

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

Michael Paul, Sam Stribling

Tetra Tech, Inc.

Kim Caviness

Mississippi DEQ

Rene Camacho, Lei Zheng

Tetra Tech, Inc.

Project Objectives

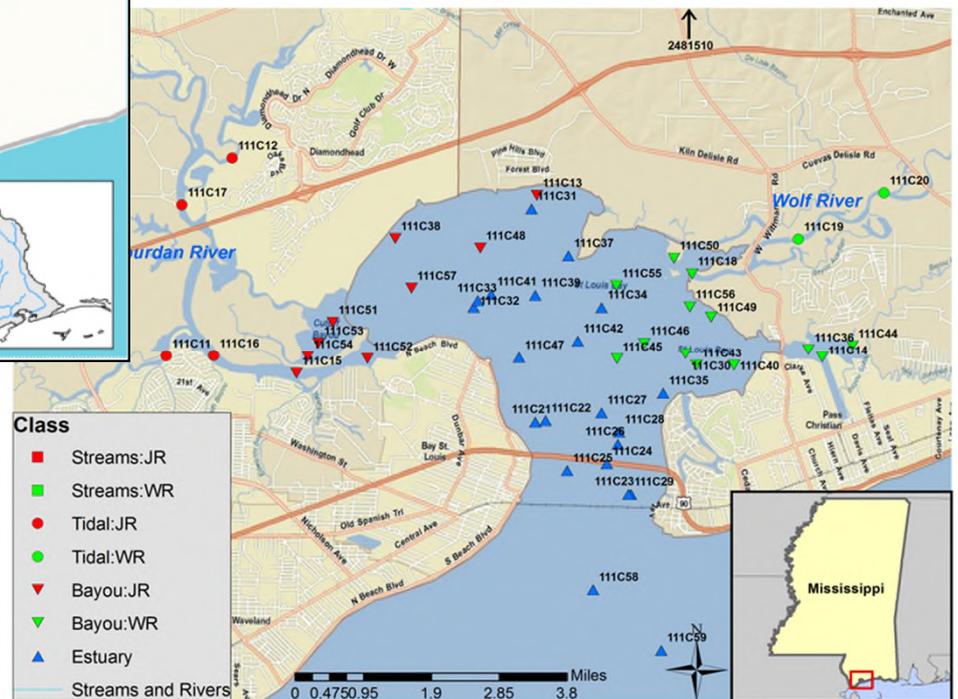
- Calibrate and validate a water quality model for Bay Saint Louis, MS watershed and estuary
- Run nutrient loading scenario gradient to assess response of estuary
- Compare to empirical stressor-response models
- Generate candidate nutrient criteria
- Place in state coastal and regional context
- Contribute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

Bay St. Louis



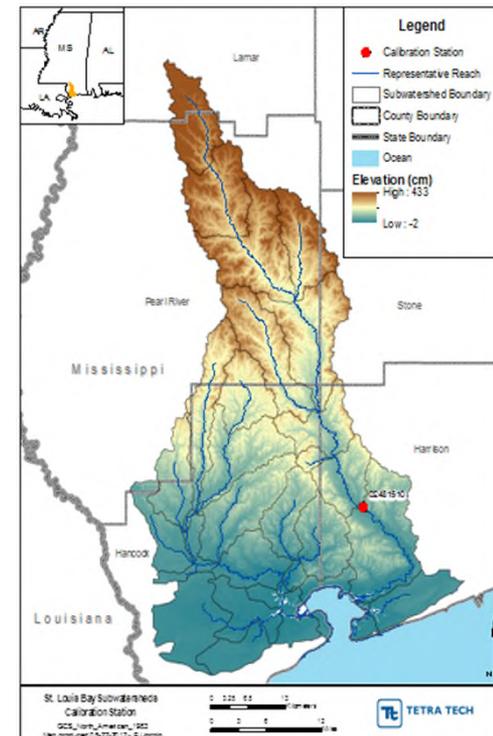
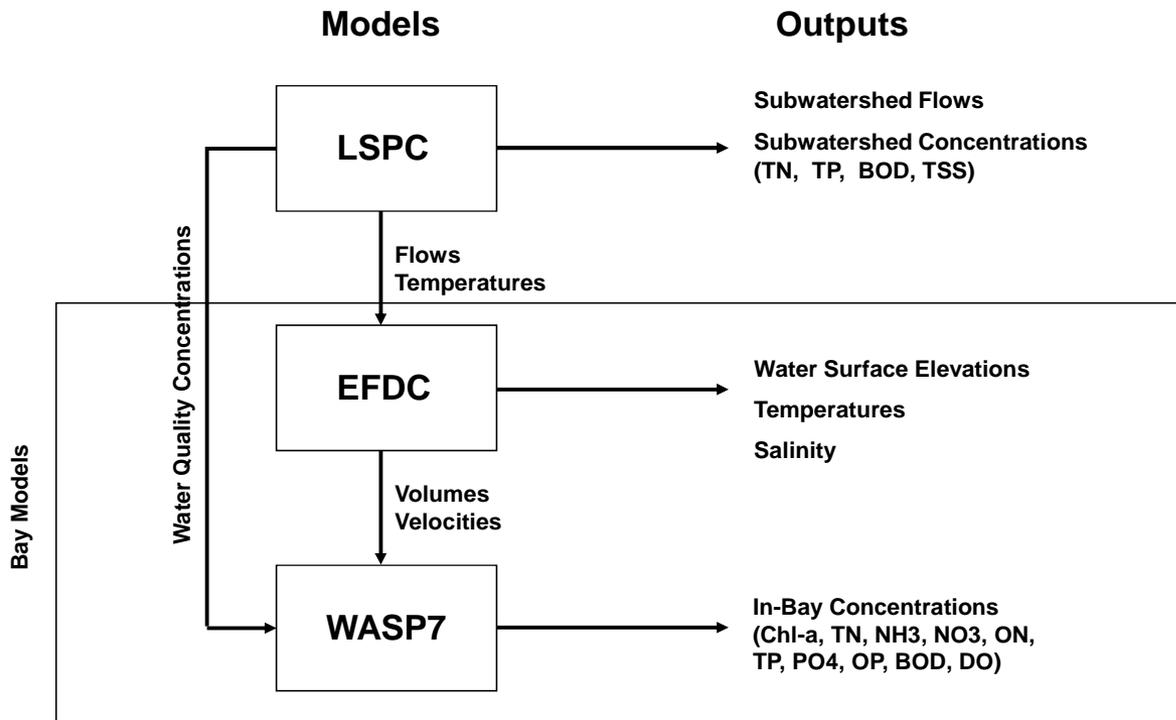
Estuary Location

Sampling Locations



Modeling Efforts – Weeks Bay

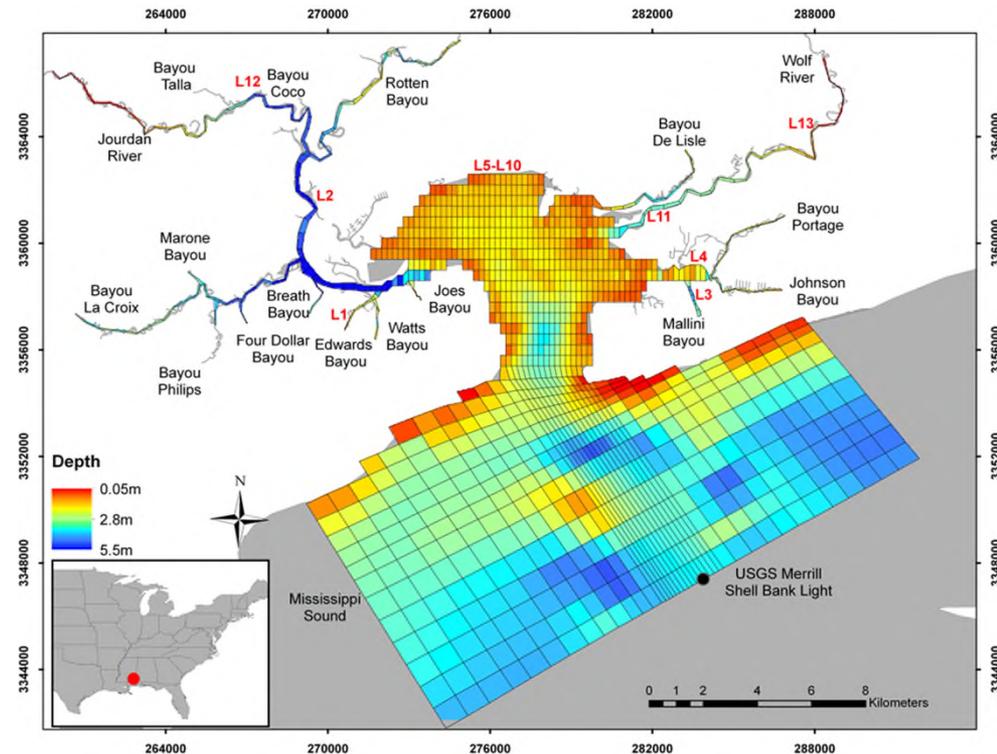
- Linked watershed loading (LSPC), hydrodynamic (EFDC), and water quality (WASP7) models



Modeling Effort – Bay St. Louis

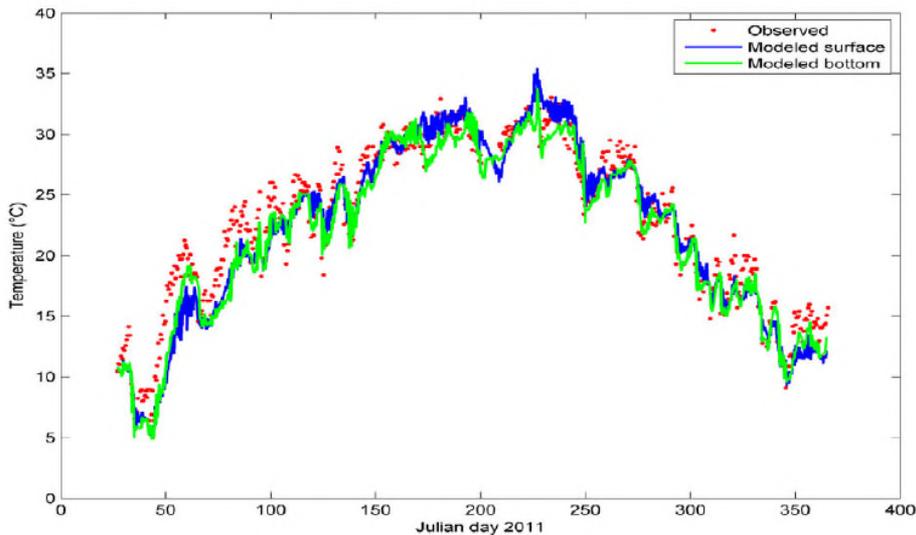
- Updating previously established models
- Models run and scenarios completed

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

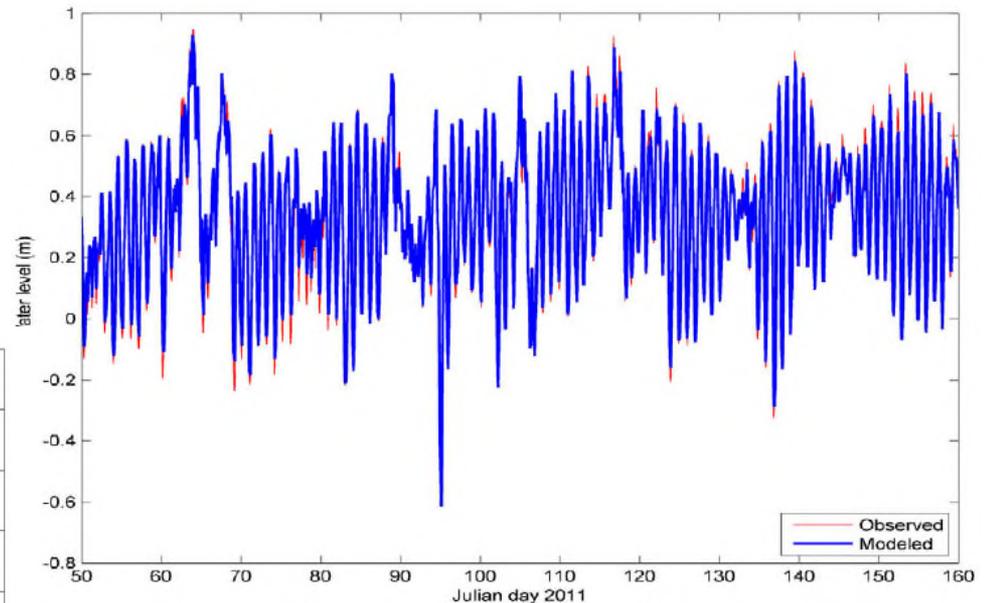


Modeling Effort – Bay St. Louis

- Physical variables are well modeled



Temperature



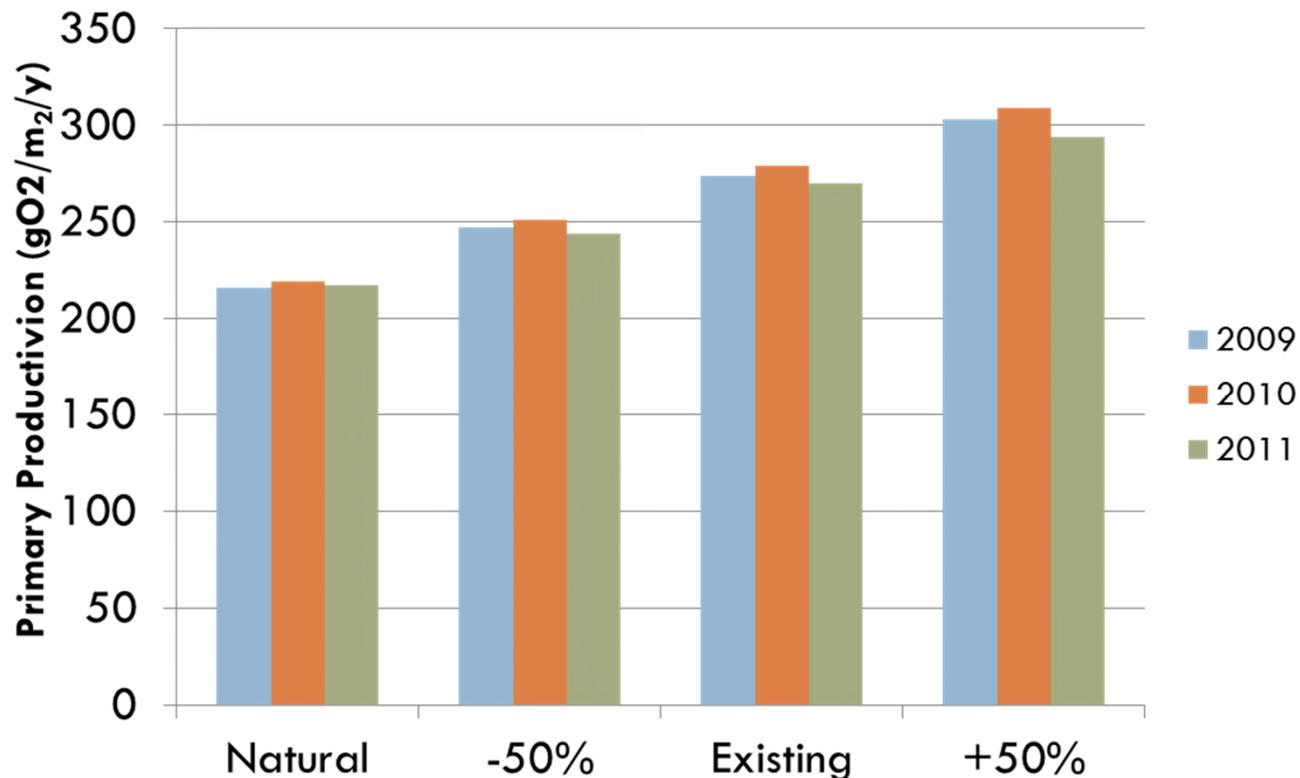
Water Elevation

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

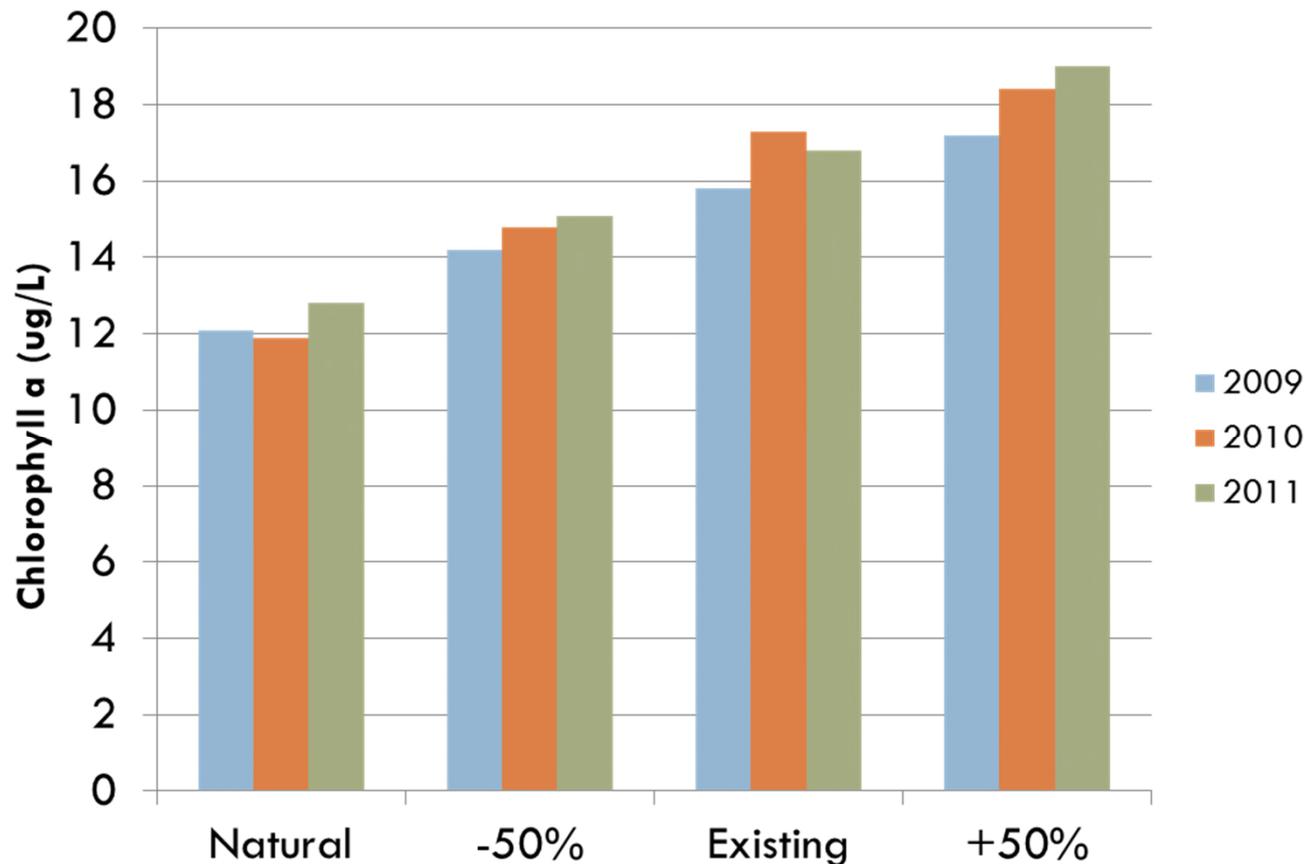
Modeling Effort – Bay St. Louis

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



Modeling Effort – Bay St. Louis

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



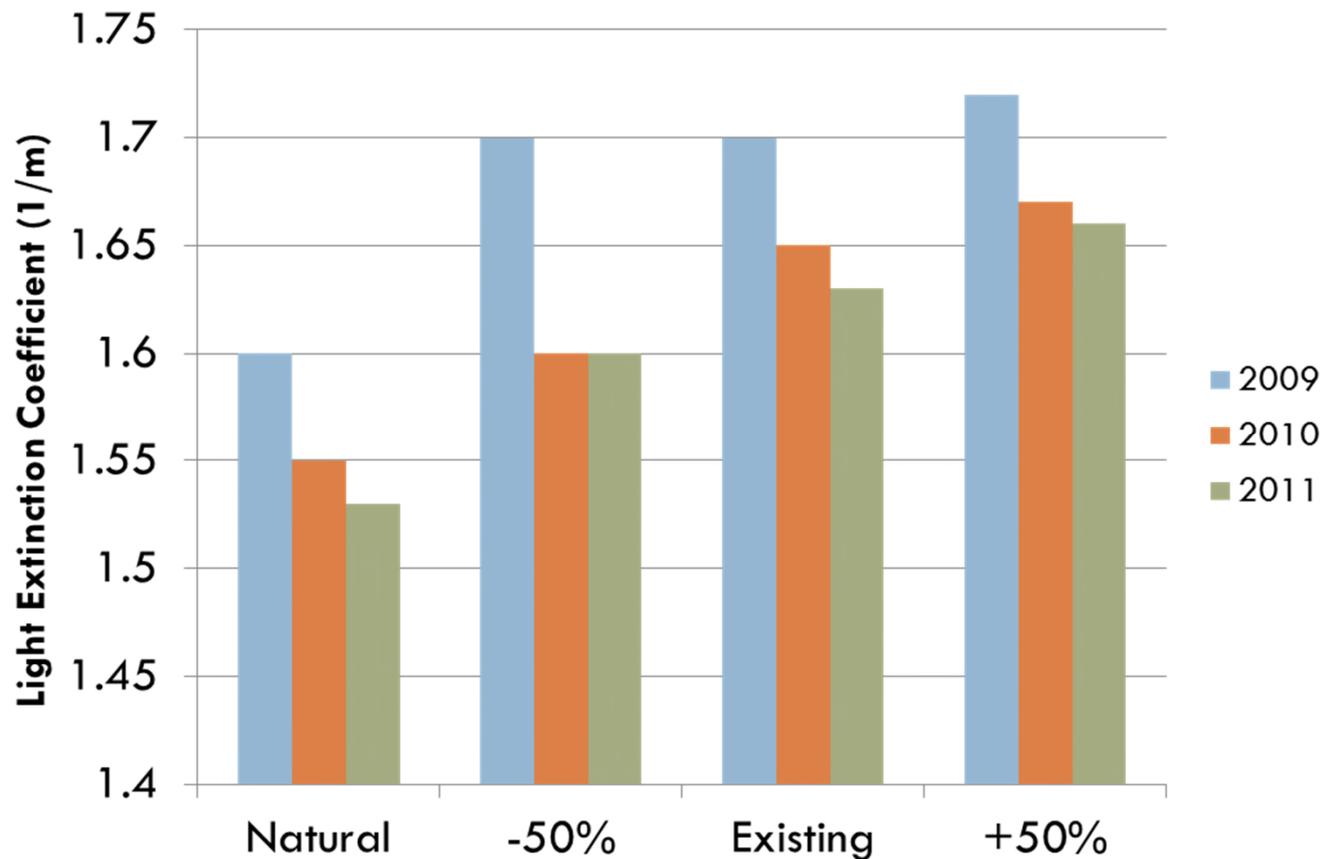
Modeling Effort – Bay St. Louis

- 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

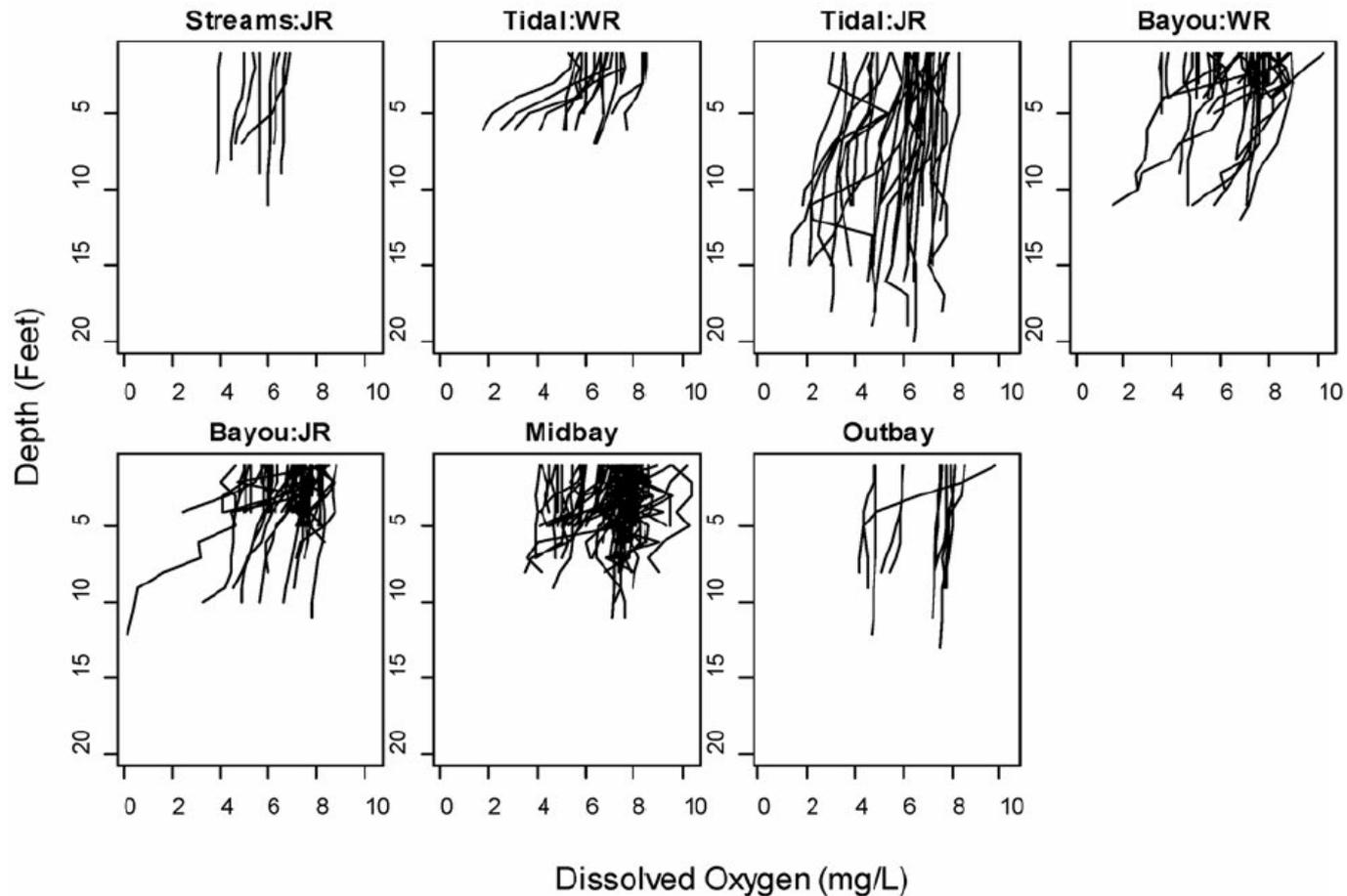


Empirical Models – Bay St. Louis

- 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

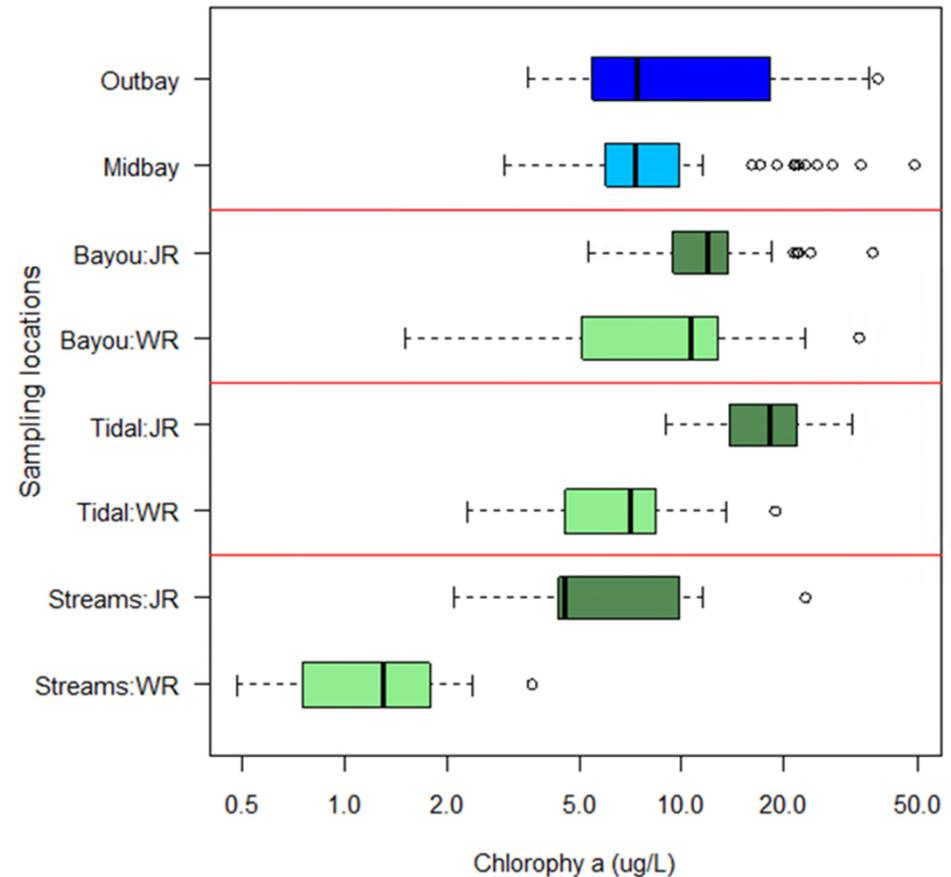
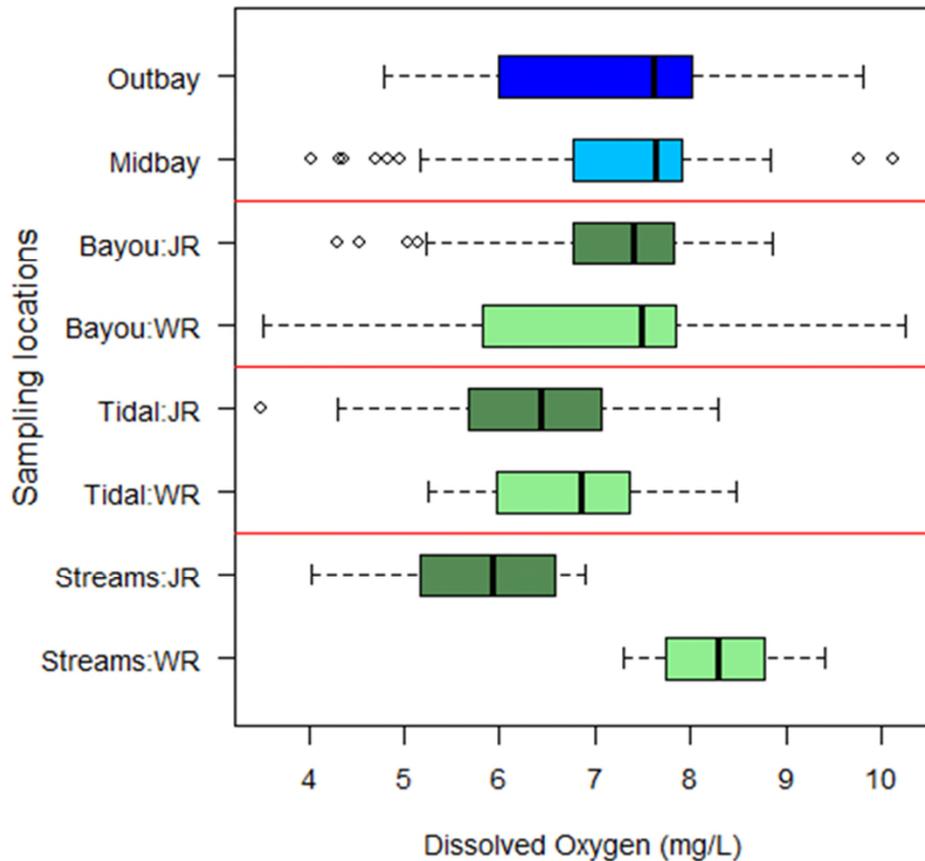
Empirical Models – Bay St. Louis

- Oxygen profiles generally above criteria



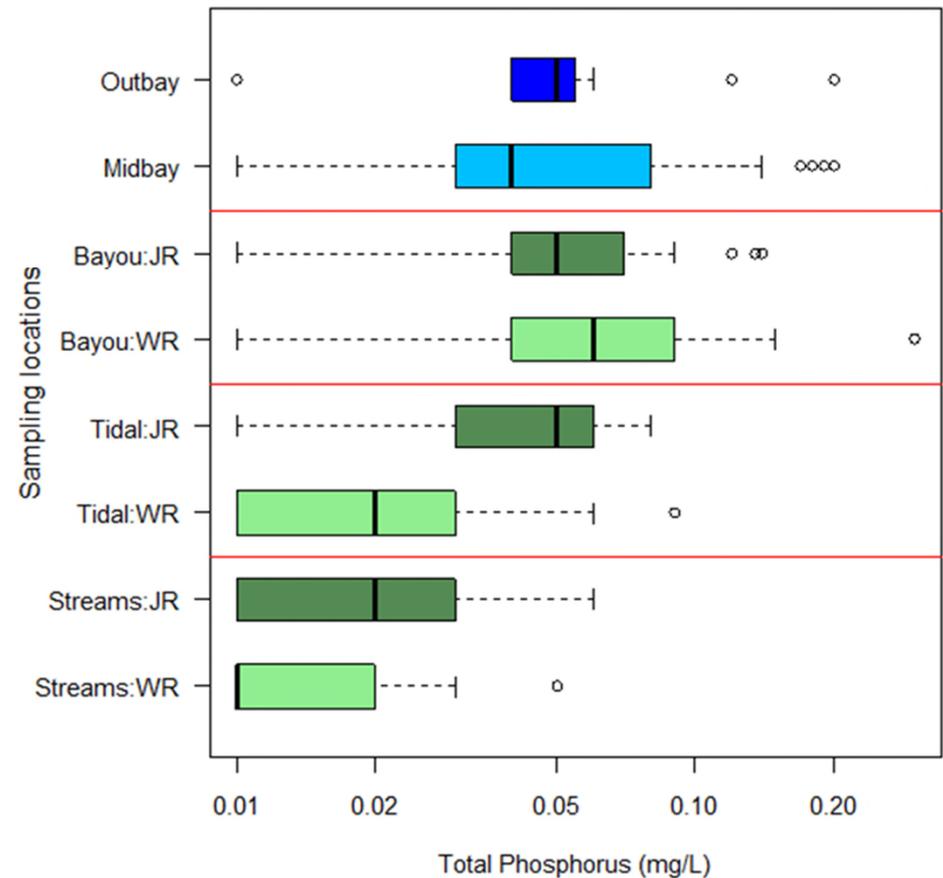
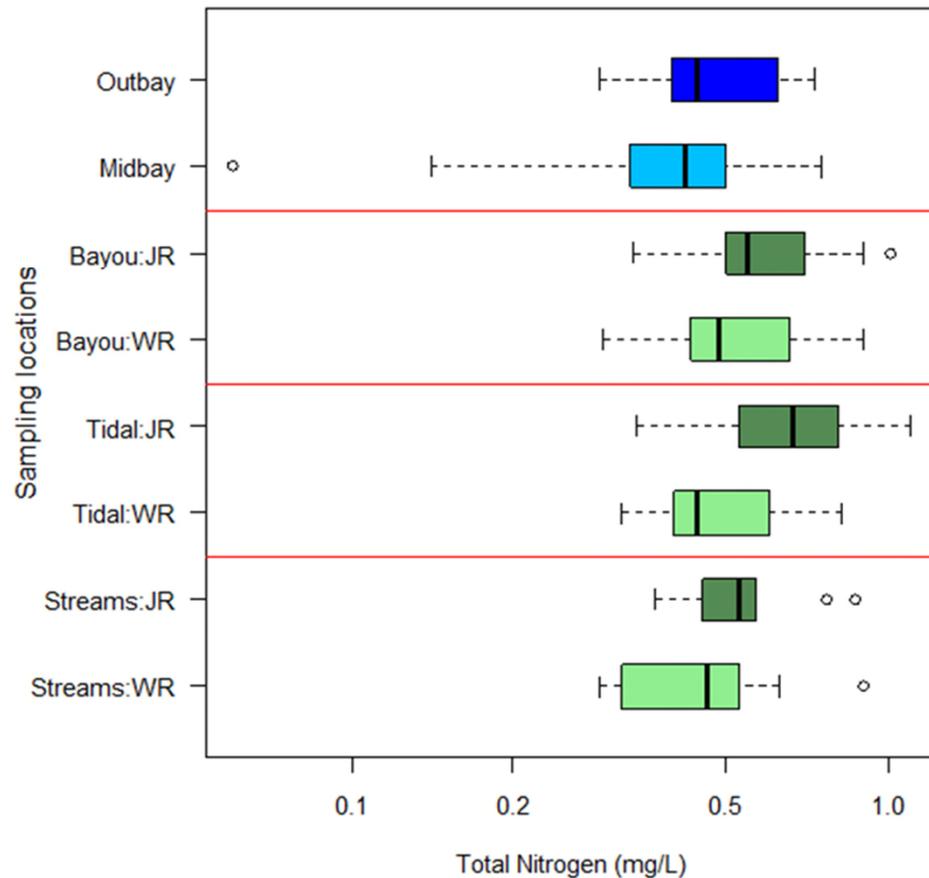
Empirical Models – Bay St. Louis

- Chl a generally moderate, on average



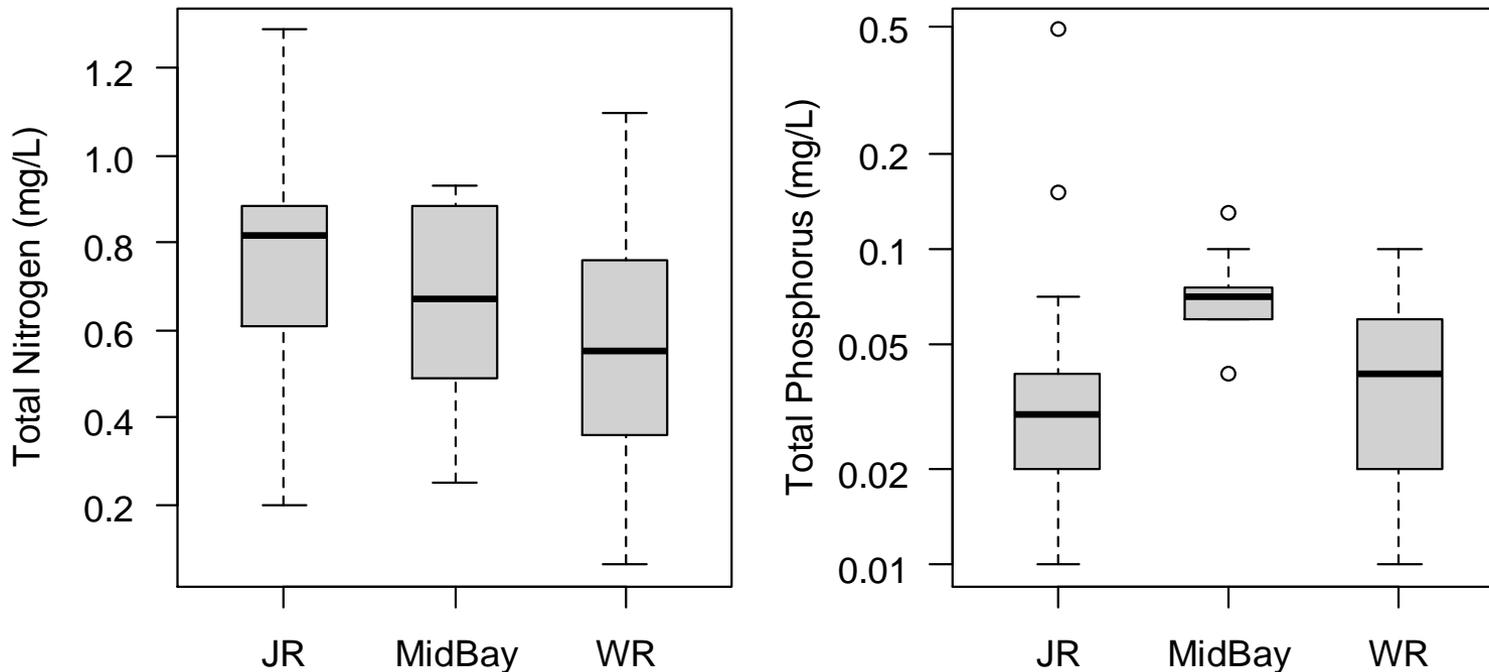
Empirical Models – Bay St. Louis

- TN and TP also generally moderate to low



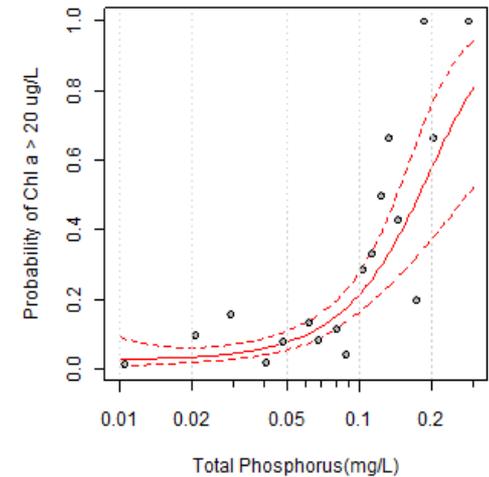
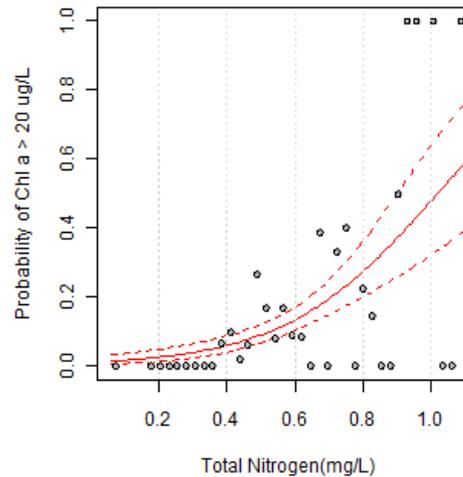
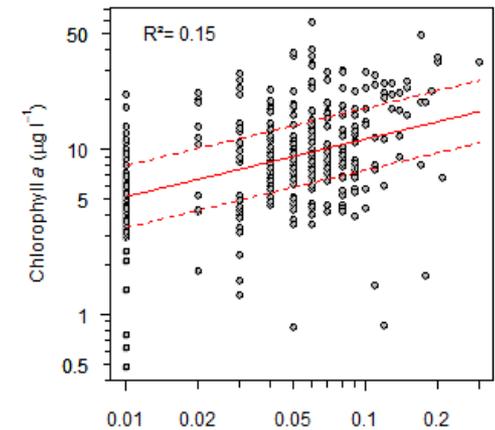
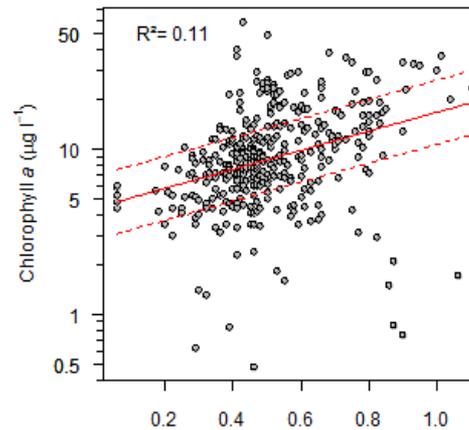
Empirical Models – Bay St. Louis

- Current trends similar to previous data (2005)



Empirical Models – Bay St. Louis

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

Contact

Kim_Caviness@deq.state.ms.us

601-961-5390

MS DEQ

Michael.Paul@tetratech.com

910-485-2073

James.Stribling@tetratech.com

410-902-3159

Tetra Tech, Inc.

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



Prepared for



Gulf of Mexico Alliance
Nutrient Priorities Issues Team

Prepared by



TETRA TECH

Tetra Tech, Inc.
Center for Ecological Sciences
400 Red Brook Boulevard, Suite 200
Owings Mills, MD 21117-5172

Under the direction of



Mississippi Department of Environmental Quality
Office of Pollution Control
515 Amite Street
Jackson, MS 39201



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