

July 28th | 2010

Ryan Chouest Cruise 10 Cumulative Report

Period covered: 1707 07/25/2010 -1444 07/28/2010

428.89 - Nautical miles covered

Vessel science party:

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Cruise notes:

Cruise 10 was designed to survey the waters near the MC 252 spill site and also investigate the seeps previously identified in MC 294. The whole route is shown in Figure 1. The first leg of this cruise from Port Theodore, returned the Ryan Chouest to the 5 nautical mile circular route round the spill site as shown in Figure 2. After completing a full revolution of the MC 252 site at 5 nautical miles the vessel was brought to 4.34 nautical miles (5 statute miles) from the MC 252 site and followed a semi-circular route to the previously identified MC 294 seep area (Figure 3). In order to identify seeps and seep features a survey box was designed to optimize coverage of the echo sounder over the sea floor in the area of the previously detected seeps. The EK-60 echo sounder operating at 38 KHz has a beam footprint of 7°. At a depth of 1400m, the beam footprint is ~172m wide ($\tan 7^\circ \times \text{water depth}$). As such, survey lines at ~152m apart were planned to allow enough overlap to fully survey the seabed (Figure 4). To finalize the survey the remainder of the 4.34 nautical mile semicircle route around the MC 252 spill site was completed the vessel took a route which transited to Port Fourchon past the Mississippi delta. Whilst at Port Fourchon the vessel was resupplied and a crew change took place (Figure 5).

The hydrocarbon sensor array and echo sounder were operated smoothly throughout the period. Water samples were also collected across the Mississippi passes in order to help describe the fluctuations in sensor responses which have been previously observed when passing through the same area. In this report we present a detailed summary of results of the cruise 10.

Science results and preliminary interpretation:

Fluorometry results

Fluorometry measurements are low to lower-medium for the Chelsea, Trios, and Contros sensors (Figures 6-8). In places baseline levels were measured by the Chelsea and Trios fluorometers. The Trios sensor detected slightly higher than levels in Mobile Bay and across the Mississippi passes.

Planned versus actual route taken cruise 10:

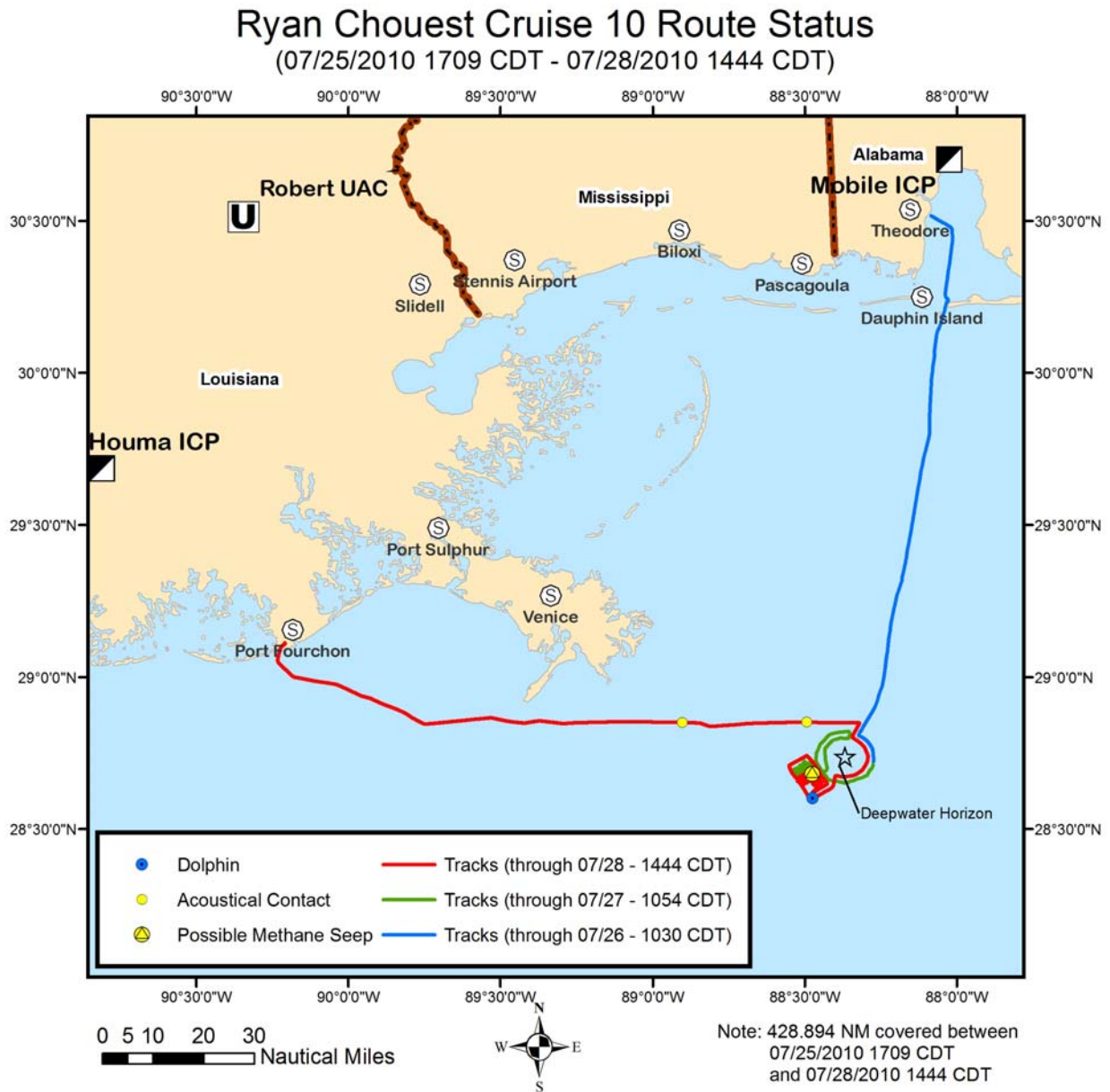


Figure 1: Actual route course of the Ryan Chouest cruise 10 plotted between 07/25 – 07/28.

Ryan Chouest Cruise 10 Route Status (07/25/2010 1709 CDT - 07/26/2010 1030 CDT)

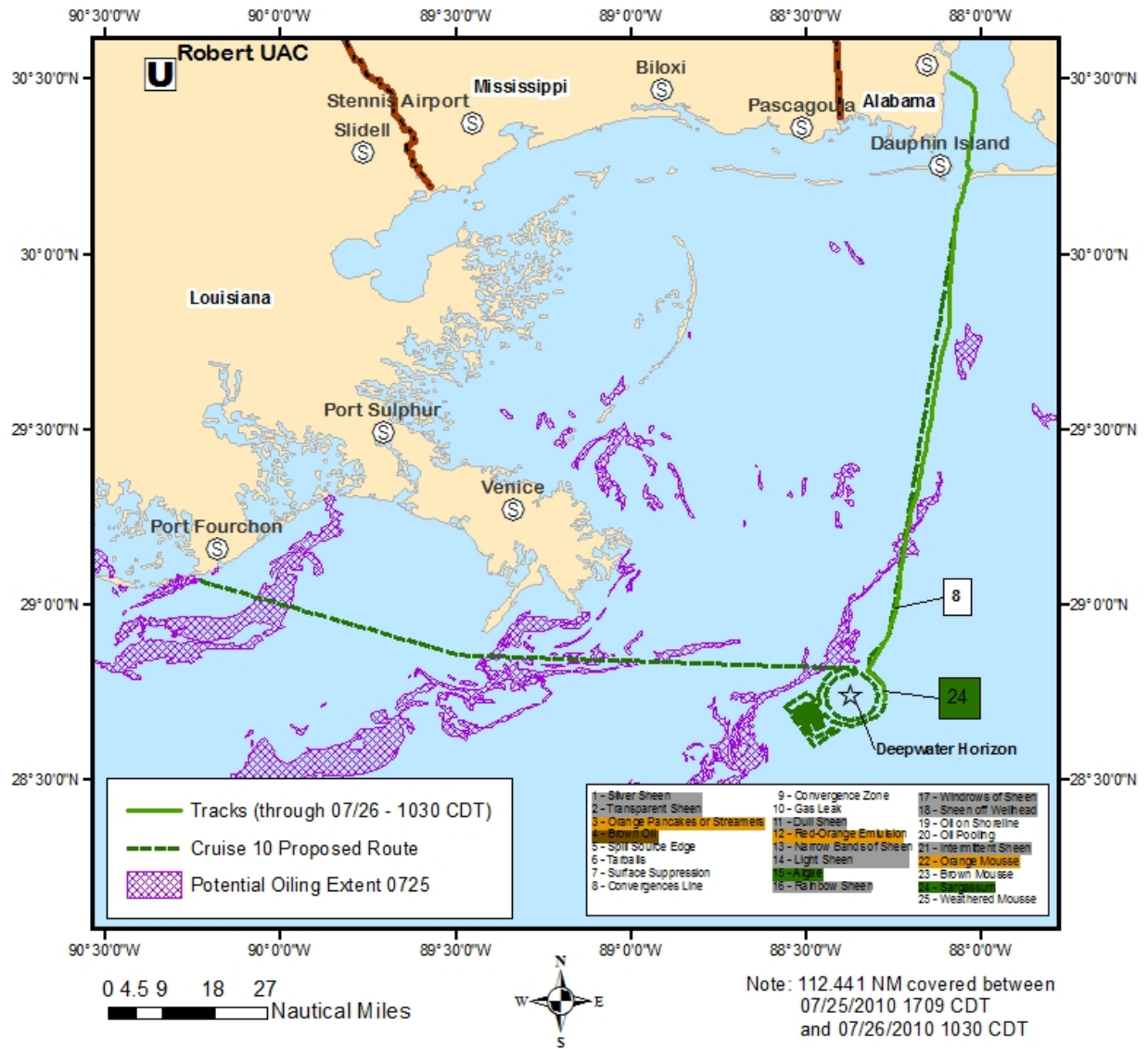


Figure 2: Planned versus actual route course plotted between 07/25 – 07/26. Purple shaded area represents outline extent of the slick from 07/25 ERMA composite.

Ryan Chouest Cruise 10 Route Status

(07/26/2010 1035 CDT - 07/27/2010 1054 CDT)

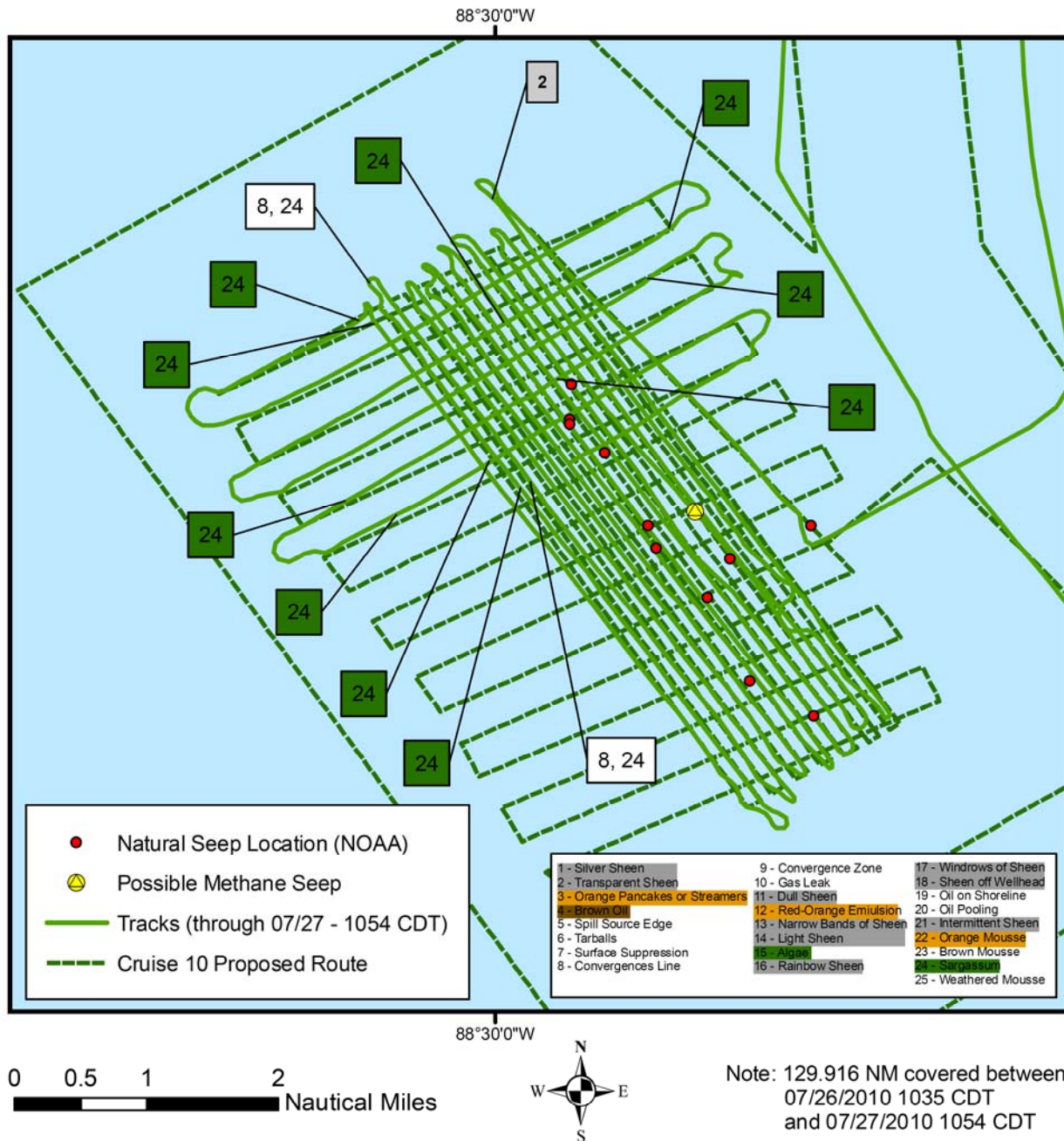


Figure 4. Detailed grid route for the cruise 10 acoustical survey over natural methane seeps previously reported by NOAA.

Ryan Chouest Cruise 10 Route Status (07/27/2010 1055 CDT - 07/28/2010 1444 CDT)

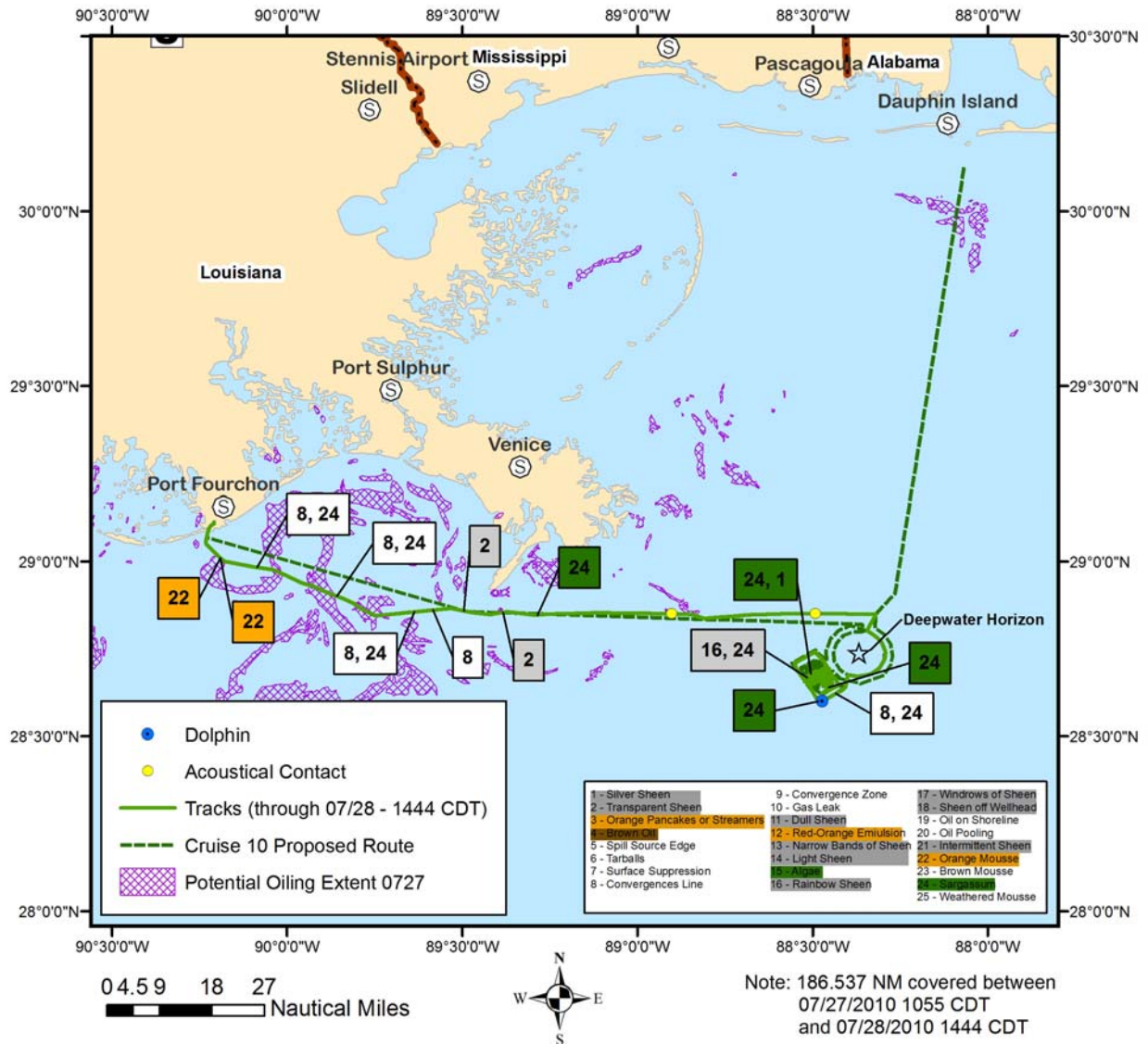


Figure 5: Planned versus actual route course plotted between 07/27 – 07/28. Purple shaded area represents outline extent of the slick from 07/27 ERMA composite.

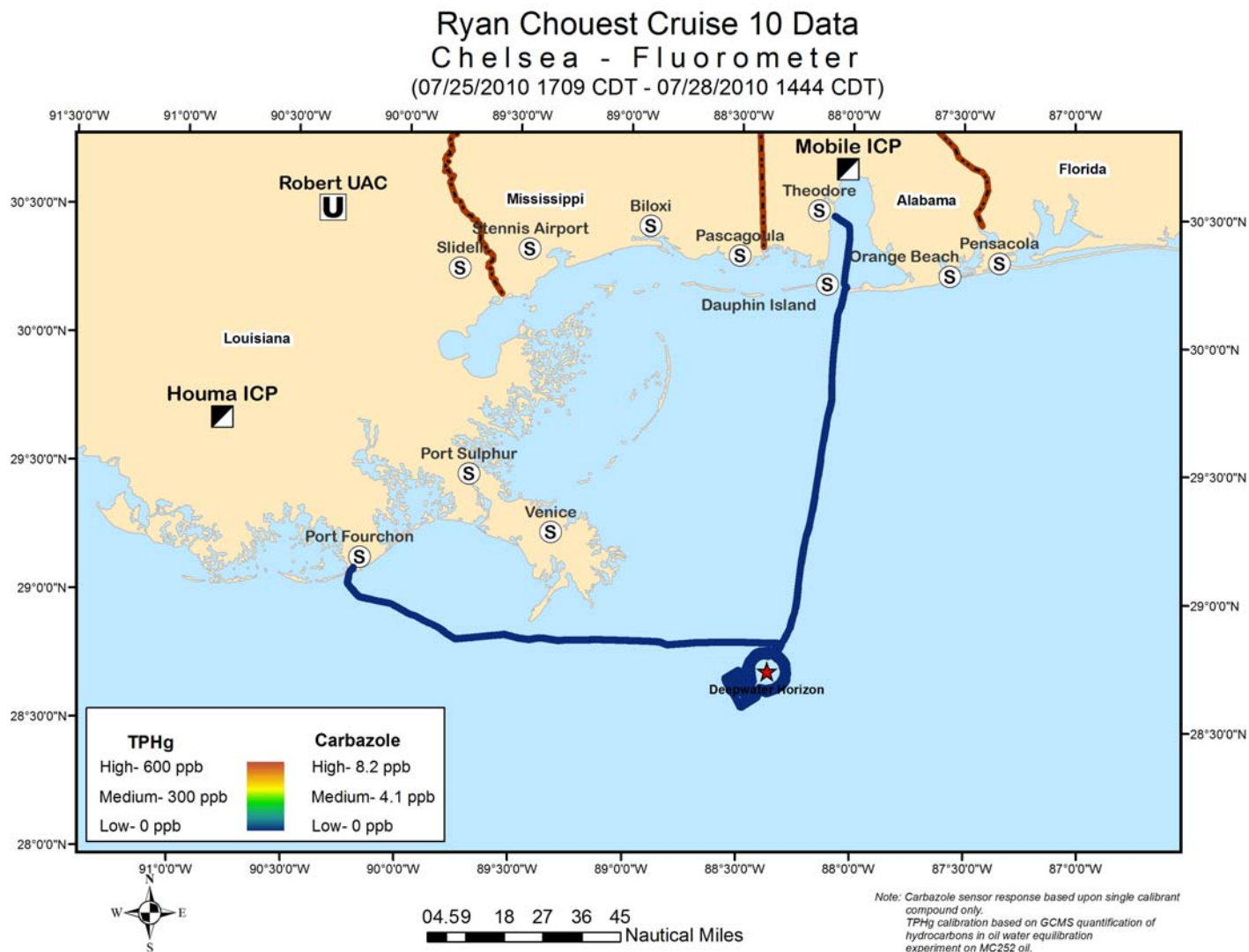


Figure 6. Chelsea fluorometer results plotted with location on cruise track 10. Breaks in data occur when either data quality is poor or the systems were turned off due to pump problems.

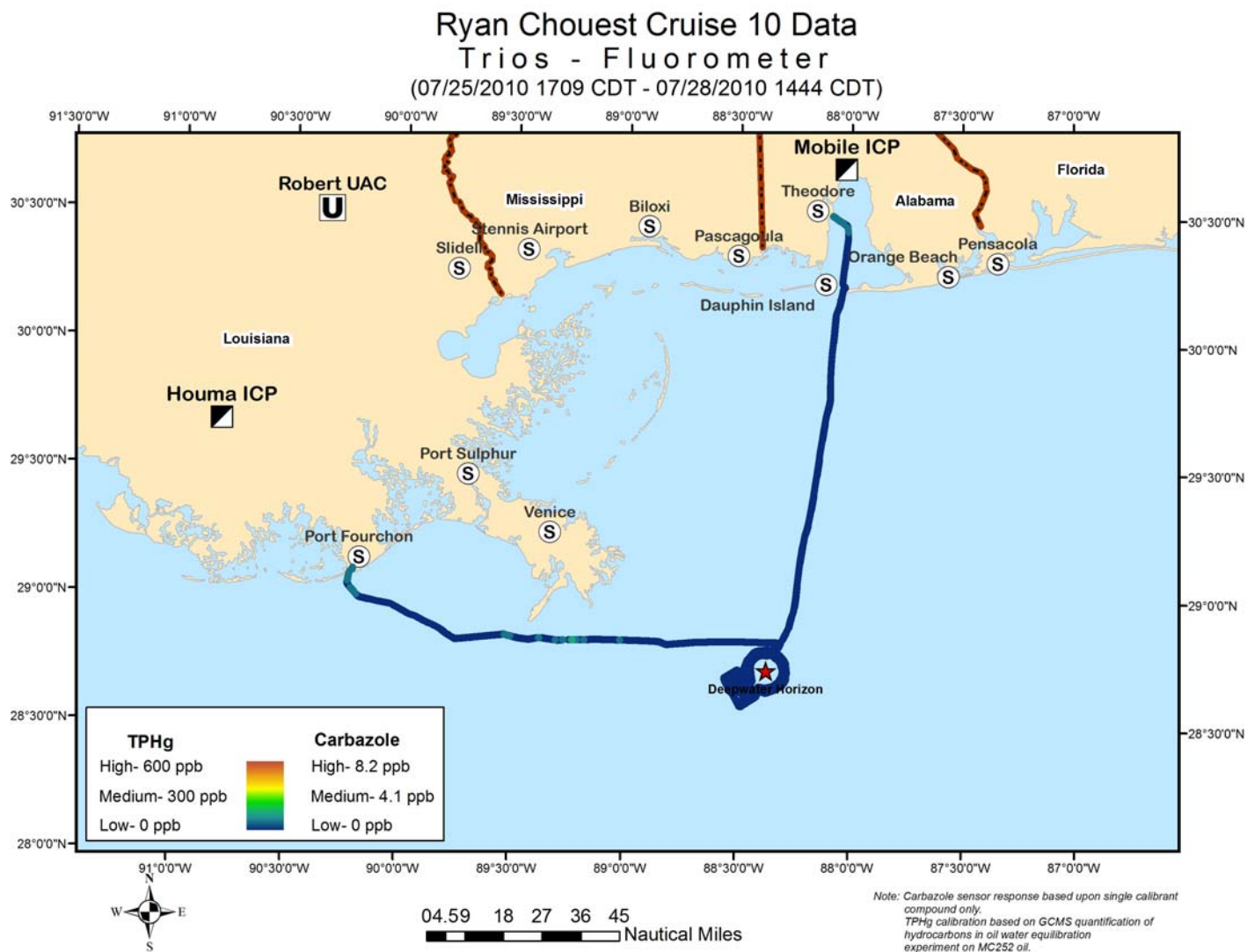


Figure 7. Trios fluorometer results plotted with location on cruise track 10. Breaks in data occur when either data quality is poor or the systems were turned off due to pump problems.

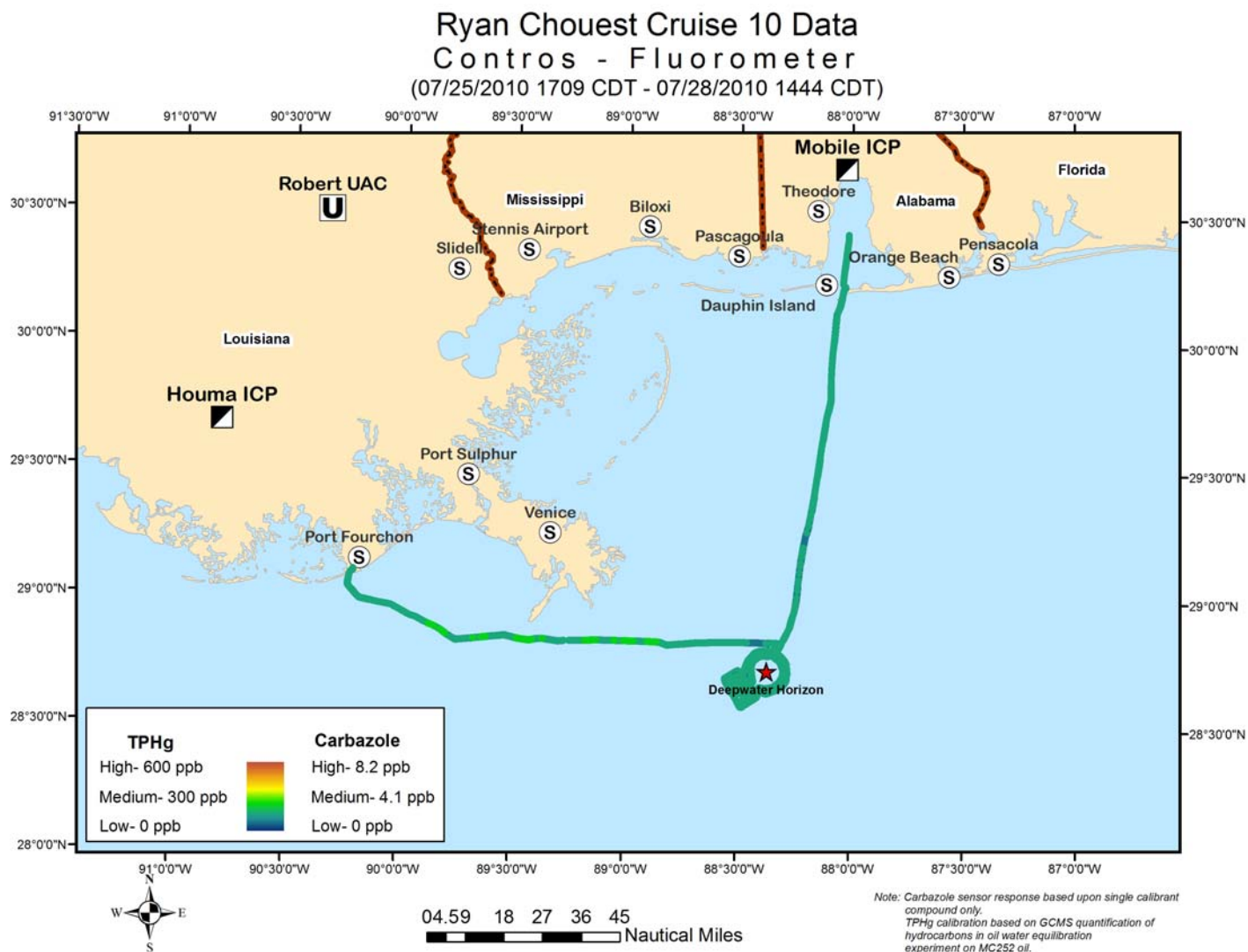


Figure 8. Contros fluorometer results plotted with location on cruise track 10. Breaks in data occur when either data quality is poor or the systems were turned off due to pump problems.

The Contros fluorometry data show lower-medium level values throughout the route surveyed with enhanced values also acquired in front of the Mississippi passes. Once in the waters close to the Mississippi delta the fluorometer responses have enhanced variability, this we attribute to turbidity or humic acids, however surface water sample were taken to help establish if this was the case.

Whilst the fluorometry results were low there are small trends within the data (not shown). The scale on the figures will be revisited in future reports in order to add more granularity to the results. Further observations on the results are described in the combined results interpretation section. Both in the survey area at MC 294 and at echo sounder contact 0728010_095442 there were small increases in there fluorometer responses. In the case of the survey area there was a well defined area of enhanced sensor response in the south west quadrant of the survey box (Figure 14), unfortunately the area of enhances sensor response extended outside the survey box so it is unclear whether the response was a defined plume or part of a larger feature. The echo sounder data suggests that the possible seep plume identified in the area may curve towards the area of enhanced response although further definition of the fluorescent feature would be required to provide further evidence that the two features are related. For the echo sounder contact 0728010_095442 (Figure 16) the fluorometer response showed a gradual increase followed gradual decrease in signal before becoming affected by possible Mississippi waters and becoming more variable. Once again further surveying at the site would be required to connect the two features. For echo sounder contact_0728010_070745 (Figure 17) there was no appreciable difference in sensor response.

Contros HydroC Methane Sensor

We are in the early stages of integration of this sensor into the system and testing and as such these results require further processing.

Surface Observations

Only light surface sheens, convergence lines, and seaweed are observed throughout the majority of the cruise route (Figures 2-5). Towards Port Fourchon areas of sheen and small distributed brown mousse were observed (figure 5).

EK-60 Echosounder results

During the cruise good evidence for a three seeps was acquired by the echo sounder.

Within the survey area of MC 294 evidence for a currently active seep was found on two separate survey lines in a Northwest-Southeast direction (Figures 9 & 10). The acoustical contact begins at 700m and extends downward as a slightly wavy vertical feature to the seabed at 1370m water depth (Figures 9 & 10). The width of the vertical feature varies from a tapered tip to slightly wider towards the base (see also Figures 7 and 8). The absence of the plume extending to the sea surface directly above the contact is likely due to any gas dissolving into the water and possible currents in the area off setting the location of any surface expression.

Due to the narrow line spacing of the survey lines it was possible to grid the seafloor bathymetry to obtain a three dimensional representation of sea bed features. Figure 13 shows a clear curved escarpment with a trough behind, from which the possible seep contact is issuing. All of the reported seeps in the MC 294 block are associated with this feature, which is on the north western flank of the

Biloxi salt dome. This feature could be a result of crestal collapse, accompanied by concentric, extensional faulting of units around structure due to salt movement. Further geological data will be required to confirm this assessment. As discussed in the previous section, a fluorometry enhanced response exists to the southwest of the plume which may or may not be related to the seep (please refer to the previous section for discussion and Figure 14).

This possible seep is in addition to those previously reported by other vessels. Within the MC 294 no additional mid water contacts were observed along our survey lines. However seeps with plumes oblique to the lines sailed would be more difficult to identify.

The two additional echo sounder contacts made were made on the transit track from the MC 252 site through to Port Fourchon. The two contacts contact_0728010_070745 and contact_0728010_095442 (Figures 16 & 17) are both interpreted as possible seeps as they consist of near vertical to vertical plumes in the mid water column. Contact_0728010_095442 is of particular interest as the feature is a clear seafloor routed plume which gradually becomes less intense towards the surface finally dissipating within 150 meters of the sea surface. The intention is to return to this site at a later date to perform a cast over the feature to attempt to detect hydrocarbons and confirm that the plume is a hydrocarbon seep.

Science Operations:

Fluorometer measurements were logged and observations of sea-surface conditions were made throughout the cruise. Two new sensors were added to the HSA and include a Contros HydroC methane sensor and a dissolved volatile organic compounds sensor. We are in the early stages of testing the methane sensor and need to optimize its incorporation into the equipment. We conducted further sensor calibrations on single compounds (such as carbazole and toluene) and also on the MC252 extract. The volatile organic compounds sensor is in use but over the period of this report was not calibrated. We continue to perform liquid-liquid extractions on seawater samples and analyze the extracted material by GCMS. The EK-60 echo sounder is continuously collecting data to evaluate the seabed and water column for methane seeps.

Problems/operational issues:

During cruise 10 there were no operational problems.

Echosounder Results:

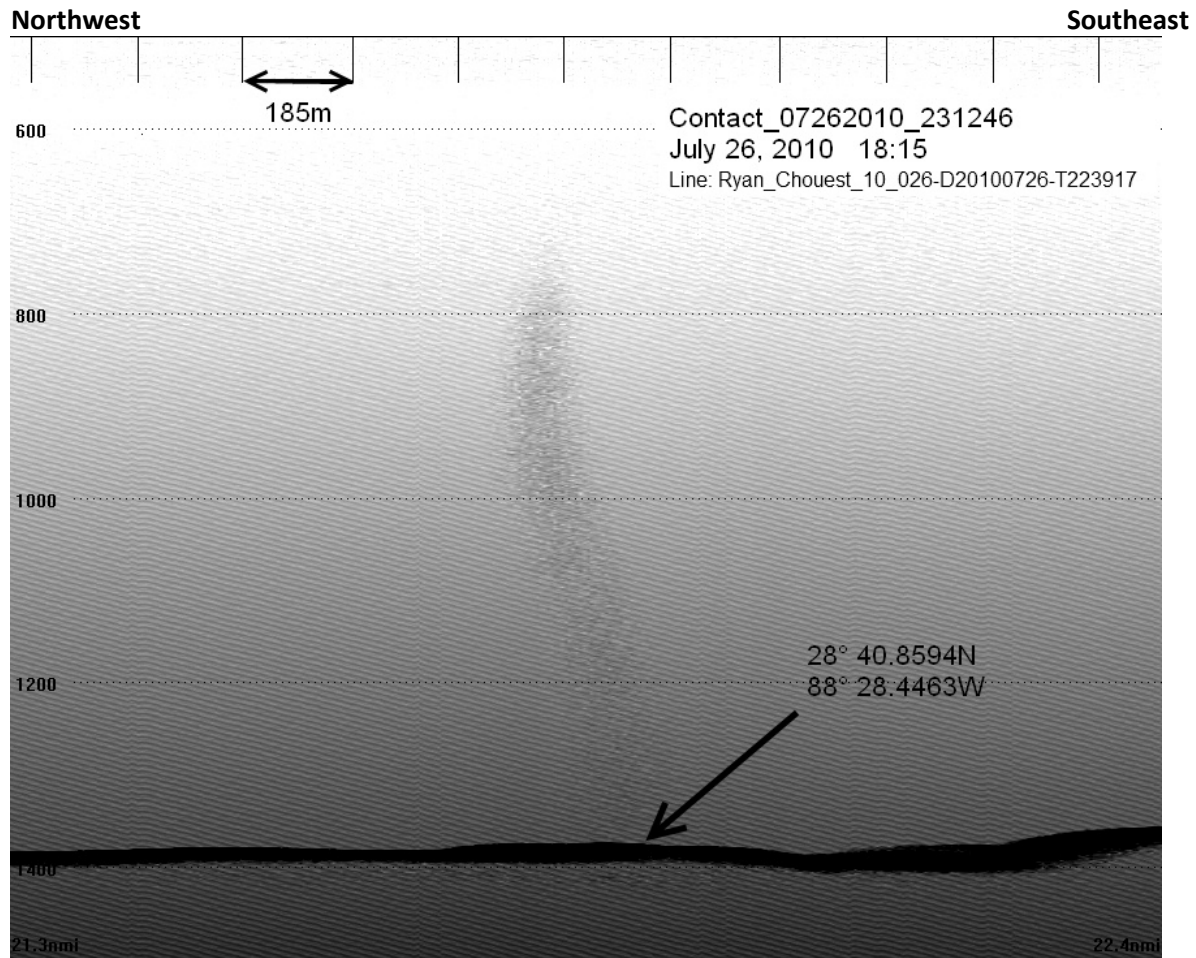


Figure 9. Two-dimensional view of possible methane seep located in MC294 adjacent to a cluster of seeps previously detected seeps by the NOAA R/V's Gunter and Thomas Jefferson. This line is oriented from Northwest on the left to Southeast on the right.

Description: Possible deep-water seep, same target as Contact_0727010_000624

Time (UTC): 07/26/2010 23:15:28

Location: 28° 40.8594N; 88° 28.4463W

Depth: 700m to 1370m

Southeast

Northwest

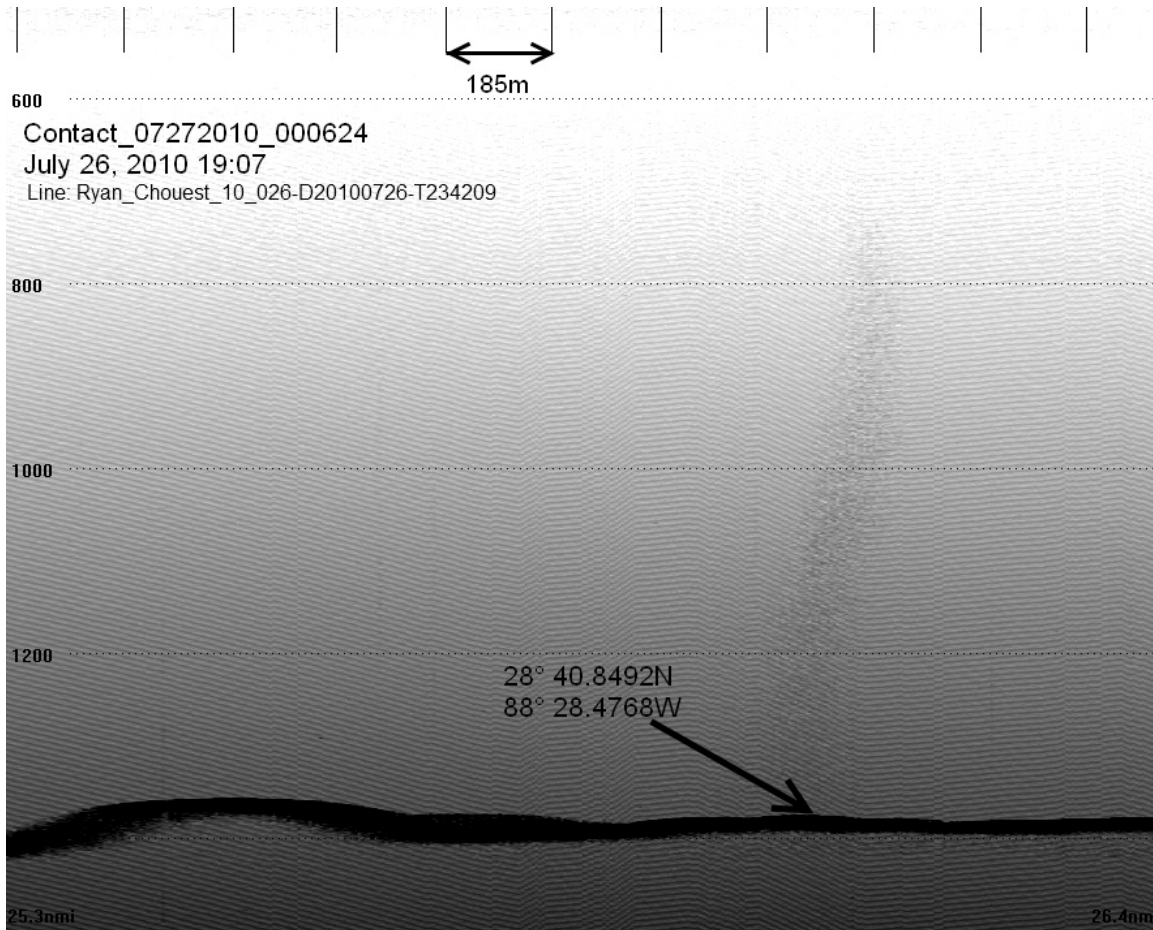


Figure 10. Same acoustical contact in Figure 5 from a different orientation. This line is oriented from Southeast on the left to Northwest on the right.

Description: Possible deep-water seep, same target as Contact_0726010_231246

Time (UTC): 07/27/2010 00:07:15

Location: 28° 40.8594N; 88° 28.4463W

Depth: 700m to 1370m

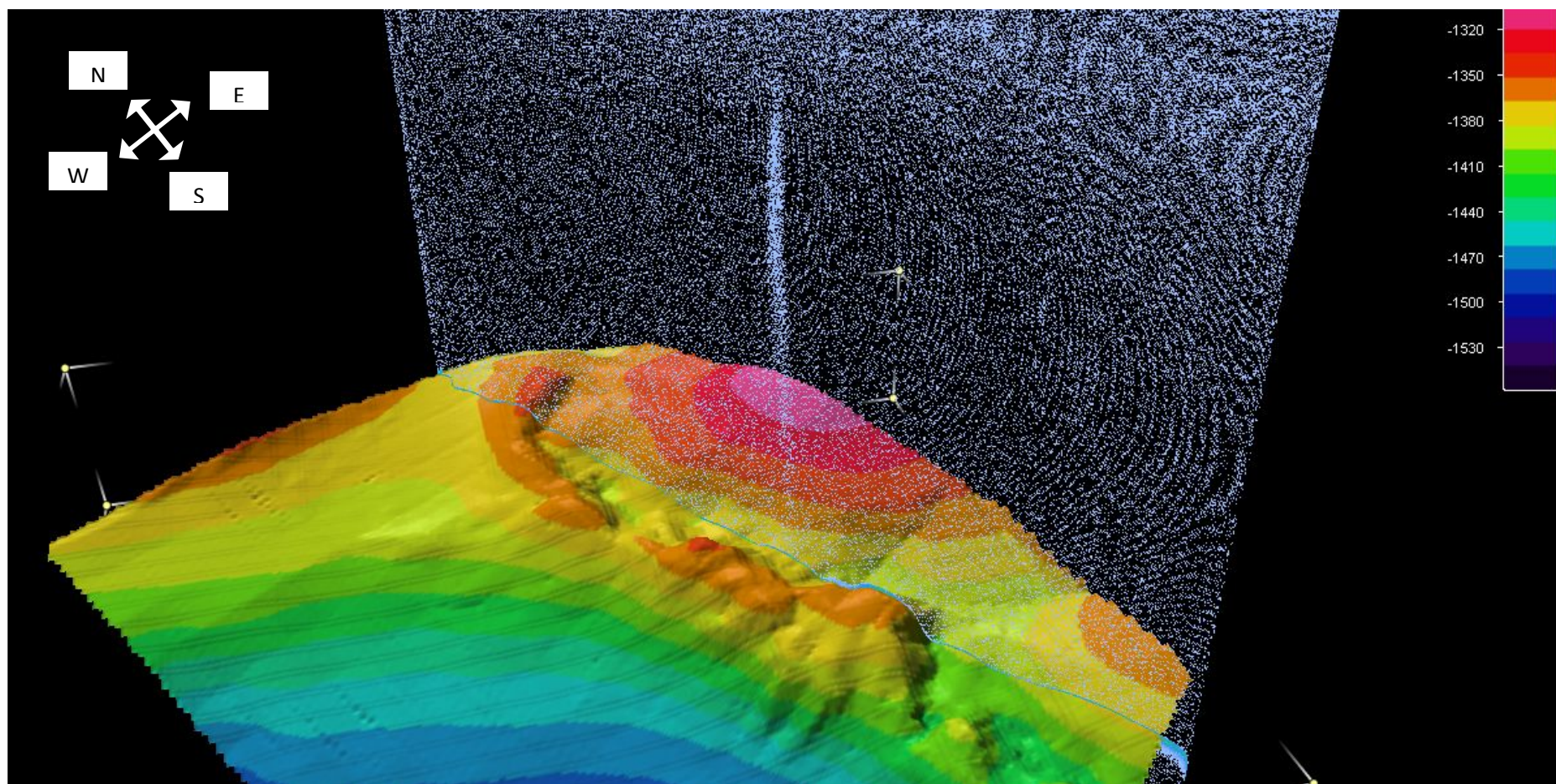


Figure 13. Three-dimensional view of bathymetric data and possible methane seep in MC294. Data contoured and compiled in Fledermouse (please note that there 6 x vertical exaggeration in seafloor relief).

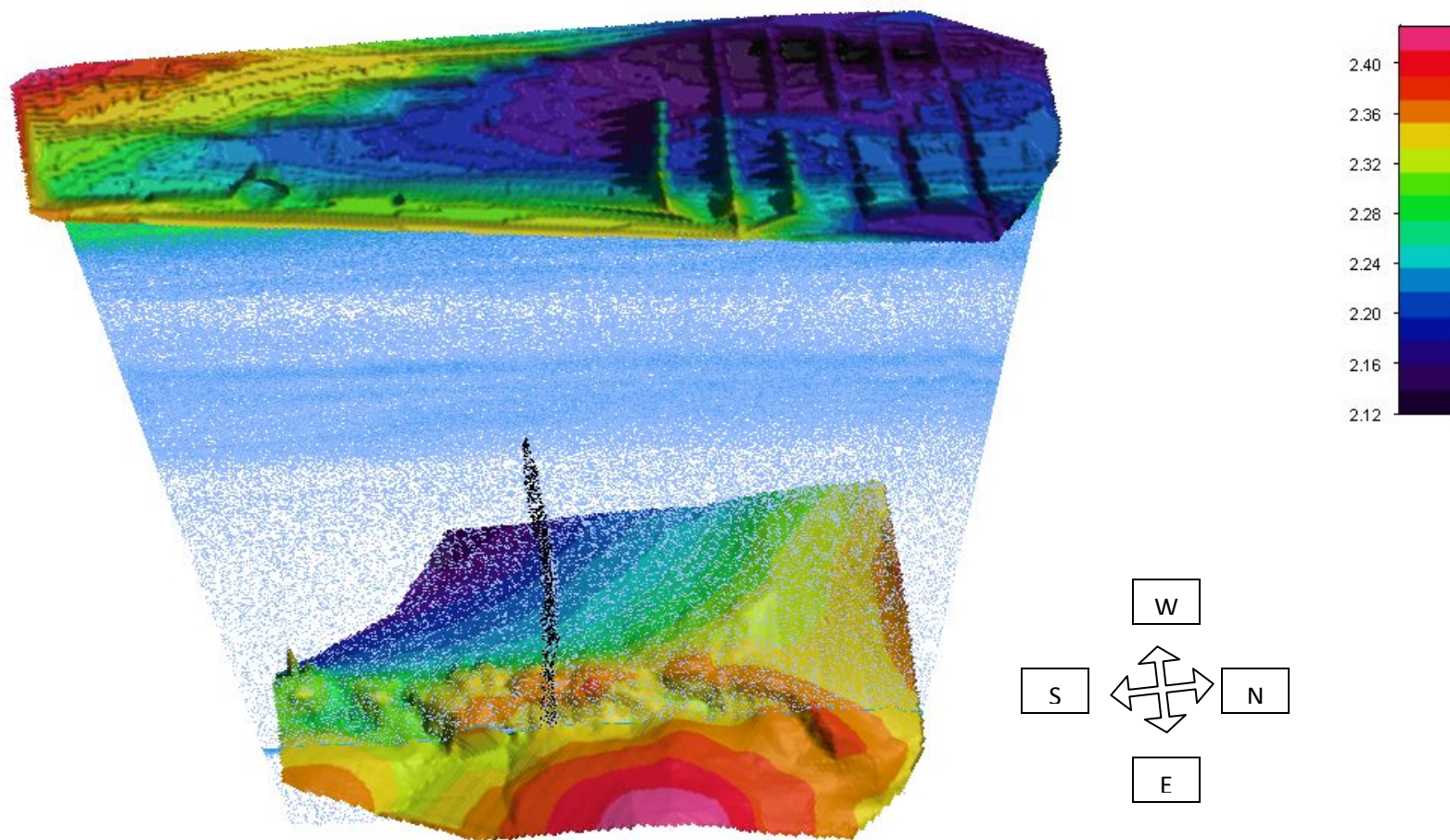


Figure 14. Three-dimensional view of bathymetric data and possible methane seep in MC294 overlain by Chelsea fluorometer data. Data contoured and compiled in Fledermouse. Please note that there 6 x vertical exaggeration in seafloor relief. The key relates to the sensor raw voltage values. These are all very low and do not related to the normal scaling of the fluorometer data.

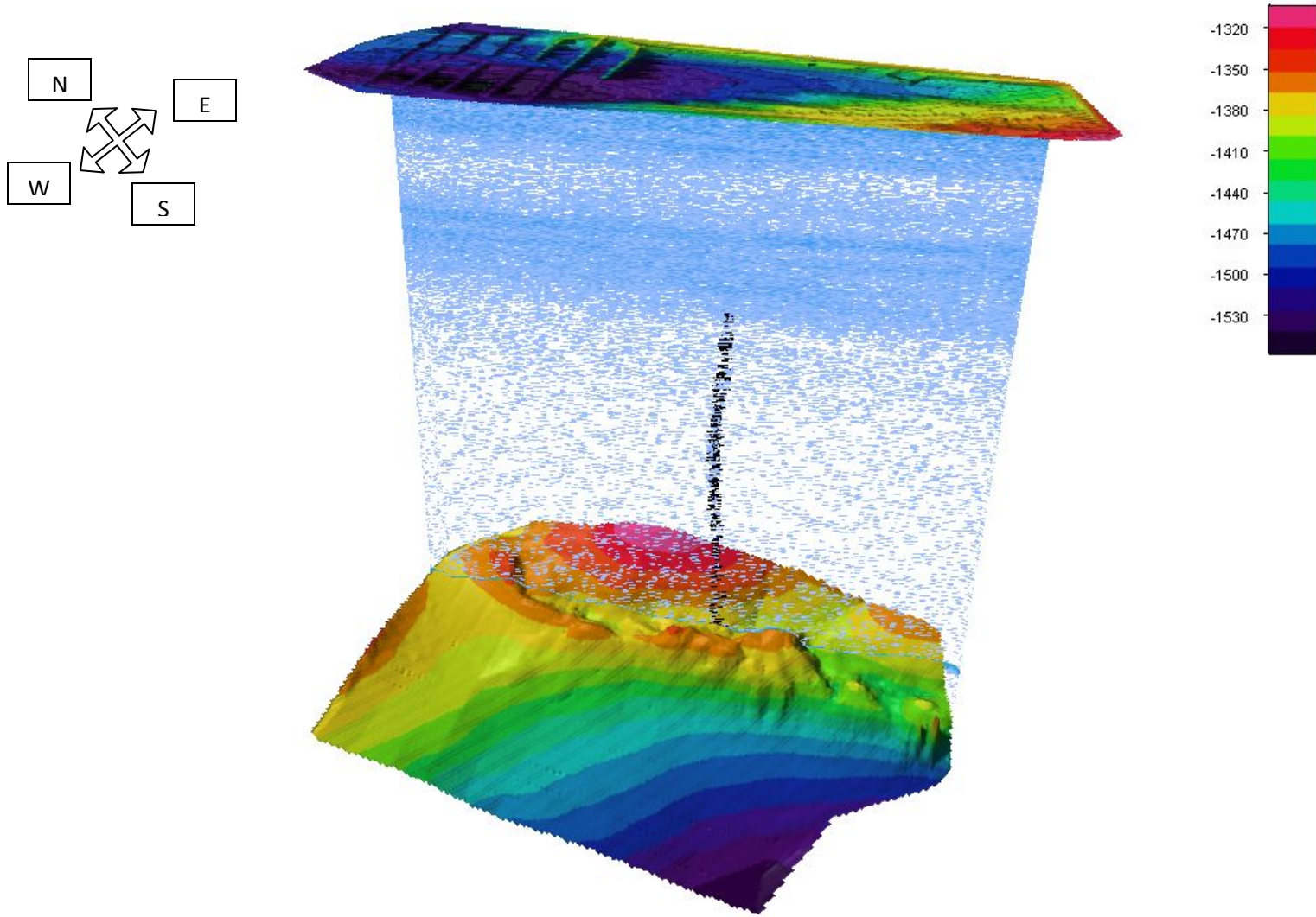


Figure 15. . Three-dimensional view of bathymetric data and possible methane seep in MC294 overlain by Chelsea fluorometer data. Data contoured and compiled in Fledermouse. Please note that there 6 x vertical exaggeration in seafloor relief. The key relates seafloor depth.

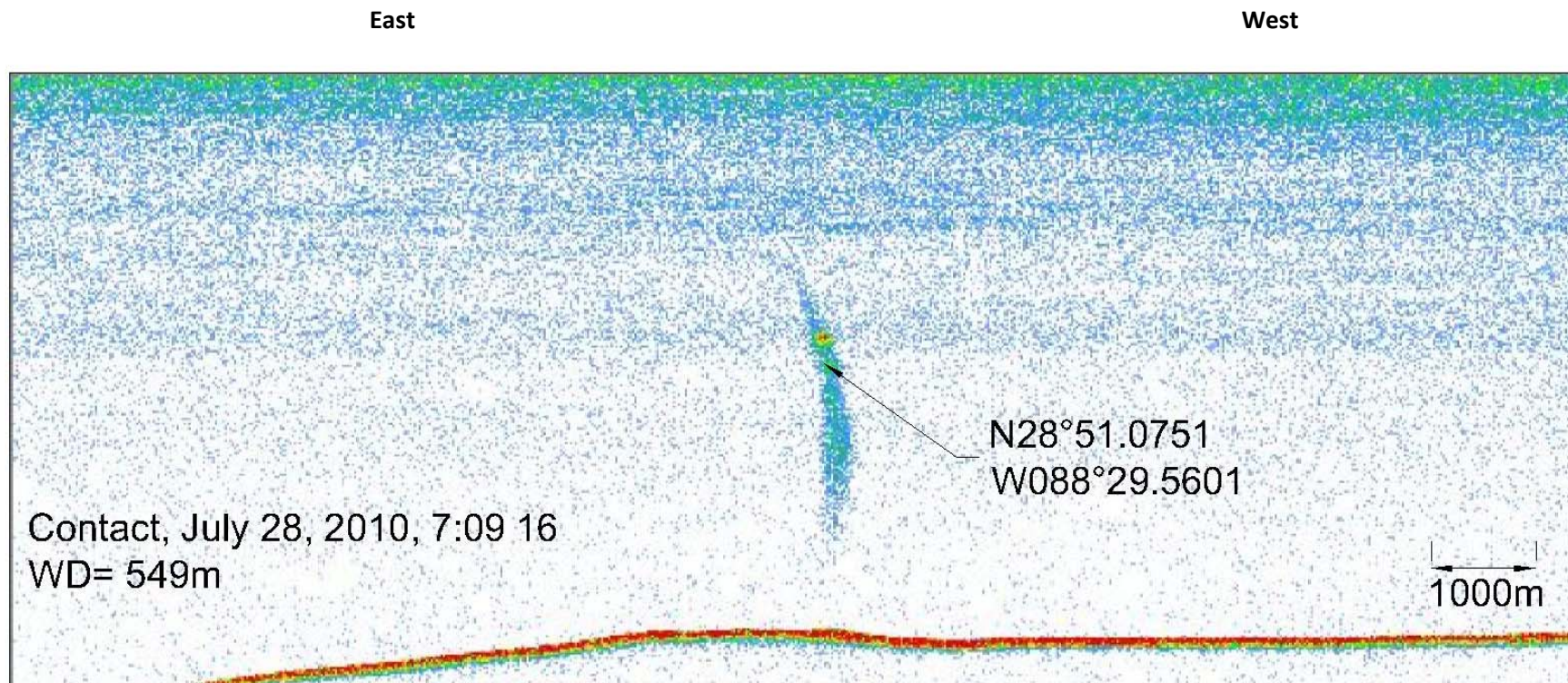


Figure 16. Contact_0728010_070745 the more easterly contact as marked on figure 1 along track line from MC252 site to Port Fourchon. This line is oriented from East on the left to West on the right.

Description: Possible seep related plume in mid water column

Time (UTC): 07/28/2010 7:09 06

Location: 28° 51.0751N; 88° 29.5601W

Depth displayed: 338.02m to 843.22m

East

West

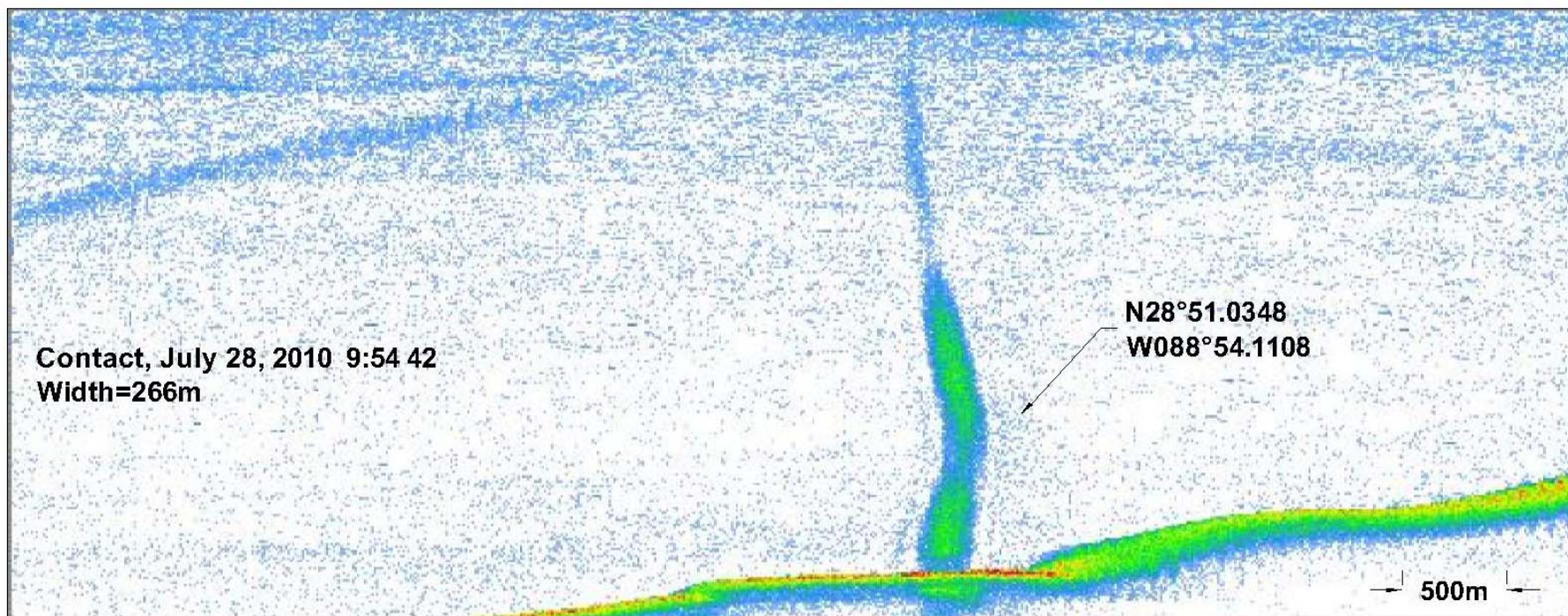


Figure 17. Contact_0728010_095442 the more westerly contact as marked on figure 1 along track line from MC252 site to Port Fourchon. This line is oriented from East on the left to West on the right.

Description: Clear seafloor rooted plume gradually becoming less intense towards the surface.

Time (UTC): 07/28/2010 9:52 42

Location: 28° 51.0348N; 88° 28.4463W

Depth displayed: 141.80m to 457.26m

Planned activities for next 24 hours and next cruise:

The Ryan Chouest in C-Port 1 at Port Fourchon for crew change and groceries delivery and will be setting out to sea shortly on cruise 11. Cruise 11 is designed with dual objectives. The first objective is to test the effects of natural seepage on the hydrocarbon concentration in surface waters and validate the EK60 Echo sounder on further natural seep sites. These studies will take place in the prolific seep area of the Green Canyon. The second objective is to survey coastal waters from Point Au Fer, Louisiana through to Port St Joe, Florida following the 30m bathymetric contour along the coast. During this part of the cruise we will perform surface mapping and sampling and vertical casts to seabed approximately every 20 nautical miles. Figure 18 shows the proposed route for cruise 11.

Ryan Chouest Planned Cruise 11 Route

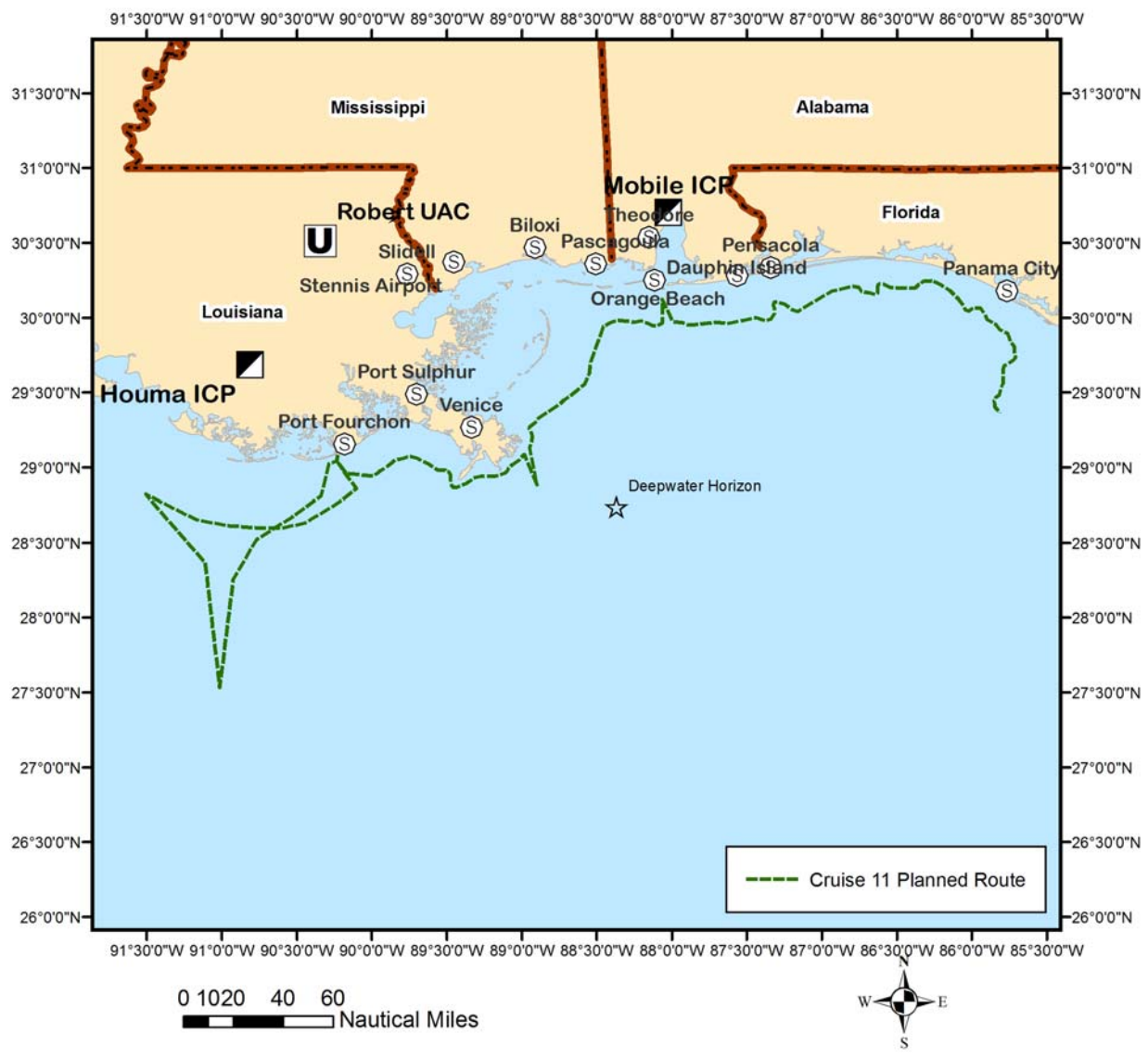


Figure 18. Planned route for cruise 11 between 07/28/2010 - 08/11/2010 of the Ryan Chouest.

Selected Photos:

No photographs were taken over the cruise period.

Full crew list before crew change:

William A. Smith	MASTER	Brian Corley	Mate
Robert Thompson	ENG	Craig Lyons	ENG
Eduardo Zepeda	A/B	Patrick Cousin	A/B
Mark Harmon	A/B	Arthur Triggs	O/S
Steven Morgan	OS/Cook	Roderick Baker	OS/Cook
Lawrence Febo	BP	Gui de Almeida	Entrix
Andrew Ross	CSIRO	David Fuentes	CSIRO
Emma Crooke	CSIRO	Asrar Talukder	CSIRO
Charlotte Stalvies	CSIRO	Kelly Bates	C&C
Ryan Larsen	C&C	Mathew Baham	C&C
Jen Carlson	C&C	Jay Ridgeway	C&C
Greg Richard	C&C	Ben Autin	C-Port
Braden Wilson	C-Port		