

Nutrient Threshold Development for Saint Louis Bay, Mississippi: Content and Context

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Project Objectives

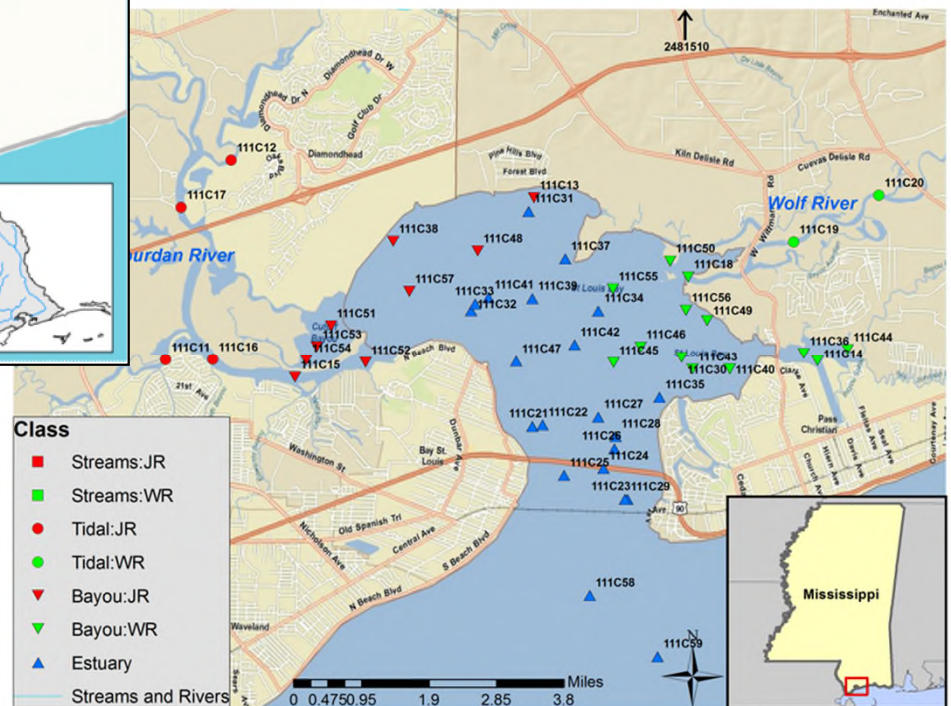
- Calibrate and validate a water quality model for Bay Saint Louis, MS watershed and estuary
- Run nutrient loading scenario gradient to assess response of estuary
- Compare to empirical stressor-response models
- Generate candidate nutrient criteria
- Place in state coastal and regional context
- Contribute to demonstration of approach for deriving nutrient criteria Gulf wide

Bay St. Louis



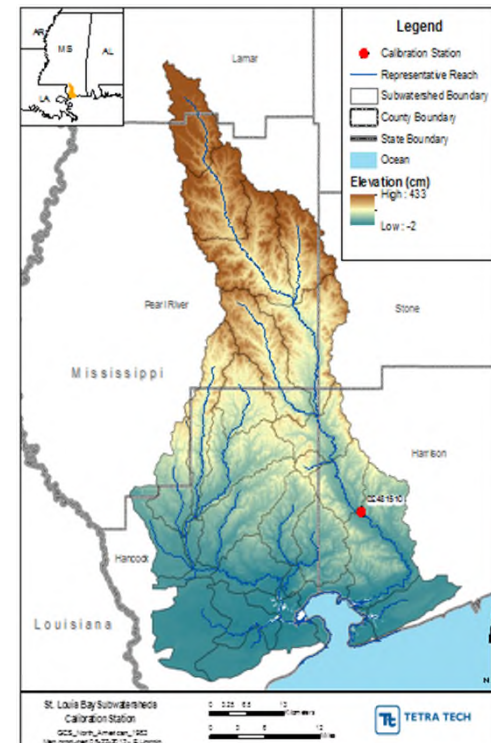
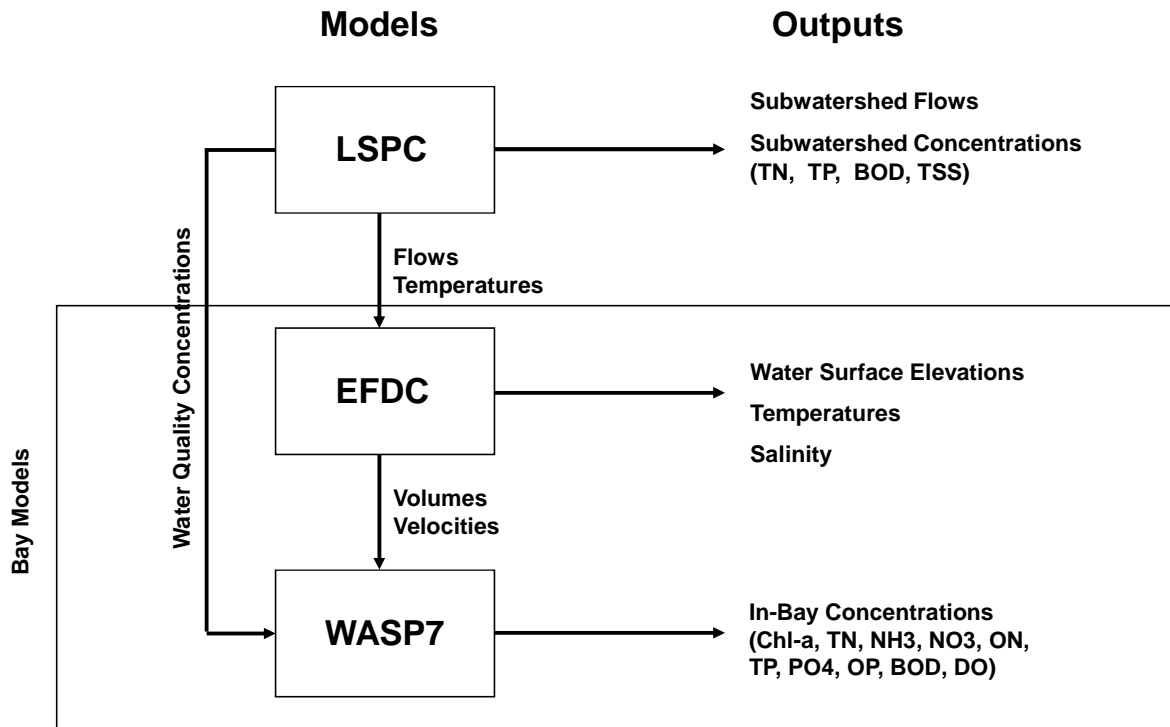
Estuary Location

Sampling Locations



Modeling Efforts – Weeks Bay

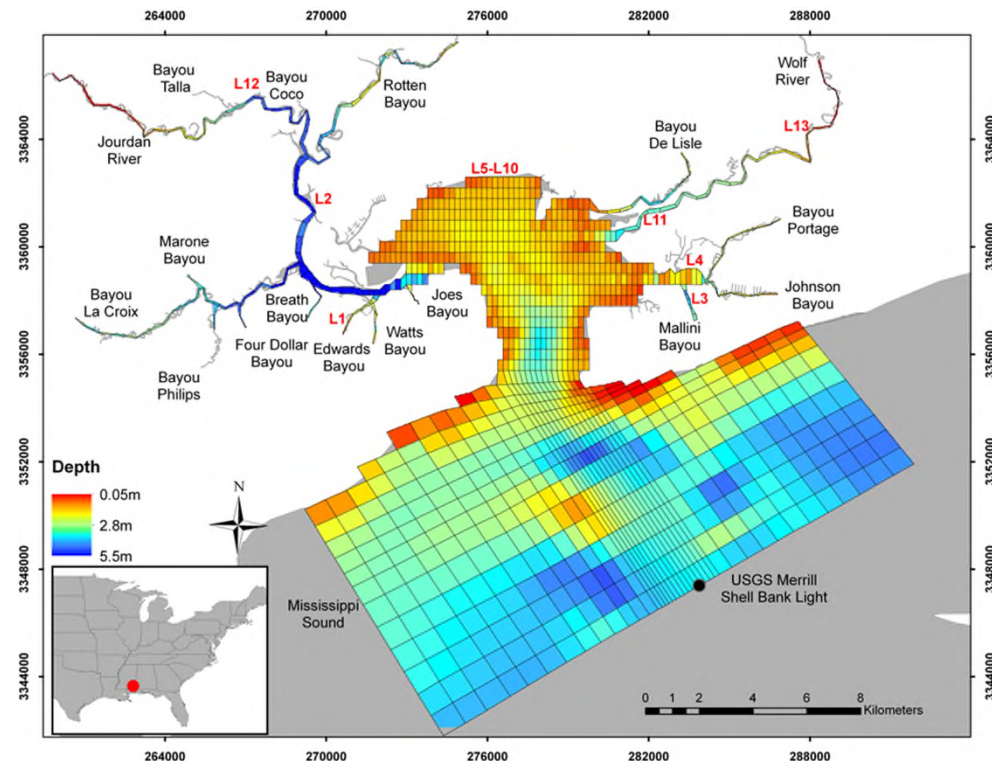
- Linked watershed loading (LSPC), hydrodynamic (EFDC), and water quality (WASP7) models



Modeling Effort – Bay St. Louis

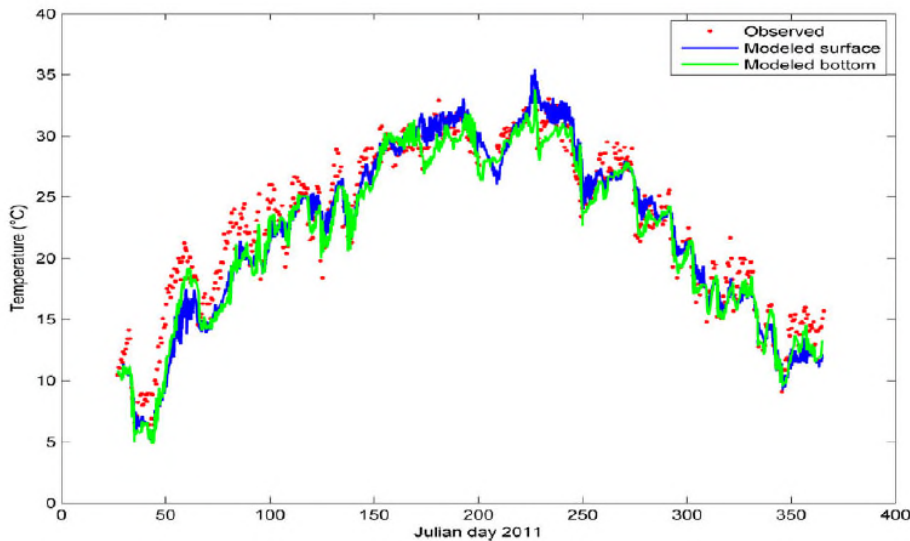
- Updating previously established models
- Models run and scenarios completed

- 0% Human Load
- -50% Current
- Current Load
- +50% Current

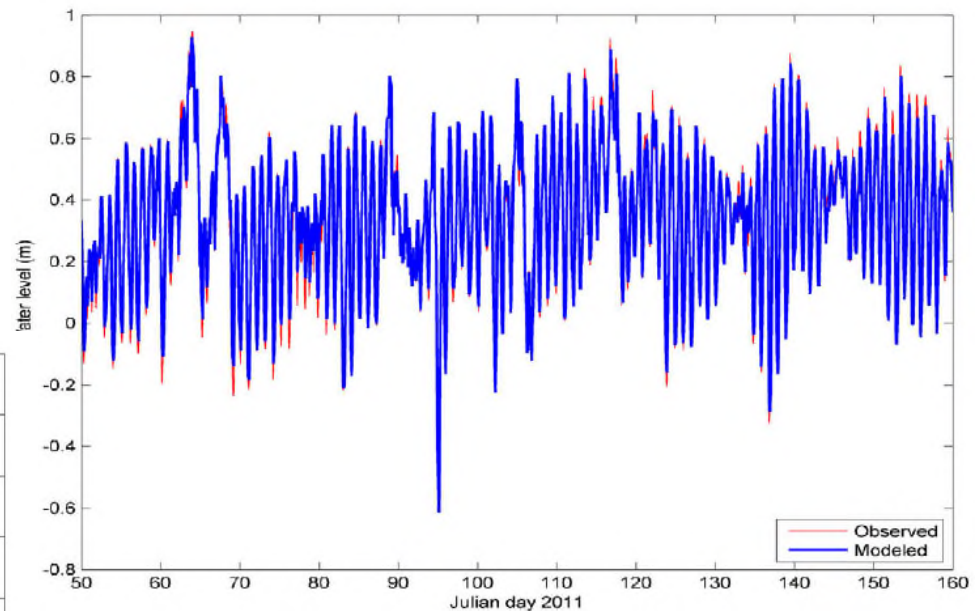


Modeling Effort – Bay St. Louis

- Physical variables are well modeled



Temperature



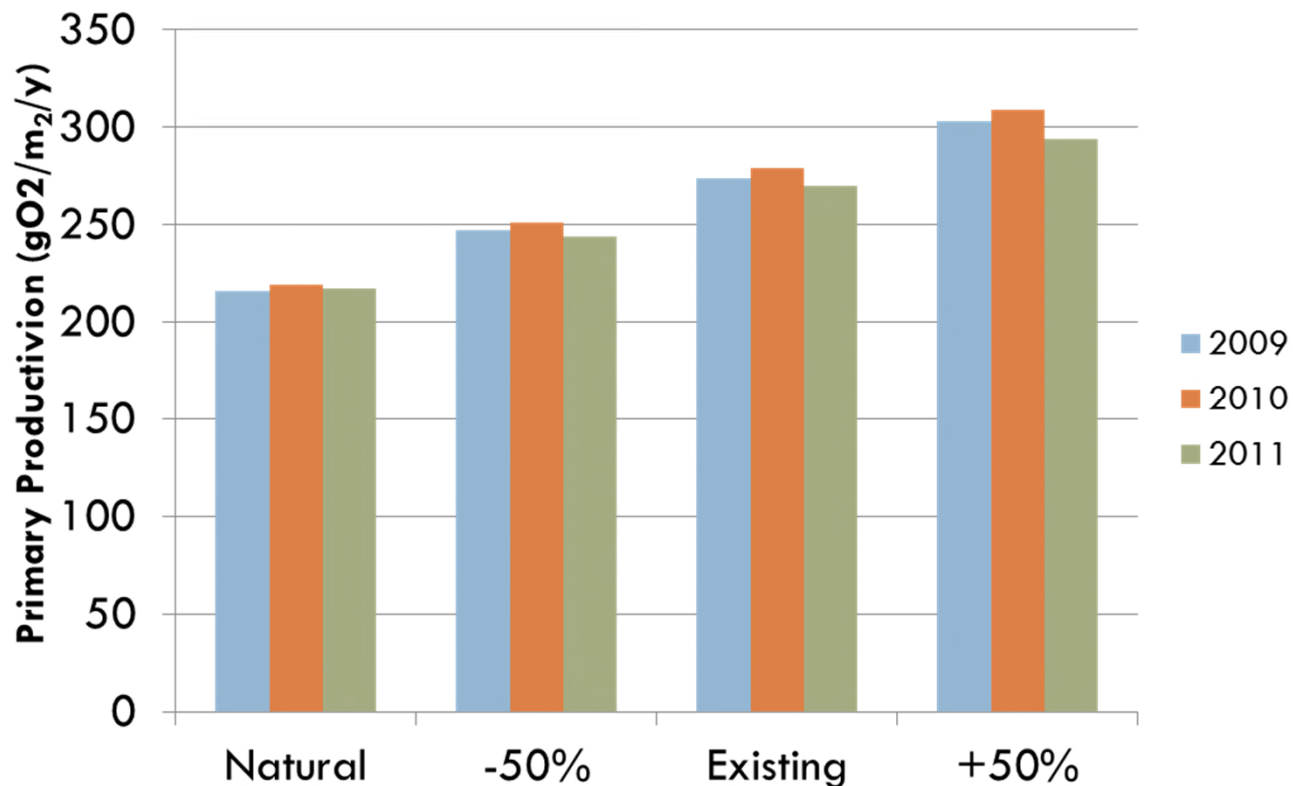
Water Elevation

Modeling Effort – Bay St. Louis

- Chemical variables were accurately modeled as well
- Calibration/validation of water quality model
 - ▣ TP: 82 percent of stations = very good/good
 - ▣ PO_4 : 82 percent of stations = very good/good
 - ▣ OrgN: 94 percent of stations = very good/good
 - ▣ DO: 100 percent of stations = very good/good
 - ▣ TSS: 86 percent of stations = very good/good
 - ▣ Chla: 68 percent of stations = very good/good

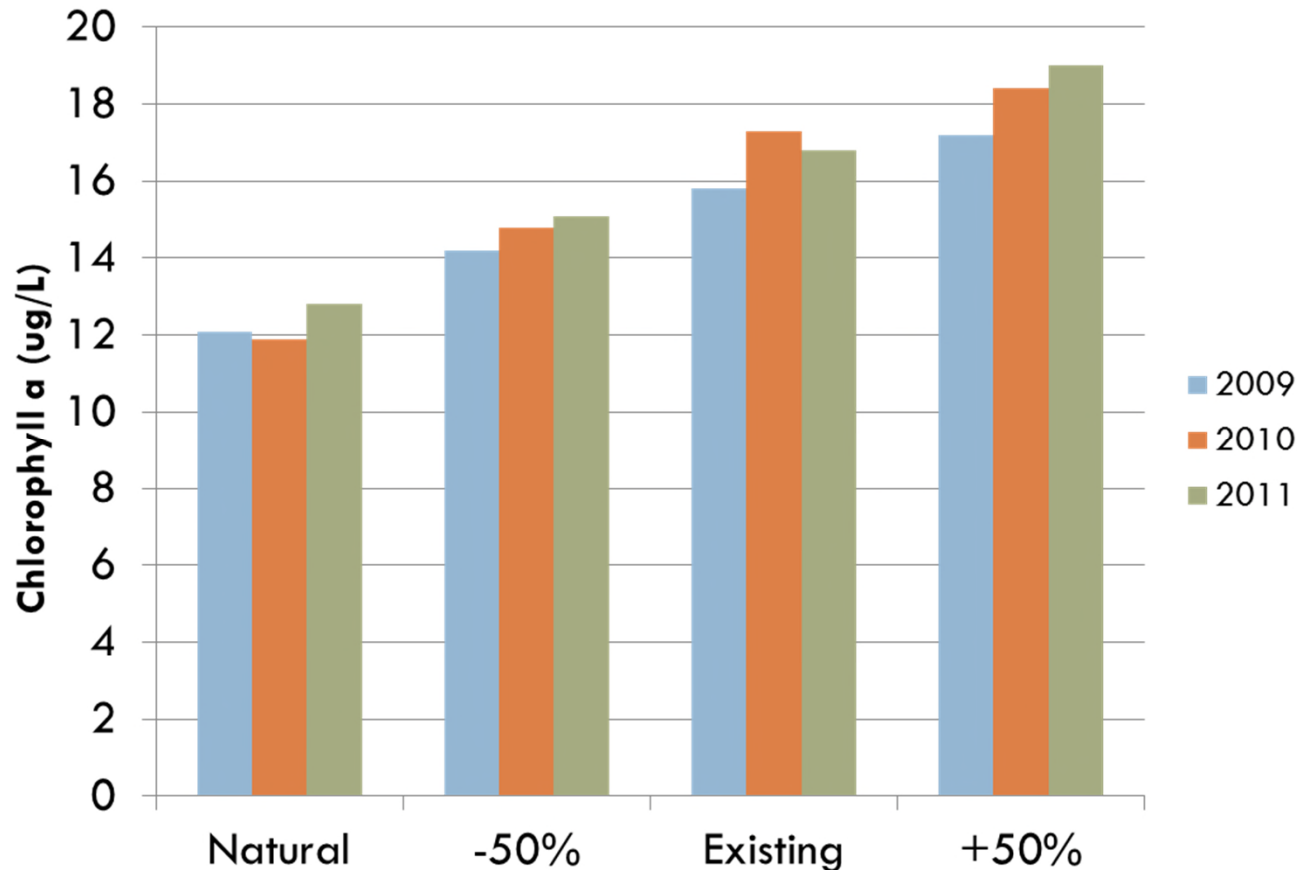
Modeling Effort – Bay St. Louis

- Primary productivity increases 10% under 50% load increase;
- Decreases ~20% under natural condition



Modeling Effort – Bay St. Louis

- 90th %ile Chl *a* increases 9% under 50% increase;
- Decreases ~23% under natural condition



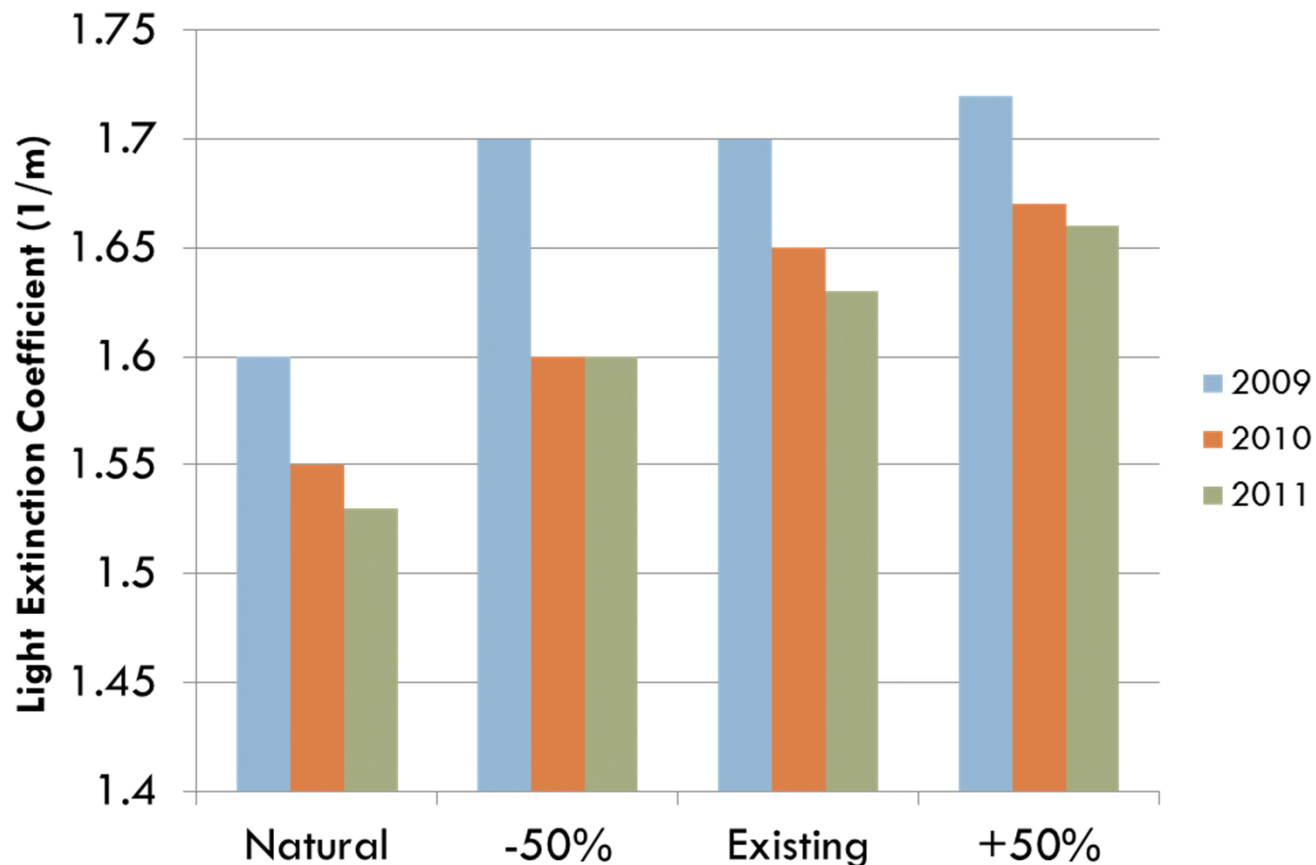
Modeling Effort – Bay St. Louis

- Percent of time DO is below standard shows relatively little response;
- Actually decreases under increased loads
 - ▣ Increase primary production gets flushed from system?

Flow condition	Loading scenario			
	Natural	Existing	-50%	+50%
2009-2011	4.0%	4.5%	4.5%	4.2%

Modeling Effort – Bay St. Louis

- Water clarity decreases marginally

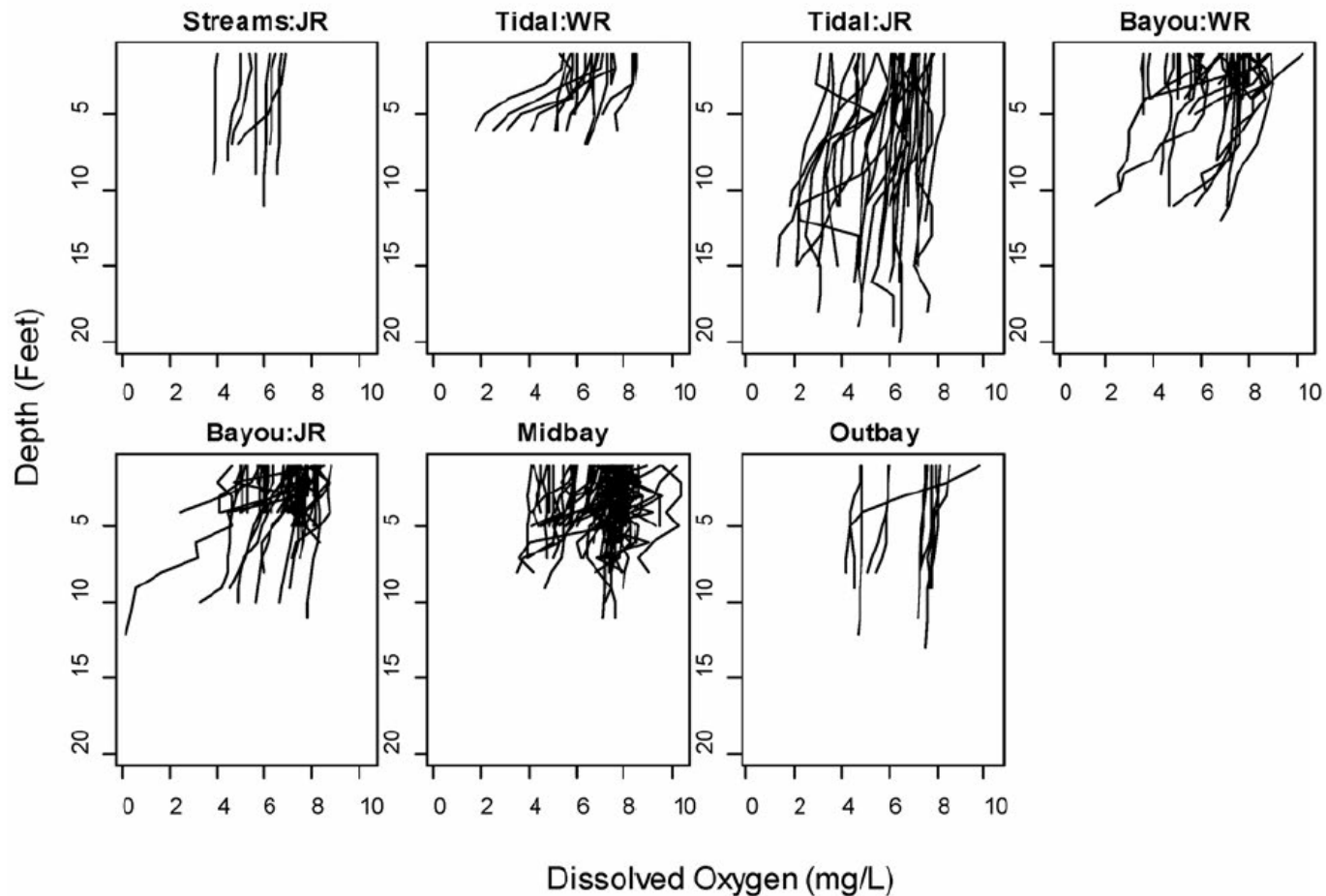


Empirical Models – Bay St. Louis

- Empirical models of monitoring data were also developed
- Used to provide additional line of evidence for threshold development
- Also contributing to larger statewide coastal analysis

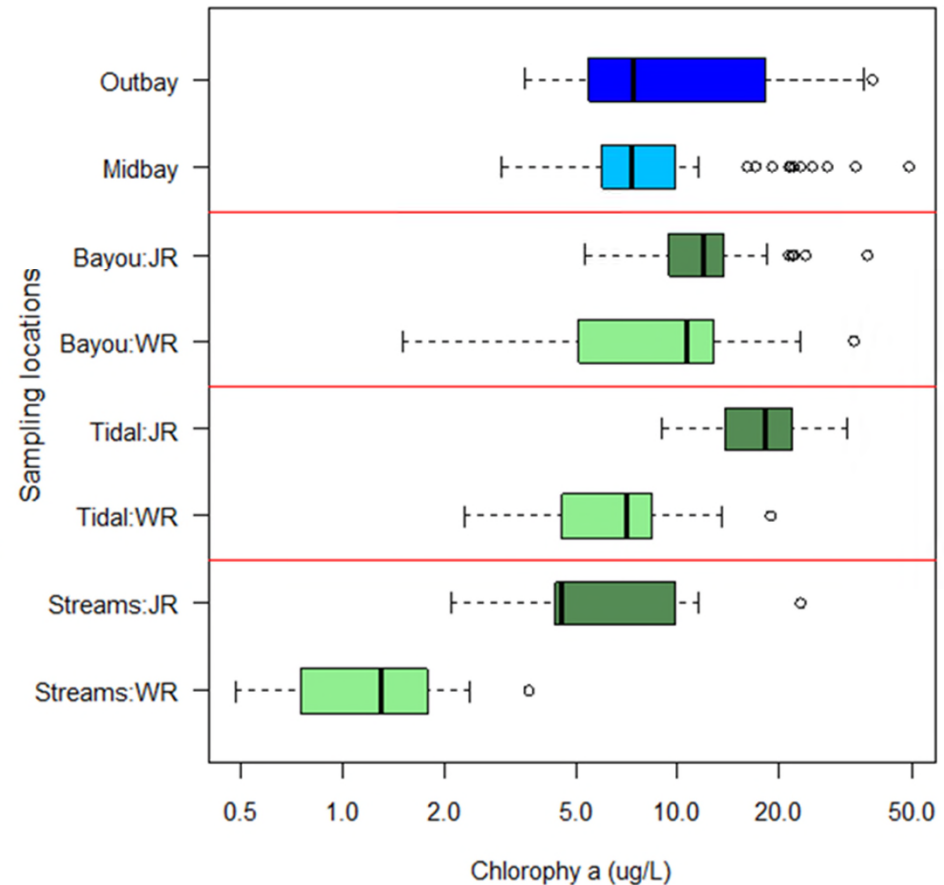
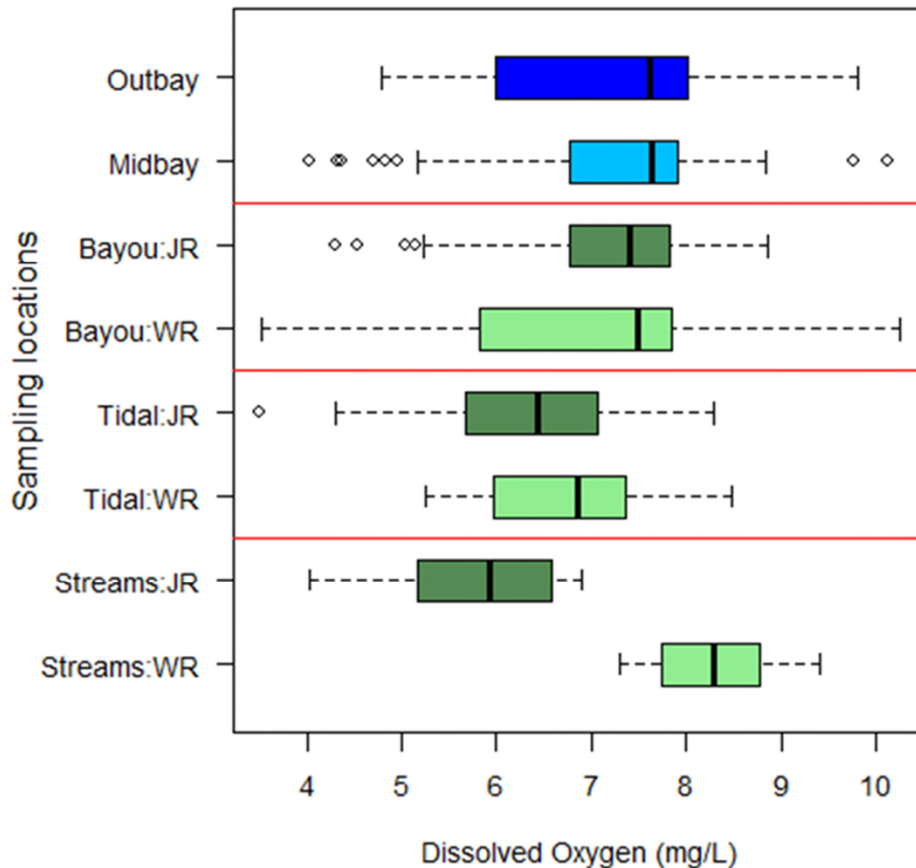
Empirical Models – Bay St. Louis

- Oxygen profiles generally above criteria



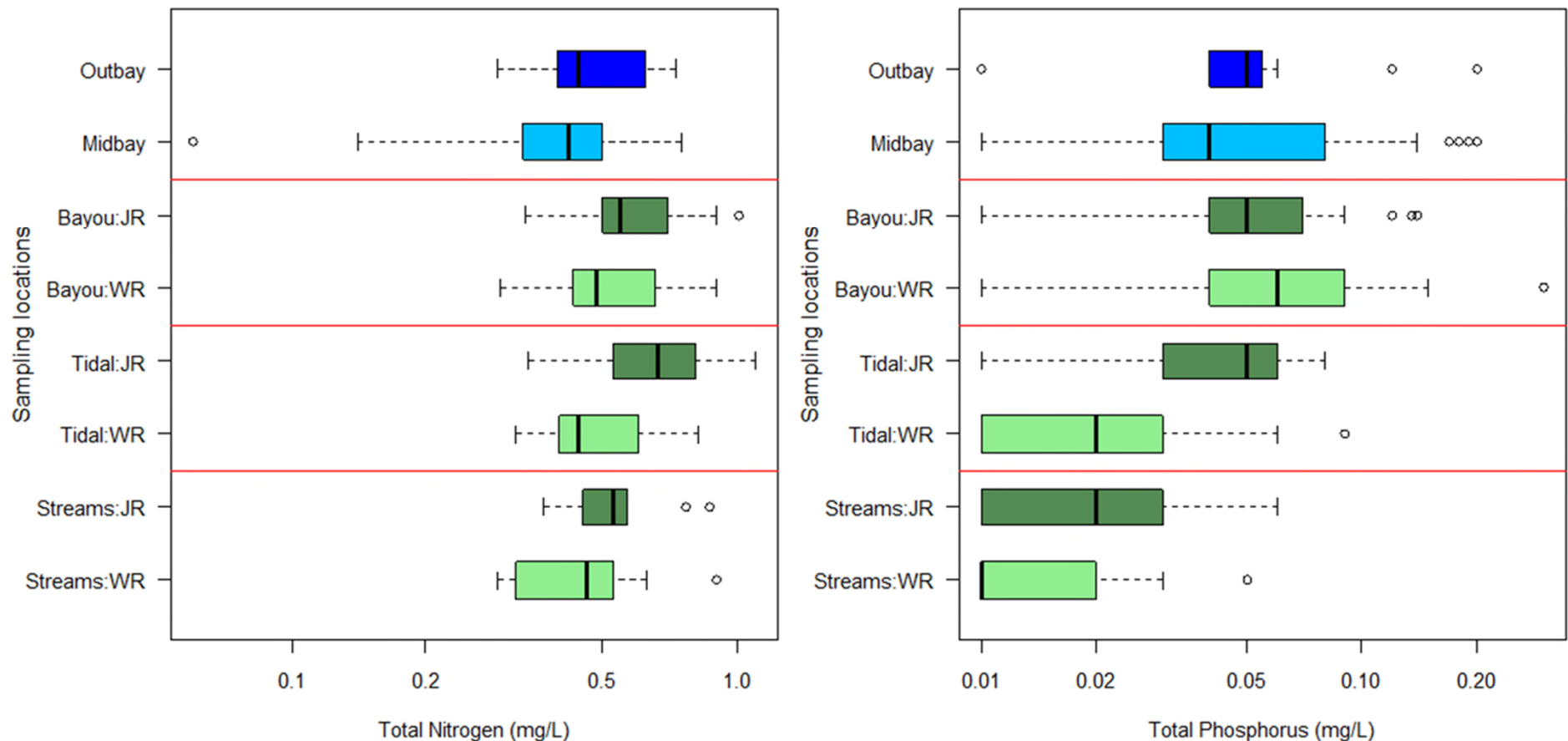
Empirical Models – Bay St. Louis

- Chl a generally moderate, on average



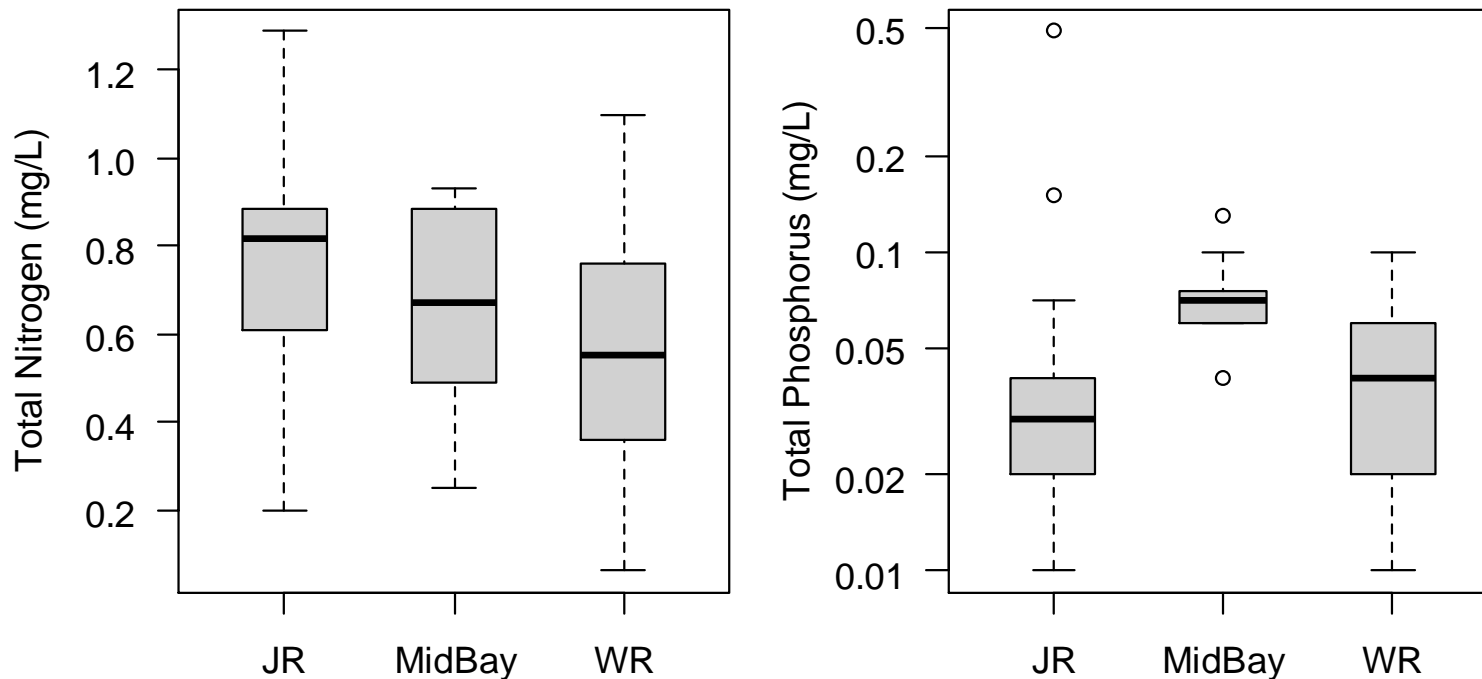
Empirical Models – Bay St. Louis

- TN and TP also generally moderate to low



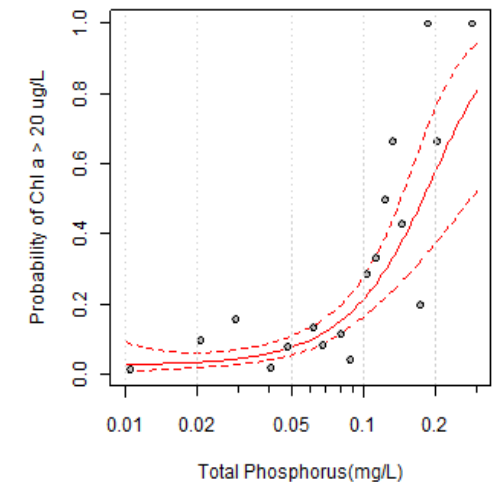
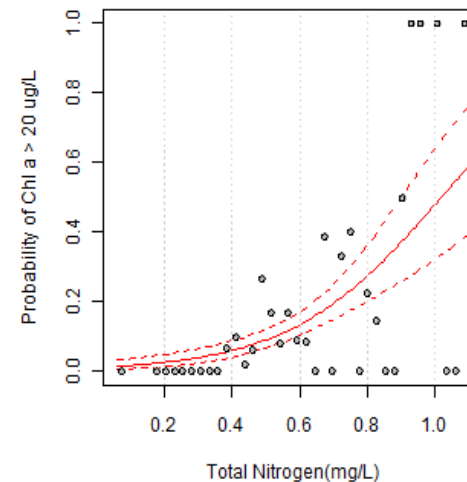
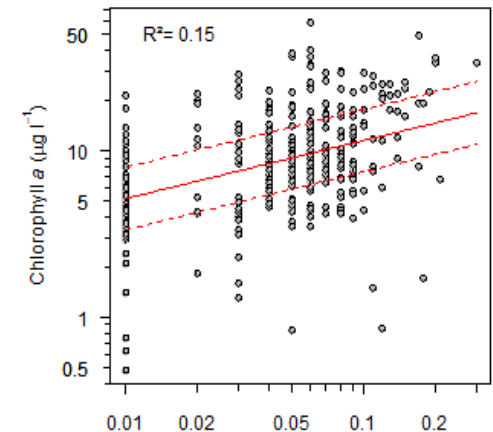
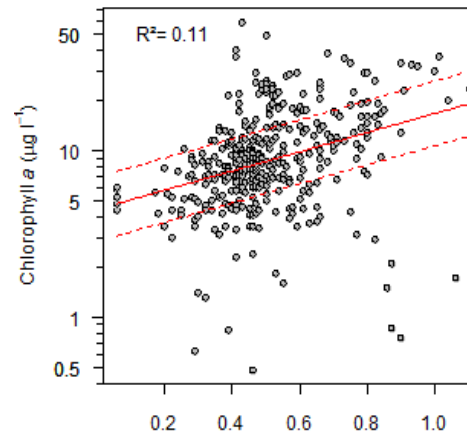
Empirical Models – Bay St. Louis

- Current trends similar to previous data (2005)



Empirical Models – Bay St. Louis

- N and P correlated with Chl a;
- Risk of observations $> 20 \text{ ug/L}$ increases at $\text{TP} = 0.1 \text{ mg/L}$ and $\text{TN} > 0.6\text{-}1.0 \text{ mg/L}$



Bay St. Louis

- Jourdan slightly enriched vs. Wolf and Bay
- Existing condition may be an option
 - ▣ Trophic range: medium based on Chl, TP, and TN
 - ▣ No evidence, that we've seen, for excessive nutrient effects
 - ▣ Gulf Benthic Index did not respond to nutrient gradient.

Nutrient Thresholds		
	Mechanistic	Empirical
TN	0.66	0.56
TP	0.065	0.06
Chl_a	16	11

Comparing Results

□ Thresholds in context

	Saint Louis Bay		MS Coastal	Pensacola (Oligo)	Medium Trophic
	Process	Empirical			
TN	0.66	0.56	<1.0	0.5	0.1 - 1.0
TP	0.065	0.06	<0.1	0.03	0.01 - 0.1
Chl α	16	11		8	5 - 20
	90th %	Means	Medians	Summer Medians	90th %

Larger Context

□ Statewide analysis

- ▣ Models and empirical analysis are being put into state coastal water quality empirical modeling context;
- ▣ Supporting values being derived from statewide analysis;
- ▣ Pursuing other water quality model information for other major MS estuaries.

□ Gulf-wide efforts

- ▣ GOMA pilots: e.g., Bay St. Louis, MS; Weeks Bay, AL; Mission-Aransas and Galveston Bays, TX
- ▣ Florida estuaries – Florida Rule
- ▣ Model output growing, will inform regional thresholds analysis.

Thanks

Reports Available:

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Sources, Fate, Transport, and Effects (SFTE) of Nutrients as a Basis for Protective Criteria in Estuarine and Near-Coastal Waters

Saint Louis Bay, Mississippi Pilot Study

