Gulf of Mexico Dead Zone Surprisingly Small in Area, but Severe

July 24, 2009

Scientists from the Louisiana Universities Marine Consortium (LUMCON) and Louisiana State University (LSU) found the size of this year's Gulf of Mexico dead zone to be 8,000 square kilometers (just over 3,000 square miles). "This was surprisingly small given the forecast to be among the largest ever and the expanse of the dead zone earlier this summer," reported Dr. Nancy Rabalais, Chief Scientist for the mapping expedition.

The interagency Gulf of Mexico/Mississippi River Watershed Nutrient Task Force goal is to reduce the dead zone to a size of 5,000 square kilometers (2,000 square miles) or less by 2015, based on a 5-yr running average. This average is now at 15,670 square kilometers (6,000 square miles).

The dead zone is an area of oxygen-starved water, also known as hypoxia, and is fueled by nitrogen and phosphorus runoff, principally from agricultural activity in the Mississippi River watershed, which stimulates an overgrowth of algae that sinks, decomposes, and consumes most of the life-giving oxygen supply in the water.

NOAA-sponsored forecast models developed by Dr. R. Eugene Turner of Louisiana State University and Dr. Donald Scavia of the University of Michigan had predicted a larger than normal dead zone area of between 22,000 and 25,000 square kilometers (7,500 – 8,500 square miles) for this summer. The forecast was driven primarily by the high nitrate-nitrogen load and high freshwater flows from the Mississippi and Atchafalaya rivers in May and June.

What contributed to the smaller than predicted and average size of the dead zone this summer?

First, the high flow of the Mississippi River fell below average for July depriving the Gulf of Mexico of the nutrients that stimulate phytoplankton growth and the fresh water that forms a physical barrier (stratification) to the re-oxygenation of the bottom layer.

Second, the timing of the single cruise in late July does not always capture the maximum extent, e.g., following hurricanes or variable weather conditions, thus pointing out the need for multiple measurements during the summer.

Third, persistent winds from the west and southwest in the few weeks preceding the mapping cruise likely pushed the low oxygen water mass to the east and 'piled' it up along the southeastern Louisiana shelf. The area of hypoxia (less than 2 mg/L), and often anoxia (no oxygen) on the eastern part of the study area was an unusually thick layer above the bottom and was severely low in oxygen, usually less than 0.5 mg/L. A similar situation was documented in 1998 following persistent winds from the west, that is, a smaller footprint in area but a larger volume of low oxygen. This result points to the need for multiple measurements and inclusion

of volume in the assessment of hypoxia 'size' to better characterize the zone, but the current and commonly understood benchmark value is the area of bottom-water less than 2 mg/L.

Fourth, the winds and waves were high in the last half of the cruise in the area to the west of the Atchafalaya River delta and likely mixed oxygen into these shallower waters and reduced the hypoxia in that region.

Fifth, although current models used to predict hypoxia in the northern Gulf of Mexico are robust for long-term management purposes, they are not optimized to predict the area for years where short-term weather patterns move water masses or mix up the water column. Field measurements, thus, remain imperative for understanding the dynamics of hypoxia and contributing to modeling studies.

The dead zone was larger in late June – early July based on maps developed as part of the NOAA National Marine Fisheries Southeast Monitoring and Assessment Program (SEAMAP) fisheries-independent surveys conducted from June 8 – July 17 (**http://ecowatch.ncddc.noaa.gov/hypoxia/products/2009-hypoxia-contours-image.jpg**) with areas of low oxygen across the inner shelf of western Louisiana, the upper Texas coast, off Galveston, TX and as far south as offshore Matagorda Bay, TX.

Some stations were anoxic with the release of toxic hydrogen sulfide from the sediments into the overlying water column. At these and other severely low oxygen stations, several types of blue crabs, eels, and penaeid shrimp were seen swimming at the water's surface. From other studies conducted by Rabalais and colleagues, severely low oxygen levels were present on the eastern part of the study area in early July and contributed to 'jubilees' off Grand Isle, LA. 'Jubilees' are the forced movement of fish, crabs and shrimp into shallow waters along the barrier islands by movement of low oxygen waters onshore due to changes in winds and currents.

The 2009 summer hypoxia cruise is a Silver Anniversary of the first cruise in 1985. The ability to conduct long-term regional ecosystem research and maintain a consistent long-term data record is rare, but shows how much these types of data are necessary to understand and manage complex coastal ecosystems. Three of the participants of the 1985 cruise were on board for the 2009 Silver Anniversary cruise, Nancy Rabalais, LUMCON, Principal Investigator and Chief Scientist; Jim Lee, LSU, Research Associate; Sam LeBouef, R/V *Pelican* crew. Gene Turner, Principal Investigator for LSU, was also present on the 1985 cruise.

For further information, contact:
Dr. Nancy Rabalais, LUMCON, **nrabalais@lumcon.edu**, 985-851-2801, 985-870-4203
Dr. Gene Turner, LSU, **euturne@lsu.edu**

On the Web:

NCCOS Gulf of Mexico Dead Zone Research for Management:
http://www.cop.noaa.gov/stressors/extremeevents/hab/features/hypoxiafs_report1206.html

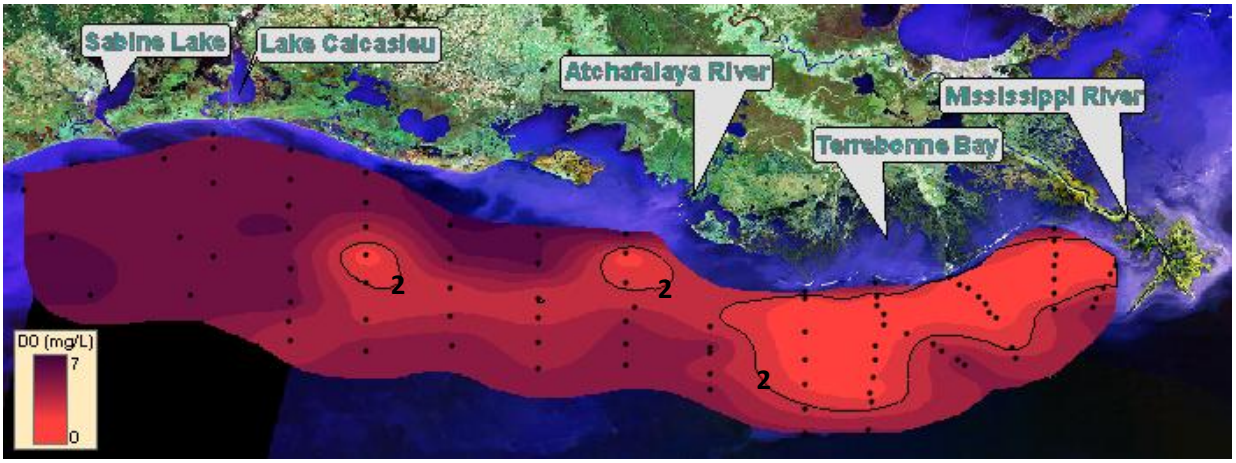
NOAA Gulf of Mexico Hypoxia Watch
http://ecowatch.ncddc.noaa.gov/hypoxia

For more detailed model information:

LUMCON Hypoxia Site:
http://www.gulfhypoxia.net and http://sites.google.com/site/2009gulfhypoxia/

University of Michigan Hypoxia Forecasting Site:
http://sitemaker.umich.edu/scavia/hypoxia_forecasts

Bottom-Water Dissolved Oxygen
18-23 July 2009



Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

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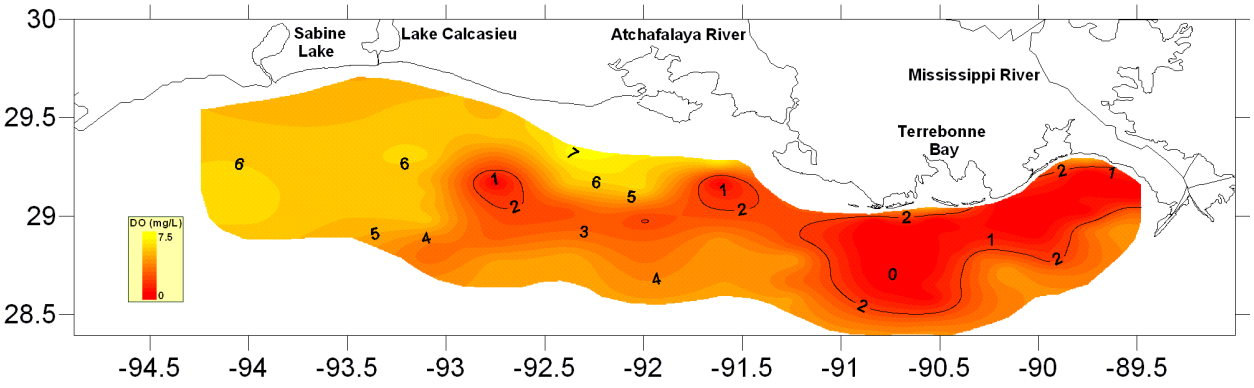

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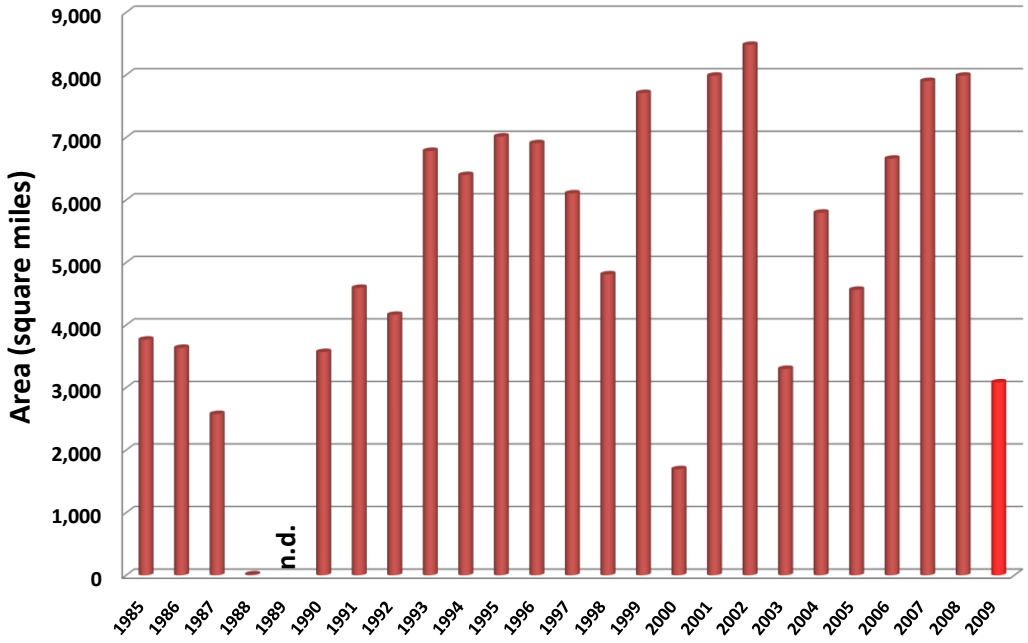
Area of Mid-Summer Bottom Water Hypoxia
(Dissolved Oxygen < 2.0 mg/L)



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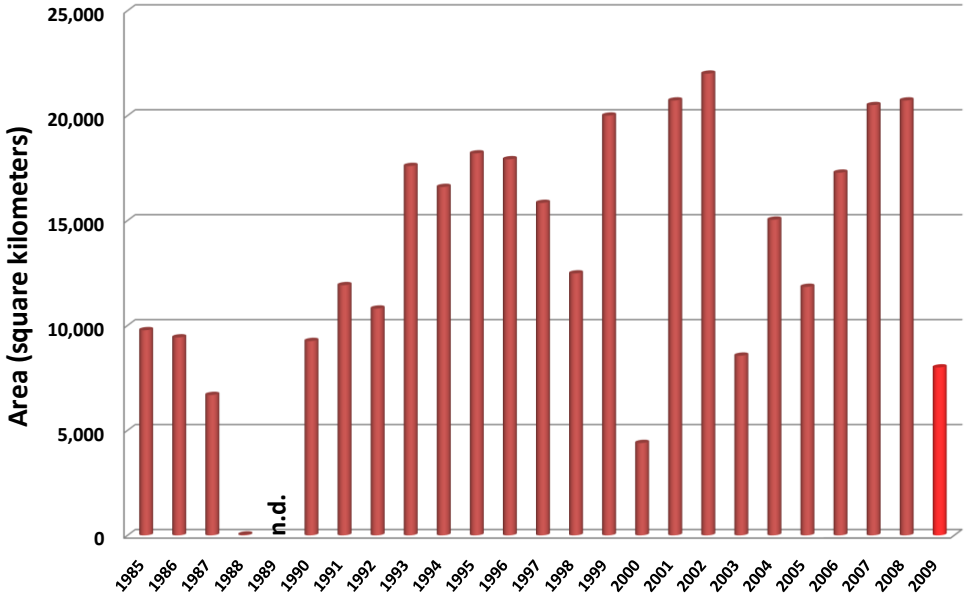

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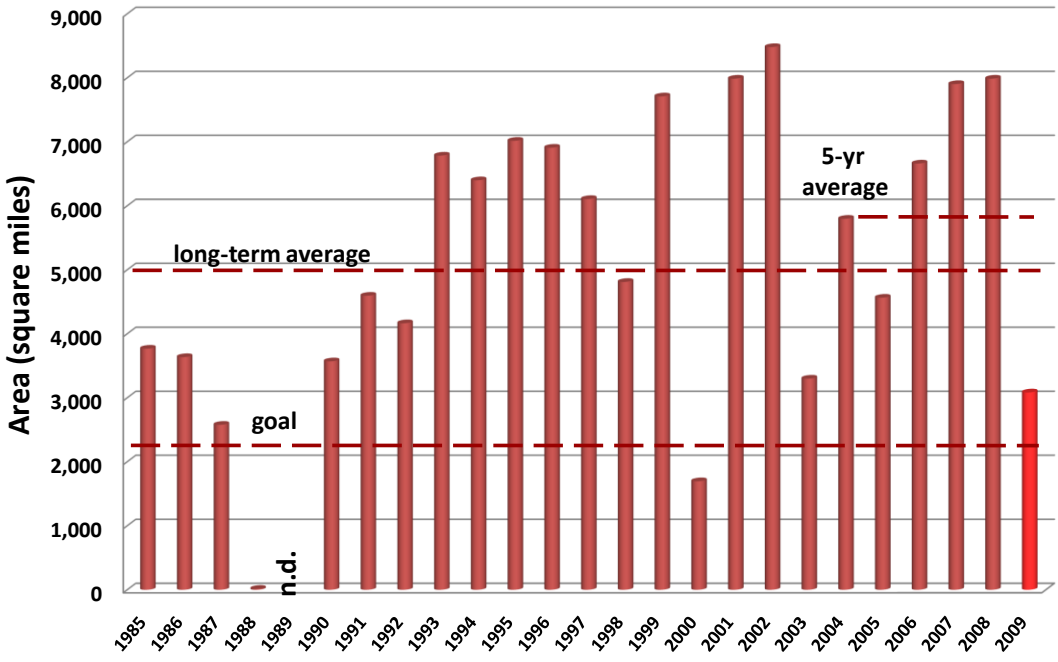

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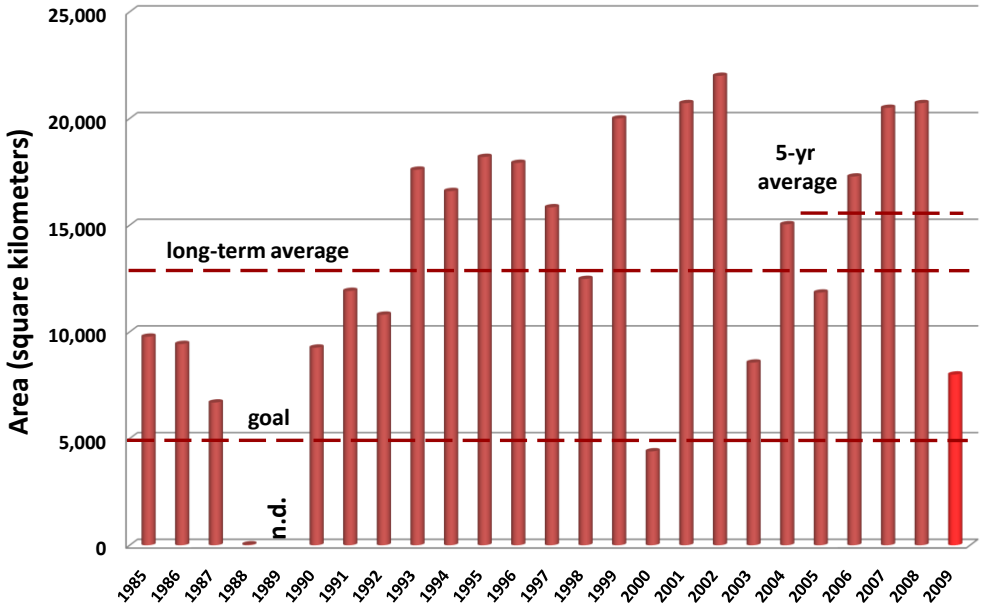

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Surface Water Salinity
18-23 July 2009

Surface Water Chlorophyll
18-23 July 2009