



HURRICANE RITA IMPACTS AT THE FLOWER GARDEN BANKS NATIONAL MARINE SANCTUARY

PREPARED BY EMMA L. HICKERSON AND G.P. SCHMAHL
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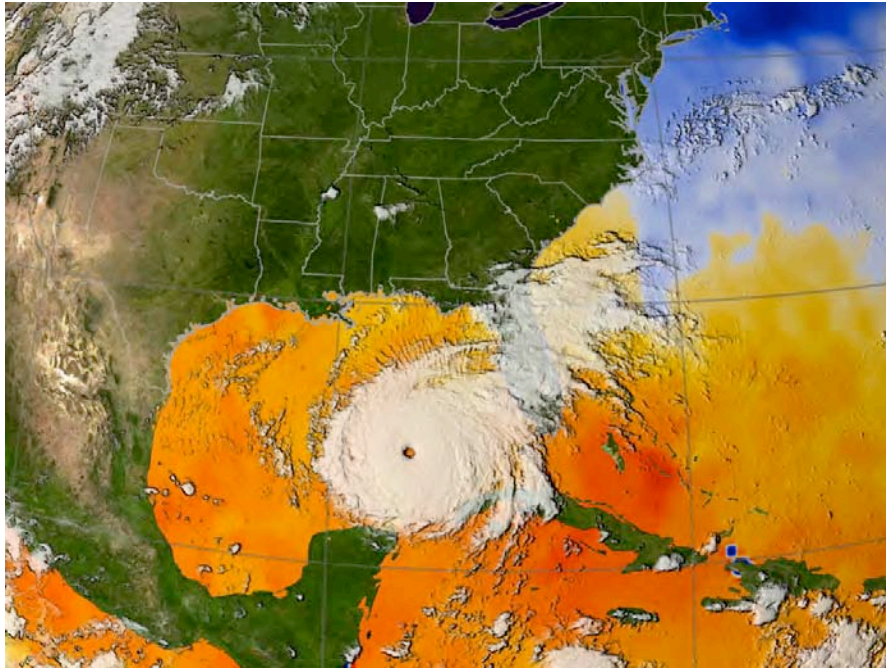


Figure 1. Hurricane Rita imagery dated September 22, 2005. Data courtesy of NASA.

Hurricane Rita made landfall on the Texas/Louisiana coast on September 24, 2005. The storm track took the eye of the storm to within 60 miles of the East Flower Garden Bank. The outer bands passed directly over the Flower Garden Banks National Marine Sanctuary (FGBNMS). NOAA Buoy 42019, located 80 miles west of the FGBNMS, recorded waves at almost 20'. Unofficial reports of wave heights of over 30' were reported west of the sanctuary. The FGBNMS research team returned to the reefs approximately two weeks after the passing of the hurricane to document the effects of the storm. Large colonies of coral, up to 3-4m across, and pieces of reef rock had been plucked out the reef, overturned, and tossed about. The wave energy must have been significant as about one meter of sand had been scoured out from the sand flats. Large barrel sponges had been "topped", and those that were close to sand patches, and survived the storm, were filled with sand.

Prior to Hurricane Rita, Hurricane Katrina made landfall in Louisiana, on August 29, 2005. The Flower Garden Banks NMS research team was on site at the sanctuary just days before Katrina's landfall. Prior to the two storm events, SCUBA dives were made by FGBNMS personnel on FGB Buoy #2 and East FGB Buoy #1 on August 8, 2005, and at East FGB Buoy #4 on August 27, 2005. No physical damage to the reef was noted on any of these occasions.

Emma Hickerson, Research Coordinator of the FGBNMS, participated in an overflight of the sanctuary on board a NOAA aircraft. The purpose of this flight was to verify that no oil and gas structures had impacted the sanctuary, as many platforms were repositioned as a direct result of the storm. Post-hurricane surveys were conducted by the FGBNMS research team at East and West Flower Garden Banks, and Stetson Bank, in October and November, 2005. We continue to document hurricane damage as we come across it.

Researchers from Oberlin College and Rutgers conducting research at the East Flower Garden Bank Brine Seep reported experiment stations that were impacted by the storm at 72m – the deepest impact of Hurricane Rita within the FGBNMS boundaries.

In November, 2005, a team of researchers were assembled to collect repetitive photostation images at the East Flower Garden Bank. This is a long term dataset that had been collected as recently as June, 2005, so provides a quantitative comparison set of dataset. Approximately 1.5% of the coral colonies (21 colonies) photographed in June, 2005, were missing. It is assumed that this is a result of Hurricane Rita. Also during this sampling effort, it was reported that the expansive field of *Madracis mirabilis*, adjacent to the study site, experienced catastrophic levels of breakage and toppling (Precht et. al, in press).

Hurricane Rita's landfall on the coasts of Texas and Louisiana caused a sizeable plume of turbid water that originated from shore, moved over 100 miles south, directly over the Flower Garden Banks and beyond. The plume was persistent over many weeks, and eventually dissipated as it progressed further west and south. The FGBNMS research team was scheduled to be on board the NOAA Ship Nancy Foster September 3-13, 2005. This shiptime was cancelled due to Hurricane Katrina, and subsequent response by the ship. A request was made to the NOAA Fleet to obtain samples of the plume as the NOAA Ship Nancy Foster was in the region. Unfortunately this was not granted, so no water samples were available for analysis.

In October, 2005, during the FGBNMS response cruise, water, coral, and sediment samples were obtained and sent to NCCOS researchers, through NOAA's Coral Health and Disease Consortium. Results from this sampling are inconclusive.

Figure 2 was taken in April, 2005. It shows the only elkhorn coral (*Acropora palmata*) colony at the West Flower Garden Bank, located at Buoy #2. It is growing at the base of a very large barrel sponge (*Xestospongia muta*) colony.



Figure 2. Elkhorn coral and barrel sponge at WFGB#2, May, 2005. Photo credit: FGBNMS/Schmahl

Figure 3 shows the same coral and sponge colony in October, 2005, after the passage of Hurricane Katrina and Rita. The majority of the sponge had been removed during the storm.

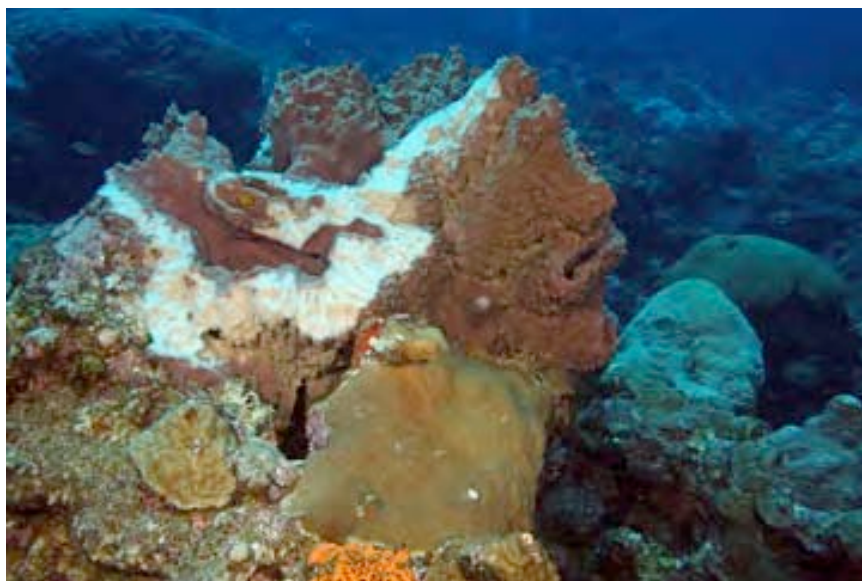


Figure 3. Elkhorn coral and barrel sponge at WFGB#2, October 2005. Photo credit: Joyce and Frank Burek

Figure 4 shows the slow recovery of the sponge, in June, 2006.



Figure 4. Elkhorn coral and barrel sponge at WFGB#2, June, 2006. Photo credit: FGBNMS/Hickerson

Numerous barrel sponges this size and larger have been documented as having suffered similar damage as a result of the Hurricane.

Figure 5 illustrates the scouring in sand flats:



Figure 5. At least one meter of sand was scoured out the sand flats and deposited elsewhere on the reef – photograph taken in October, 2005. Photo credit: Joyce and Frank Burek

The water quality instrument racks at both the East and West Flower Garden Bank were also affected by the sand movement, as illustrated in these before and after photographs, Figures 6 and 7.



Figure 6. Water quality instrument rack at West Flower Garden Bank prior to Hurricane Rita. Photo credit: FGBNMS/Schmahl



Figure 7. Water quality instrument rack at West Flower Garden Bank after Hurricane Rita in October, 2005. Photo credit: Joyce and Frank Burek.

Figures 8 thru 12 were taken in October, 2005, the first opportunity sanctuary personnel were able to return to the site to survey for damage:



Figure 8. A diver hovers over a large brain coral (*Colpophyllia natans*) that was plucked out of the reef and tossed onto the sand flat during Hurricane Rita. Photo credit: FGBNMS/Hickerson

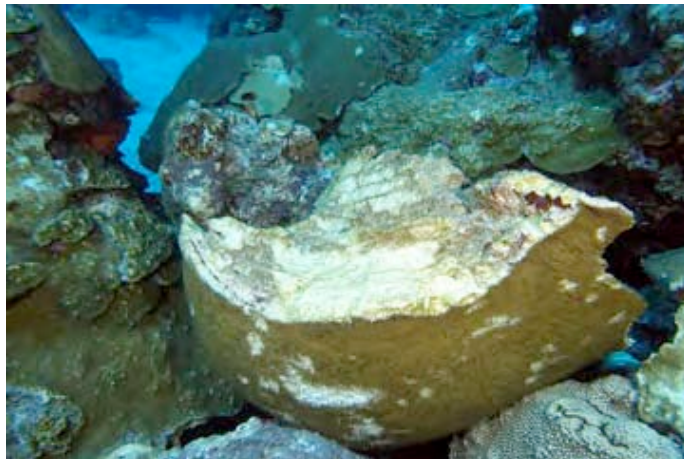


Figure 9.



Figure 10.



Figure 11.



Figure 12.

Figures 9-12. Examples of coral impacted by Hurricane Rita. Photo credit: Joyce and Frank Burek.

Large fields of yellow pencil coral, *Madracis mirabilis* are found at both the West and East Flower Garden Banks. These are the most fragile coral communities in the sanctuary. These fields were flattened as a result of Hurricane Rita, as seen in the before and after photographs, figures 13-15.



Figure 13. A field of yellow pencil coral (*Madracis mirabilis*) in August, 2005, prior to the passage of Hurricane Rita. Photo credit: FGBNMS/Schmahl

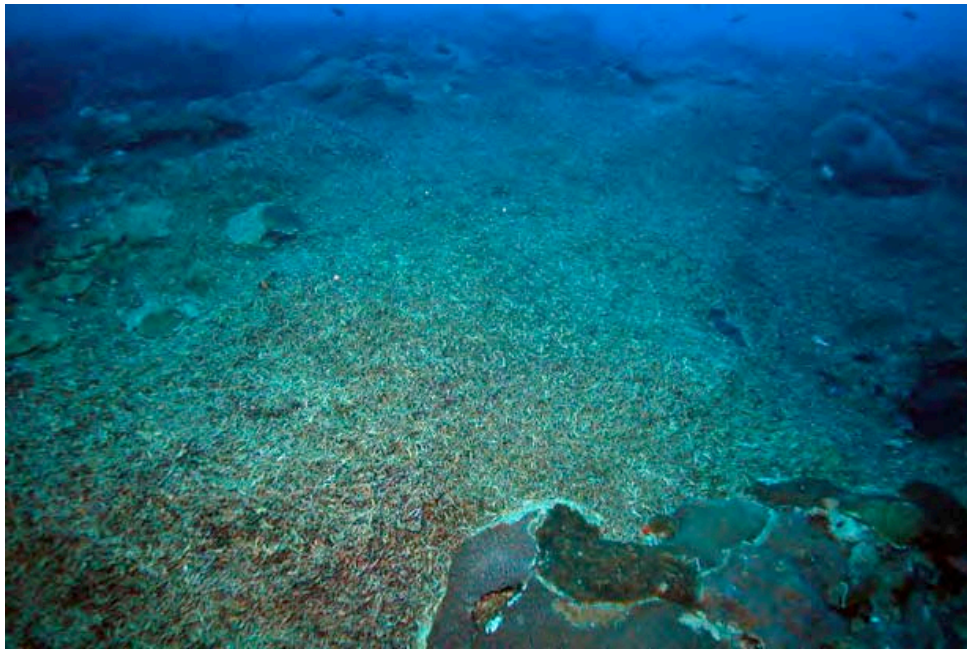


Figure 14. Decimation of the yellow pencil coral field (*Madracis mirabilis*) at the East Flower Garden Bank Buoy#2, November 2005. Photo credit: TPWD/John Embesi



Figure 15. *Madracis* rubble resulting from Hurricane Rita. Photographed in November, 2005. Photo credit: TPWD/John Embesi

Hurricane Rita's landfall on the coasts of Texas and Louisiana caused an enormous plume of turbid water that progressed from shore, over 100 miles offshore, directly over the Flower Garden Banks and beyond. The plume was persistent over weeks, and eventually dissipated as it progressed further west and south.

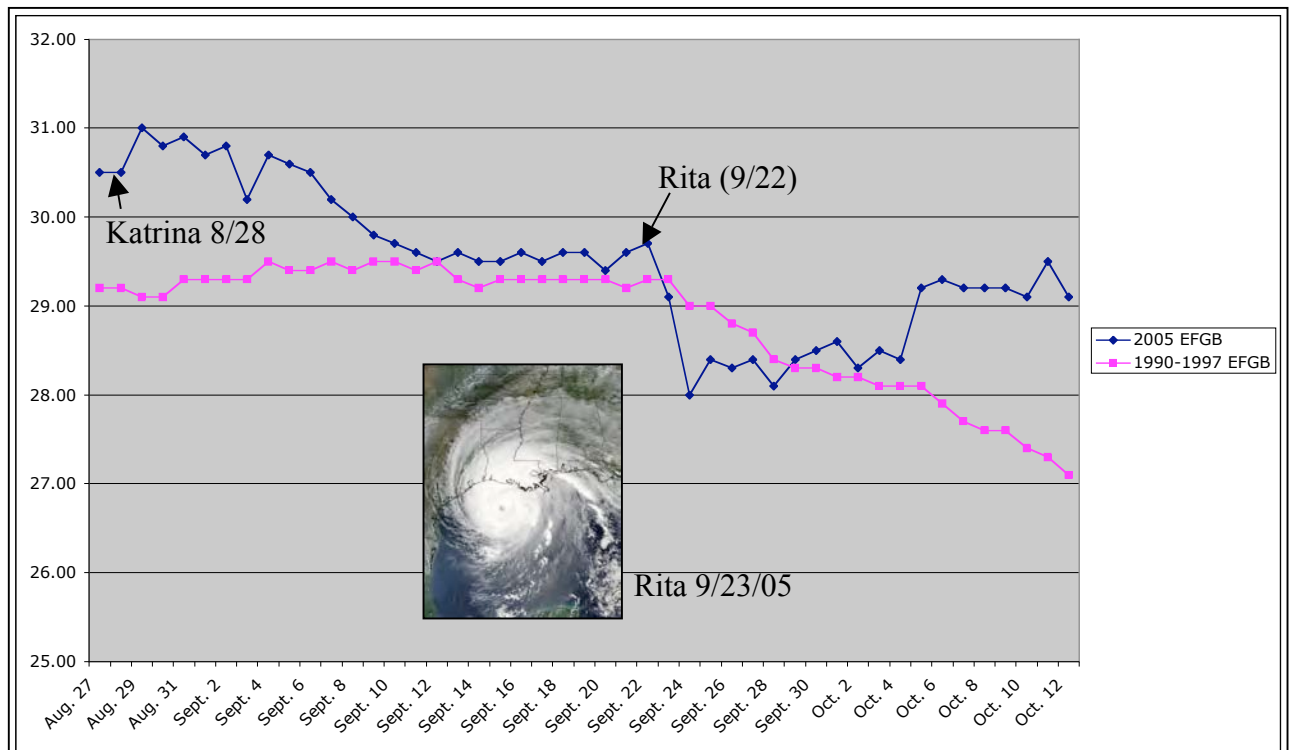


Figure 16. Graph showing water temperature at 19m at the East Flower Garden Bank. Researchers conducting research at the East Flower Garden Bank Brine Seep, reported experiment stations that were impacted by the storm at 72m – the deepest impact of Hurricane Rita within the FGBNMS boundaries.

Salinity - PPT

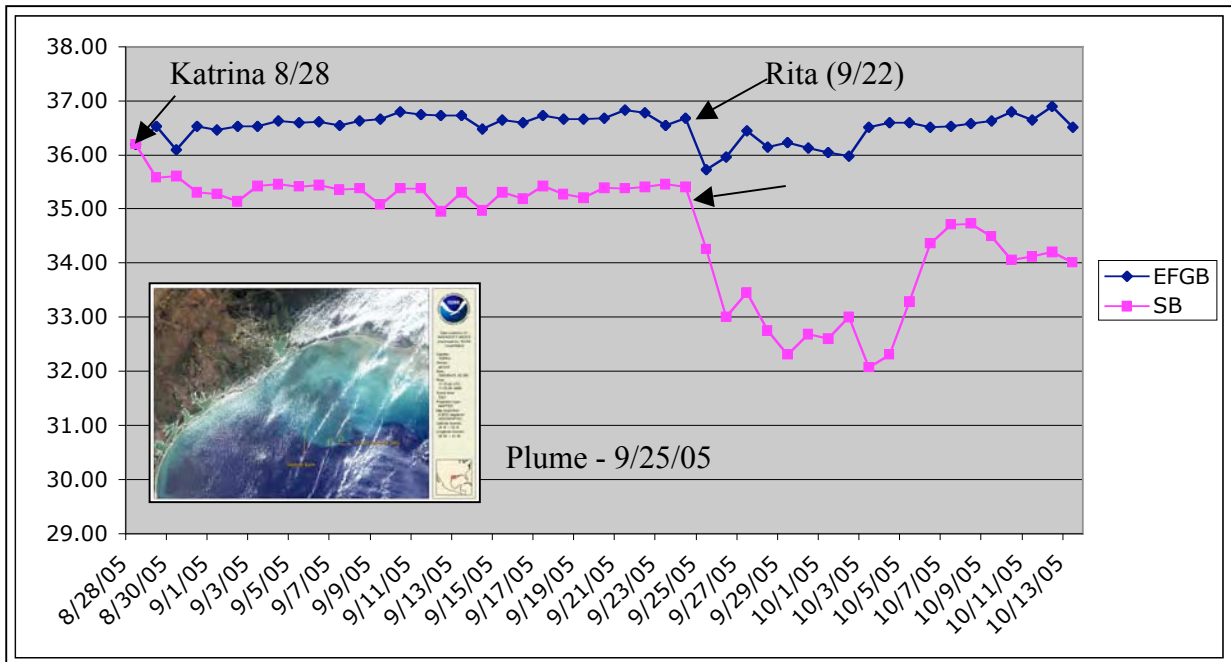


Figure 17. Graph showing salinity at the East Bank (19m) and Stetson Bank (23m) during the passages of Hurricanes Katrina and Rita.

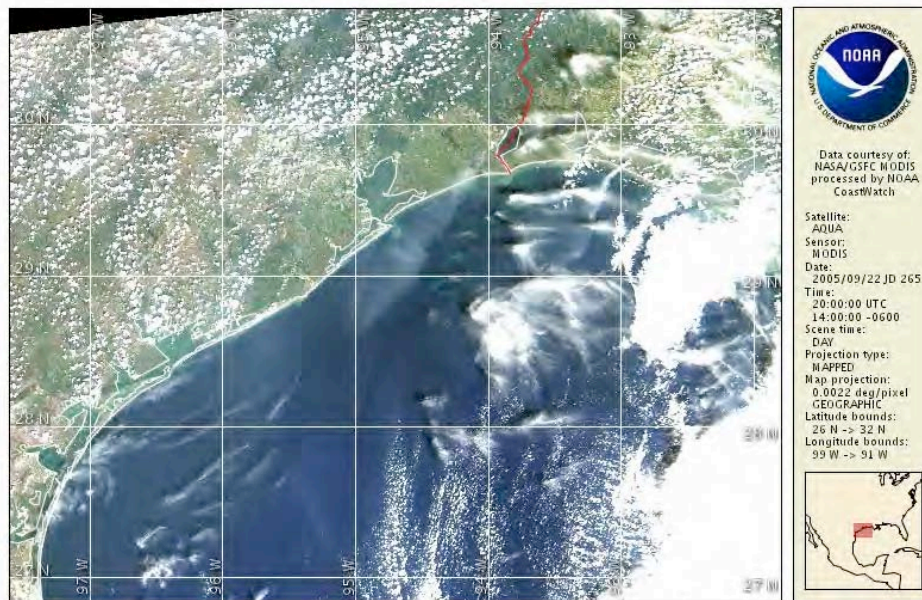


Figure 18. Satellite imagery of the Texas/Louisiana coasts dated September 22, 2005, two days before Hurricane Rita's landfall. The clouds of Hurricane Rita are visible in the South East. Data courtesy of: NASA/FSFC MODIS, processed by NOAA CoastWatch.

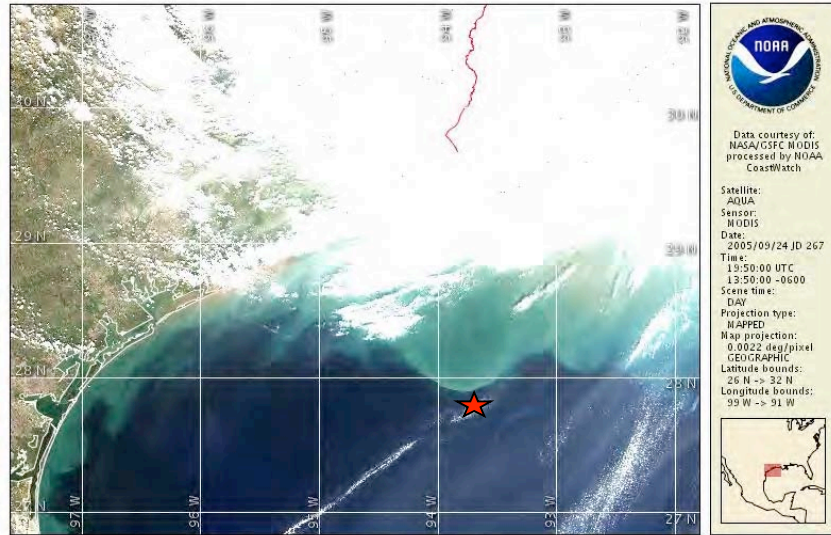


Figure 19. Satellite imagery of the Texas/Louisiana coasts dated September 24, 2005, the day Hurricane Rita made landfall in the early morning hours. The southern edge of the hurricane is still visible. This photograph was taken early afternoon, by which time, the plume had already moved very quickly offshore. Data courtesy of: NASA/FSFC MODIS, processed by NOAA CoastWatch.

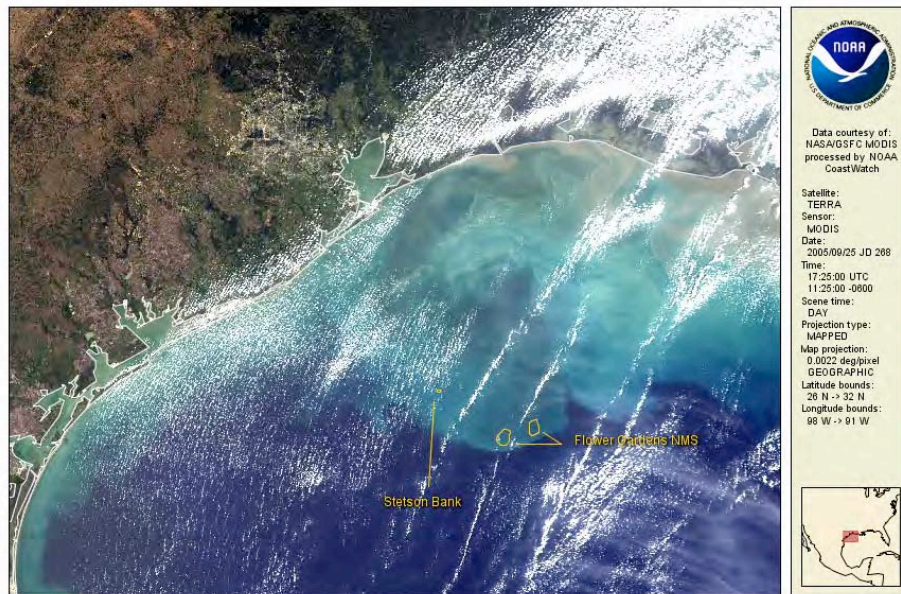


Figure 20. Satellite imagery showing the plume initiated on shore and moving over 100 miles south into the Gulf of Mexico, directly over the FGBNMS. This image is dated September 25, 2005, one day after Hurricane Rita's landfall. Data courtesy of: NASA/FSFC MODIS, processed by NOAA CoastWatch.

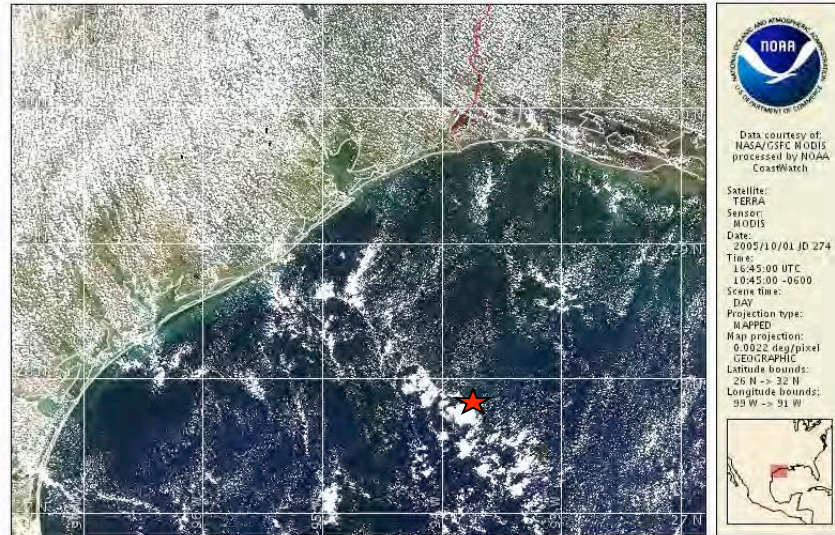


Figure 21. Satellite imagery of the Texas/Louisiana coasts dated October 1, 2005, approximately one week after Hurricane Rita's landfall. The plume is still visible in the region of the Flower Garden Banks but has dissipated to a degree. Data courtesy of: NASA/FSFC MODIS, processed by NOAA CoastWatch.

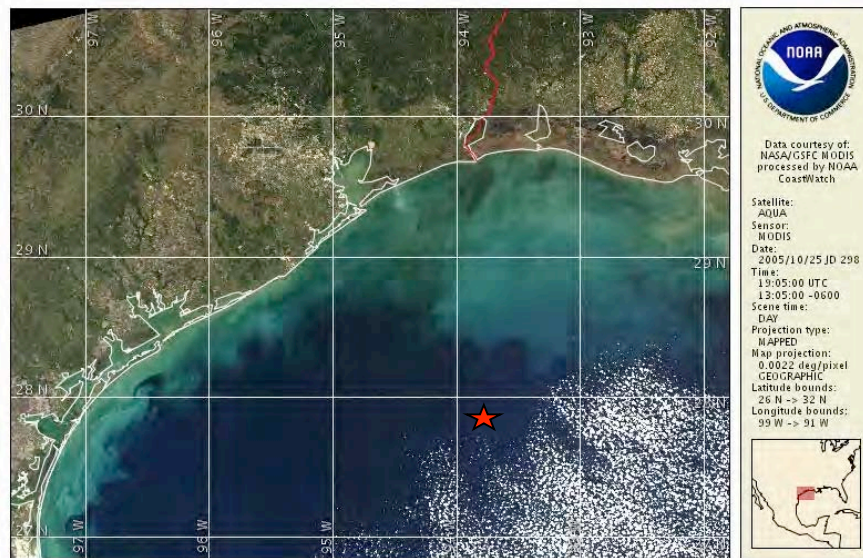


Figure 22. Satellite imagery approximately one month after Hurricane Rita's landfall. The plume is still visible, but has moved slightly south and west of the Flower Garden Banks. This is illustrative of the length of time that passed before the plume dissipated entirely. Data courtesy of: NASA/FSFC MODIS, processed by NOAA CoastWatch.

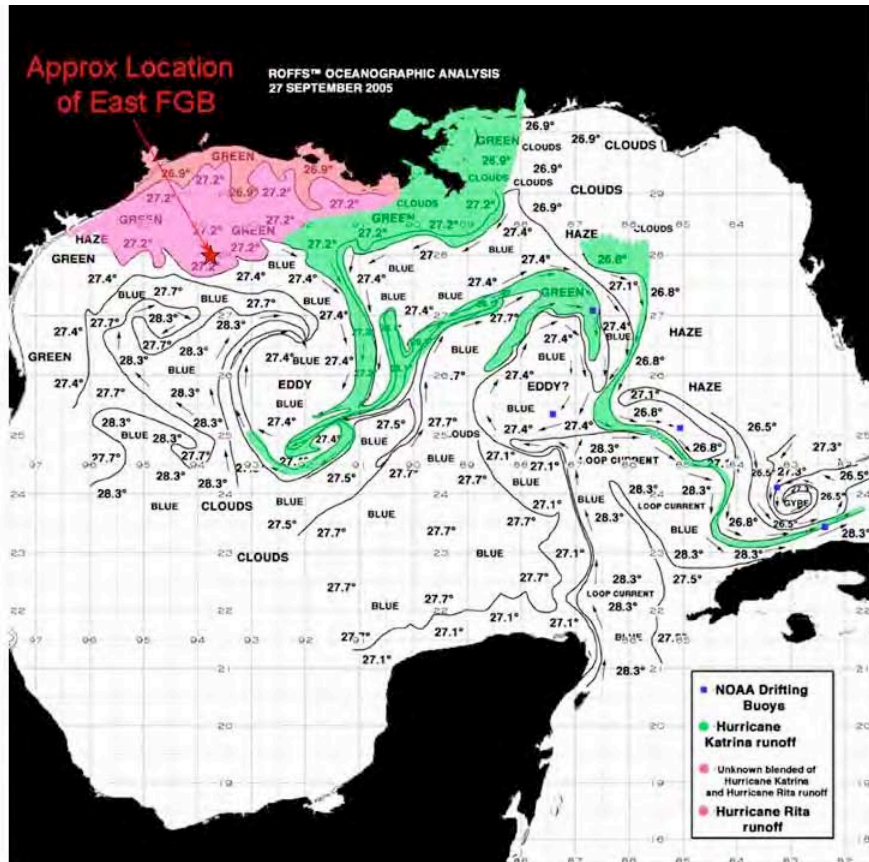


Figure 23. Oceanographic Analysis dated September 27, 2005 shows modeling of shore based runoff into the Gulf of Mexico from Hurricanes Katrina and Rita. A spin-off eddy pulled Katrina runoff into the middle of the Gulf of Mexico. Image courtesy of Roff's Oceanographic Analysis.

For information or comments, please contact:

Emma Hickerson, Research Coordinator
 Emma.hickerson@noaa.gov
 G.P. Schmahl, Sanctuary Superintendent
 George.schmahl@noaa.gov
 Flower Garden Banks National Marine Sanctuary
 409-621-5151