

BACKGROUND

Lake Okeechobee

- The heart of South Florida System that connects Kissimmee River with the Everglades with an Area of 1730 Km² and depth of 2.7 m^{1,2}
- Water supply, Flood protection, Recreation

Lake Management

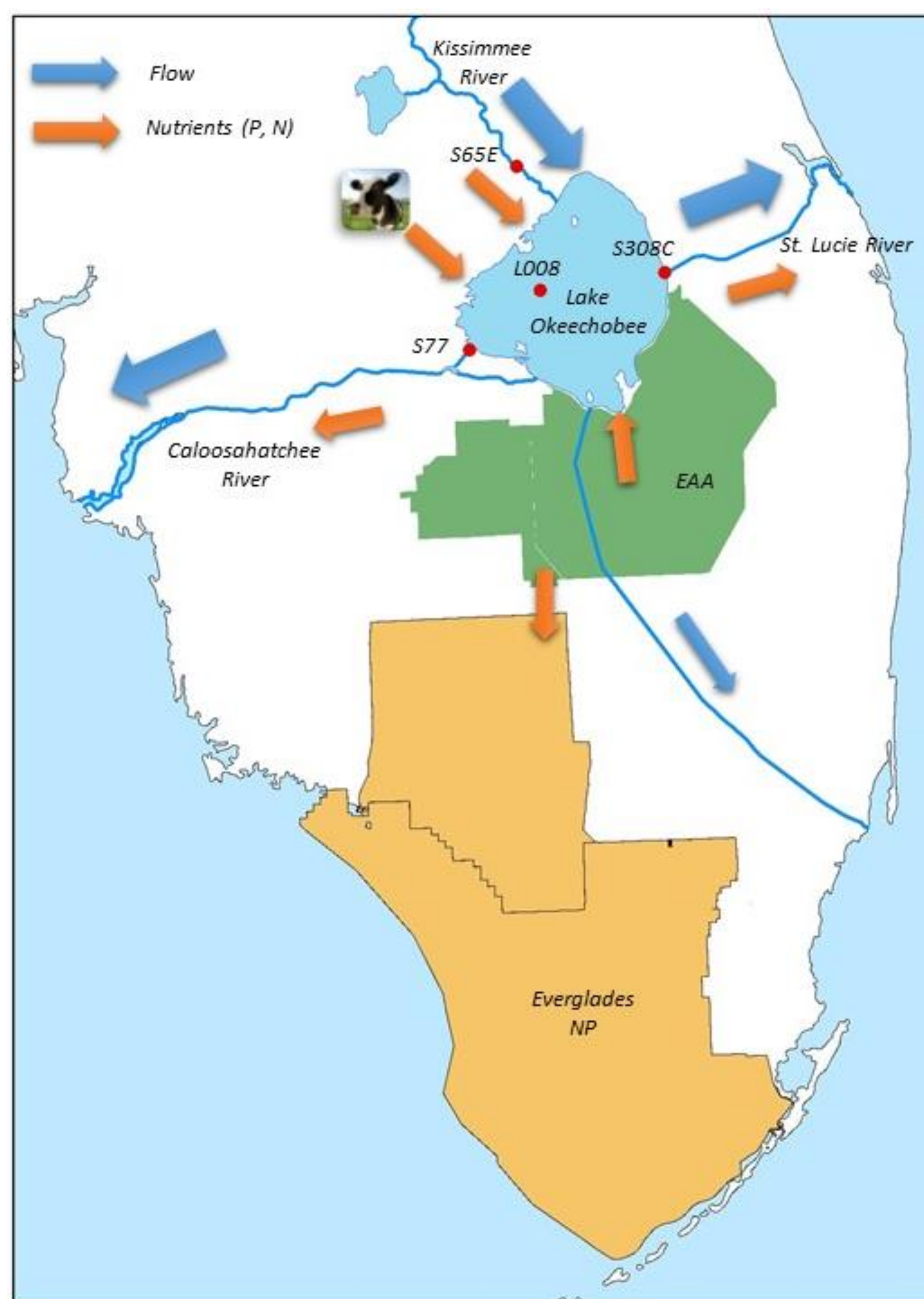
- Functions as a reservoir
- Operated by the Corps
- Several operation schedules since Herbert Hoover Dike completion
- Environmental objectives included since 1978

What Is Happening?

- Hydrologic Alterations (More water to St. Lucie and Caloosahatchee, and less water to Everglades)
- Excessive Total Phosphorous (TP) and Total Nitrogen (TN) loadings into/out of the Lake

The Consequences

- Biodiversity losses
- Harmful Algal Blooms: Algal blooms are associated with high Chlorophyll-a concentrations (> 40 µg/L)³



OBJECTIVES

Improve our understanding of Lake Okeechobee system through:

- Evaluating temporal trends in flows, Total Phosphorous (TP), Total Nitrogen (TN), and Chlorophyll-a (Chl-a)
- Assessing relationships between water flow, TP, TN, and Chl-a at the key locations

Research Questions

- What are the trends of flow, nutrients (TP, TN), and Chl-a dynamics of Lake O.?
- Are the water quality trends (TP, TN, and Chl-a) associated with trends in water flow?

METHODS

Data Collection

- Flow and Water Quality (TP, TN, Chl-a) Data: DBHYDRO datasets
- Rainfall Data: PRISM datasets

Timeseries Data Normality

Normality of the different time series data are tested using both visual and numerical methods (i.e. Shapiro-Wilk test).

Data Trend Analyses

- Flow, TP, TN, and Chl-a trends are determined for WYs 1974-2019 (46 yrs) at Key locations using the non-parametric Mann-Kendall test
- Significant trends at p-value < 0.1

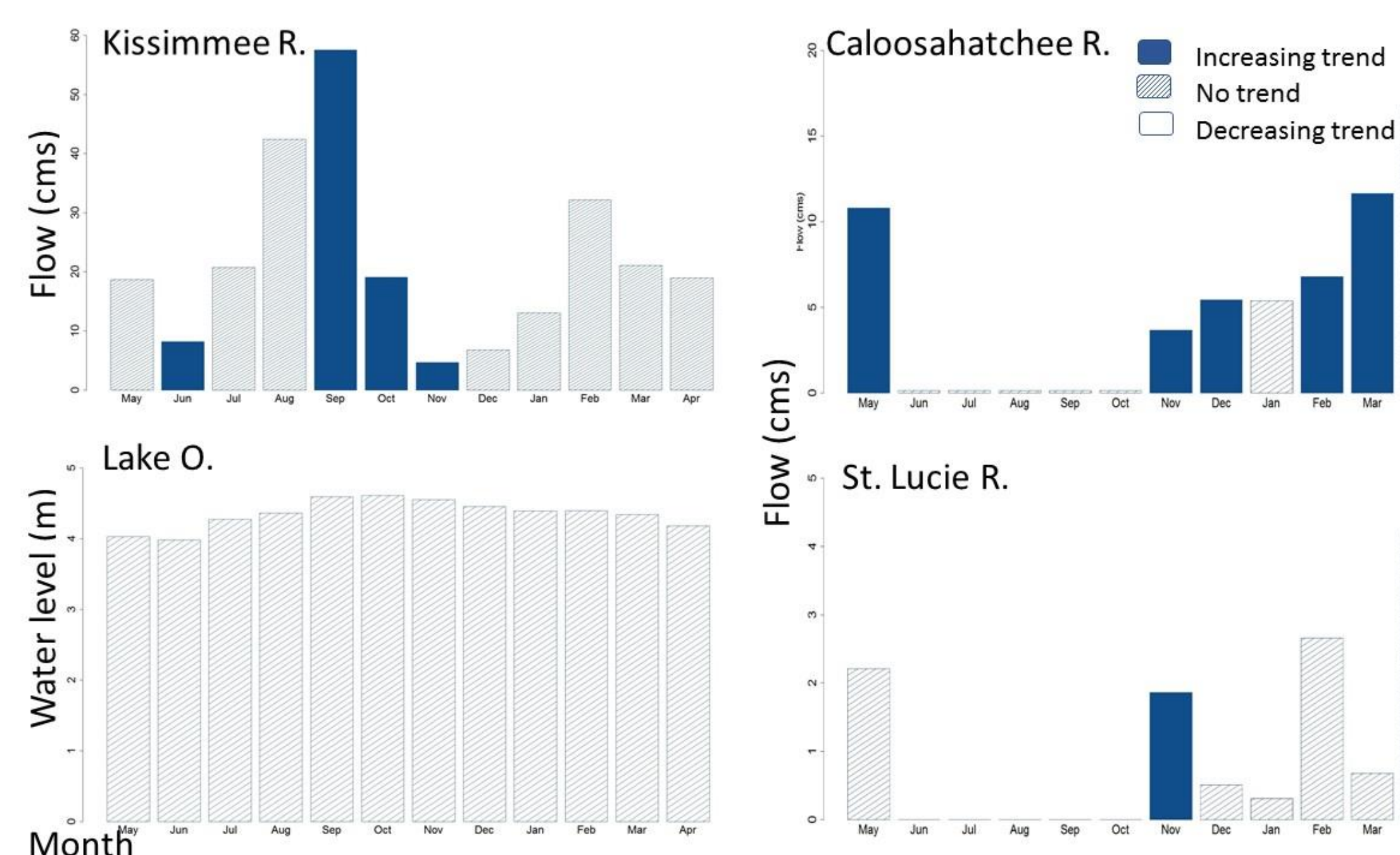
Year	May	June	-	March	April
1974	X11	X21		X111	X121
1975	X12	X22		X112	X122
-	-				
-	-				
2018	X145	X245		X1145	X1245
2019	X146	X246		X1146	X1246

τ1 & p1

τ12 & p12

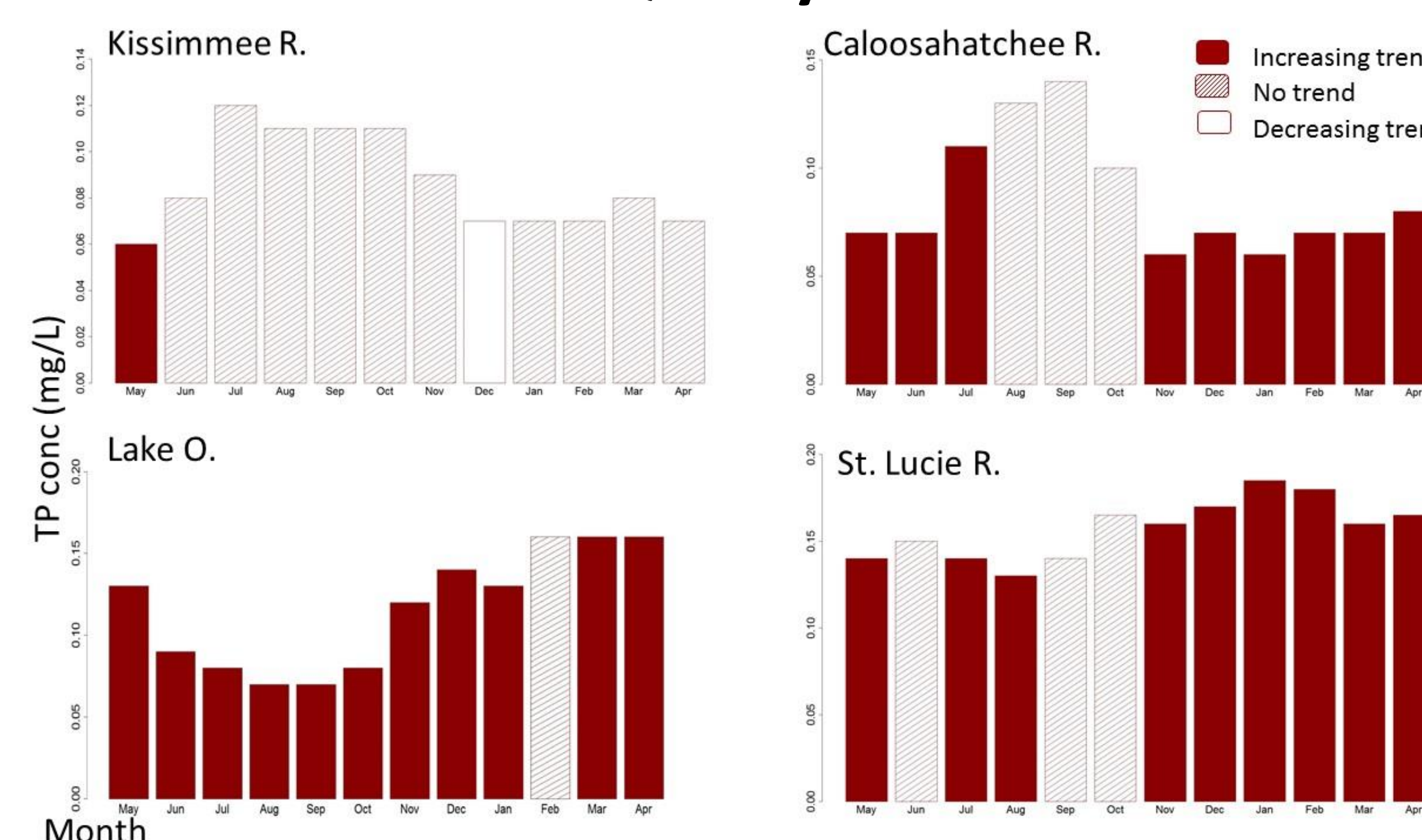
RESULTS

Hydrologic Trends



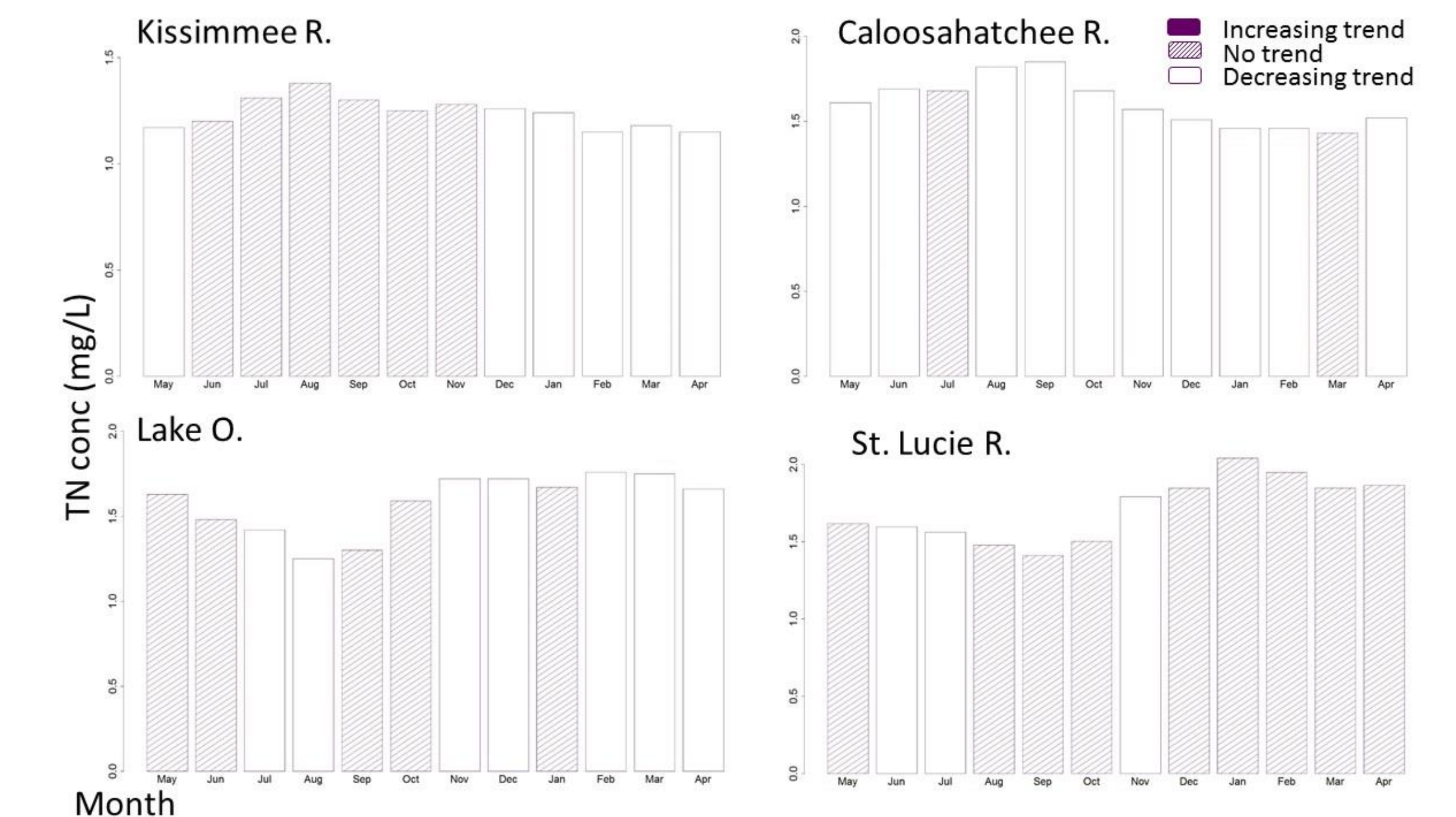
- Increasing trends in discharges into the Caloosahatchee and St. Lucie Rivers in the dry season and the wet season, respectively

Water Quality Trends

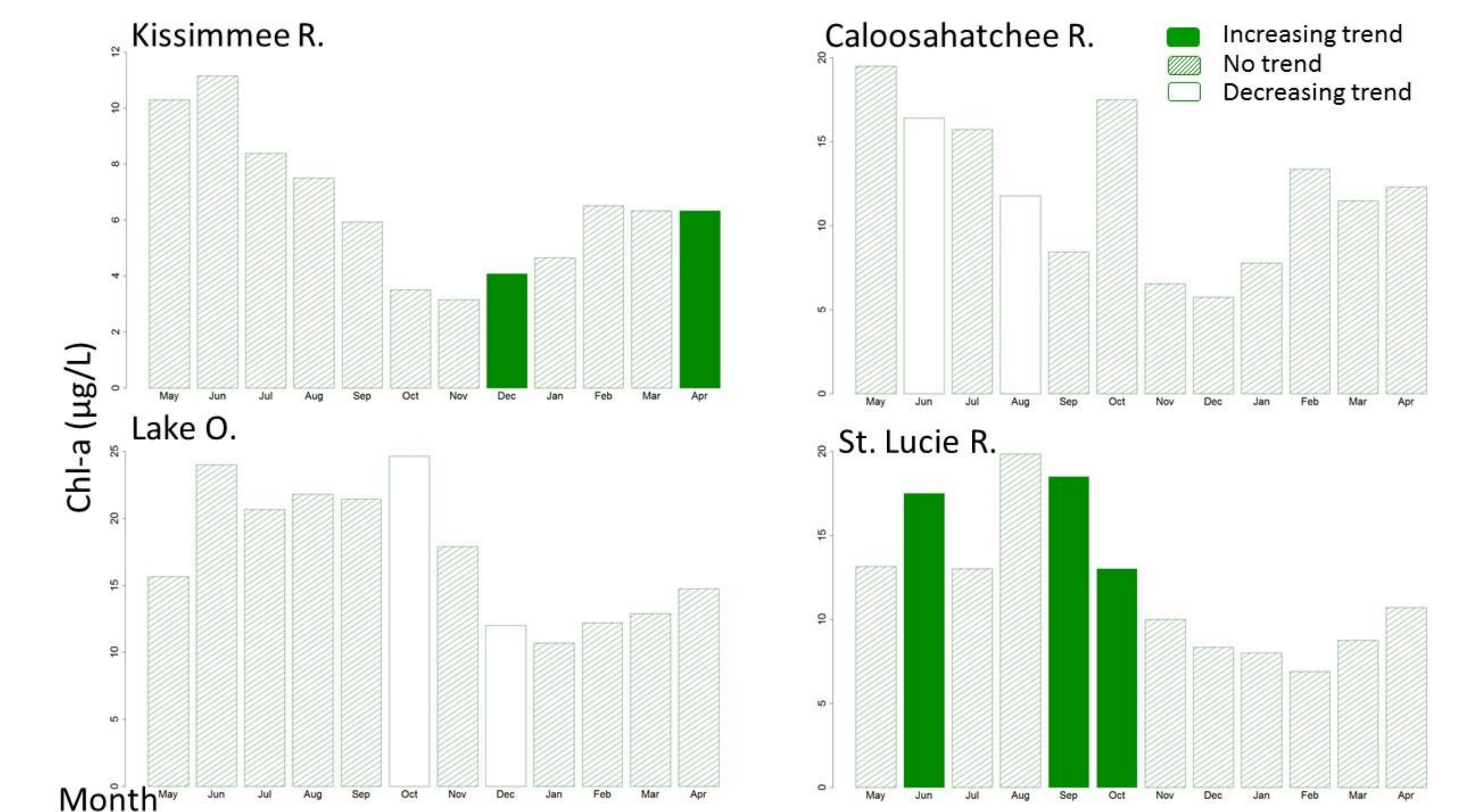


RESULTS

- Increasing trends in TP in Lake O.
- Increasing trends in TP in St. Lucie and Caloosahatchee Rivers



- Decreasing trends in TN in Lake O.
- Decreasing trends in TN in Caloosahatchee more than St. Lucie River



- Increasing trends in Chl-a entering Lake O. in Dec. and April
- Increasing trends in Chl-a in St. Lucie River in wet season

CONCLUSIONS

- TP concentrations in Lake O. are increasing, however, loadings into the Lake are not increasing, indicating significance of internal processes of this shallow Lake
- Trends of flow are not associated with water quality trends, indicating that flow regime should be considered rather than water volume
- Chlorophyll-a trends are associated with flow and TN trends (i.e. increasing Chl-a trends in St. Lucie, meanwhile no trends in Caloosahatchee)

REFERENCES

- Aumen, N G, and K E Havens. 1998. "Okeechobee Lake, Florida, USA: Human Impacts, Research, and Lake Restoration. In: Encyclopedia of Hydrology and Lakes." *Encyclopedia of Earth Science*. Springer, Dordrecht.
- Wang, Menghua, Carl J Nim, Seunghyun Son, and Wei Shi. 2012. "Characterization of Turbidity in Florida's Lake Okeechobee and Caloosahatchee and St. Lucie Estuaries Using MODIS-Aqua Measurements." *WR 46 (16)*: 5410-22. <https://doi.org/10.1016/j.watres.2012.07.024>.
- Havens, K. E. (1994) 'Relationships of annual chlorophyll a means, maxima, and algal bloom frequencies in a shallow eutrophic lake (lake okeechobee, florida, usa)', *Lake and Reservoir Management*, 10(2), pp. 133-136. doi: 10.1080/07438149409354184.