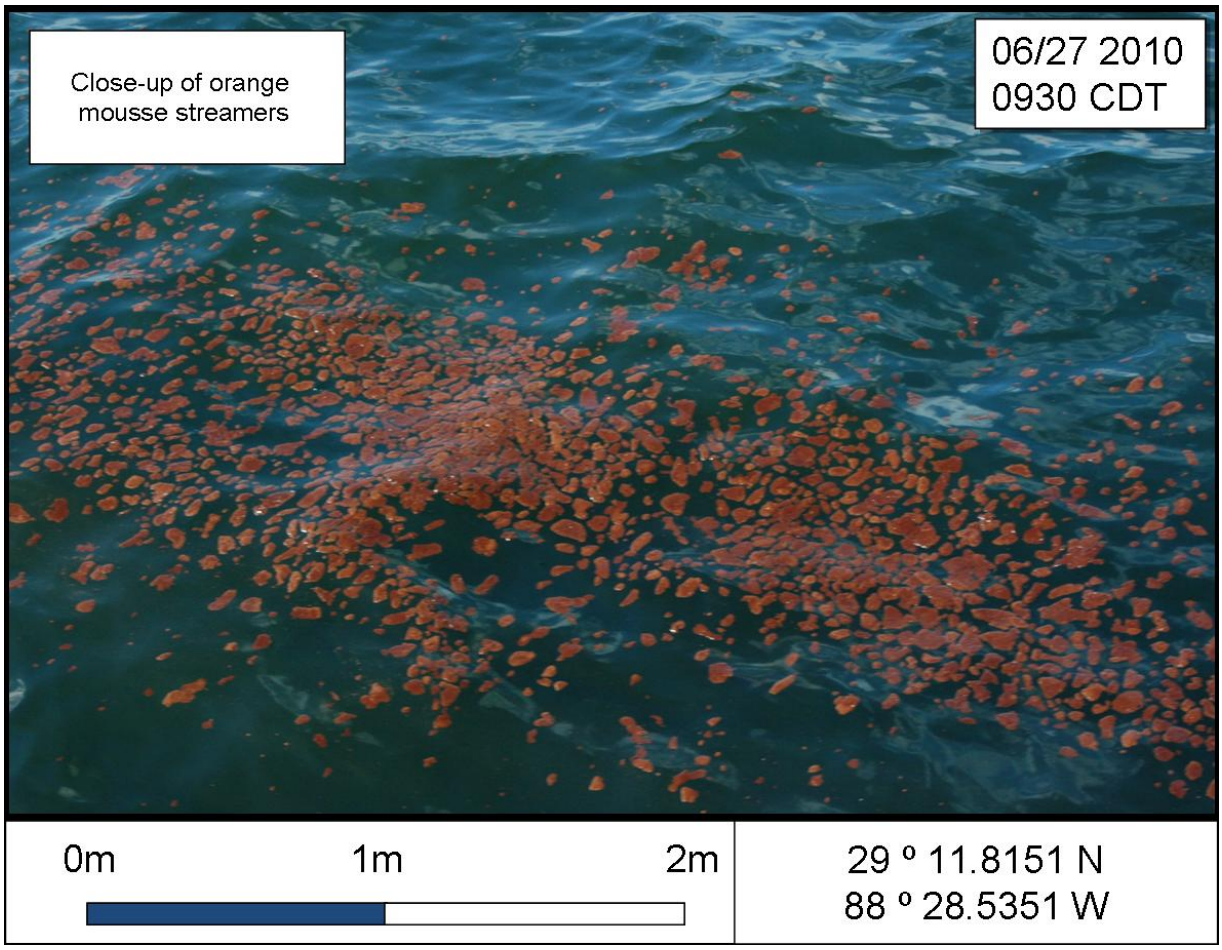

Photo 5. Close-up of dense orange mousse distributed in streamer lines.

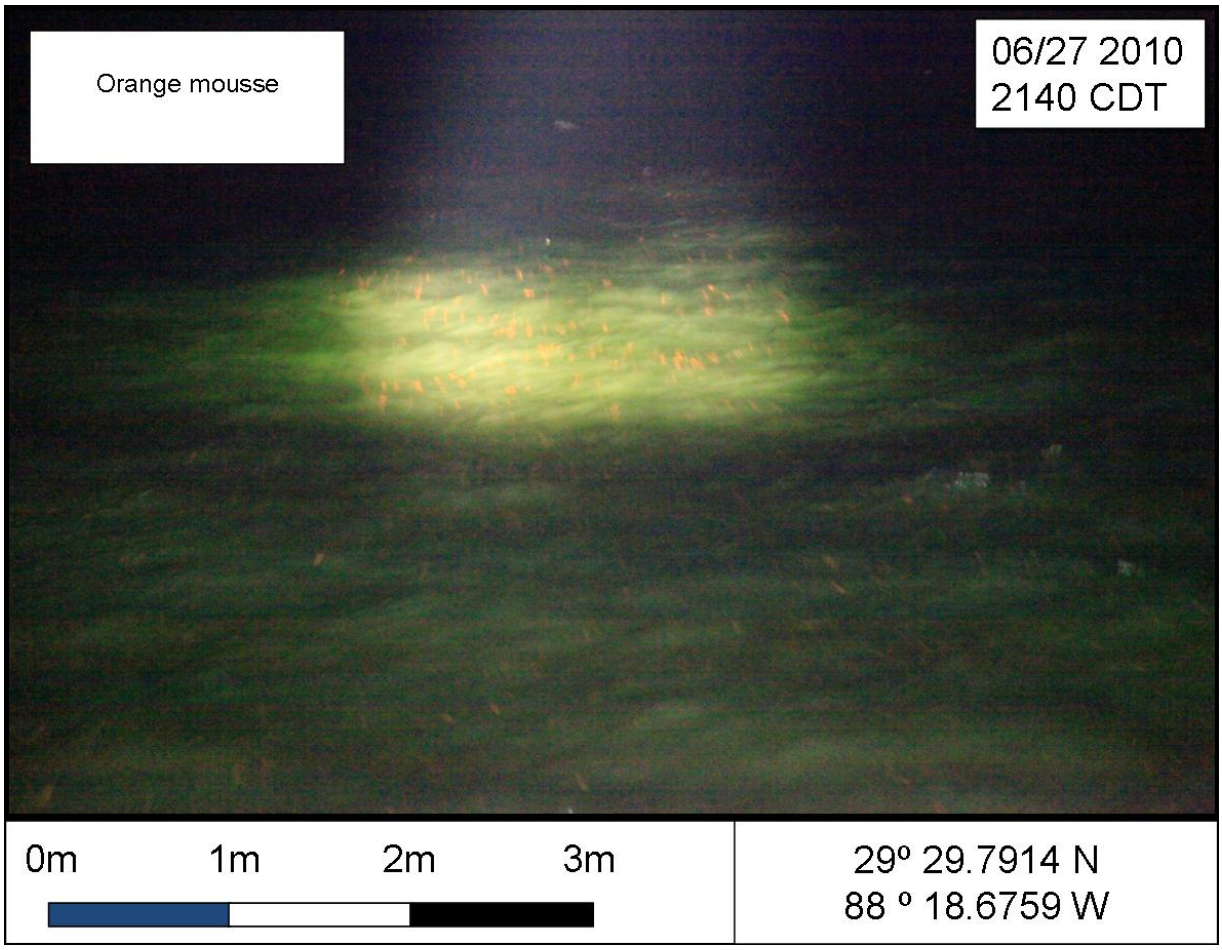

Photo 6. Region of dense orange mousse patches.

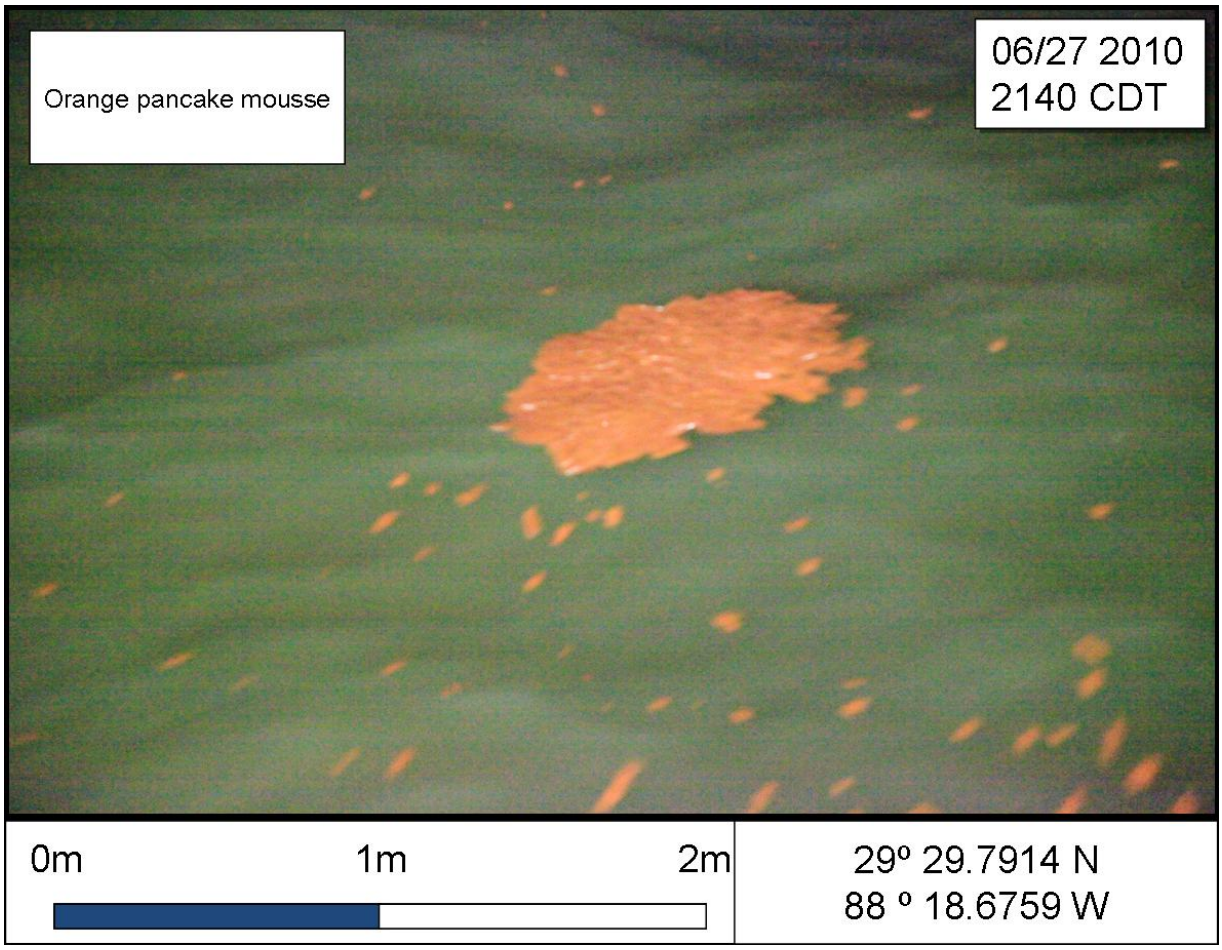

Photo 7. Orange pancake mousse, approximately 1m in diameter.

Full Crew List:

William A. Smith	MASTER
Demarco Jones	A/B
Elijah Benjamin	O/S RIG
Jon Cheney	Capt.
Brian Corley	Mate
Eduardo Zepeda	A/B
Mark Harmon	A/B
Samuel Nwosu	QMED
Craig Lyons	CHIEF ENG.
Emma Crooke	CSIRO
Xiubin Qi	CSIRO
Stephane Armand	CSIRO
David Fuentes	CSIRO
Andrew Ross	CSIRO
Lawrence Febo	BP
Guilherme De Almeida	Entrix
Brian Harmon	C&C

Greg Richard	C&C
Roderick Baker	OS/COOK
Brandon Wilson	C-PORT
Ben Autin	C-PORT