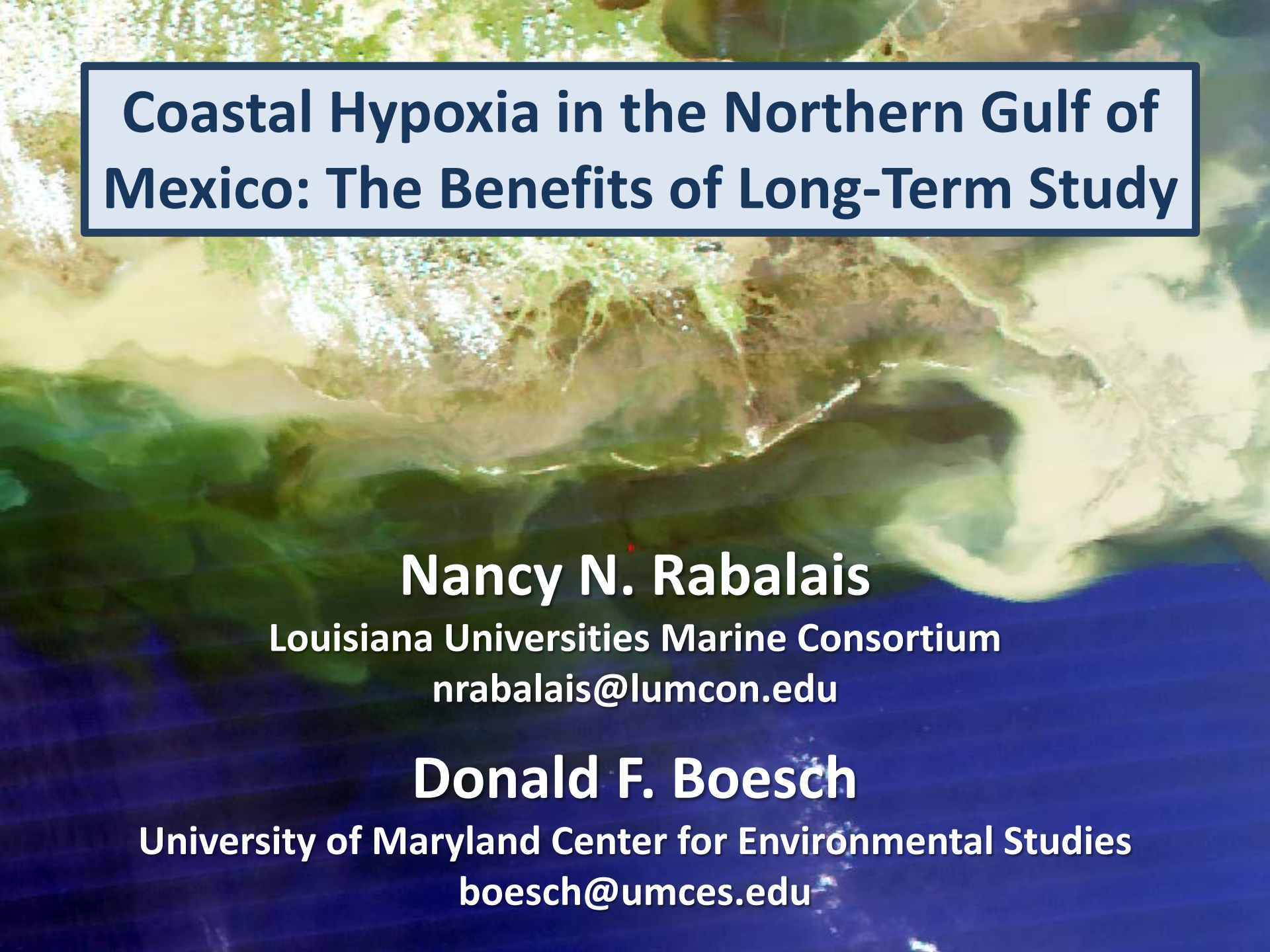
Coastal Hypoxia in the Northern Gulf of Mexico: The Benefits of Long-Term Study



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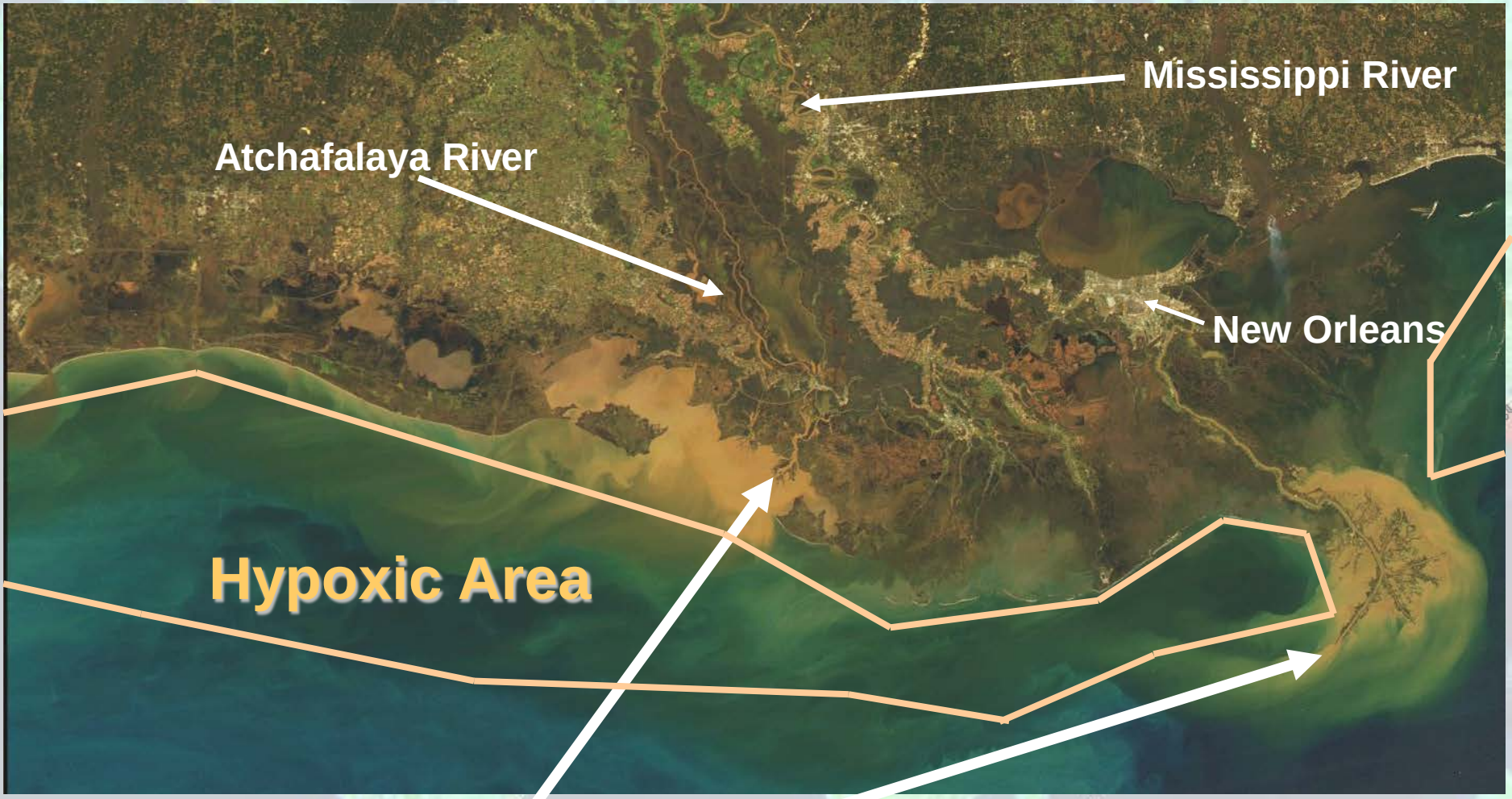
Eutrophication Global Hypoxia

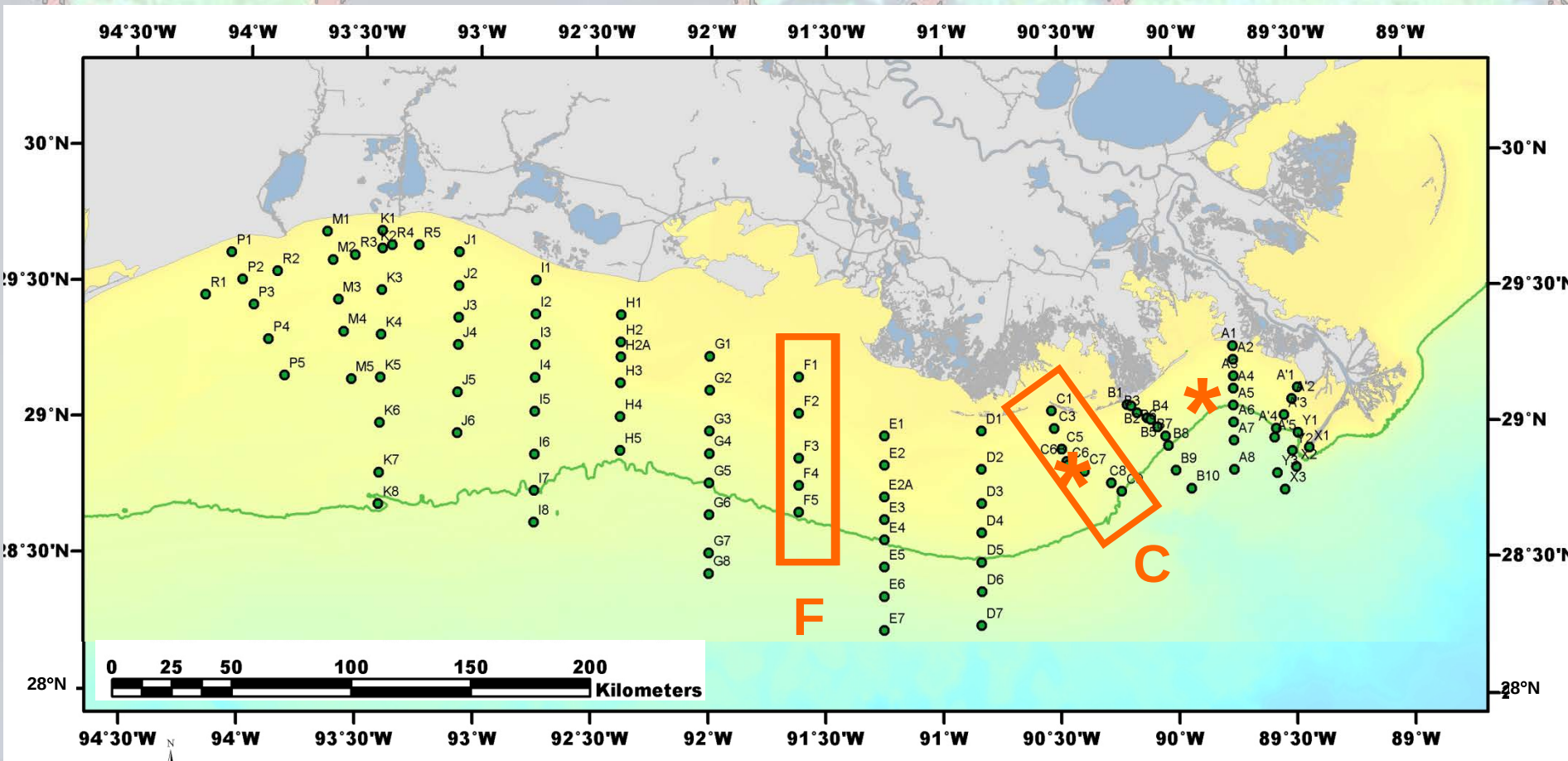


Effects are more far reaching than suspended sediment plume, esp. N & somewhat P

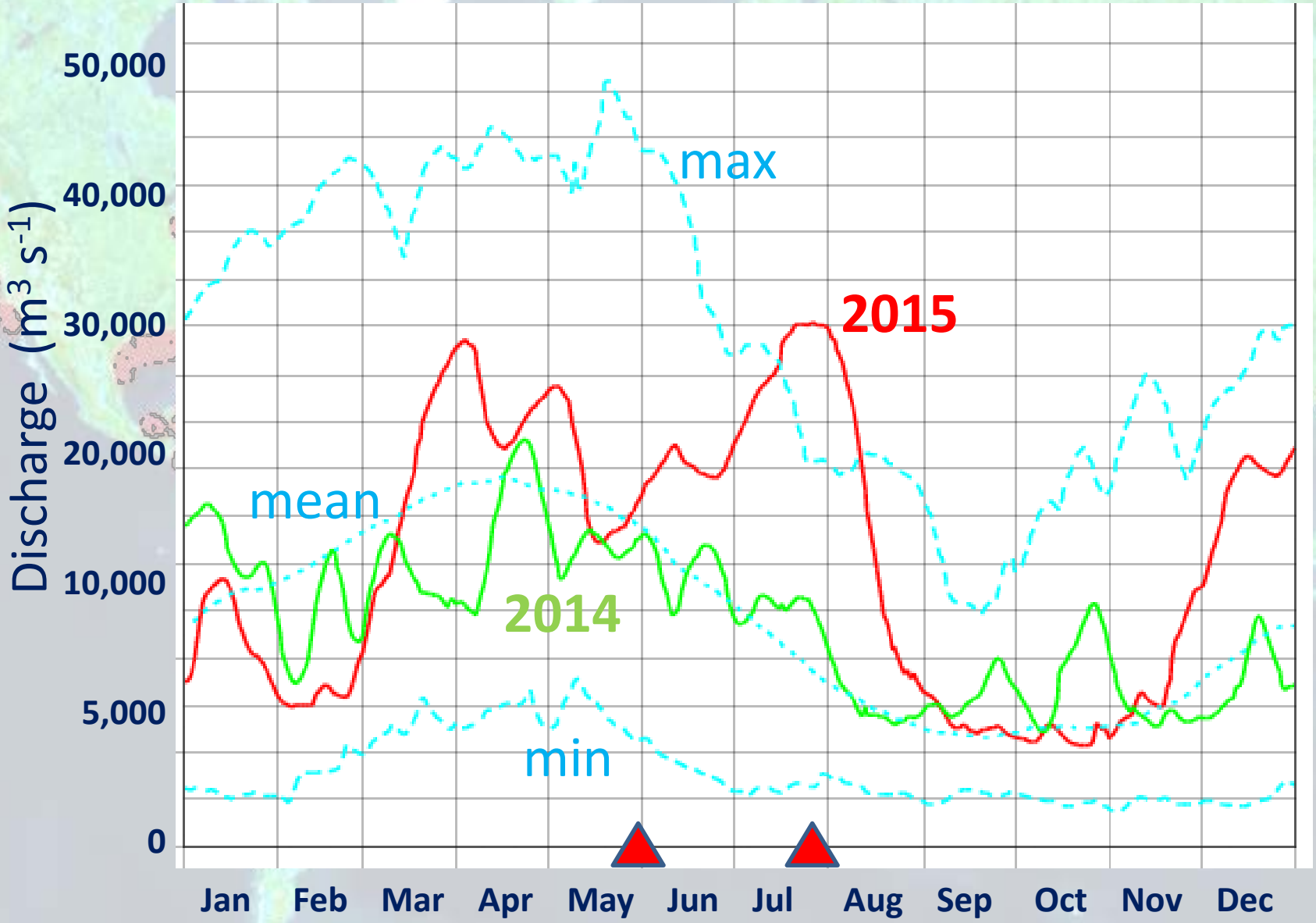
dominant wind direction

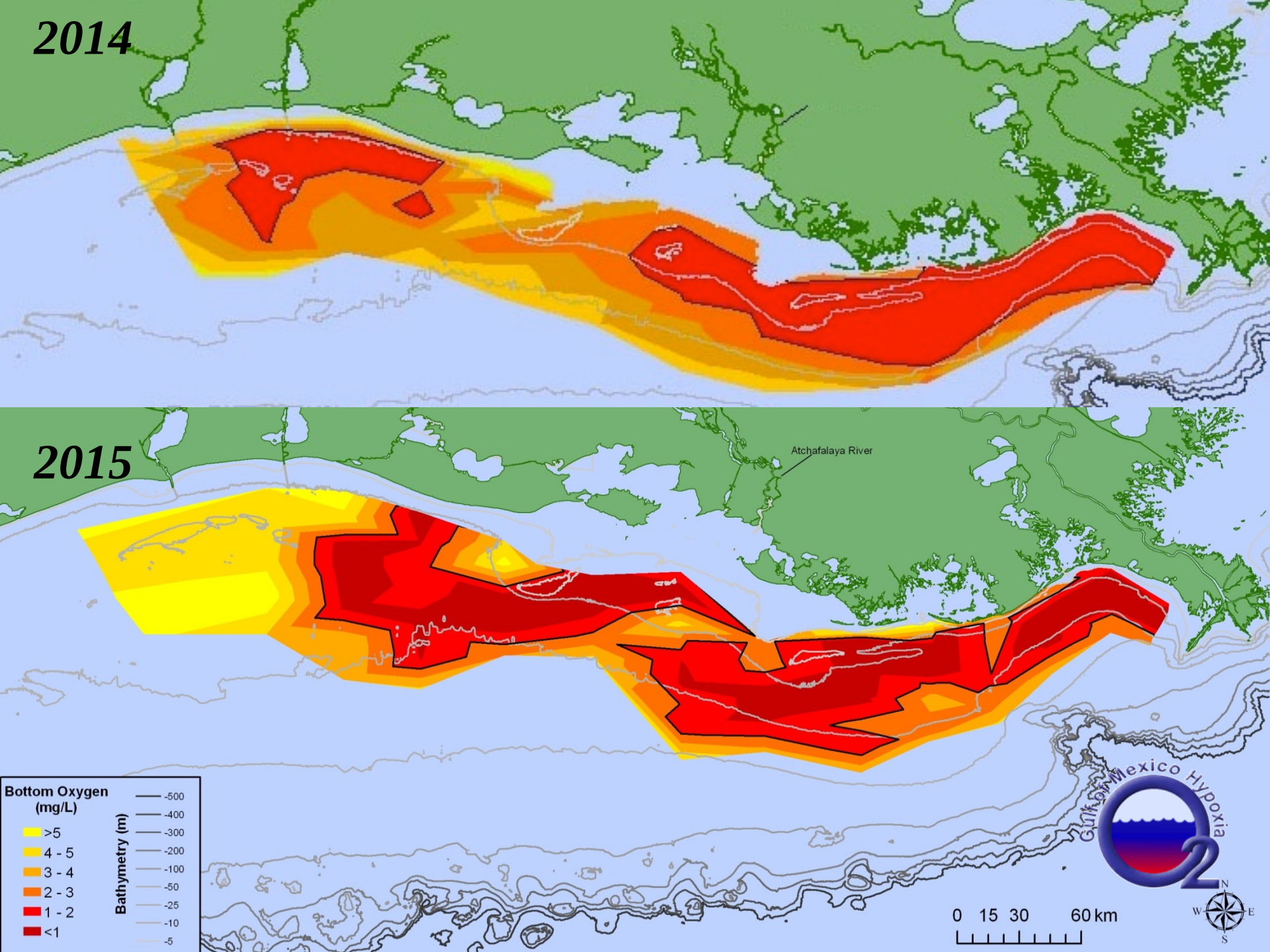
Source: N. Rabalais, LUMCON

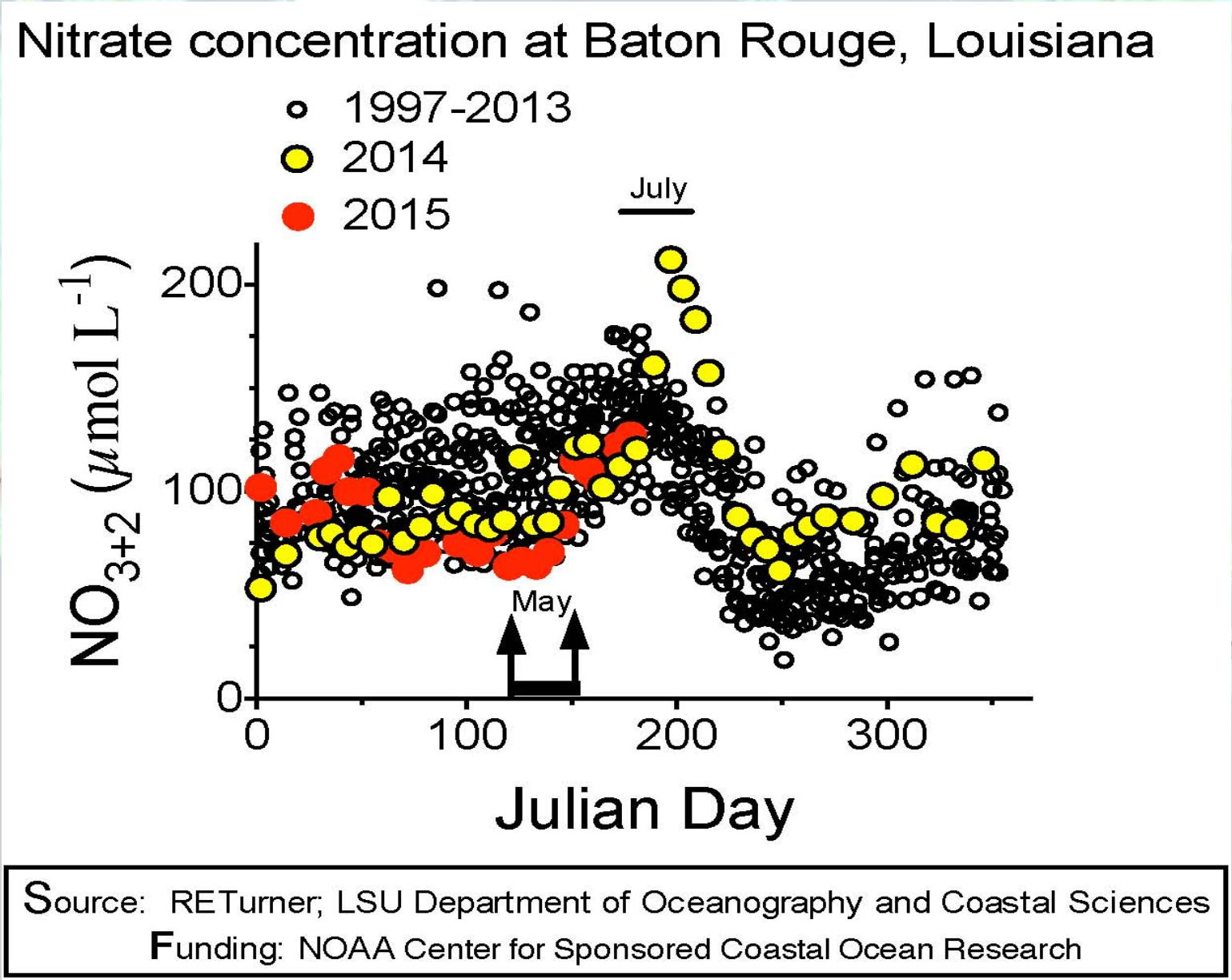
- Mid-summer shelfwide
- Monthly/bimonthly along transects C & F
- Deployed oxygen meters



Mississippi River Discharge at Tarbert Landing, 1935 – 2015



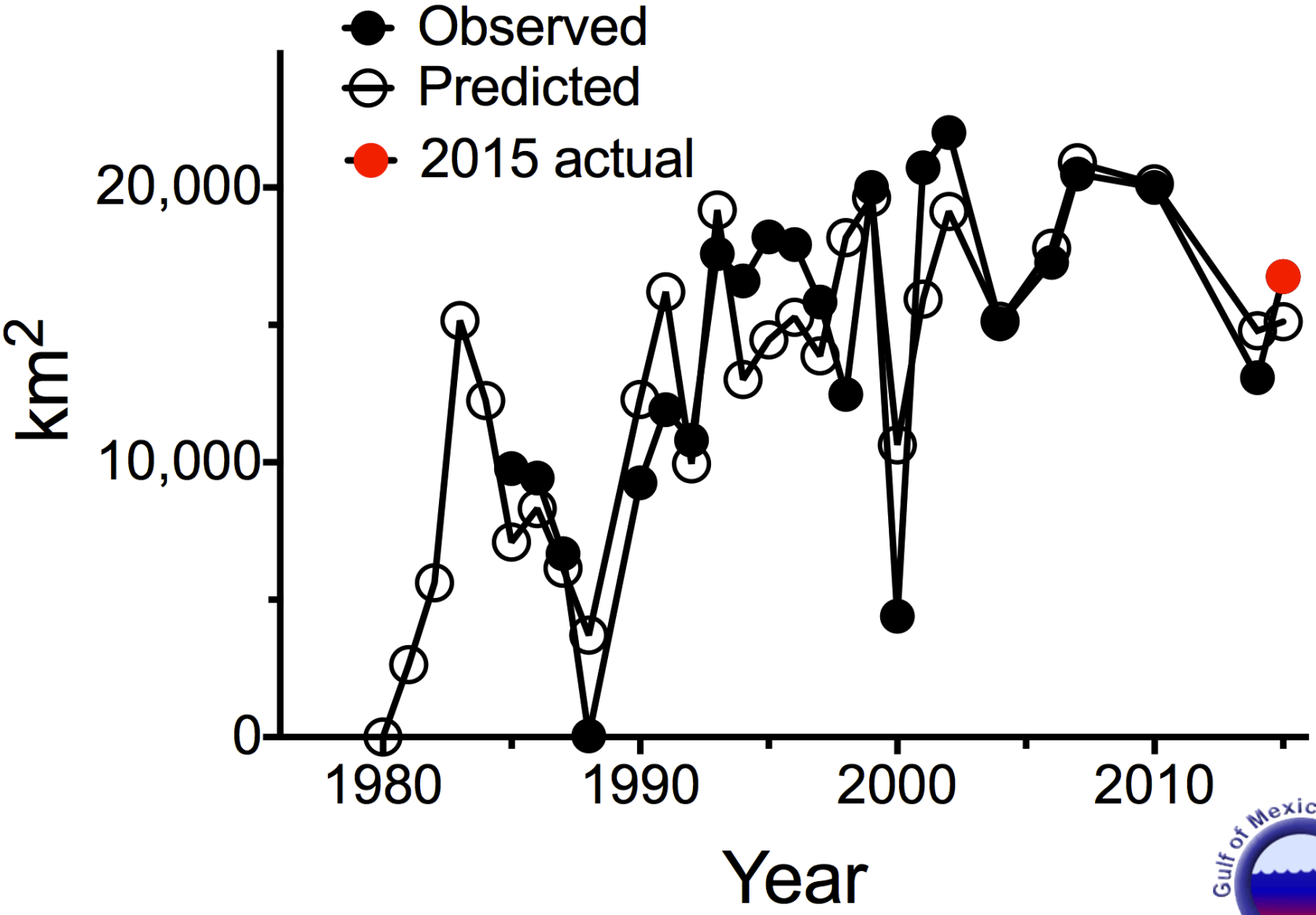

2014
2015
Atchafalaya River
Bottom Oxygen (mg/L)
>5
4 - 5
3 - 4
2 - 3
1 - 2
<1
Bathymetry (m)
-500
-400
-300
-200
-100
-50
-25
-10
-5
Gulf of Mexico Hypoxia
O2
0 15 30 60 km
N
W
E
S



Source: RETurner; LSU Department of Oceanography and Coastal Sciences
Funding: NOAA Center for Sponsored Coastal Ocean Research

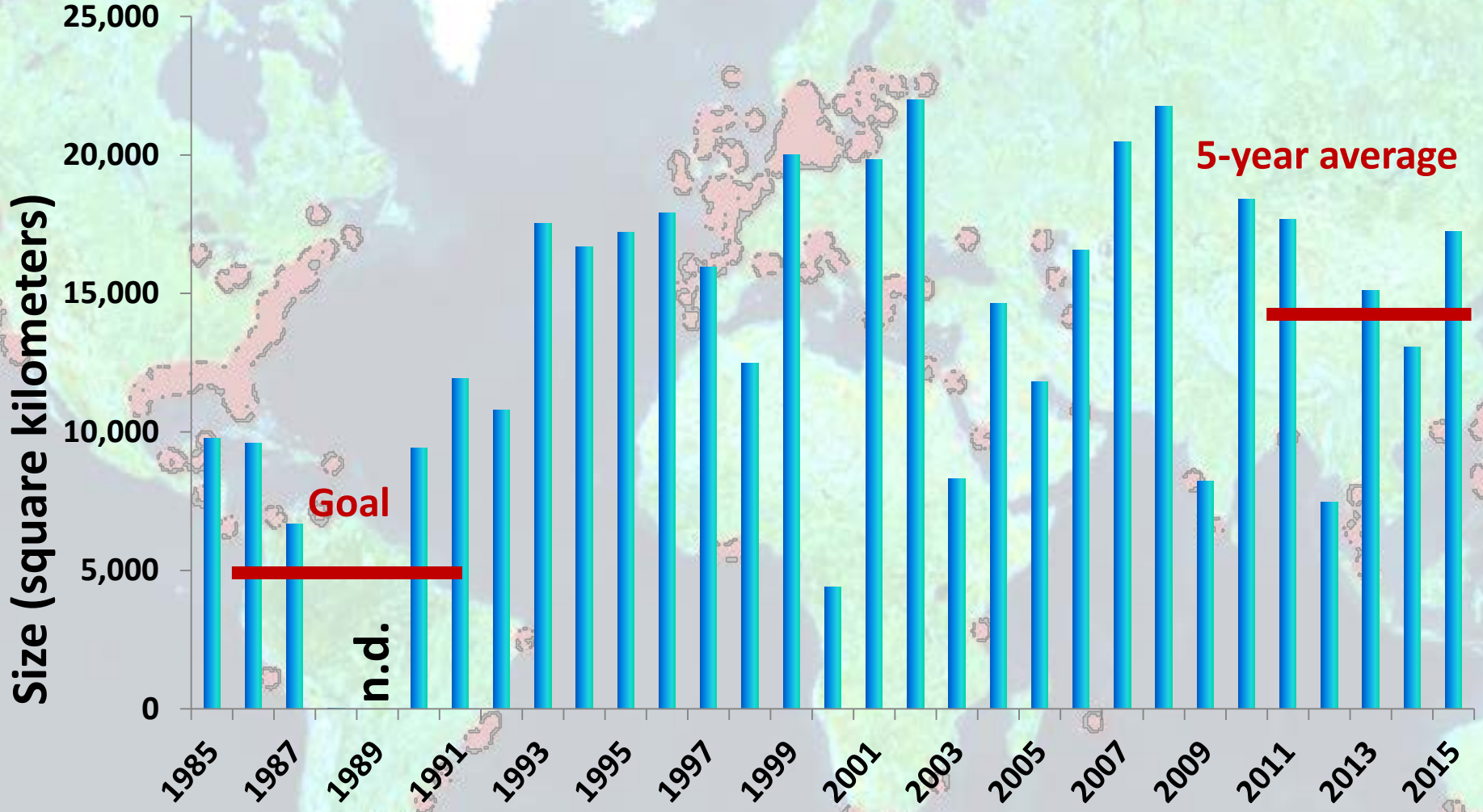
The concentration of nitrite+nitrate (NO_{2+3}) at Baton Rouge, Louisiana, from 1997 through June 24, 2015. The data for2014 and 2015 are shown separately.

Only years without storms



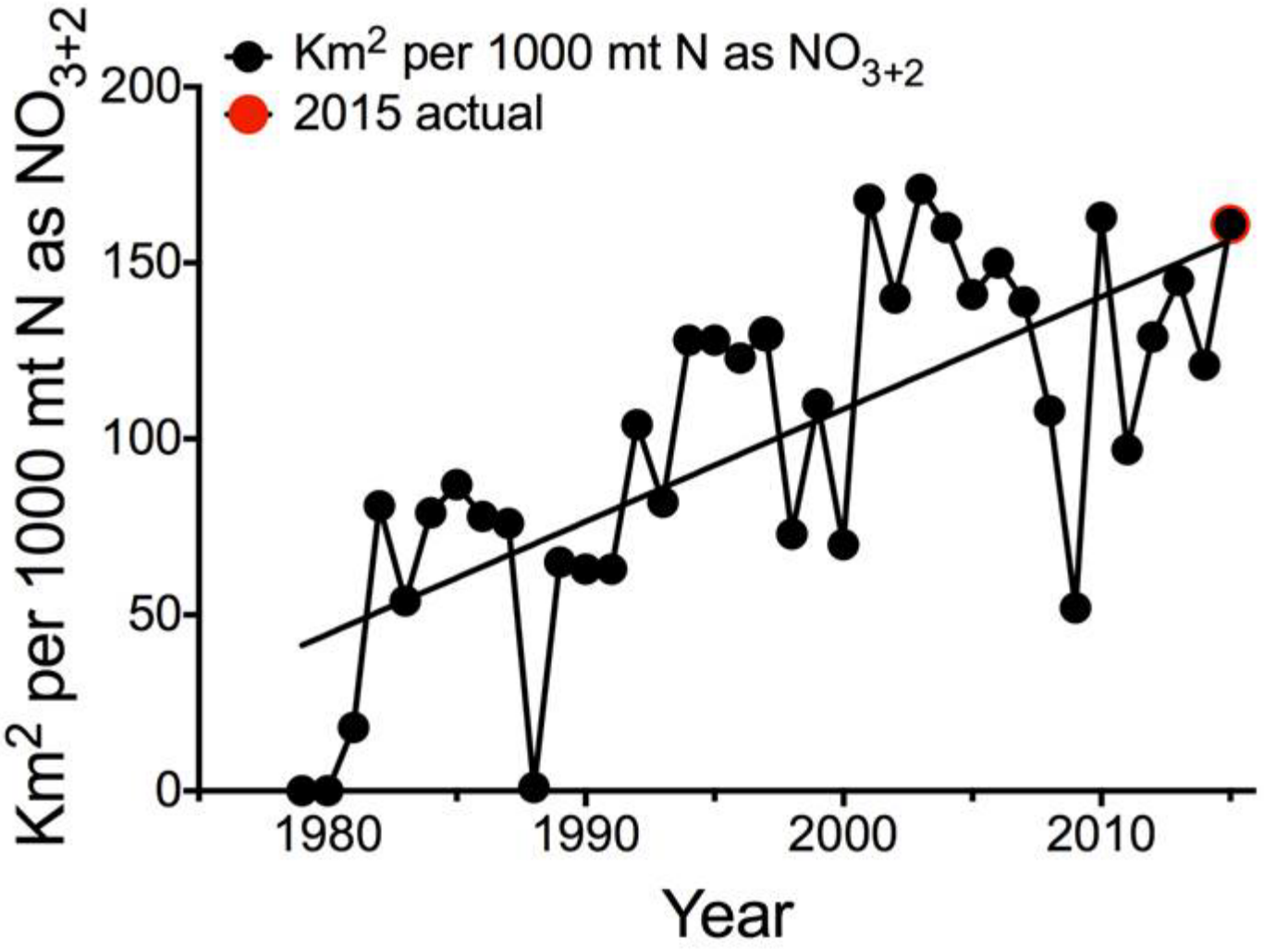
(unpublished data of Gene Turner, LSU, and Nancy Rabalais, LUMCON)

Size of bottom-water hypoxia in mid-summer



Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU

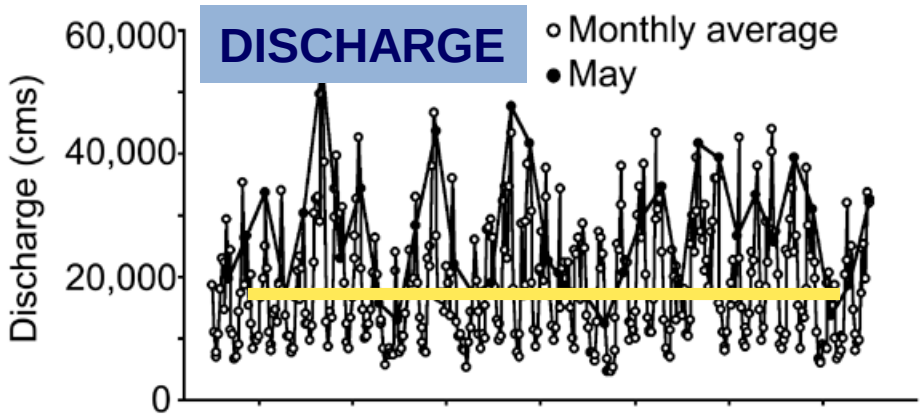
Funding sources: NOAA Center for Sponsored Coastal Ocean Research and U.S. EPA Gulf of Mexico Program

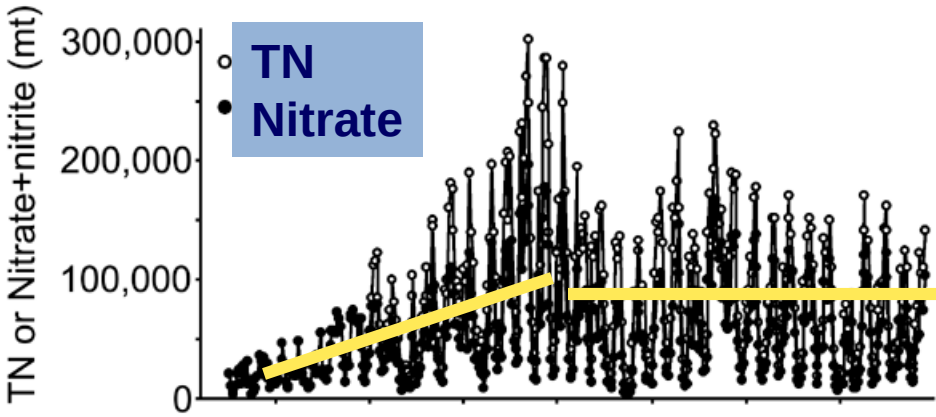


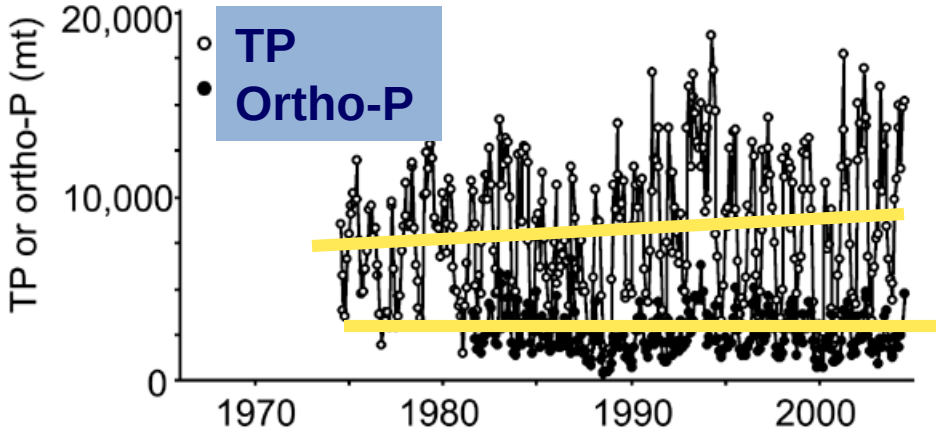
The area of bottom-water dissolved oxygen less than 2 mg l^{-1} in mid summer as a function of Mississippi River nitrate load in May has increased over the period from 1979 to 2015; graphic by R. E. Turner

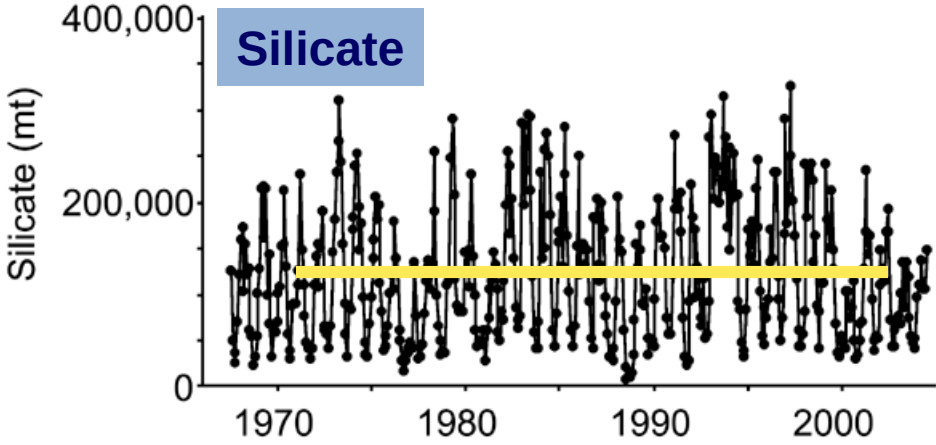
300% increase in N load

80% due to NO_3^- concentration ↑
20% due to discharge ↑



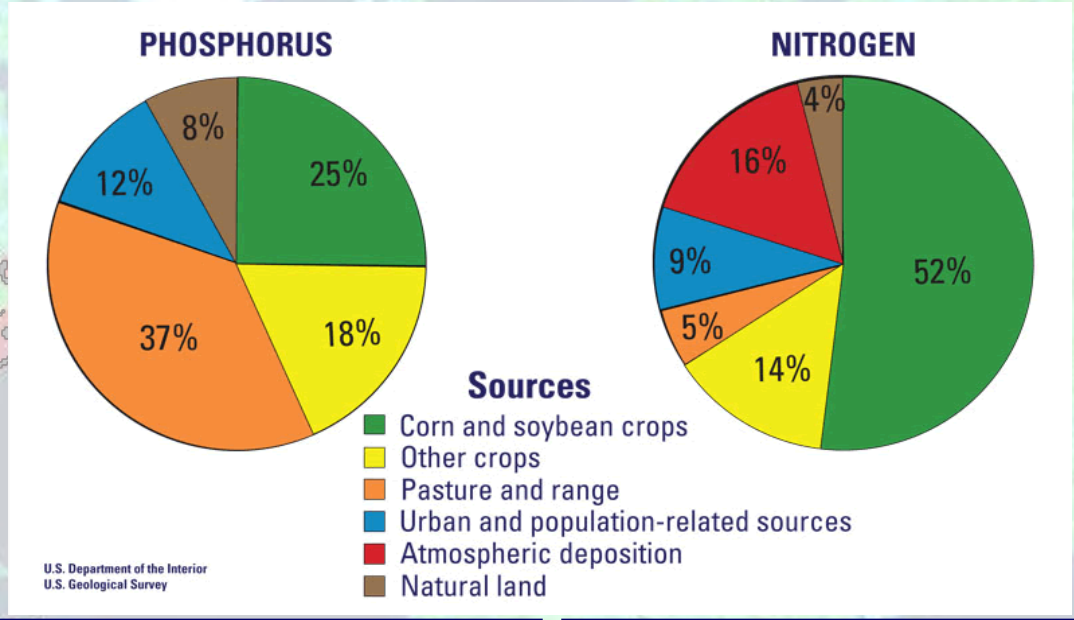


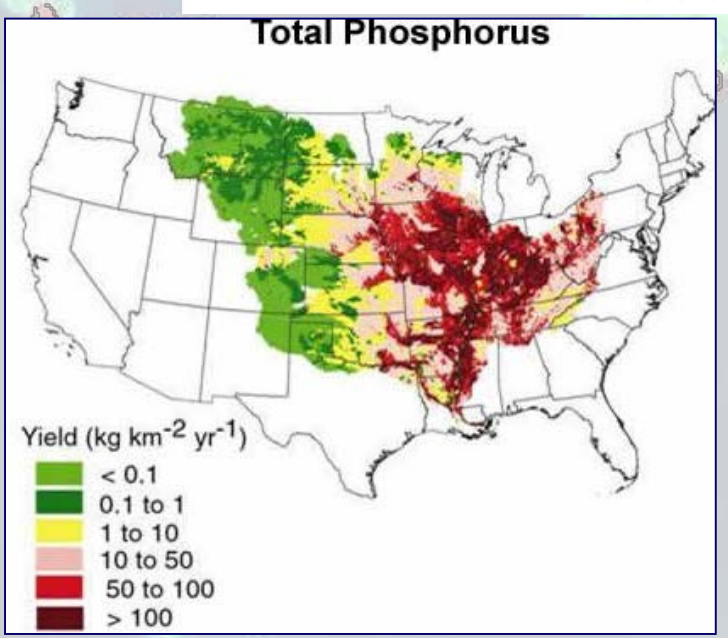


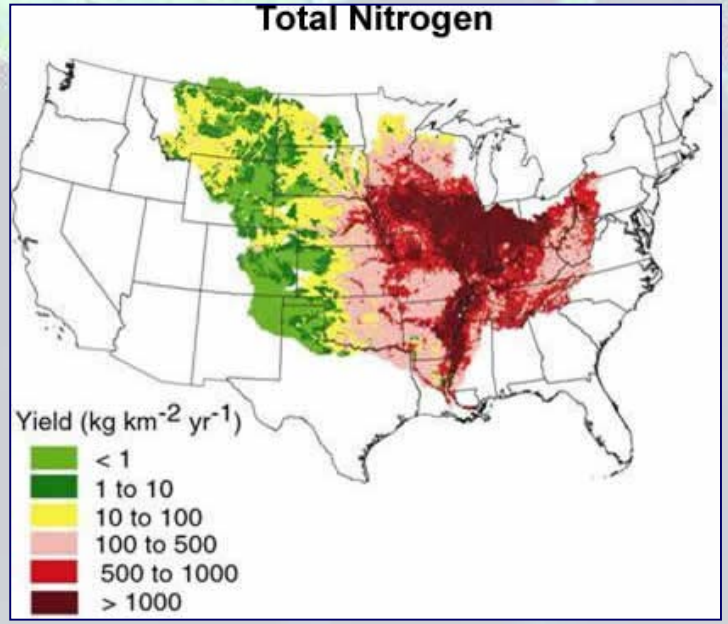


Turner et al. 2007

Nutrients Delivered to GoMx

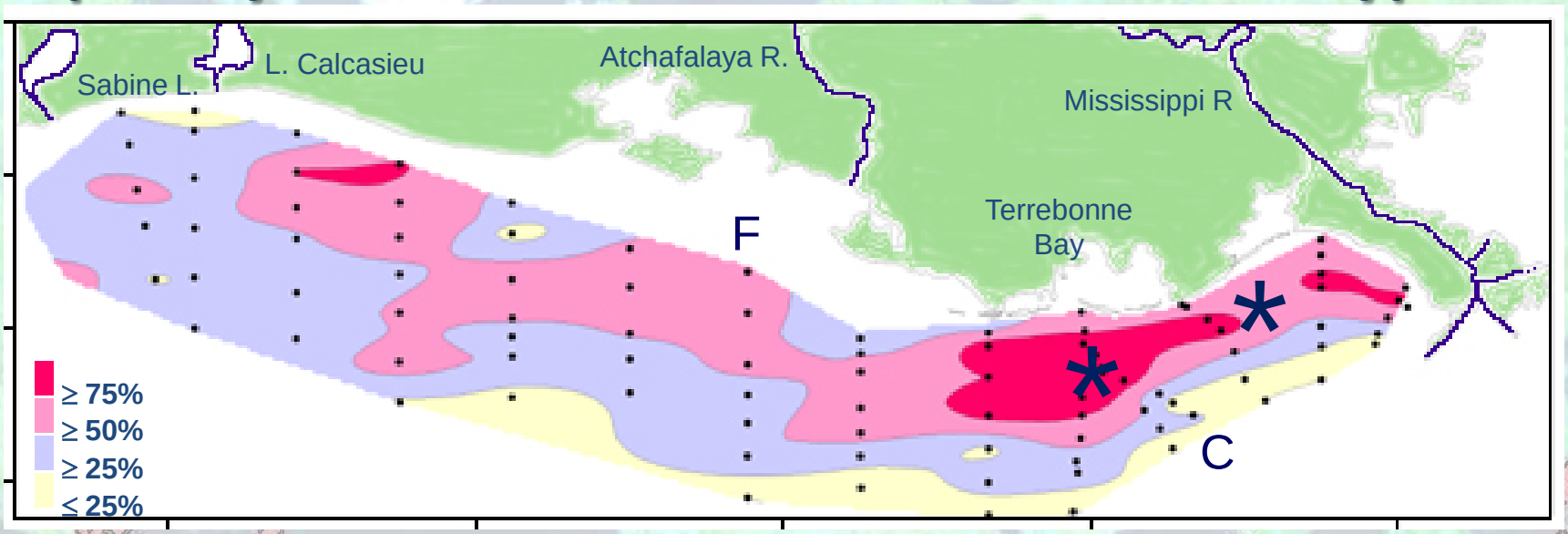


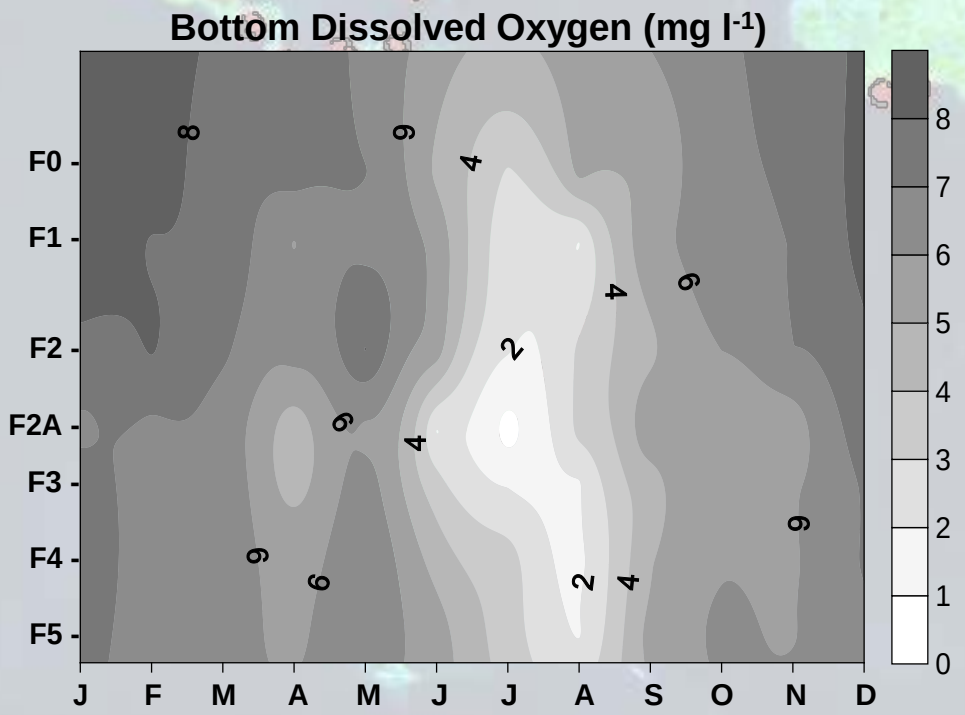


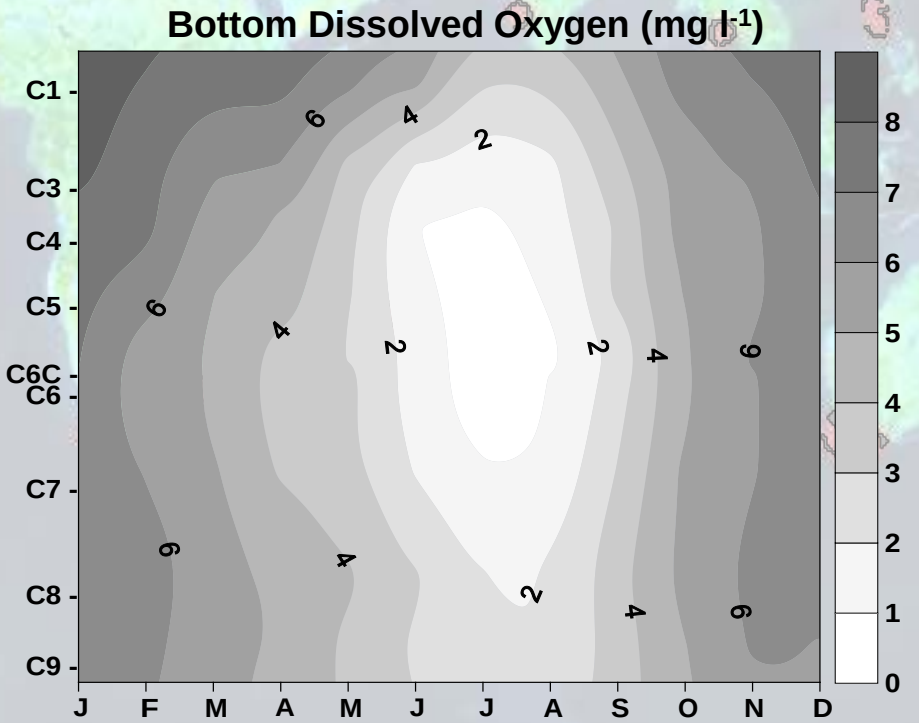


Alexander et al. 2008 & http://water.usgs.gov/nawqa/sparrow/gulf_findings/

Frequency of Mid-Summer Bottom-Water Hypoxia







Station CSI-6, LSU/WAVCIS

Full meteorological suite & wave meters

Station C6C/BIO2

Dissolved Oxygen DO
Conductivity C
Temperature T
Turbidity TB
In vivo Fluorescence F
Currents ADCP
Nutrient Experiments (selected)
Light Meter Deployments (selected)

C/T/DO/TB/F 2.4 m

C/T 6.6 m

C/T/DO/TB/F 10.7 m

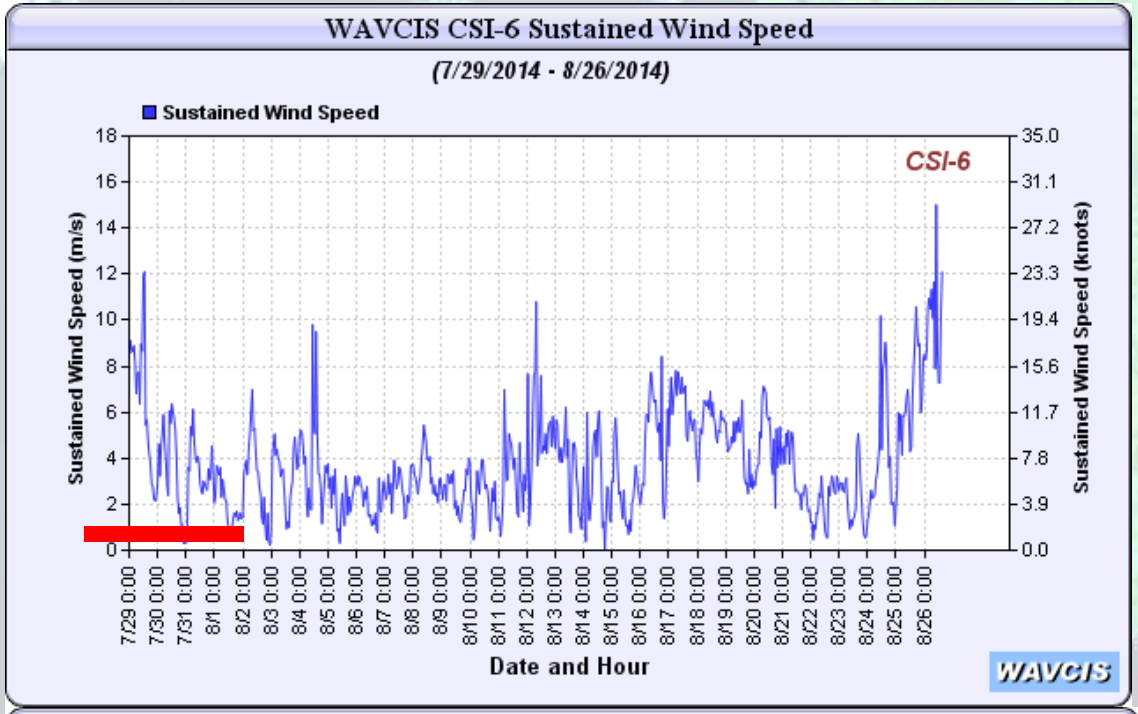
C/T 14 m

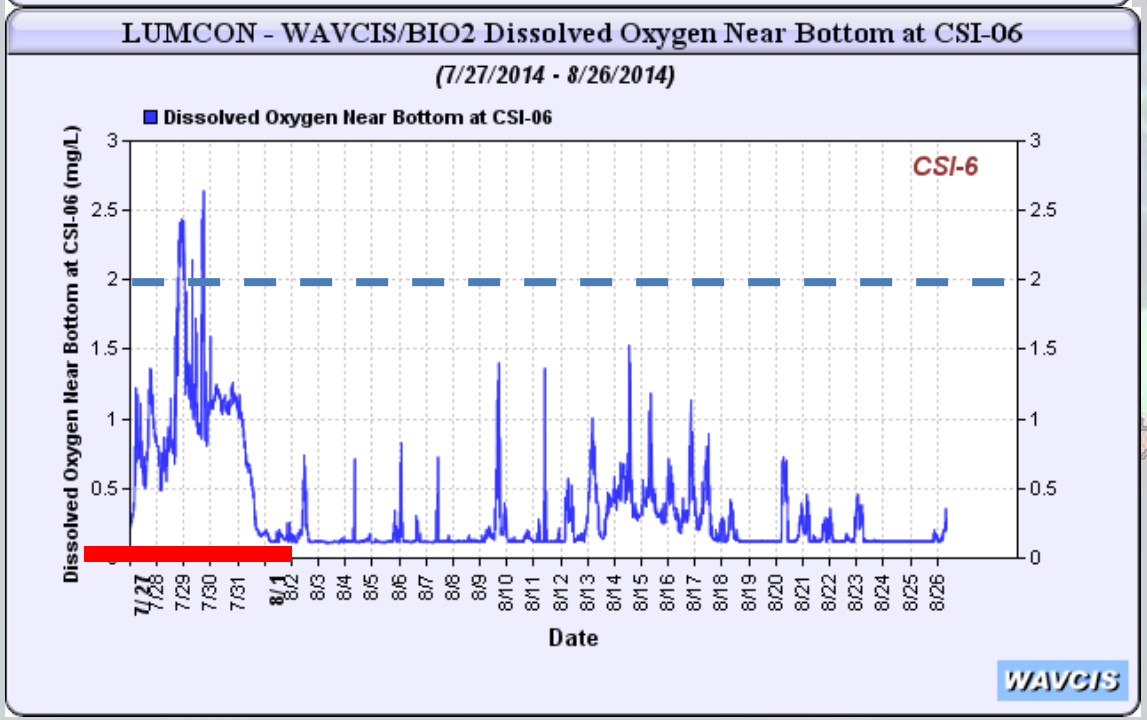
C/T/DO/TB/F 19 m

ADCP

Gulf of Mexico Hypoxia

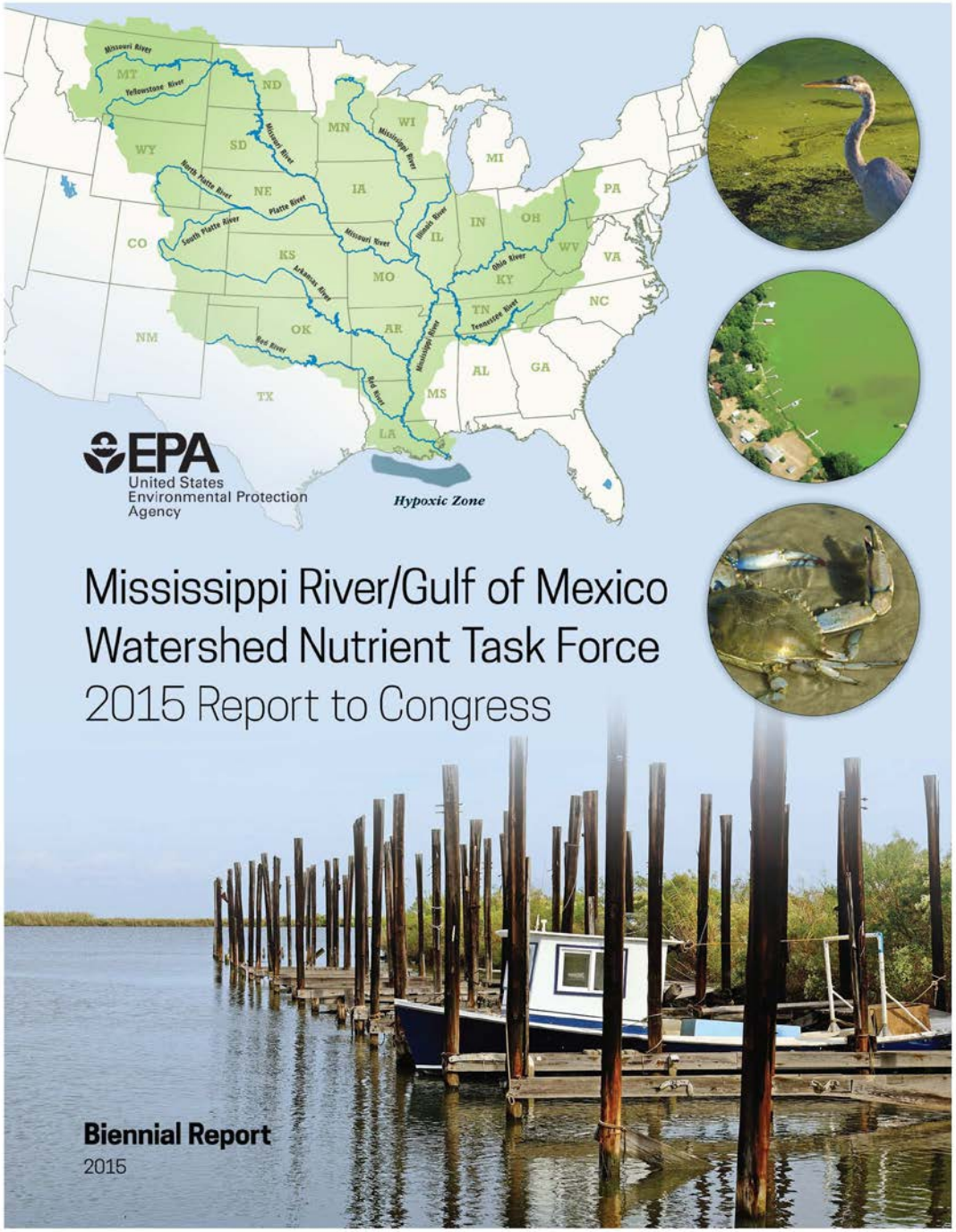
July 27 – August 26 2014 Real-Time Data





If we just want to know how large the hypoxic area is in the summer, then a map is adequate for management purposes.

But, is there management?



Revised Goal Framework

- retain the original goal of reducing the extent of hypoxic zone km^2
- extend the time of attainment from 2015 to 2035. 20 years!
- an interim target of a 20 percent nutrient load reduction by the year 2025.

If we want to understand the dynamics and relationship with land use and water quality, then much more is needed.

- Adequate spatial and temporal measurements
- Integrated physical and biological data, coupled with watershed data
- Adequate ancillary monitoring
- Long-term data acquisition
- Multi-disciplinary approach
- Experimental work
- Knowledge of process rates
- Ecosystem-level synthesis

GULF OF MEXICO HYPOXIA MONITORING

- Moving from research mode to operational
- No plan for continuing shelfwide cruises
- No plan for financing; discussions continue
- Need cooperative institute to undertake
- Multiple hypoxia monitoring plans, GCOOS, GOMA, GOMURC, NOAA
- At risk is unique 30^{+}-year data base

The Future

- Many competing uses for Mississippi River water
- The river has much less sediment than historically
- The N is 3X greater than historically, P 2X
- Sea level WILL rise
- The Mississippi River Delta is an active but regressive delta with considerable subsidence
- Landscape change in the watershed and the deltaic plain are complex, debilitating, and will change
- Solutions to coastal land loss are not easily designed and executed