Significance and Insignificance of the 2011 Mississippi Flood to Surrounding Waters

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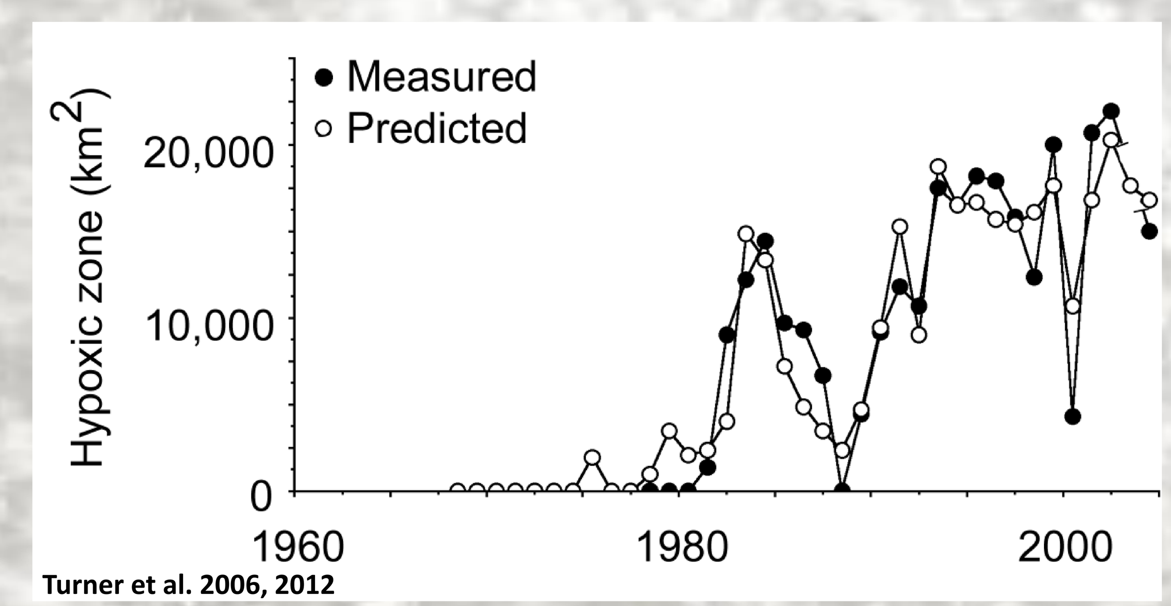
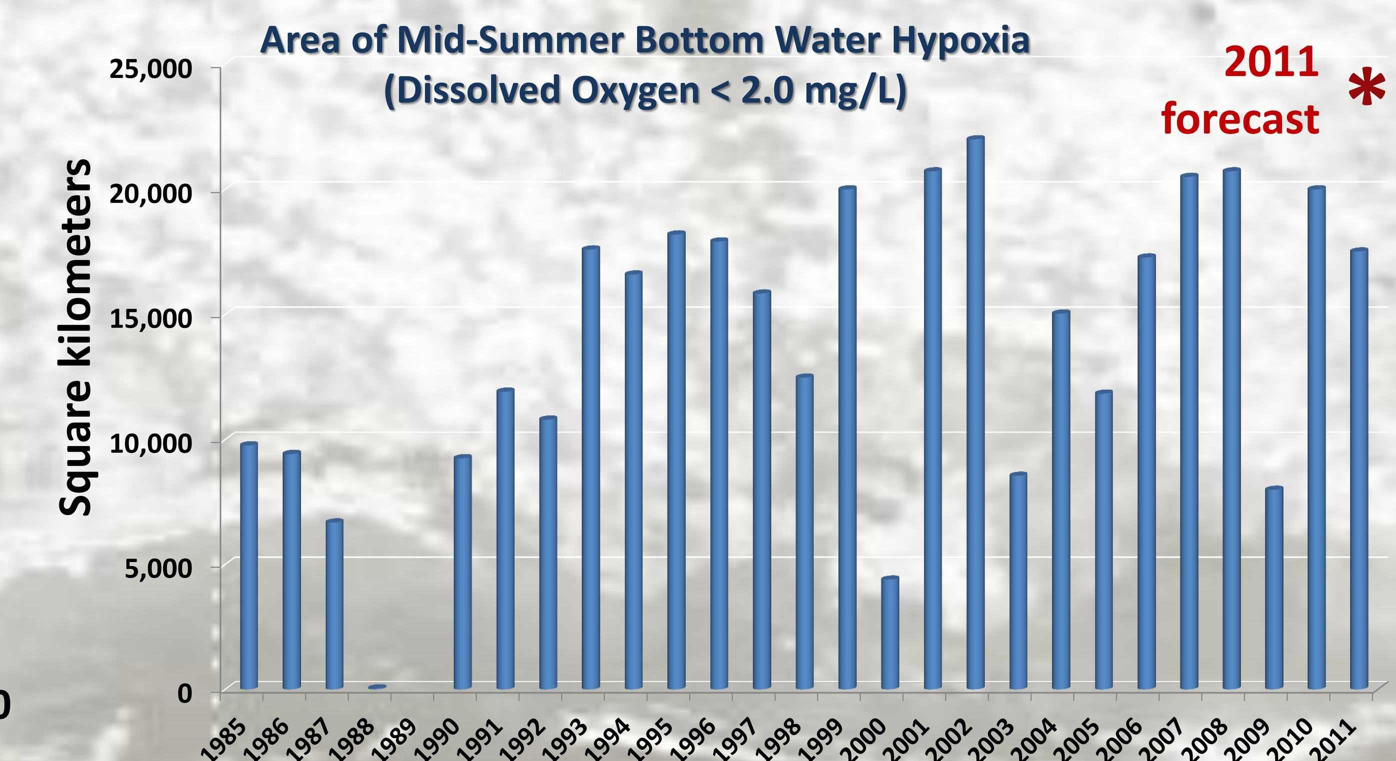
The flood of the Mississippi River in 2011 broke many freshwater discharge and nutrient load records. The record flow forced breaking levees in Missouri and opening major spillways, the Morganza into the Atchafalaya River basin and the Bonnet Carré north of the city of New Orleans into Lake Pontchartrain, and proffered expectations of dense harmful algal blooms in receiving waters and the largest to-date ‘dead zone’ (area of low oxygen) offshore. Not all expectations were realized, with lower than expected chlorophyll biomass and HAB concentrations in Lake Pontchartrain (high flushing and high turbidity) and a smaller area of shelf hypoxia (tropical storm action and ocean currents). More detrimental effects were the severity and volume of low oxygen in certain areas, noxious and harmful algal blooms west and east of the delta, and large, persistent areas of low oxygen east of the delta in summer. The 2011 scenario mirrors climate change expectations for the watershed.



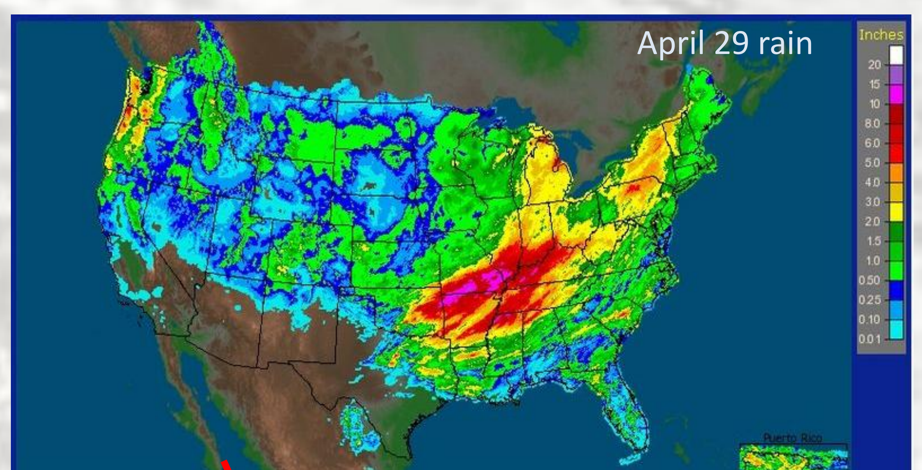
Turner et al. 2006, 2012

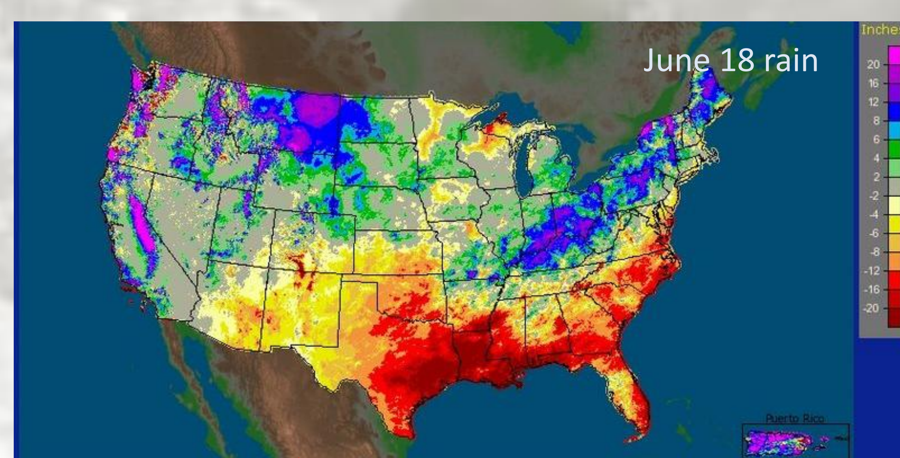


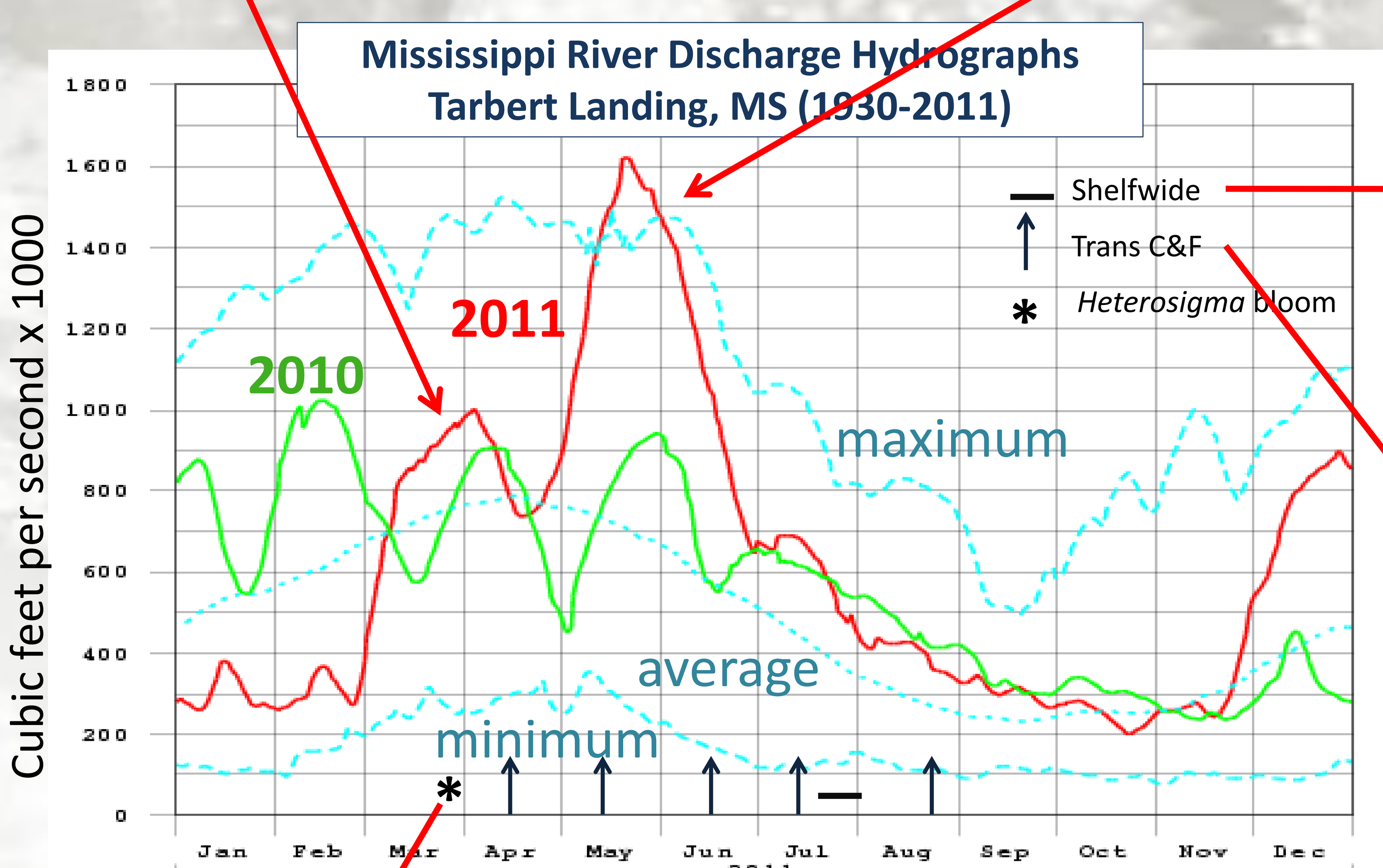
Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University

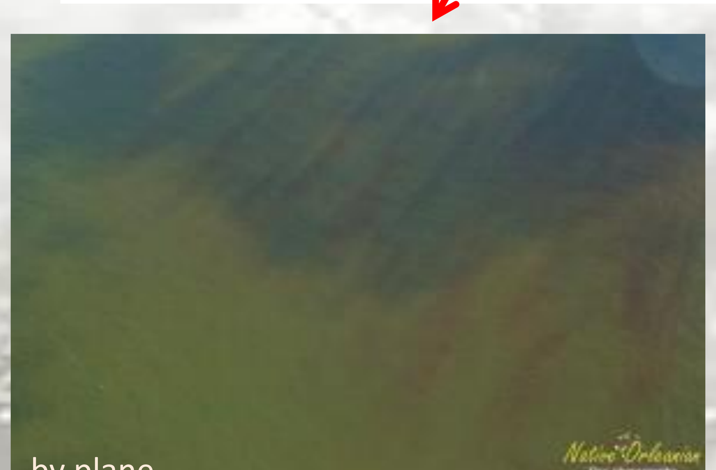
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

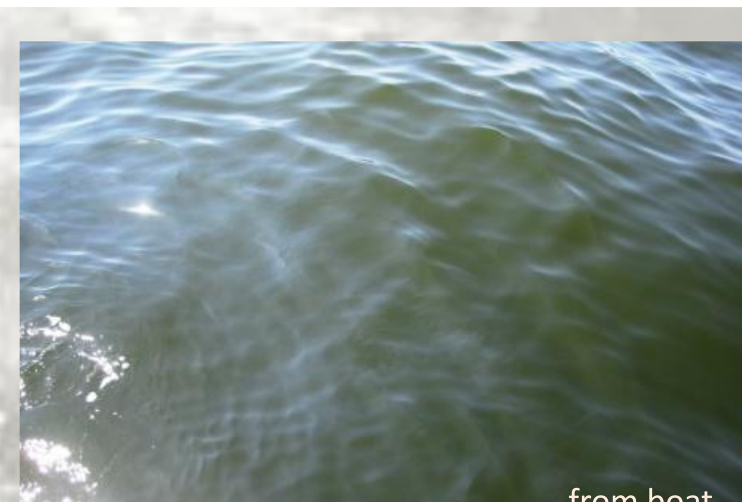
Based on the model by Turner et al. 2006, 2012 for the relationship between nitrate=N flux in May, with a year term that explains 81% of the variability, we predicted a summer hypoxic area of 24,400 km². The measured footprint was 17, 520 km². The smaller size can be attributed to a strong flow of wind and water from the east to the west and a tropical storm that disrupted stratification on the western end of the study area.











Heterosigma akashiwo

Raphidophyte bloom

Station: C6C, approx 15 miles south of LUMCON

Date: March 21, 2011

Bottom Depth: 19.5 m

Bloom Color: Greenish-brown

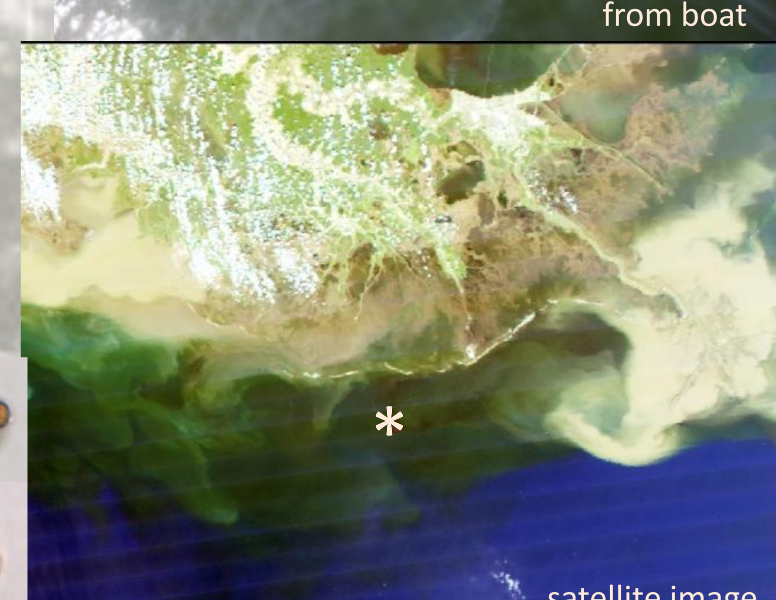
Salinity: 28.7

Chlorophyll: 117 µg/L

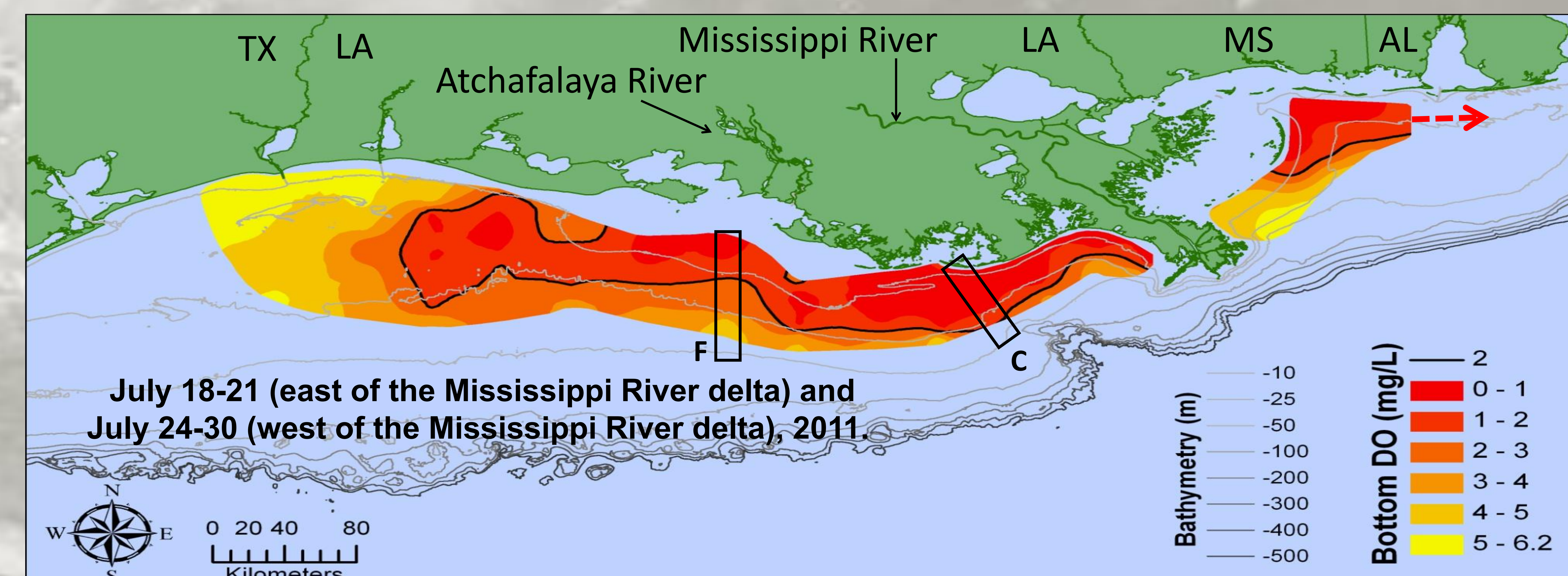
Oxygen: 204% saturation

DO: 16-17 mg/L

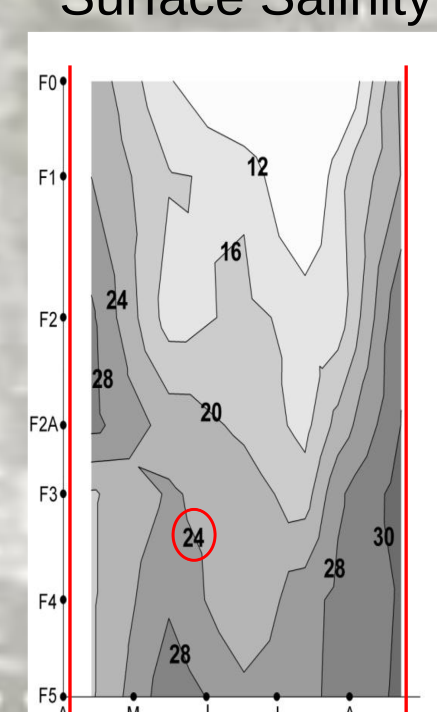
Source: N. Rabalais, unpubl



The hypoxic area footprint was less than predicted but overall there was more and more severe hypoxia temporally and spatially in 2011 than in previous years.

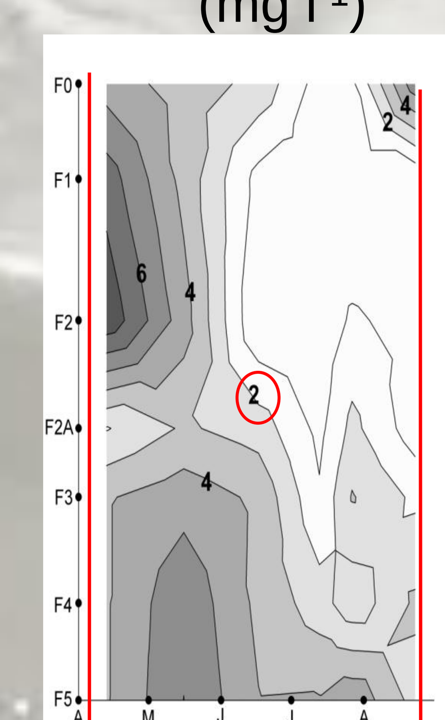


Surface Salinity



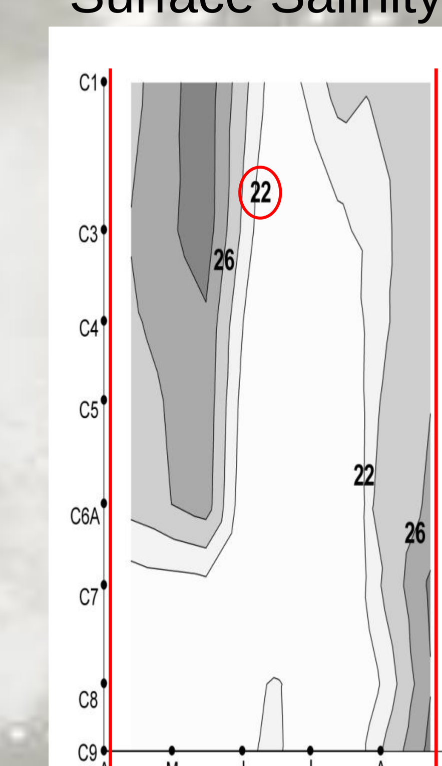
Transect F 2011

Bottom Dissolved Oxygen (mg l-1)



Lower surface salinity & lower bottom-water oxygen spatially & temporally

Surface Salinity



Transect C 2011

Bottom Dissolved Oxygen (mg l-1)