

# Hypoxia in the Northern Gulf of Mexico (the Mississippi Delta)

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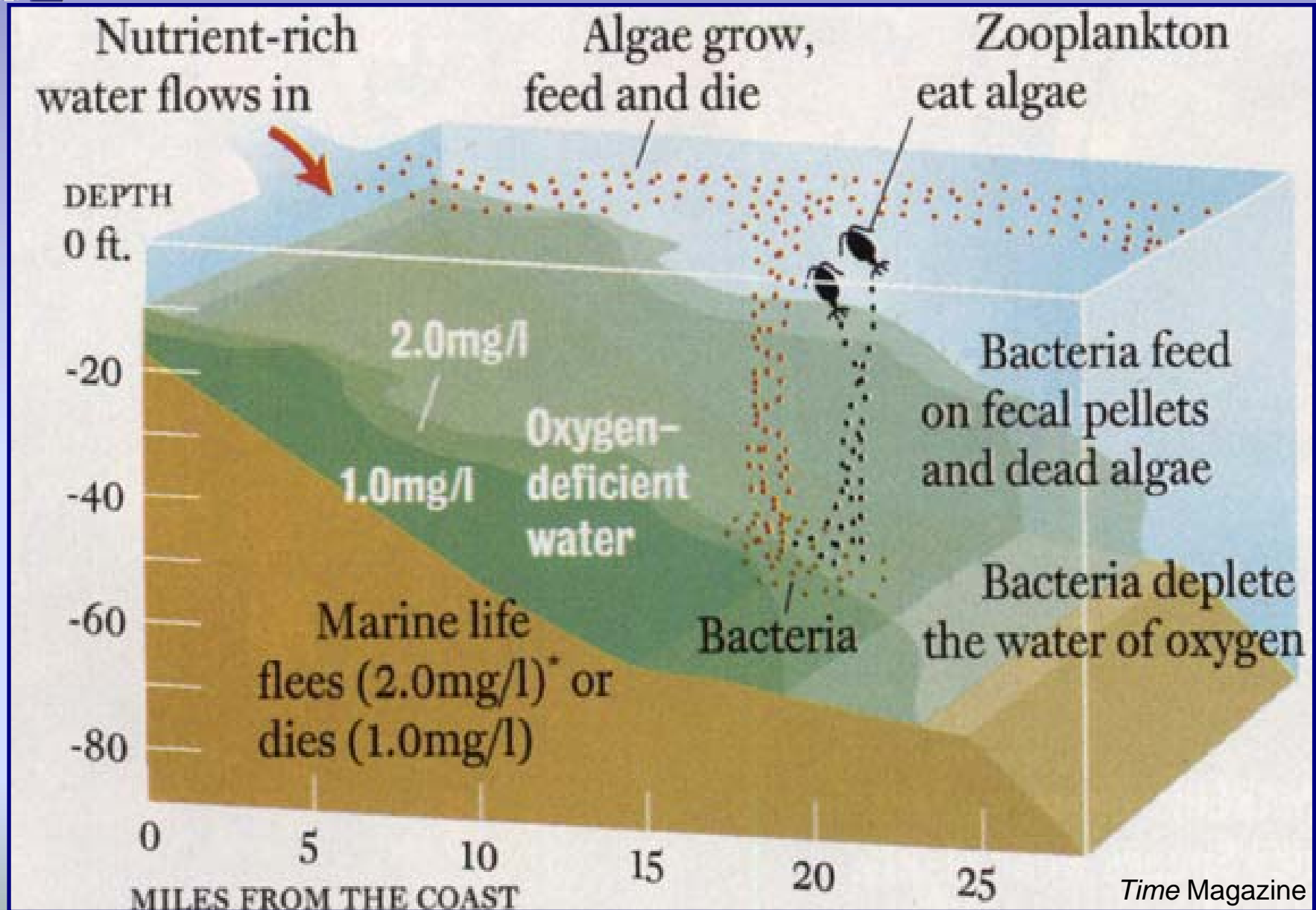
**[nrabalais@lumcon.edu](mailto:nrabalais@lumcon.edu)**

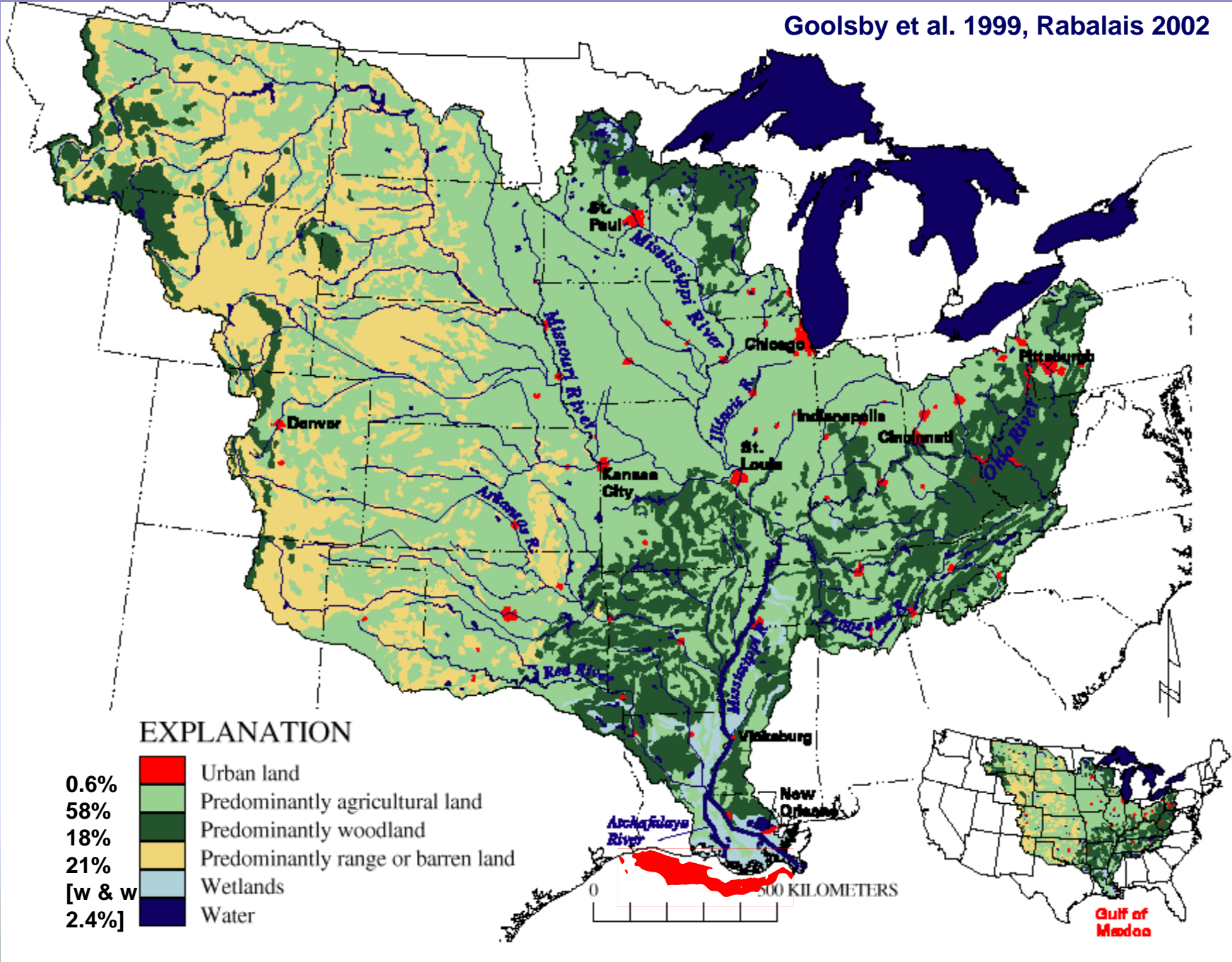
**<http://www.gulfhypoxia.net>**





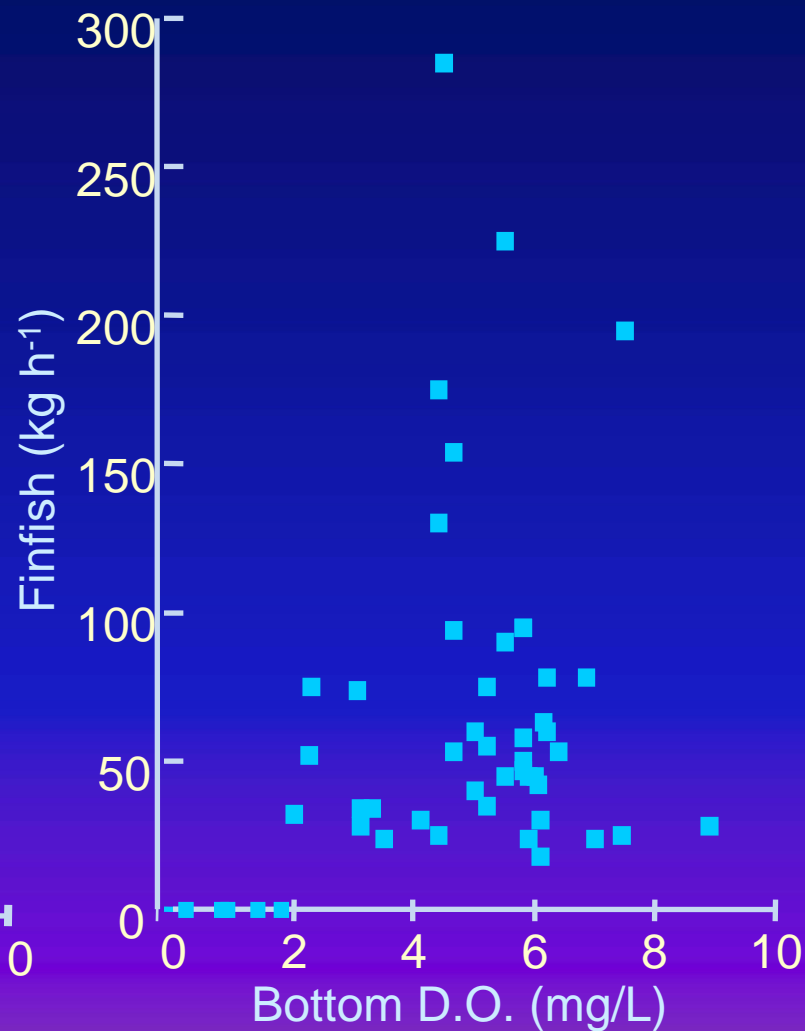
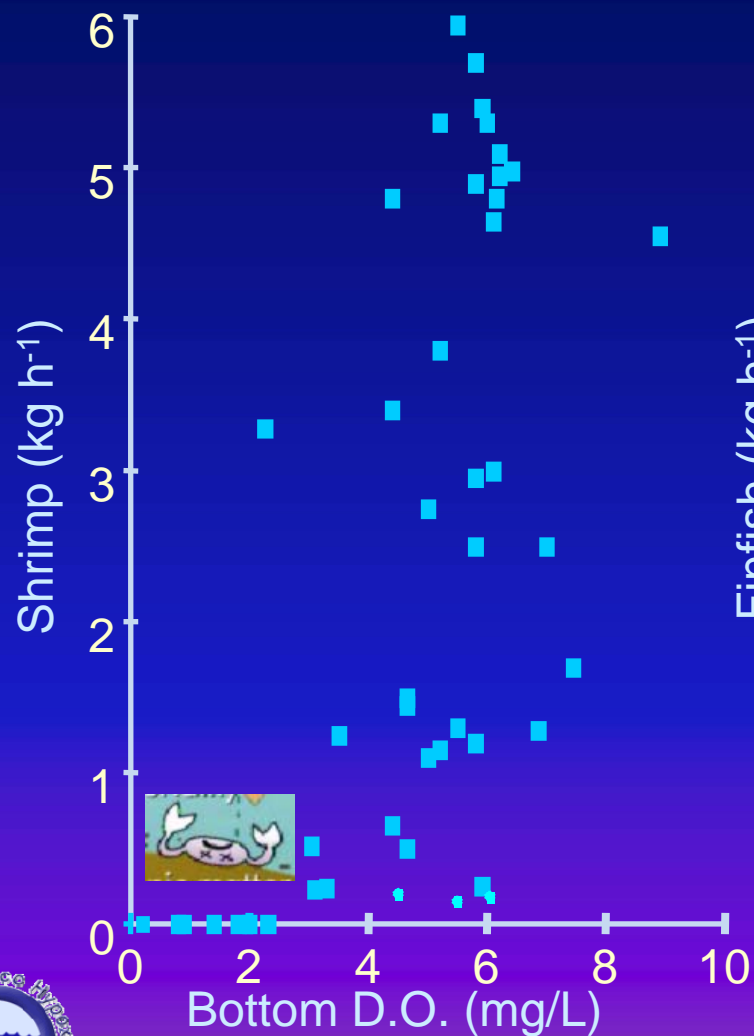
# Nutrients, Increased Growth, Low Oxygen





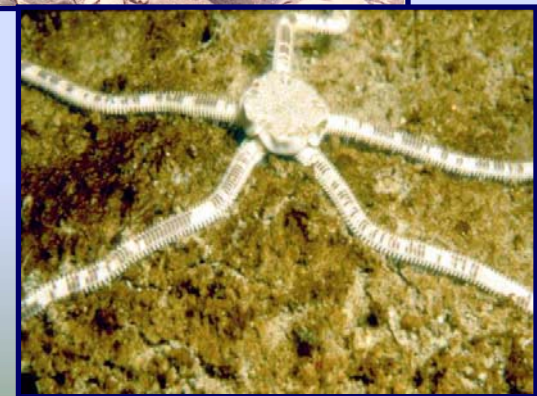
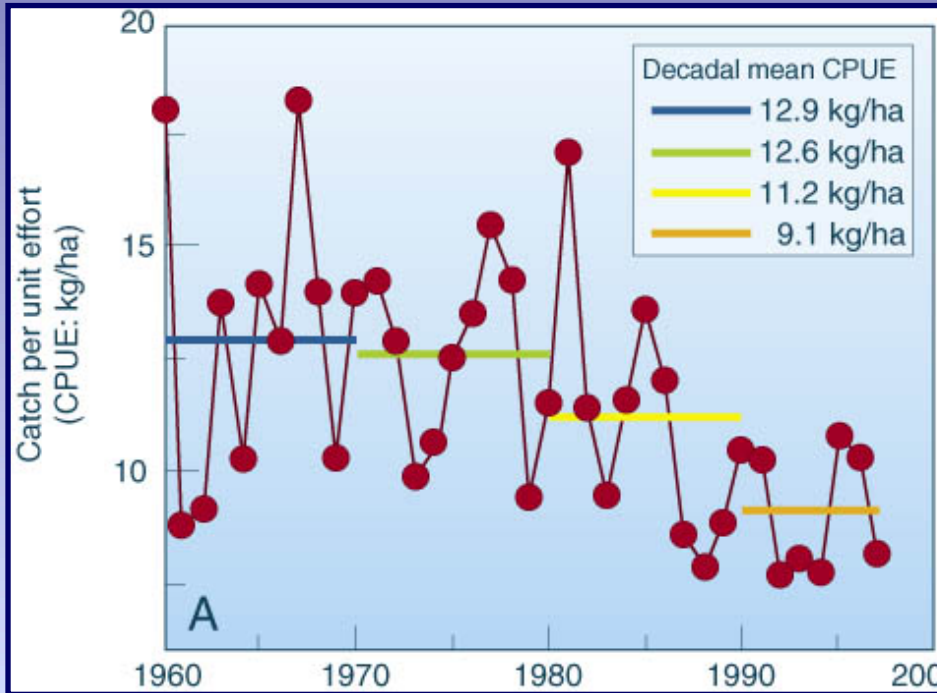
# No trawlable fish, shrimp, crabs

Hypoxia = Dissolved O<sub>2</sub> < 2 mg/L (= 2 ppm)



# The Consequences

- Fisheries resources at risk
- Altered migration
- Reduced habitat
- Changes in food resources
- Susceptibility of early life stages
- Growth & reproduction





Mississippi River

Atchafalaya River

New Orleans

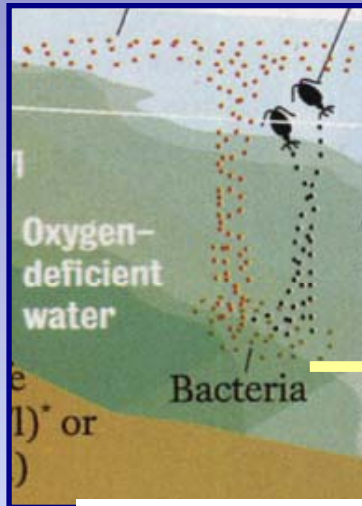
Hypoxic Area

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

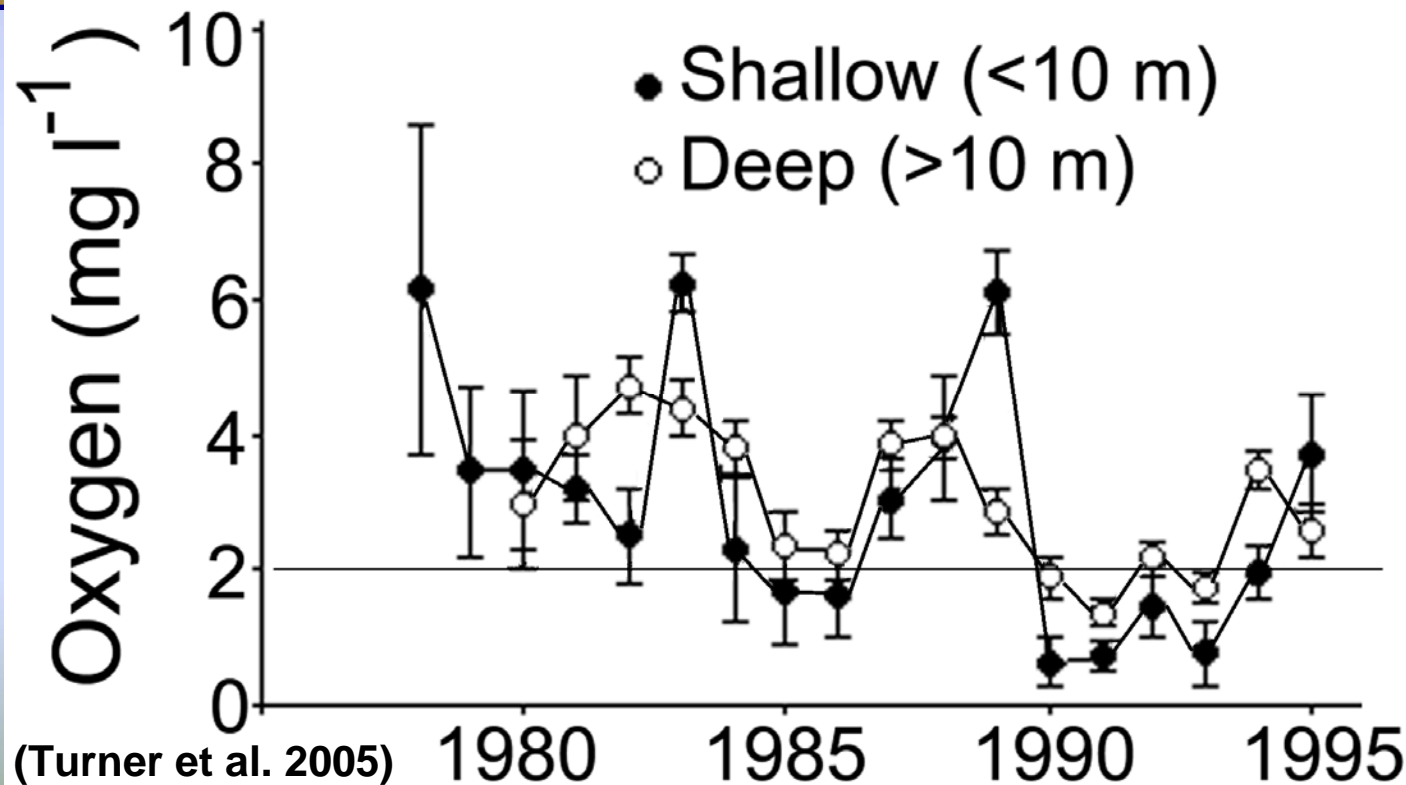
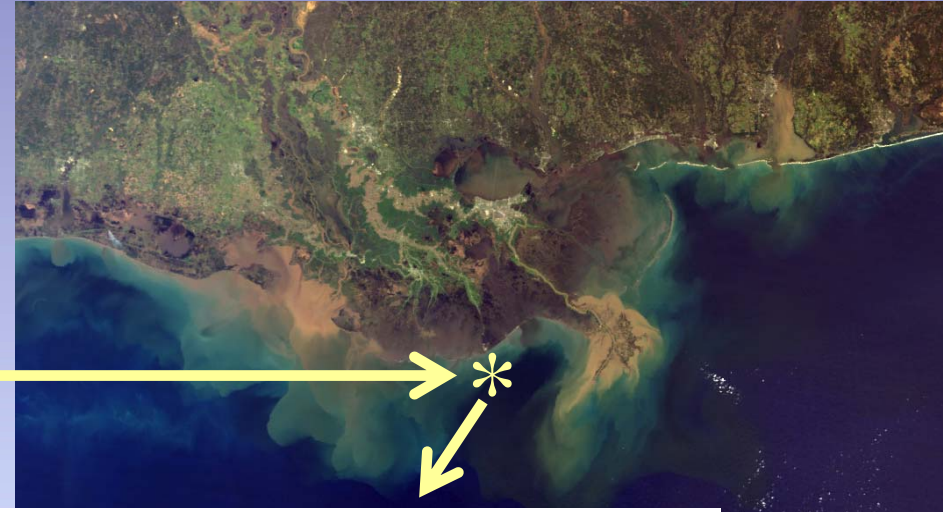
dominant wind direction



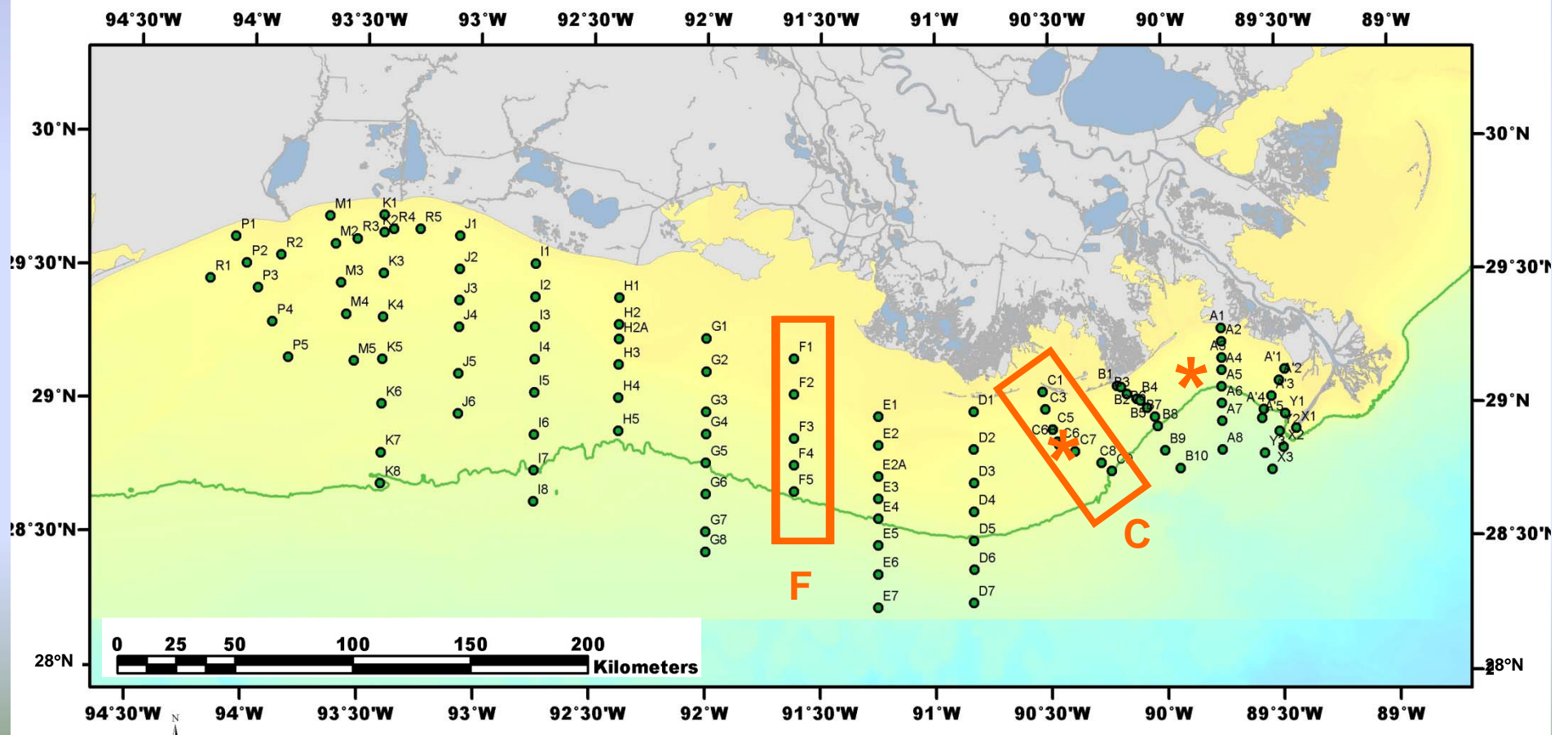
# Nutrients, Increased Growth, Low Oxygen



50% C↓

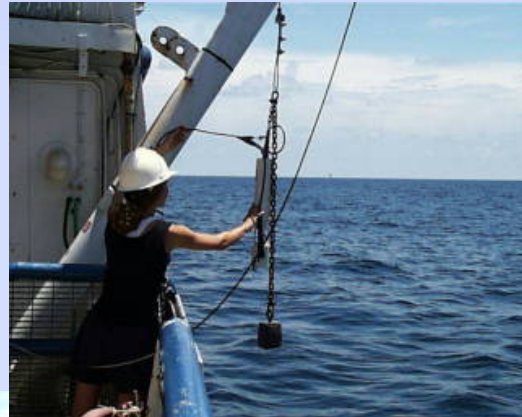
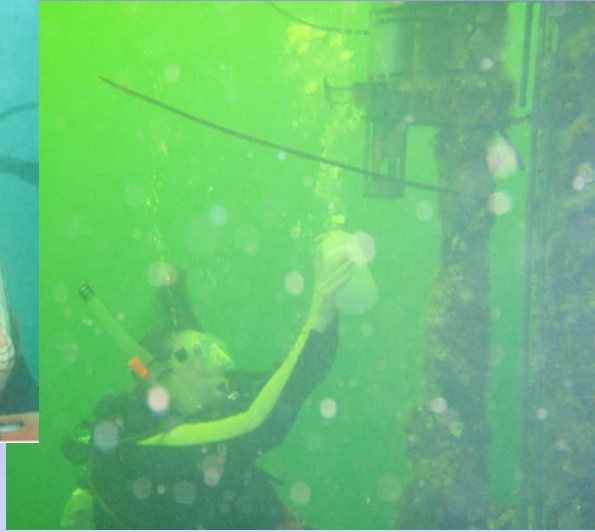


- Mid-summer shelfwide cruise
- Monthly lines C and F
- Deployed oxygen meters

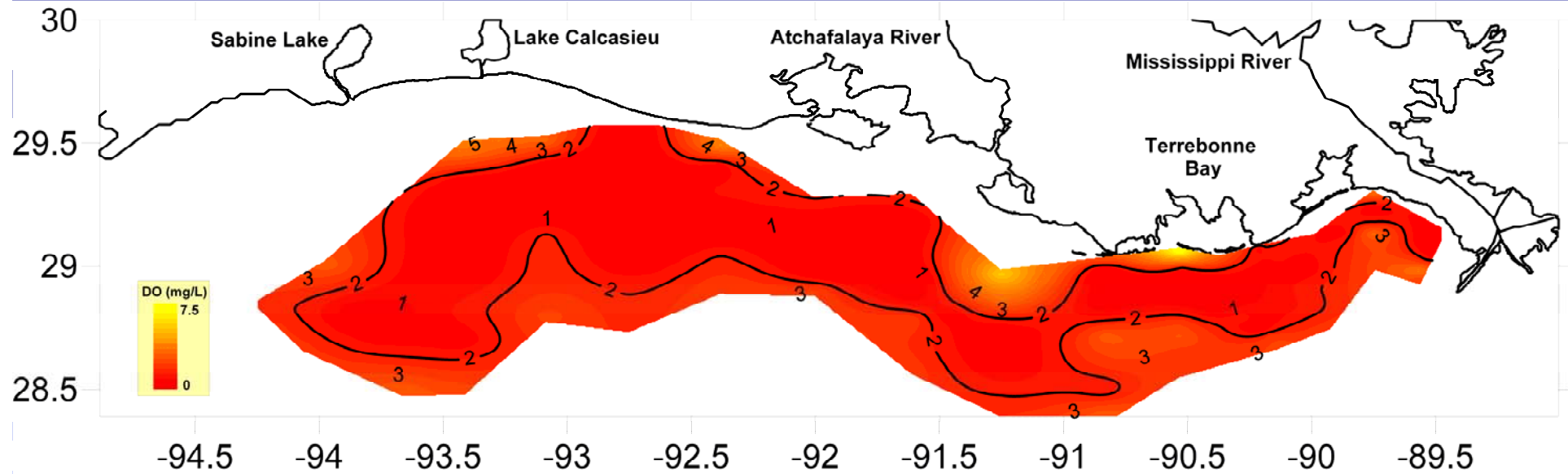




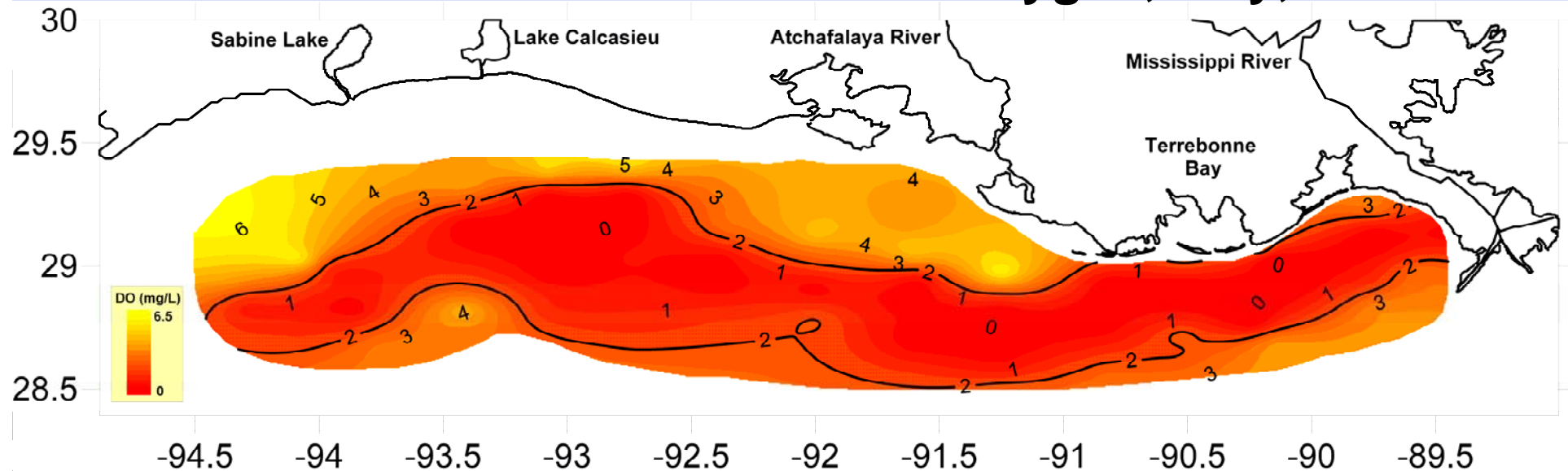
# Extensive Field Measurements



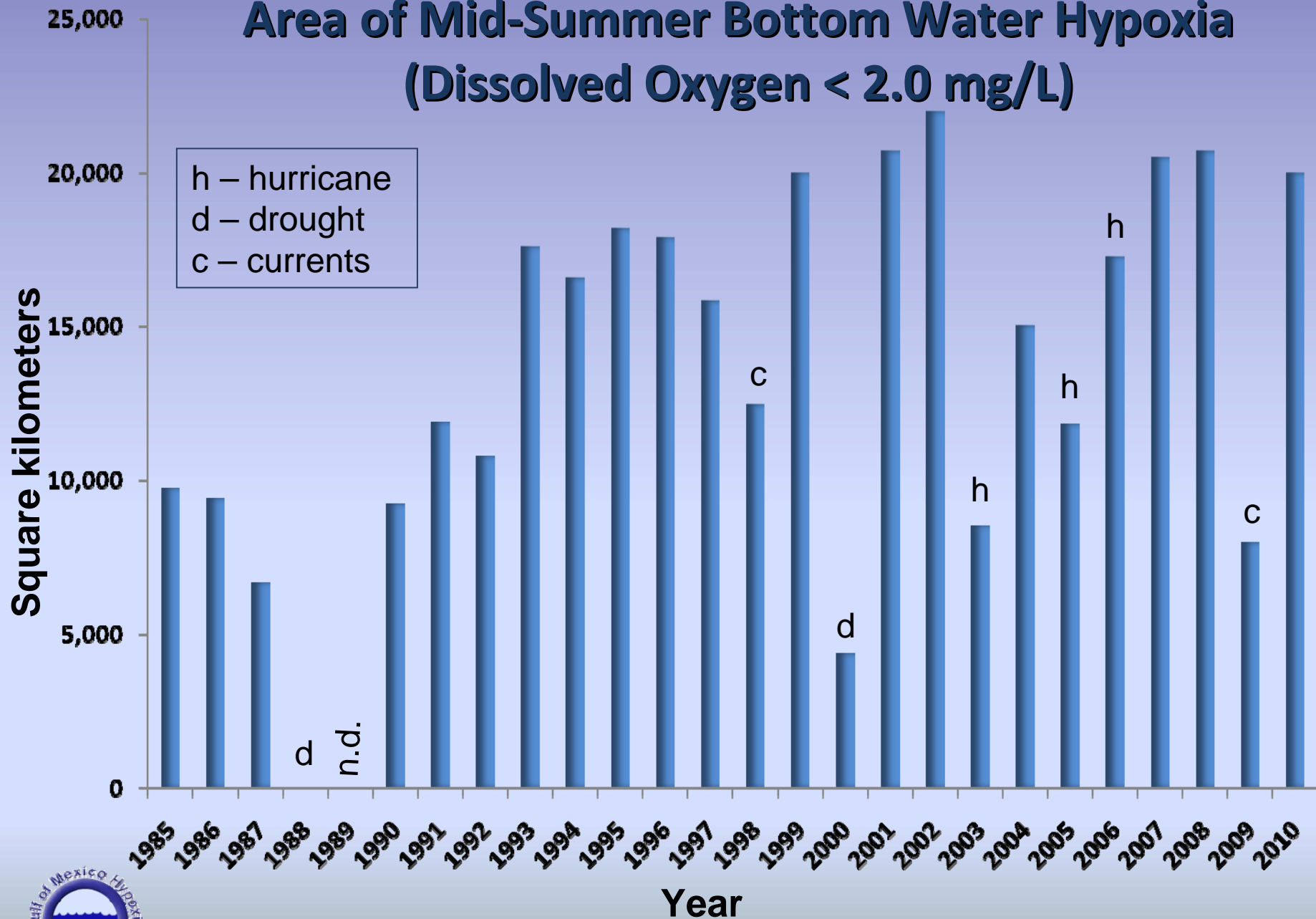
# Bottom-water Dissolved Oxygen, July, 2007



# Bottom-water Dissolved Oxygen, July, 2008

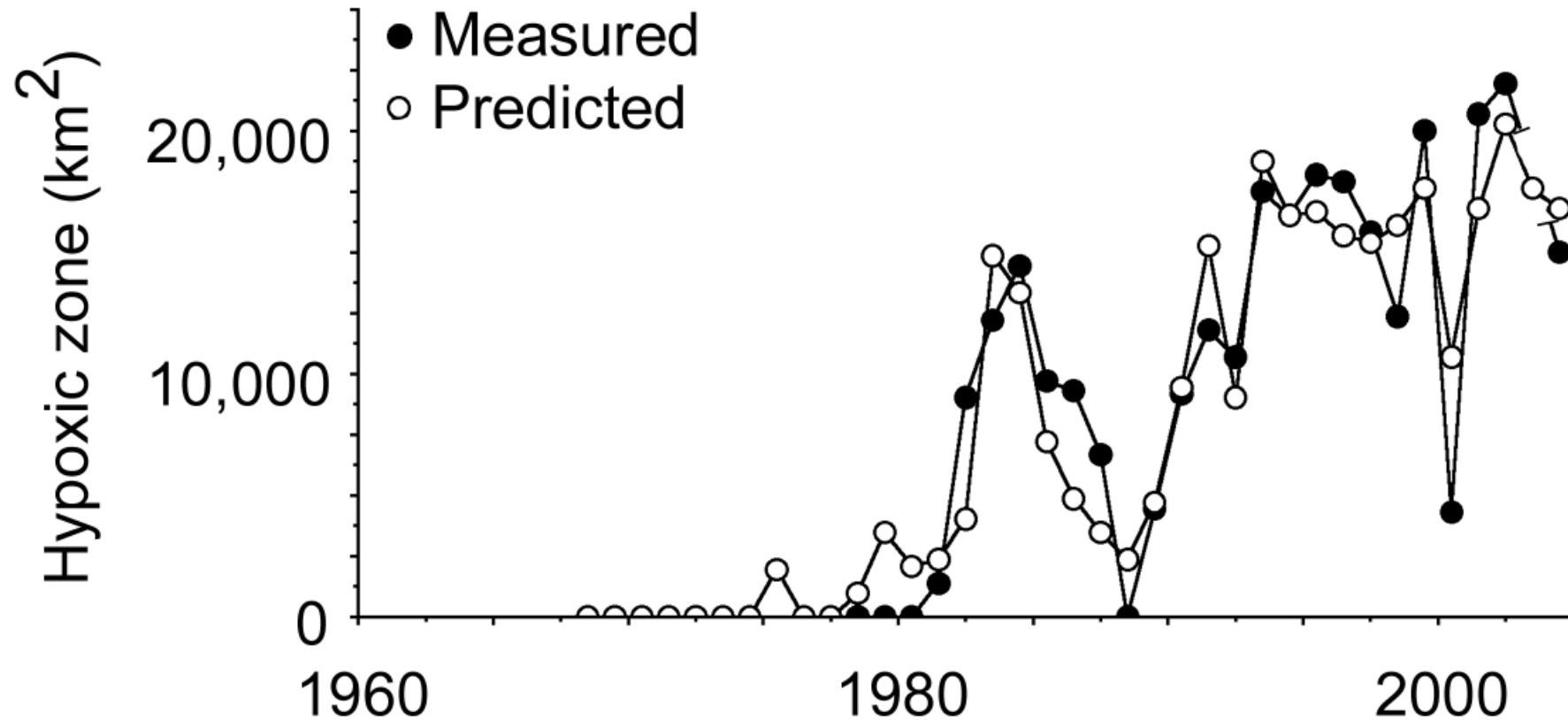


# Area of Mid-Summer Bottom Water Hypoxia (Dissolved Oxygen < 2.0 mg/L)



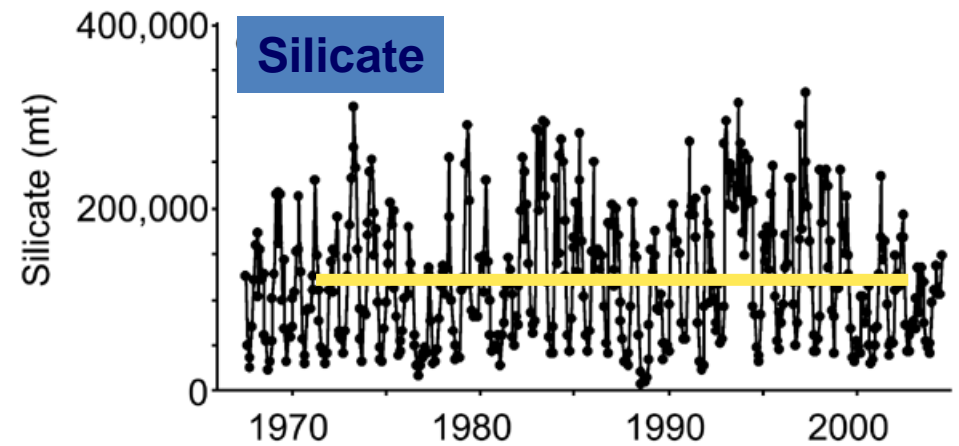
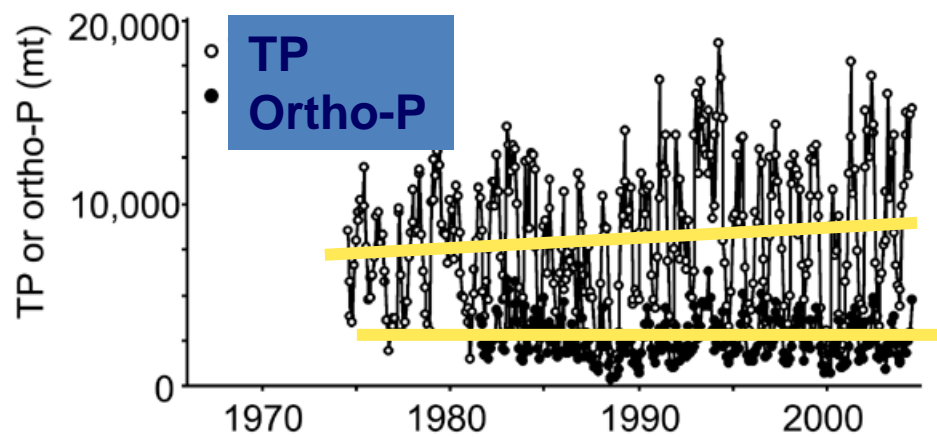
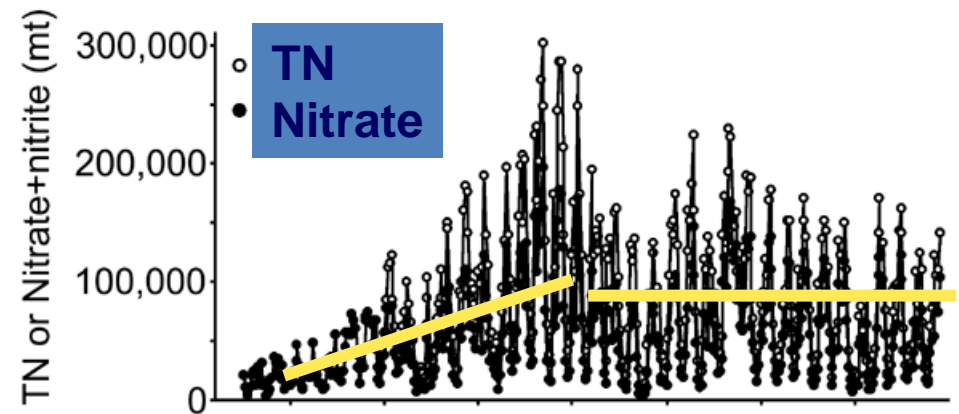
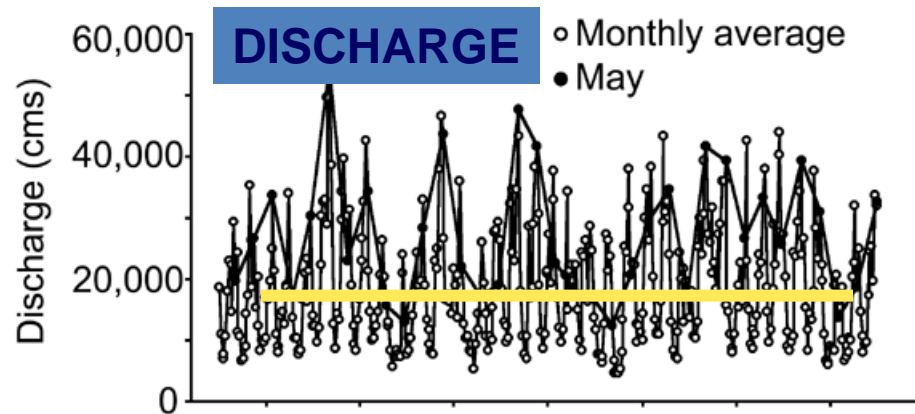
Data source: N.N. Rabalais, Louisiana Universities Marine Consortium, R.E. Turner, Louisiana State University  
Funded by: NOAA, Center for Sponsored Coastal Ocean Research

# Predicting Hypoxia in summer (nitrate-N flux in May, year)



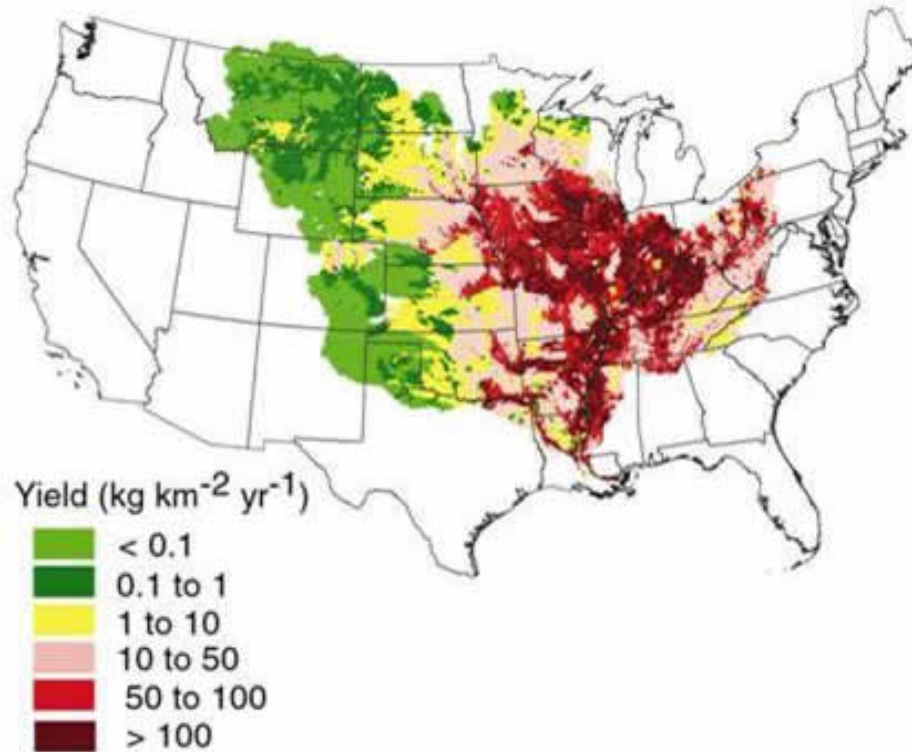
Turner et al. 2006

# 300% increase in N load 80% due to $\text{NO}_3^-$ concentration $\uparrow$ 20% due to discharge $\uparrow$

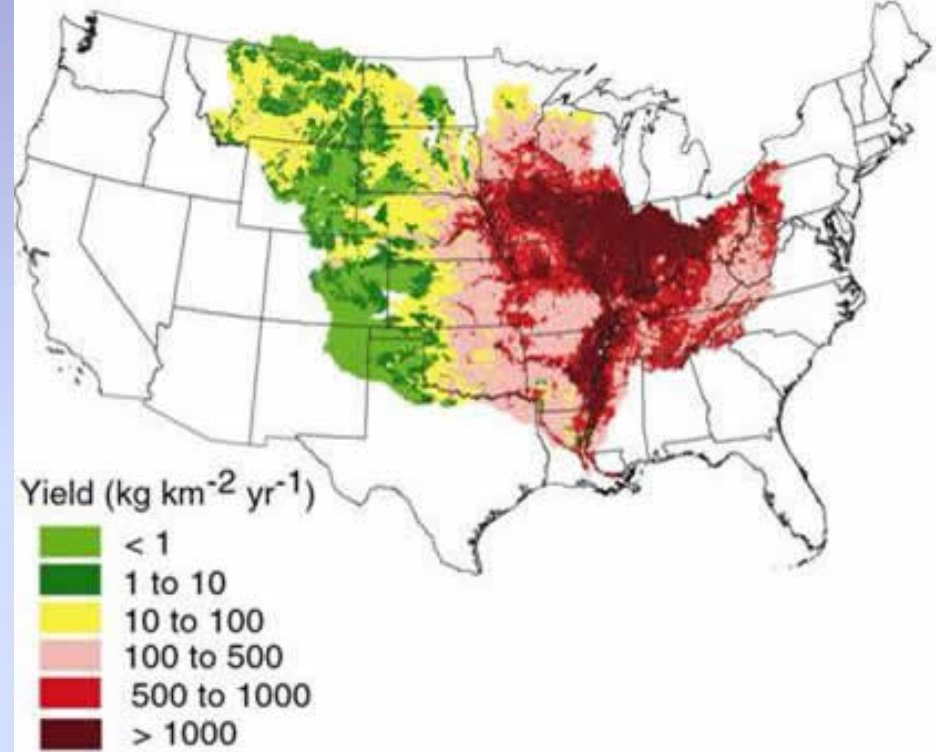


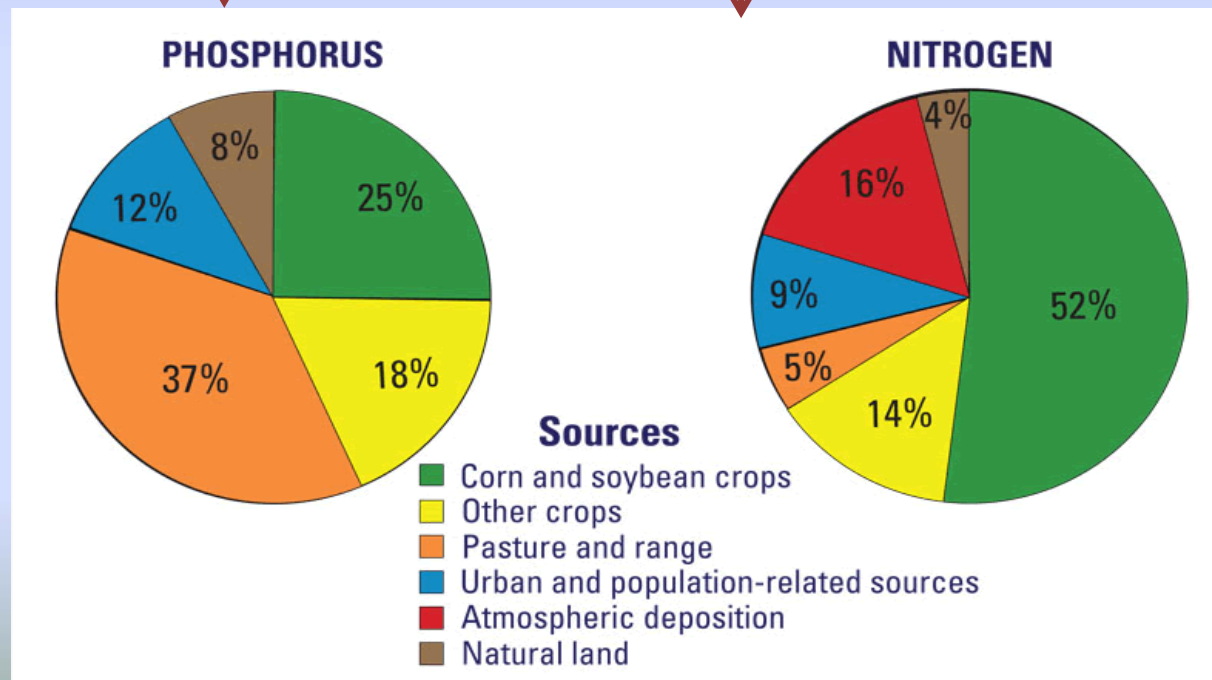
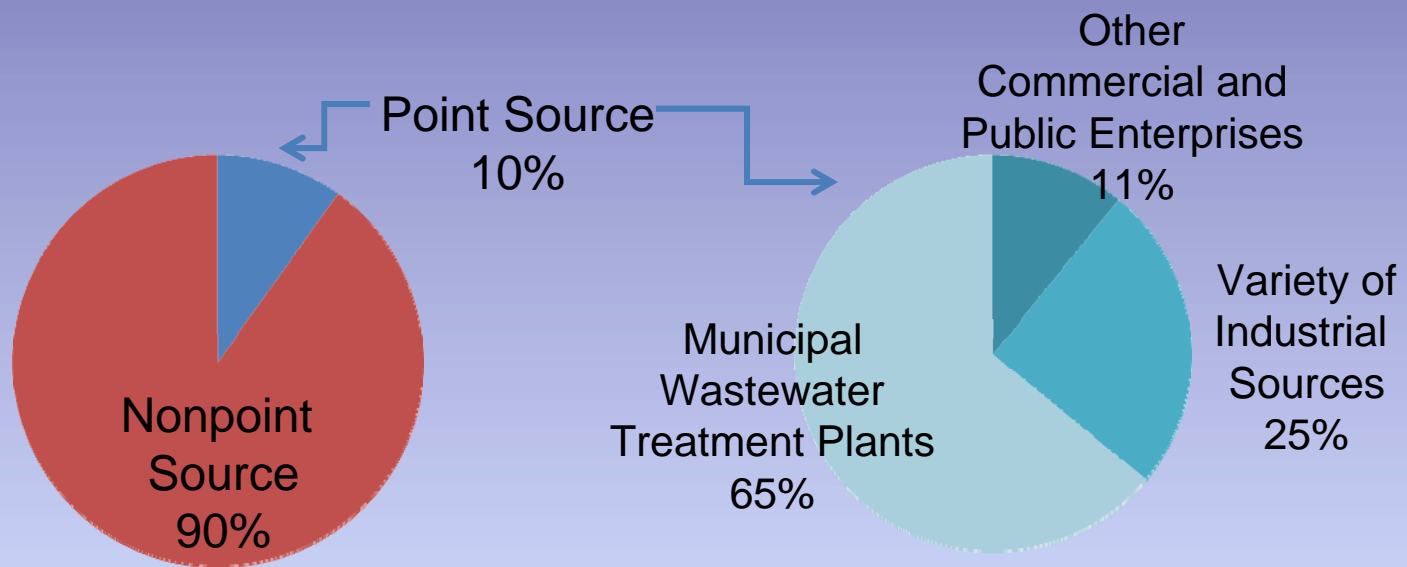
# Nutrient Yields from the Mississippi Basin

## Total Phosphorus



## Total Nitrogen

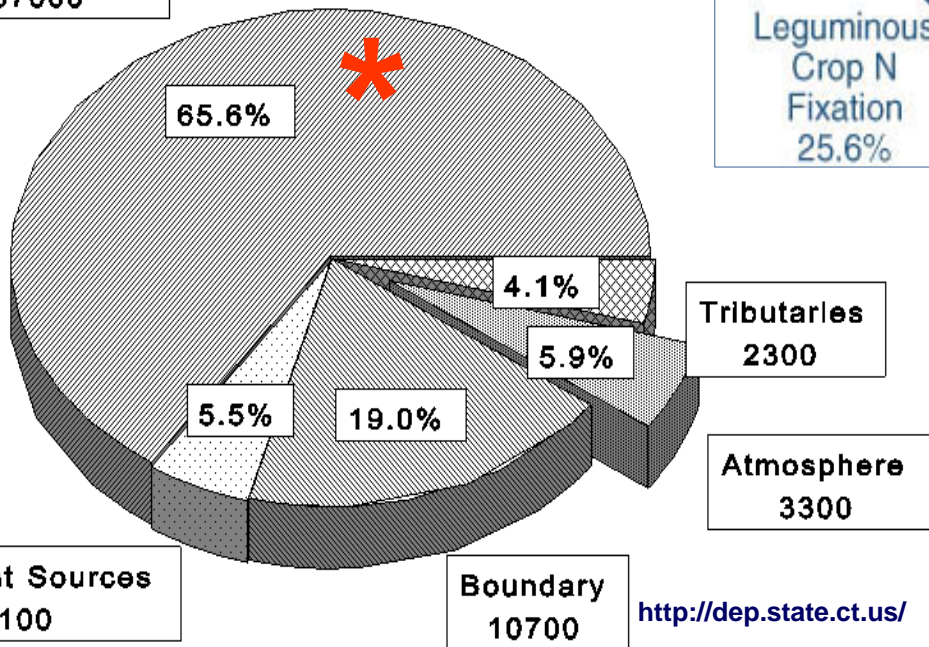




# Nutrient Sources Differ by Watershed

## Long Island Sound (tons N/yr)

Point Sources  
37000

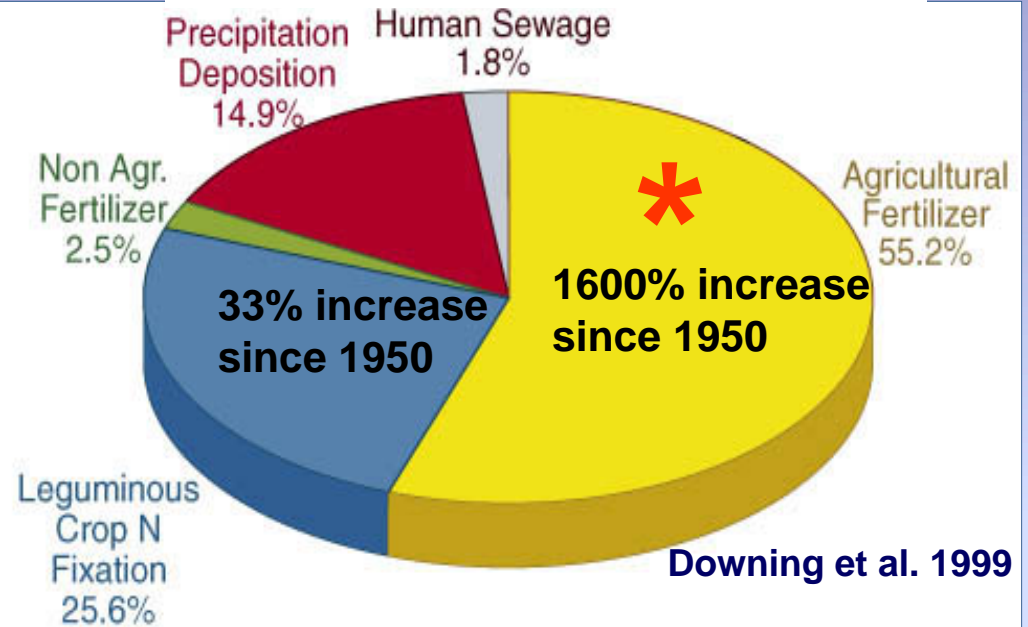


Nonpoint Sources  
3100

Boundary  
10700

<http://dep.state.ct.us/>

## Mississippi River Watershed



Downing et al. 1999



**More Nutrients >>>**  
**More Phytoplankton >>>**  
**More Carbon Reaches the Bottom >>>**  
**More Oxygen Consumed >>>**  
**More Hypoxia**