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Lake Okeechobee Tributary Water Quality Trend Analysis

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Topic

- Introduction
- Objectives
- Method
- Basin and Site Results
- Summary and Discussion



Lake Okeechobee Watershed History of Activities

- 1950s Agricultural Growth in the Watershed
- 1960s Watershed drainage and Agricultural Development
- 1970s Environmental Awareness, WQ Research
- 1979: Interim Action Plan - divert EAA water
- 1980: TC/NS Federal Rural Clean Waters Program- BMPs
- 1987: FDEP Dairy Rule
- 1989: Dairy Buy-out Program



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Lake Okeechobee Watershed History of Activities (cont.)

- 1989: SWIM Plan/WOD Regulatory Program
- 1998: South Florida Ecosystem Task Force LO Issue Team Action Plan
- 1999: Comprehensive Everglades Restoration Program Lake Okeechobee Watershed Project
- 2000: Protection Program Legislation (LOPA)
- 2001: LO Phosphorus TMDL established
- 2005: LO and Estuary Recovery Program
- 2007: Northern Everglades Legislation



Study Objectives

- **Define Trends in Phosphorus and Nitrogen**
 - **Basin Scale**
 - **Long term monitoring sites**
 - **Dairy Sites**
 - **Basin Outflows**
- **Assess the effectiveness of BMPs**
 - **Link trends to current land use data**

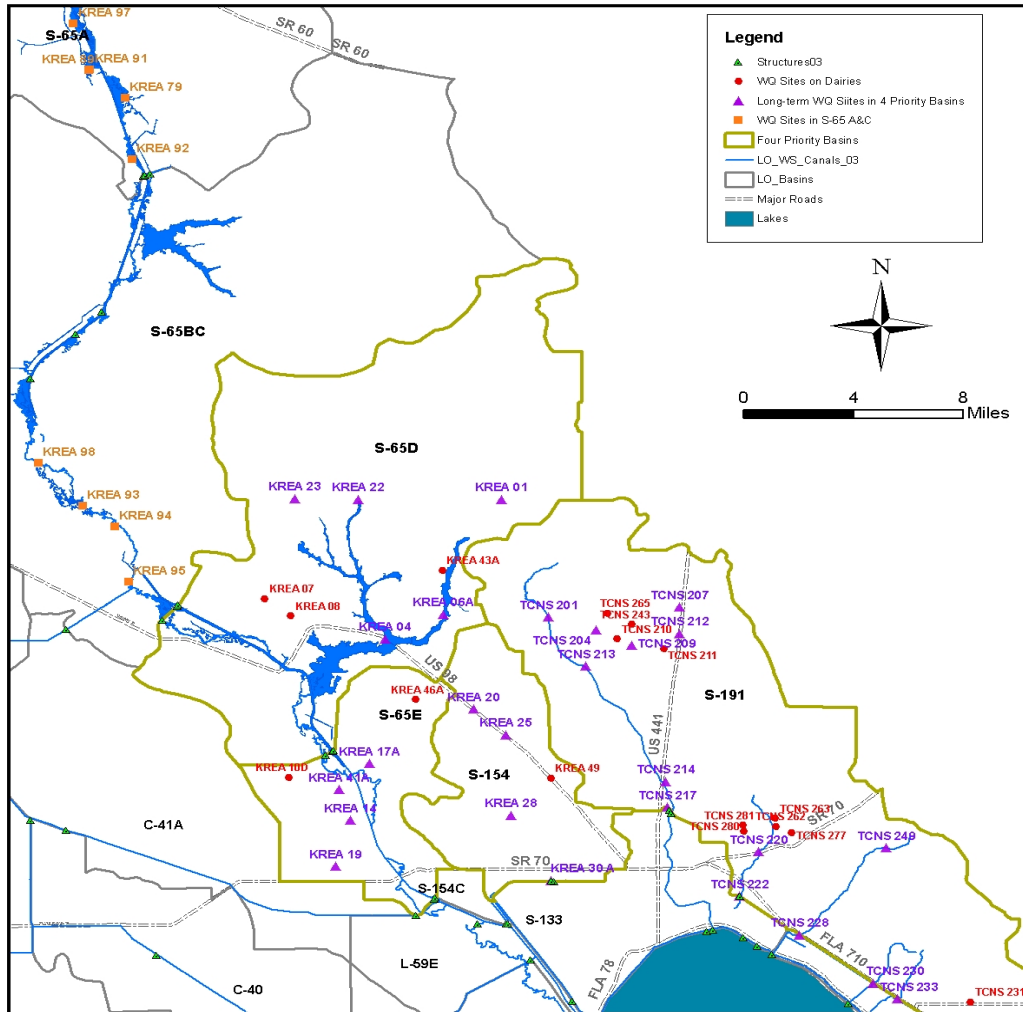


Method

- **Box and whisker plots**
 - **Baseline**
 - 1991 to 2001
 - **Implementation**
 - 2002 to 2007
 - Lake Okeechobee Protection Act of 2000
 - Extensive BMPs put in place
- **Seasonal Kendall's Tau test**
 - Monthly values from 1991 to 2007
 - $p\text{-value} < 0.05$



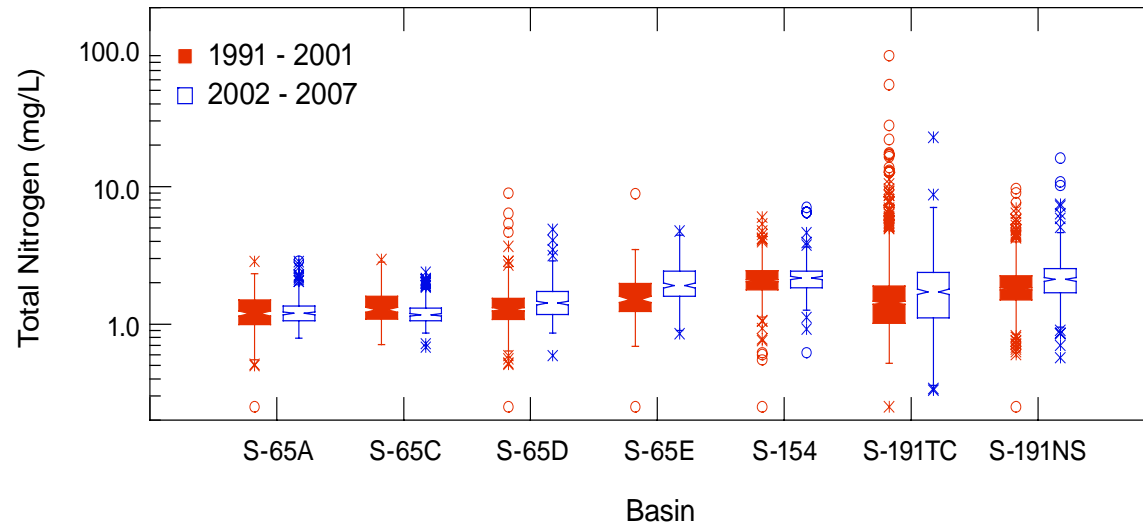
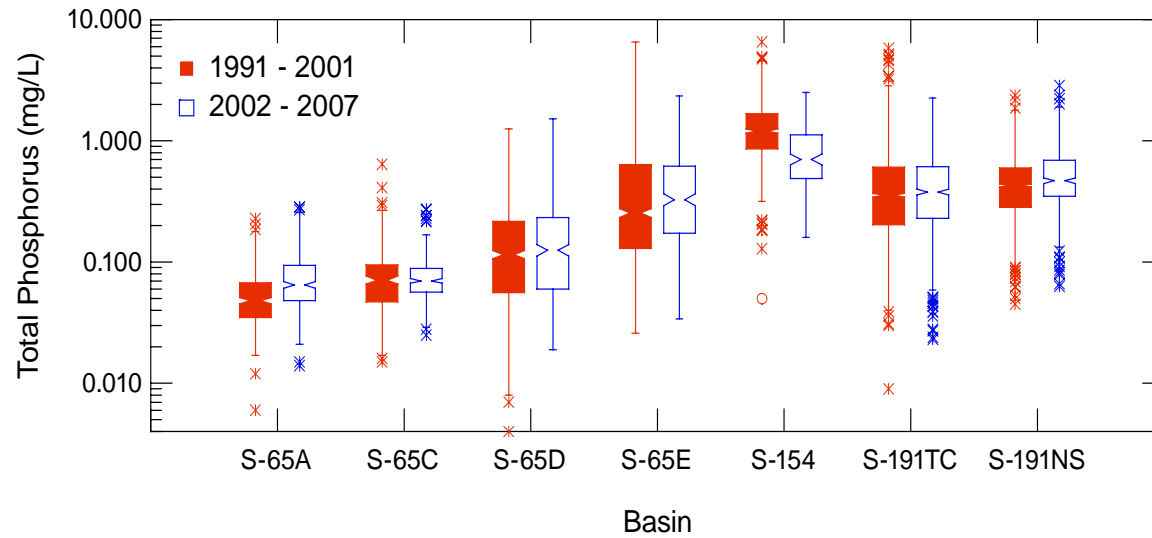
Monitoring Network



- **Priority basins**
 - 28 sites
 - S-191,
 - S-154,
 - S-65D
 - S-65E.
- **Kissimee River**
 - 9 sites
 - Tributaries of S-65 A and BC.
- **Dairy operations**
 - 16 sites
 - Phosphorus only



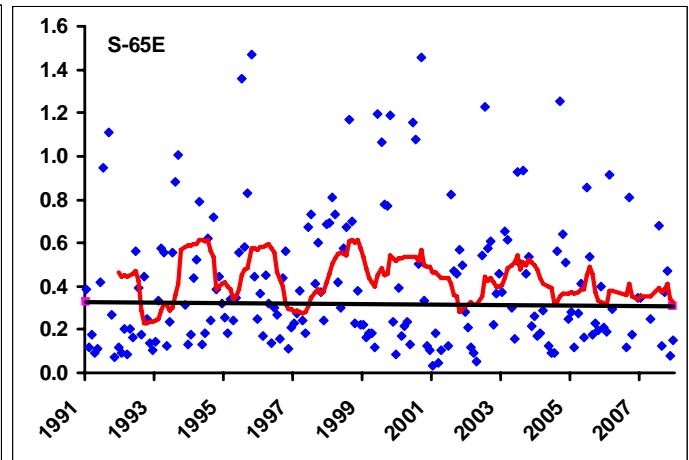
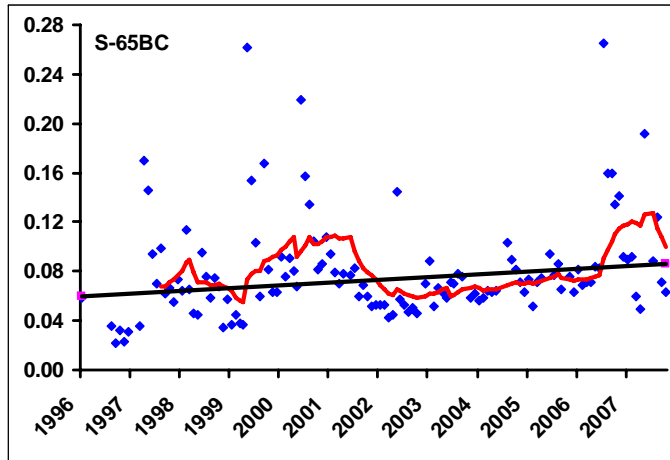
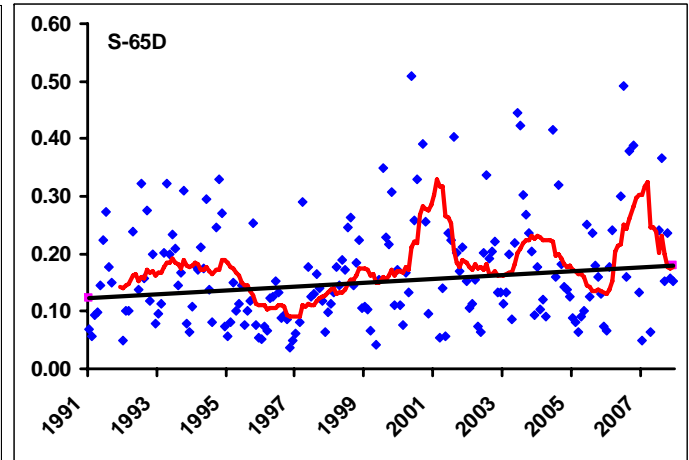
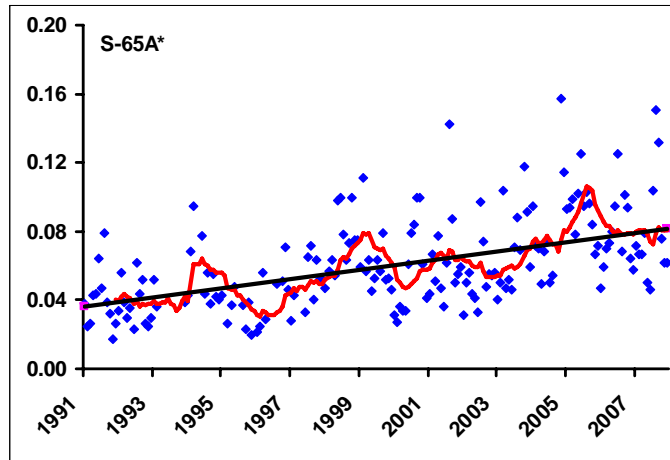
Basin Scale - Box and Whisker Plots



Basin Scale – Phosphorus Trends

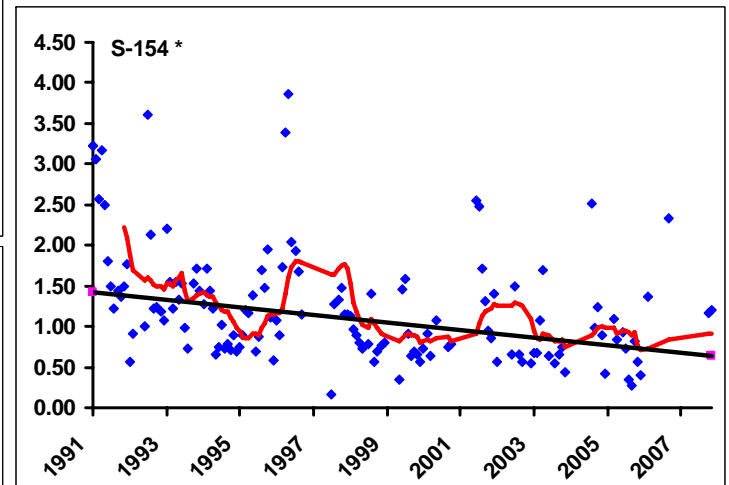
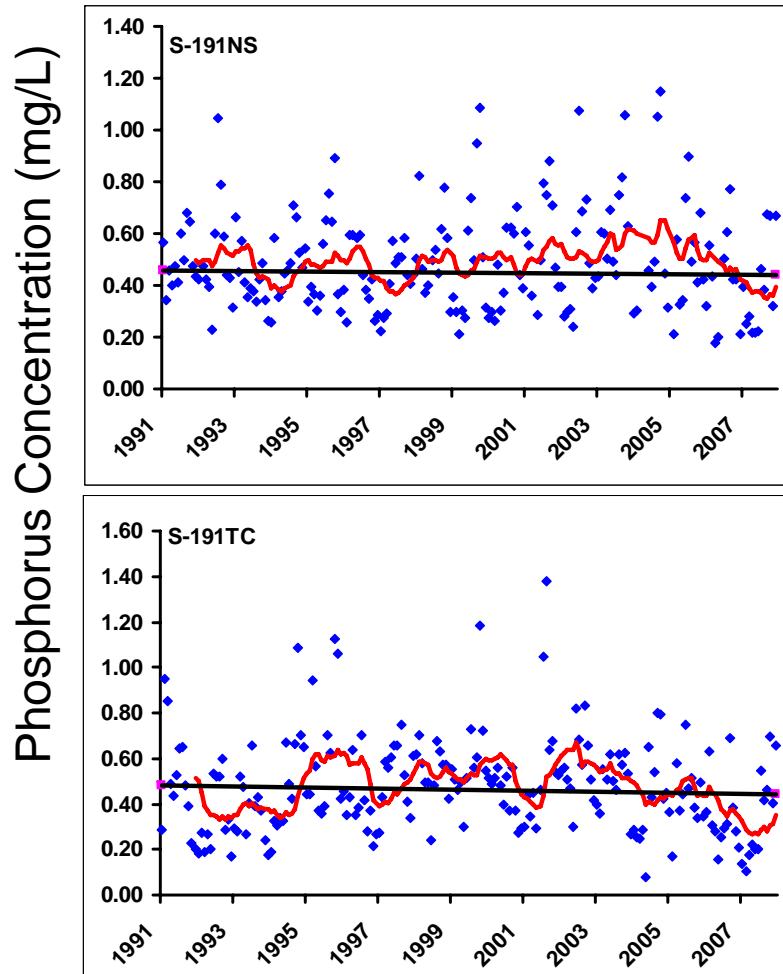


Phosphorus Concentration (mg/L)



* Significant at $p < 0.05$

Basin Scale – Phosphorus Trends (continued)

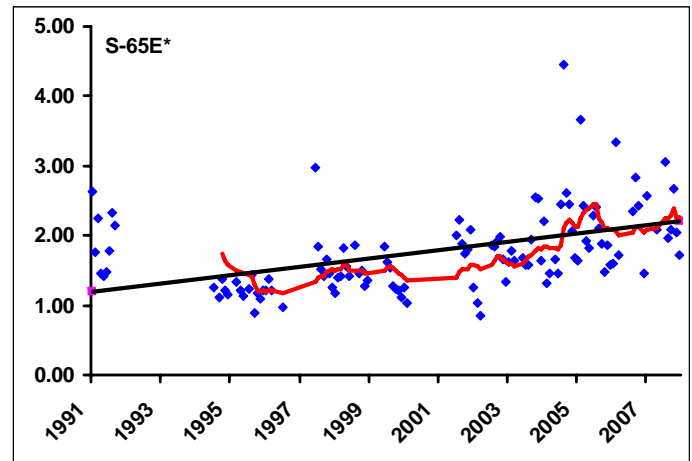
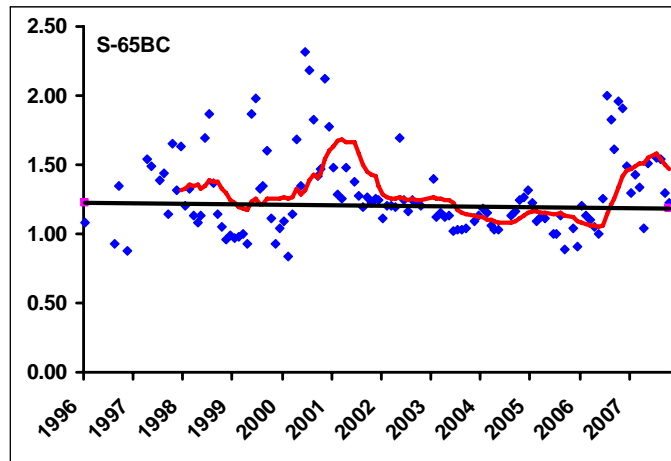
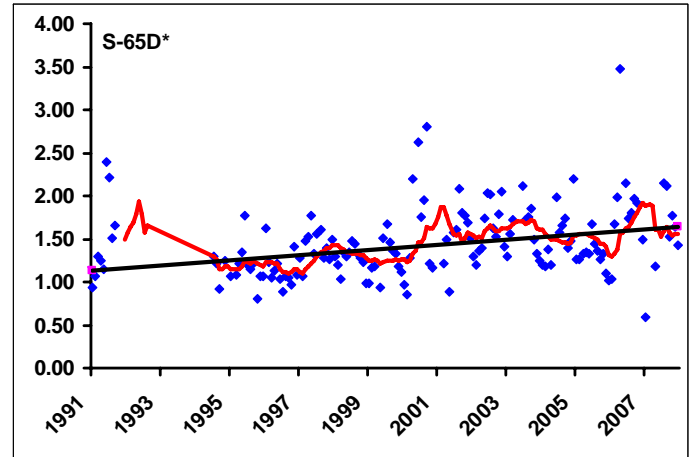
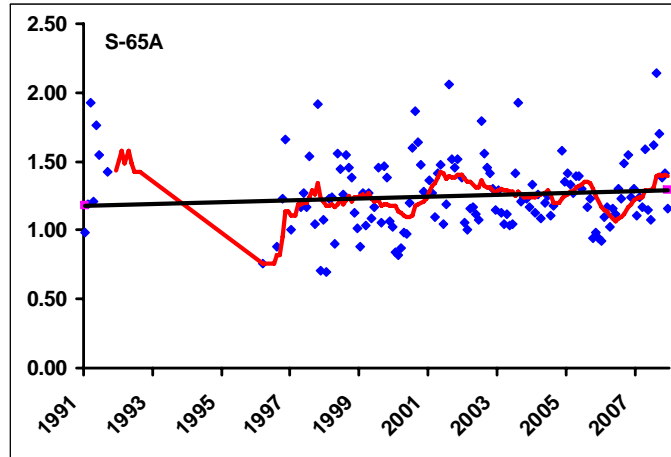


* Significant at $p < 0.05$

Basin Scale – Nitrogen Trends



Nitrogen Concentration (mg/L)

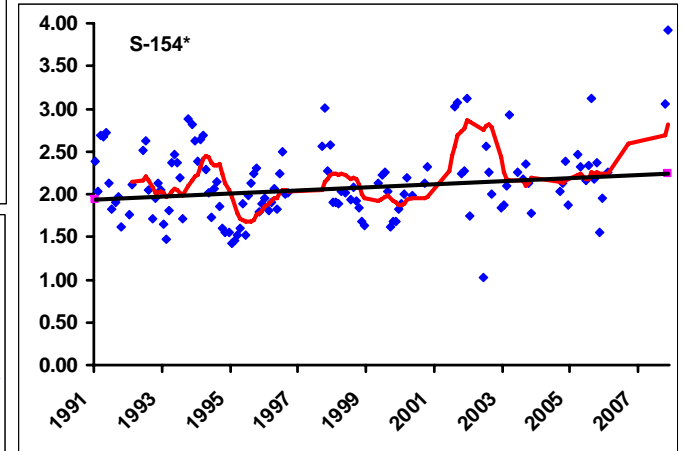
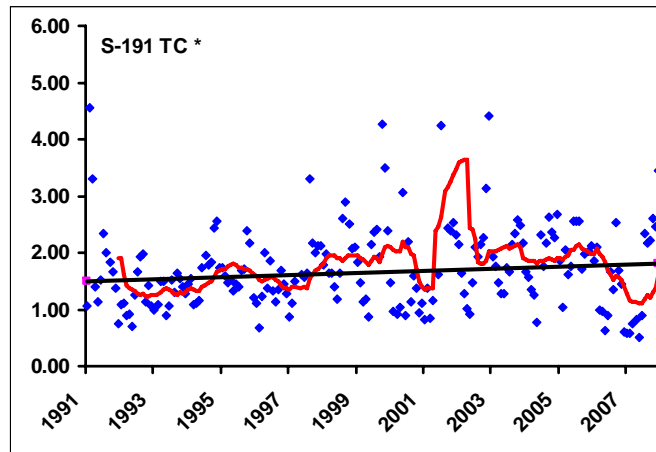
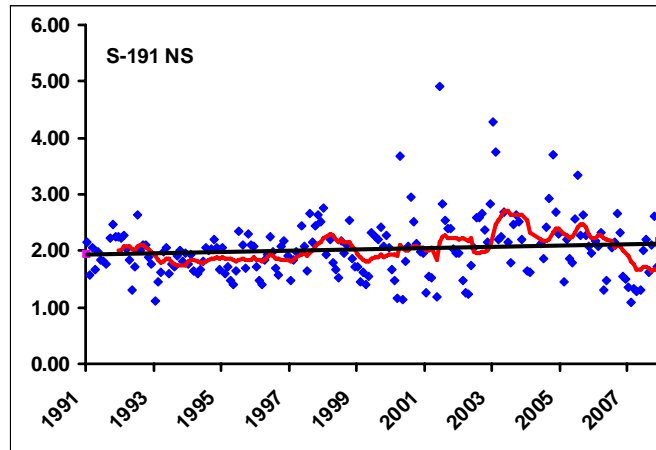


* Significant at $p < 0.05$

Basin Scale – Nitrogen Trends (continued)

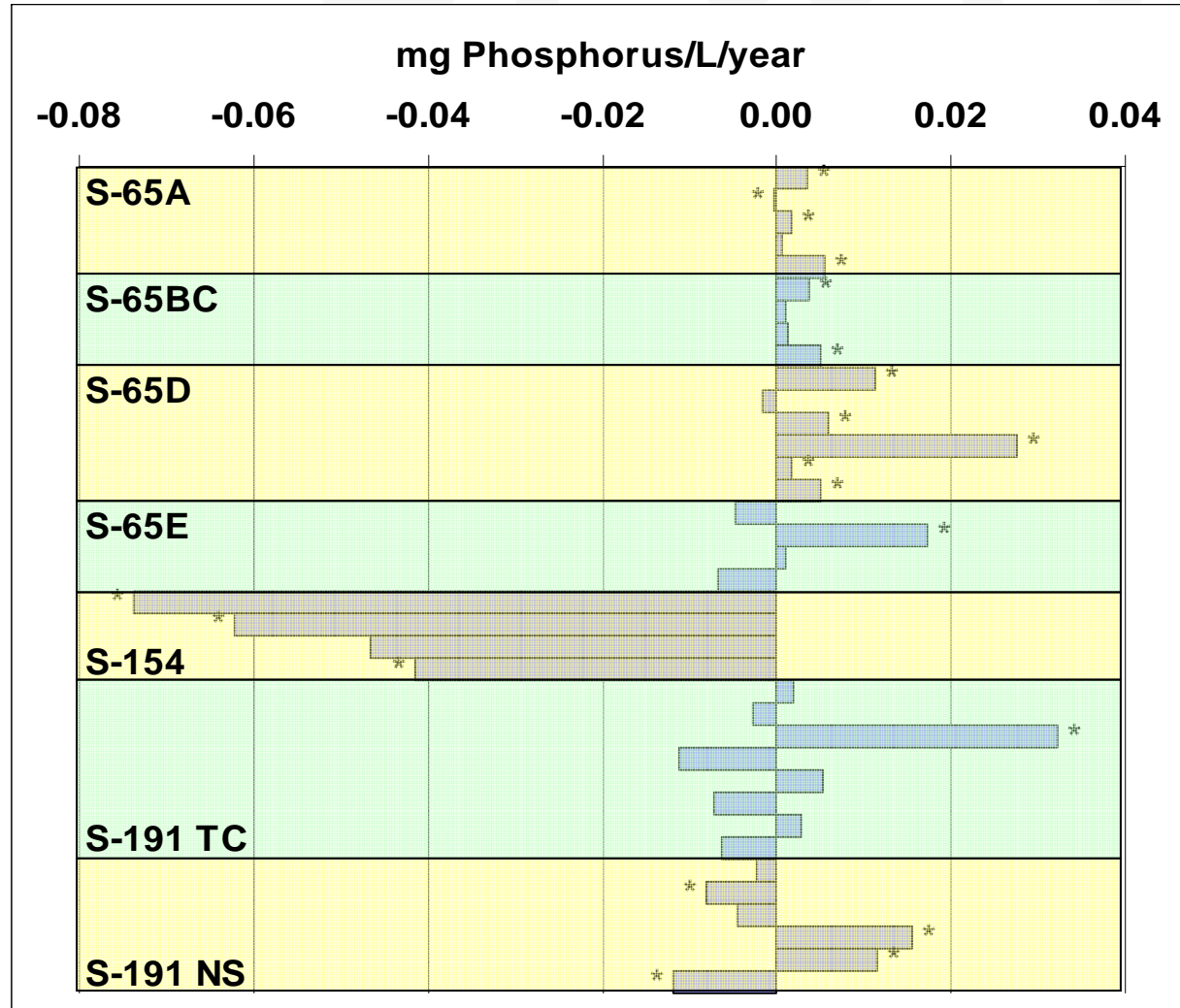


Nitrogen Concentration (mg/L)



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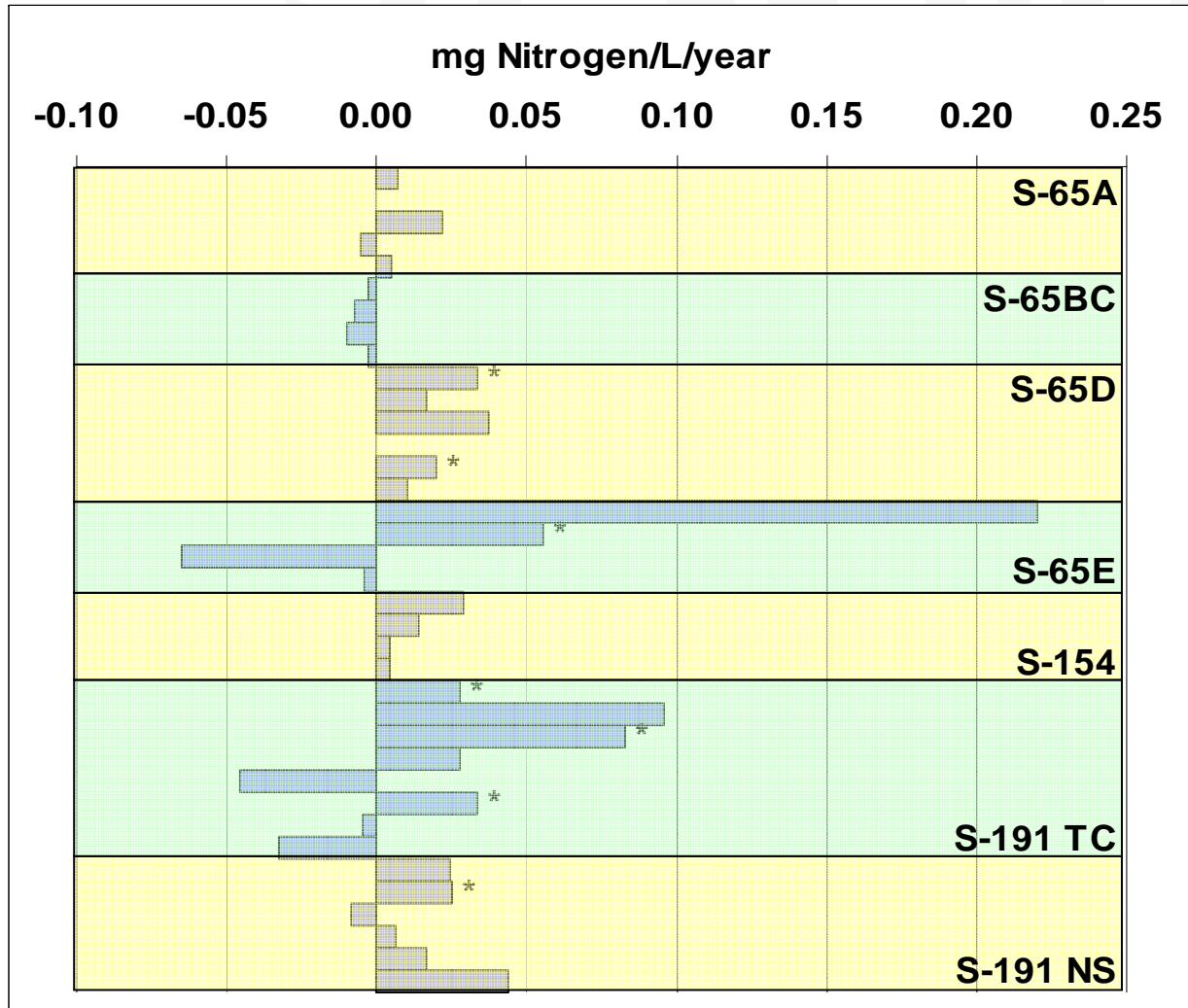
Monitoring Sites - Phosphorus Trends



* Significant at $p < 0.05$



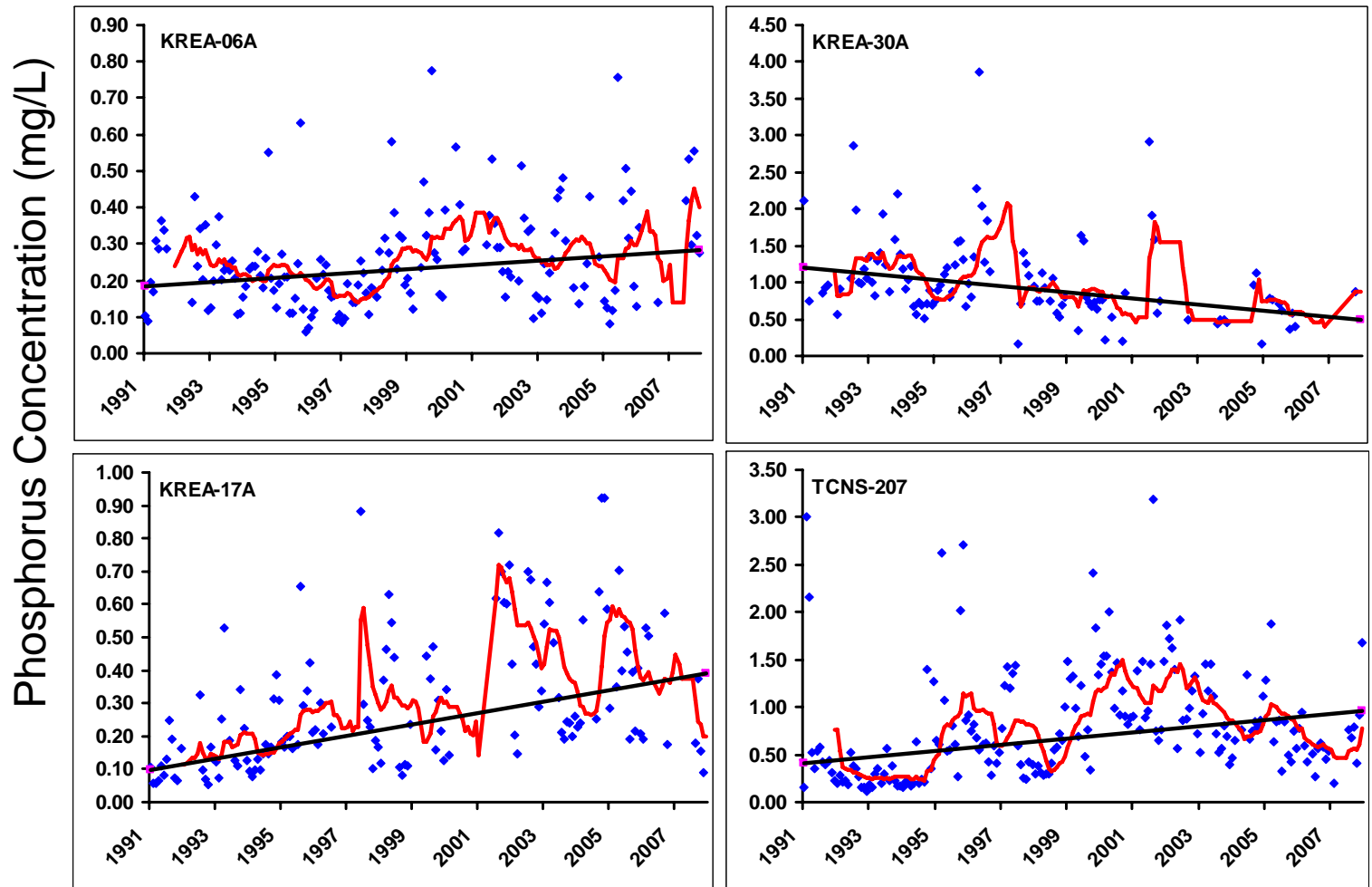
Monitoring Sites - Nitrogen Trends



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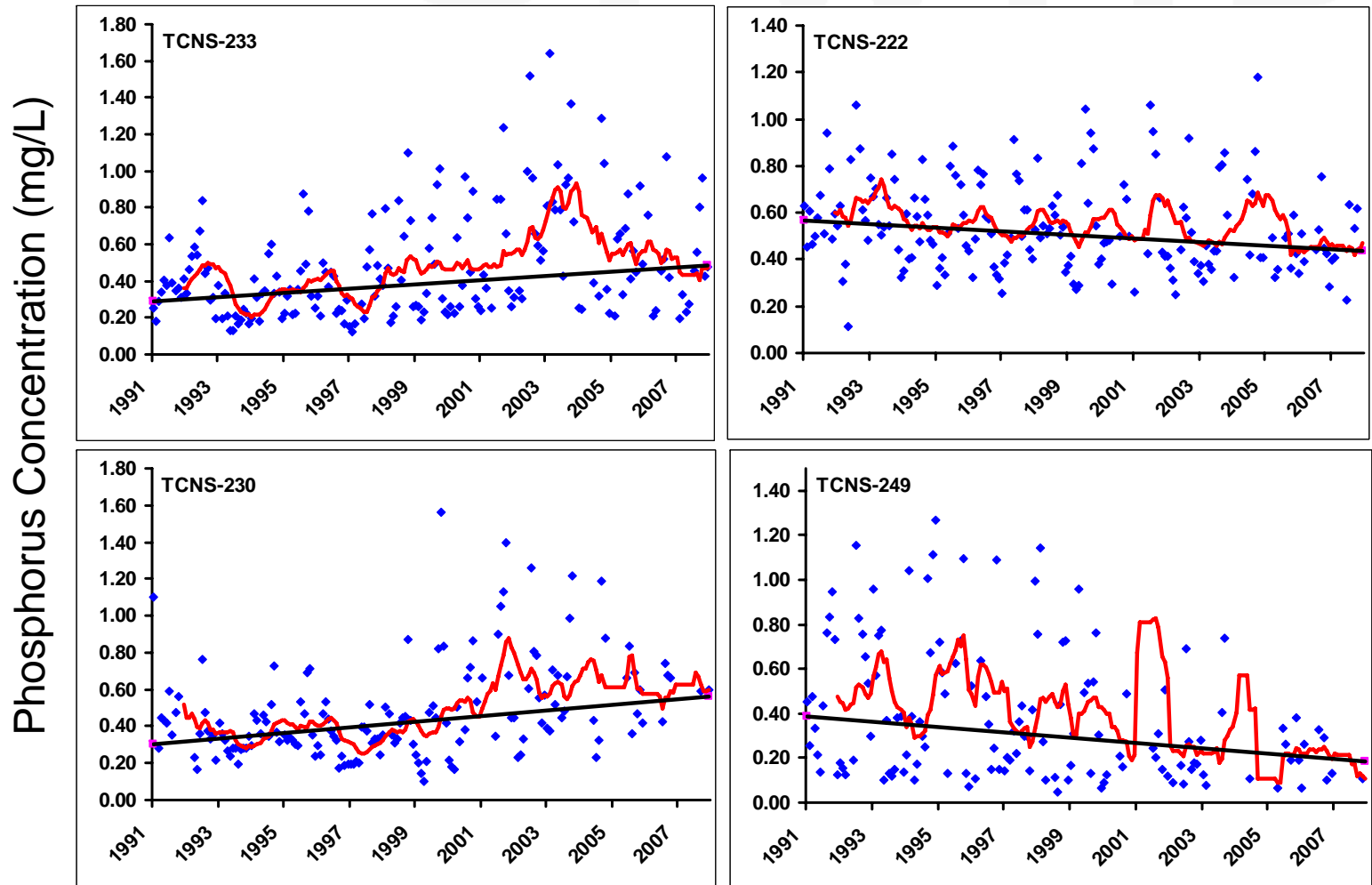


Monitoring Sites - Phosphorus Trends



All Slopes are significant

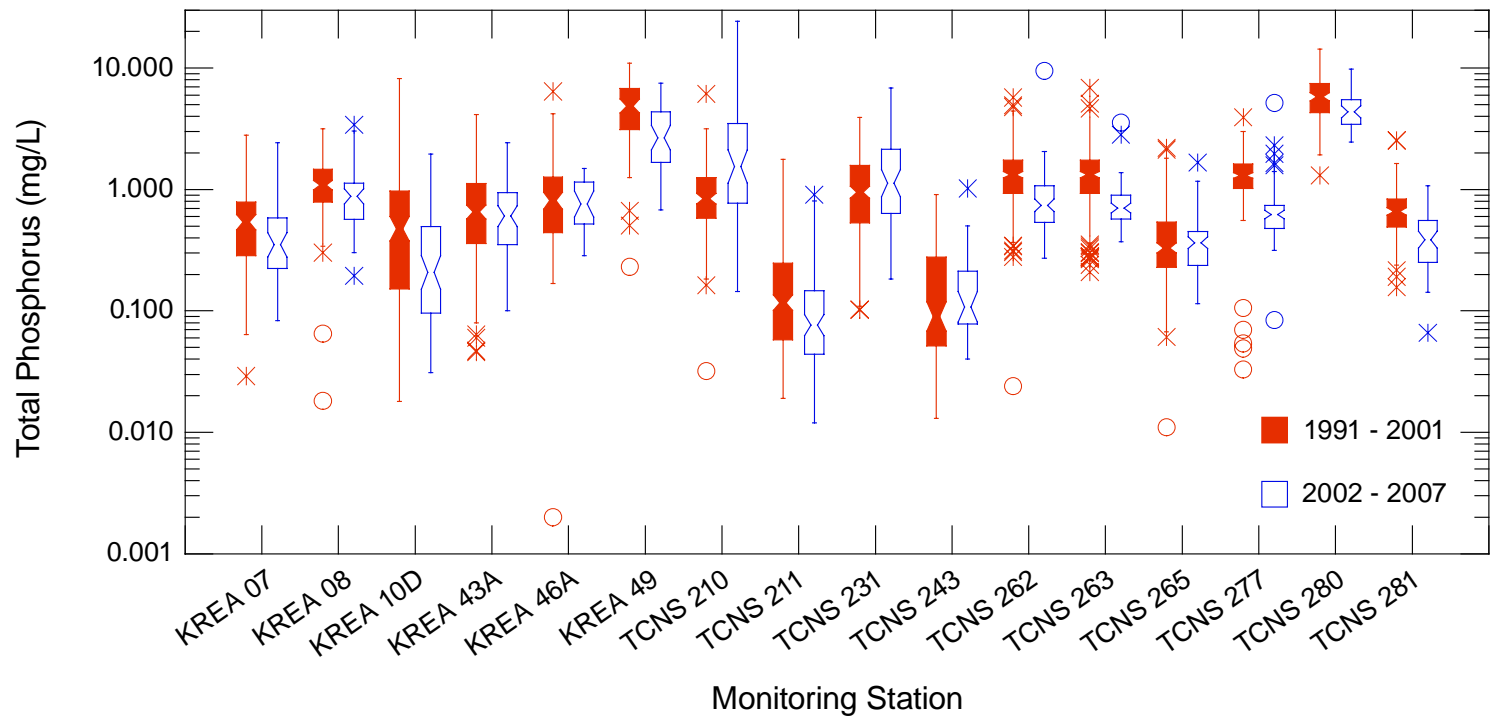
Monitoring Sites - Phosphorus Trends (continued)



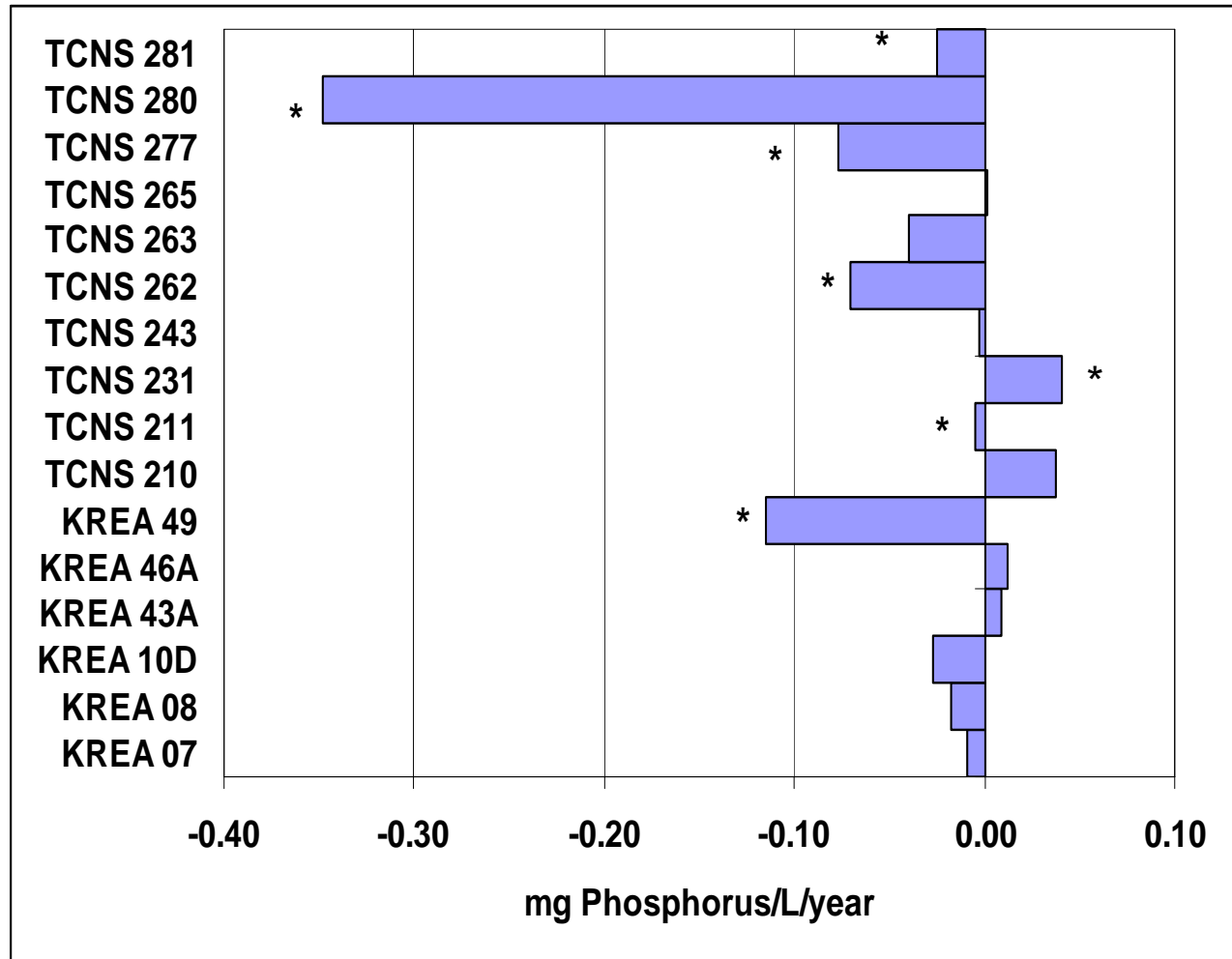
All Slopes are significant



Dairy - Box and Whisker Plots



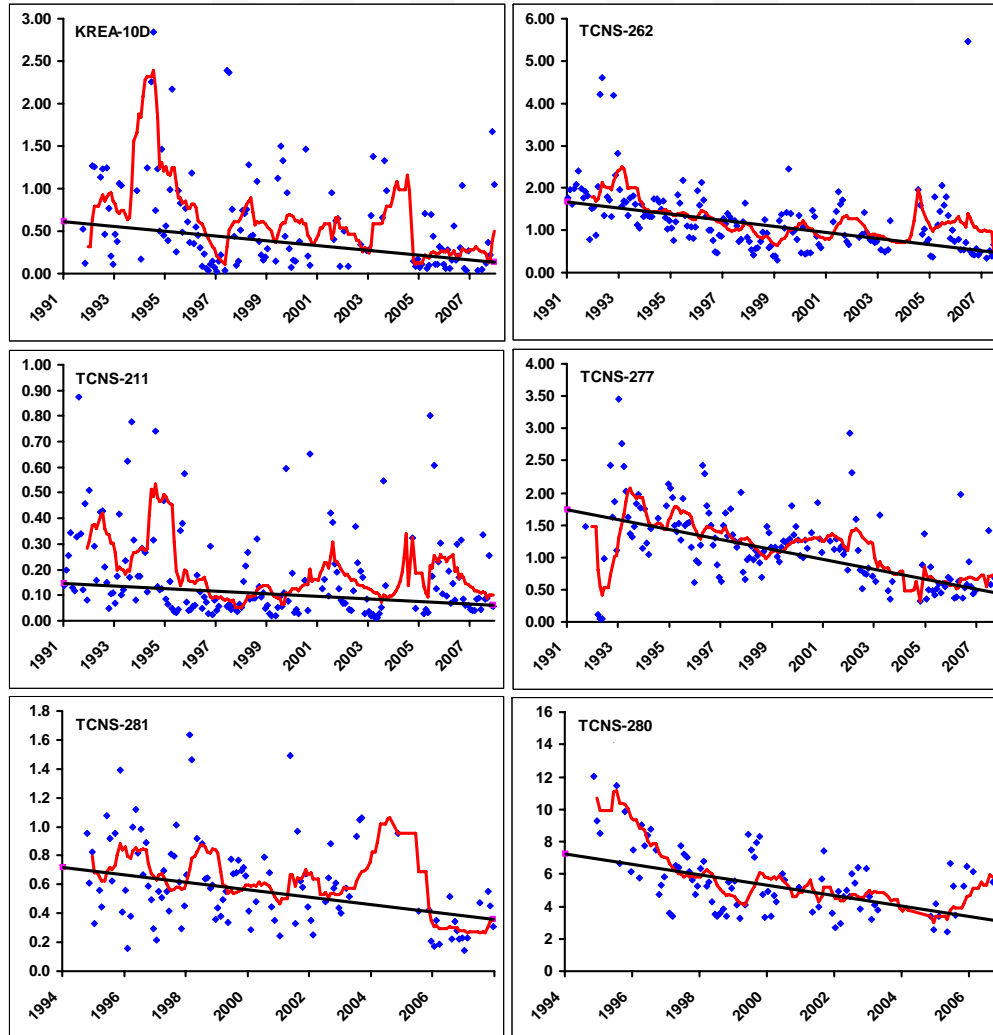
Dairy - Phosphorus Trends



* Significant at p < 0.05

Dairy - Phosphorus Trends

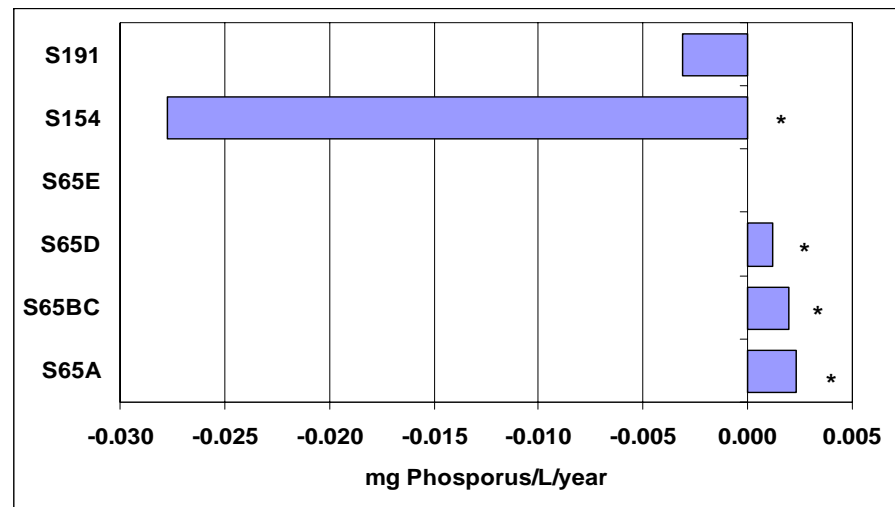
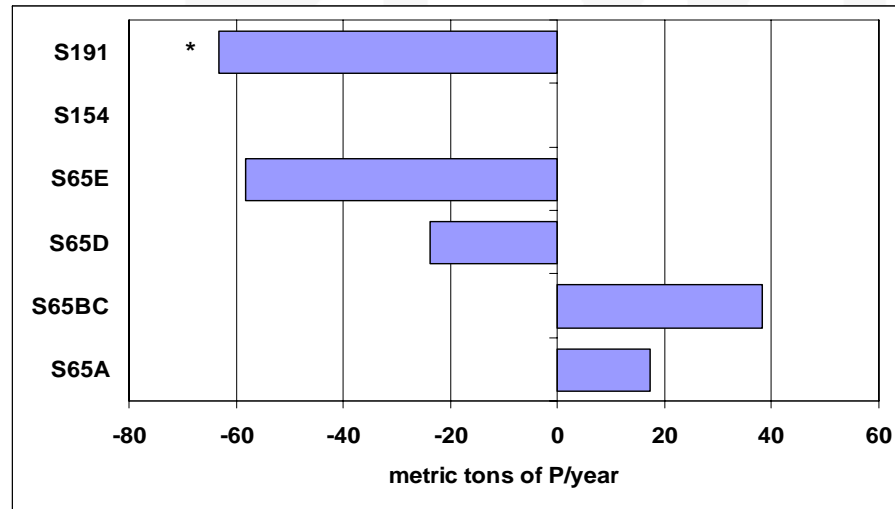
Phosphorus Concentration (mg/L)



All Slopes are significant

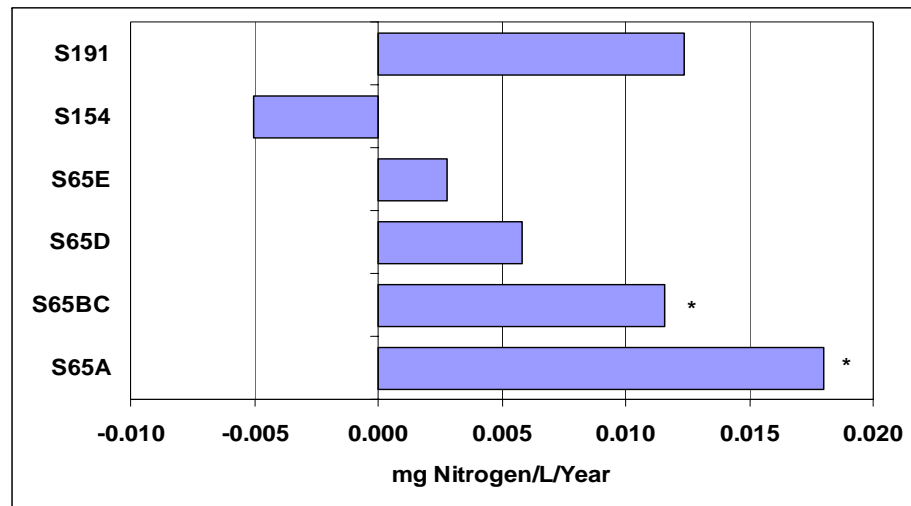
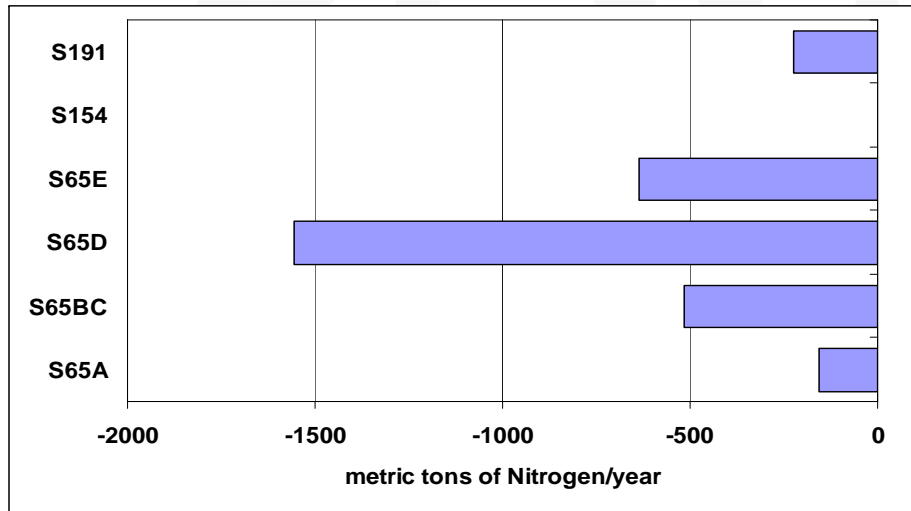


Basin Outfalls - Phosphorus Trends



* Significant at $p < 0.05$

Basin Outfalls - Nitrogen Trends



* Significant at $p < 0.05$



Summary

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- Basin Level trends (concentration)
 - Phosphorus
 - Increase (S-65A)
 - Decrease (S-154)
 - Nitrogen
 - Increase (S-65D, S-65E, S154, S191 TC)



Summary (cont.)

- **Monitoring Sites (concentration)**
 - **Phosphorus**
 - Decrease (6)
 - Increase (14)
 - **Nitrogen**
 - Decrease (0)
 - Increase (7)
- **Dairy Sites (phosphorus concentration only)**
 - Decrease (6)
 - Increase (1)
 - **BMP implementation**



Summary (cont.)

- **Basin Outlets**
 - **Phosphorus**
 - **Load**
 - Decline (S-191)
 - **Concentration**
 - Decrease (S-154)
 - Increase(S-65A, BC, D)
 - **Nitrogen**
 - **Load**
 - Decrease (S-191)
 - **Concentration**
 - Increase (S-65A, BC)

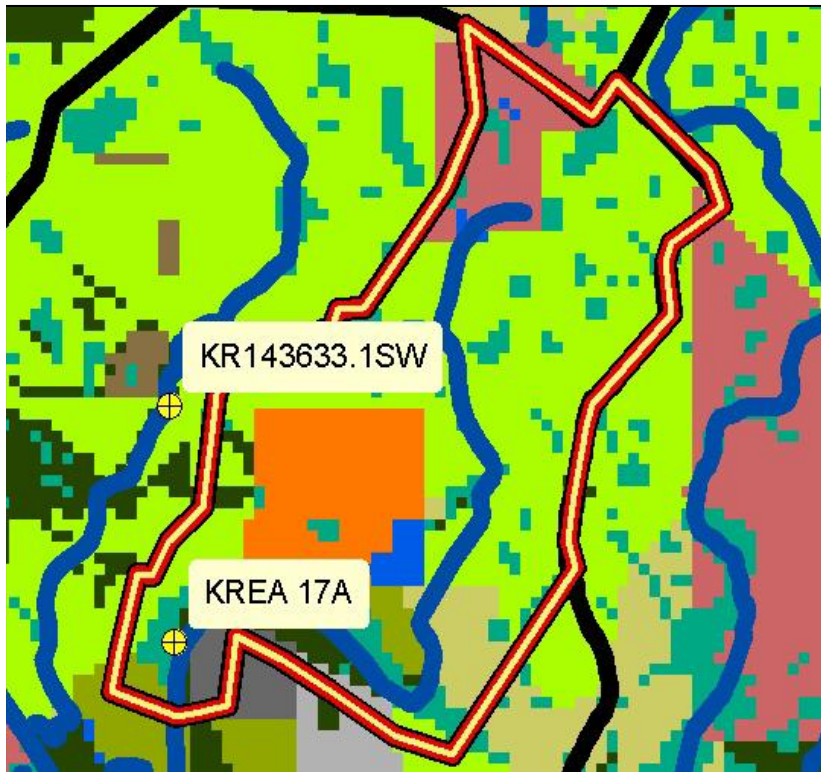


What is Next?

- Link trends with current land use data
- Assess the effectiveness of BMPs on load reductions to Lake Okeechobee.



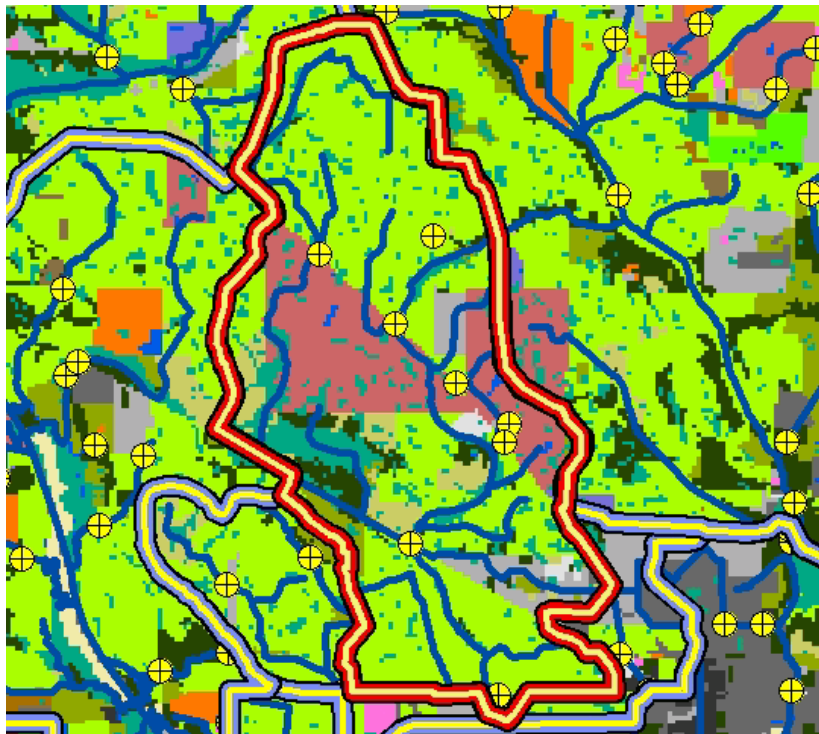
- Land Use and BMP Implementation Status



KREA 17A @ Yates (S-65E)
SS = 0.0172

LOPPCAT06	BMP Implemented	Conservation Plans In Process	No Plan	Grand Total
Dairies	3	274	20	297
Improved Pastures	1,546	0	715	2,262
Natural Areas	504	63	349	916
Other Areas	8		544	553
Urban	1		73	74
Woodland Pastures/Rangeland	128		144	272
Grand Total	2,191	337	1,846	4,374

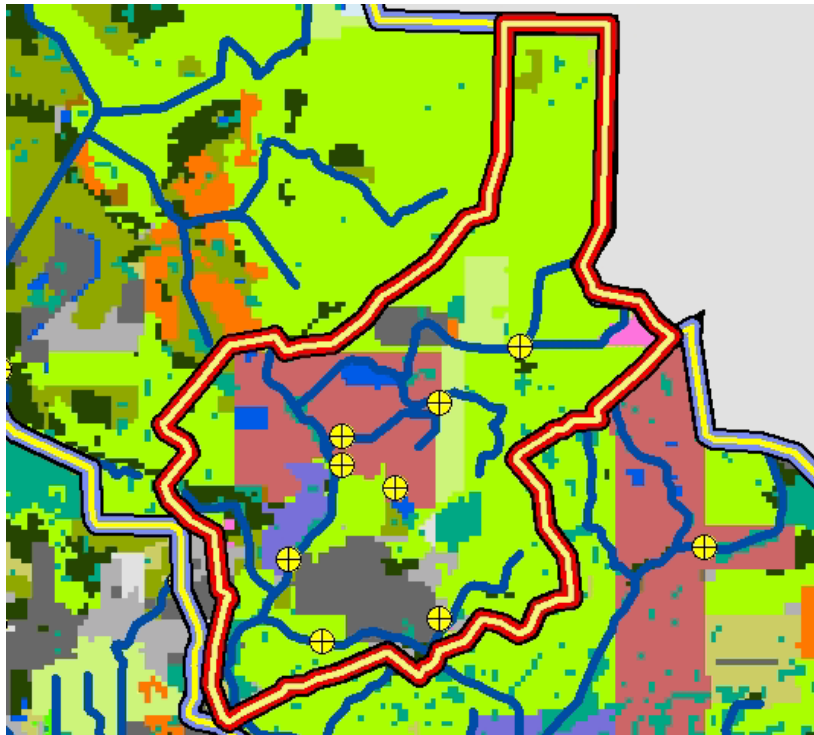
- Land Use and BMP Implementation Status



KREA 30A @Popash Slough (S-154)
SS = -0.0415

LOPPCAT06	BMP Implemented	Conservation Plans In Process	No Plan	Grand Total
Dairies	608	2	34	643
Improved Pastures	11,439	2,542	847	14,829
Natural Areas	3,621	558	611	4,790
Other Areas	102	0	5	107
Unimproved Pastures	90	5	156	251
Urban	8	2	1,876	1,886
Woodland Pastures/Rangeland	741	170	144	1,055
Grand Total	16,609	3,279	3,672	23,560

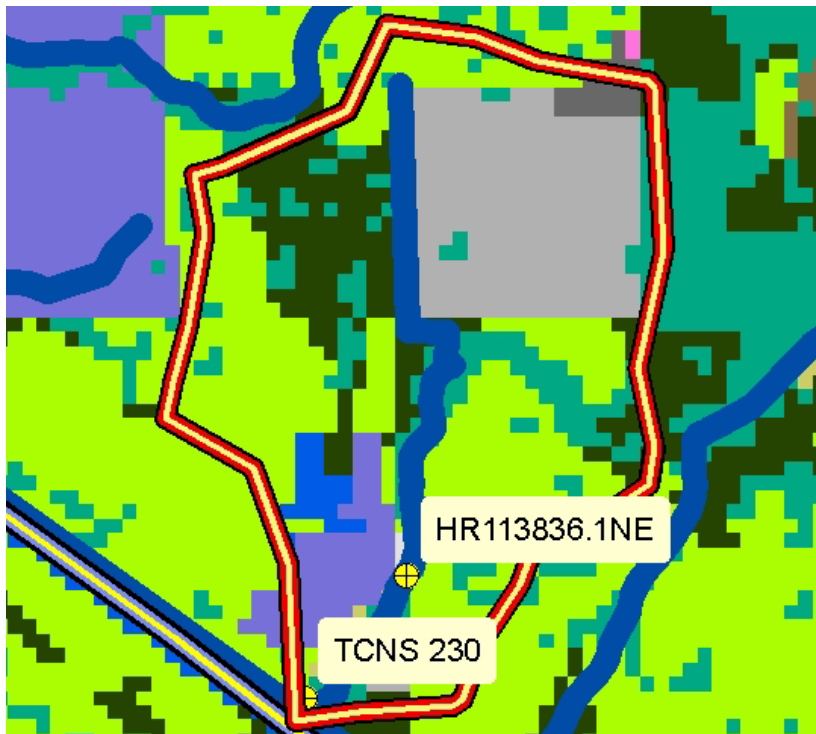
- Land Use and BMP Implementation Status



TCNS 222 @ Mosquito Creek
SS = -0.008 (S-191NS)

LOPPCAT06	BMP Implemented	Conservation Plans In Process	No Plan	Grand Total
Citrus	25		18	43
Dairies	2,297		20	2,317
Improved Pastures	3,300		1,575	4,876
Natural Areas	679	10	568	1,257
Ornamentals			5	5
Other Areas	0		41	41
Row Crops			0	0
Urban	830	274	3,377	4,481
Grand Total	7,131	284	5,605	13,020

- Land Use and BMP Implementation Status



TCNS 230 @ Henry Creek (S-191NS)
SS = 0.0154

LOPPCAT06	BMP Implemented	Conservation Plans In Process	No Plan	Grand Total
Improved Pastures	233	69	34	336
Natural Areas	379	50	403	832
Ornamentals		2		2
Urban	143	141	1,366	1,650
Woodland Pastures/Rangeland		3	9	12
Grand Total	755	264	1,812	2,831

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Thank You!

