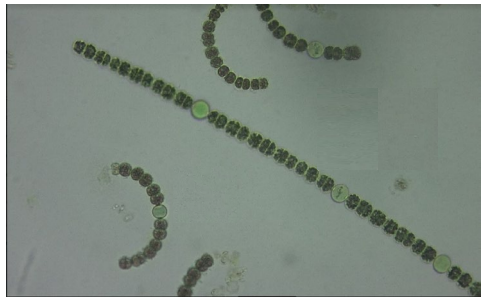
Assessment of zooplankton- phytoplankton relationships in Falls Lake to guide development of site-specific chlorophyll *a* criteria

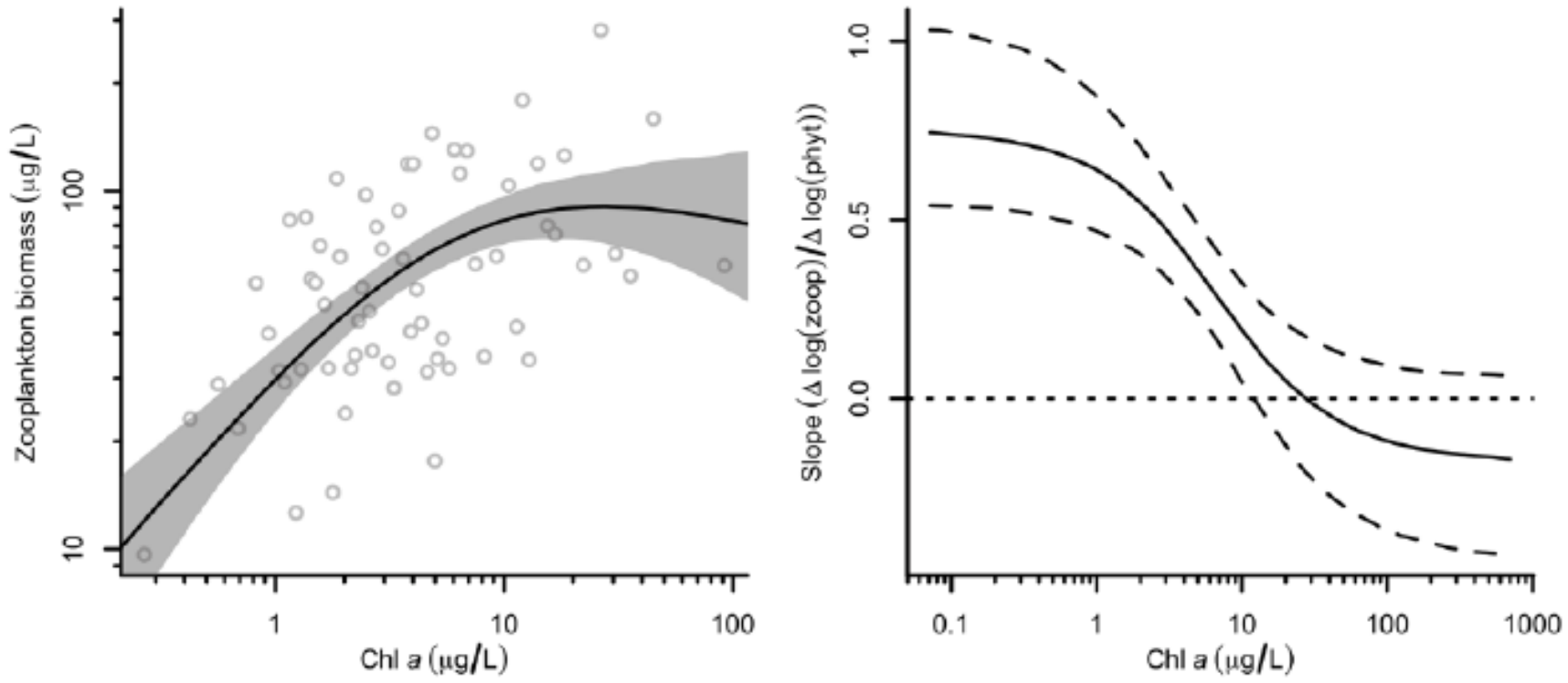


Nathan Hall and Michael Piehler
UNC Chapel Institute of Marine Sciences

Falls Lake Nutrient Study Research Symposium
19 April 2023

EPA proposes use of zooplankton: phytoplankton biomass to set standards for phytoplankton biomass

Ambient Water Quality Criteria to Address Nutrient Pollution in Lakes and Reservoirs (2021)



Data from National Lakes Assessment- summertime survey of >1000 U.S. lakes and reservoirs

Research Questions

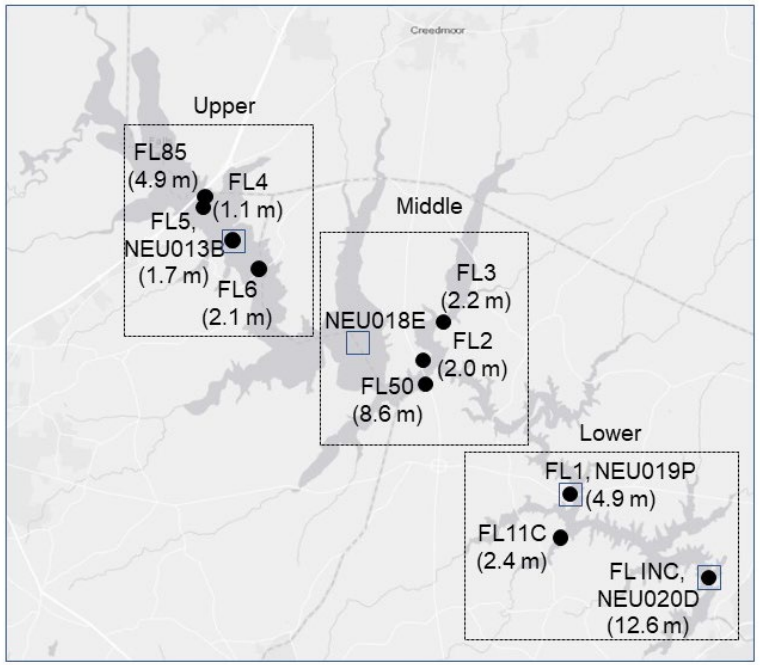
1) How does zooplankton/Chl *a* in Falls Lake compare to similar water bodies in the southeastern US?

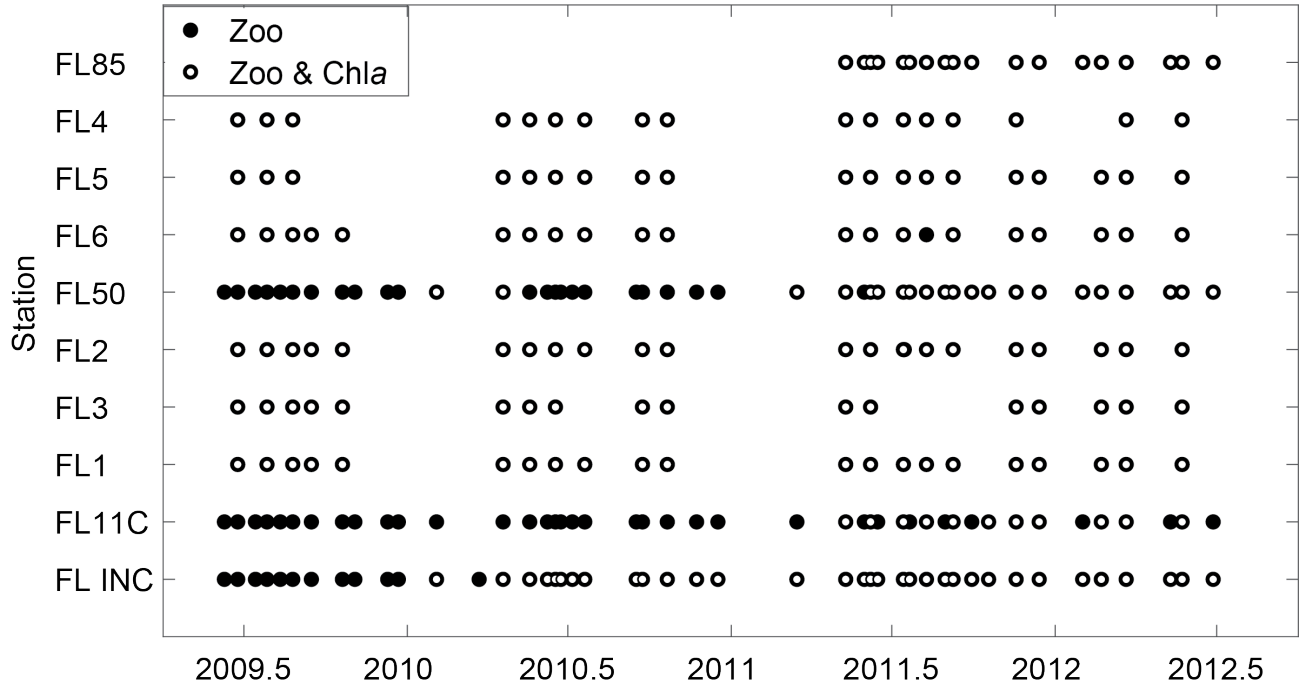
2) Is there a saturation point in Falls Lakle zooplankton/Chl *a* that could guide development of a site-specific Chl *a* criterion?

3) Is there a saturation point in zooplankton/Chl *a* for southeastern reservoirs to guide development of a region-specific Chl *a* criterion?

Description of Data Set

- Zooplankton collected, identified, counted by Dr. Sandra Cooke (Greensboro College)
- Phytoplankton biomass as chlorophyll *a* measured by NC State's Center for Applied Aquatic Ecology
- Same sampling methods as the National Lakes Assessment

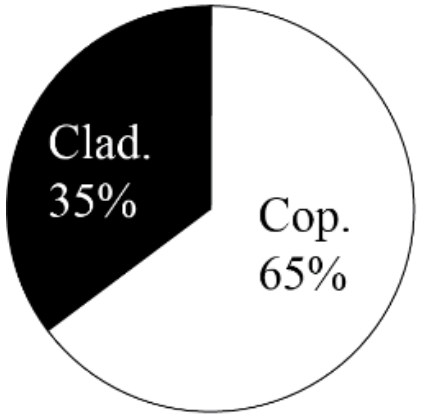




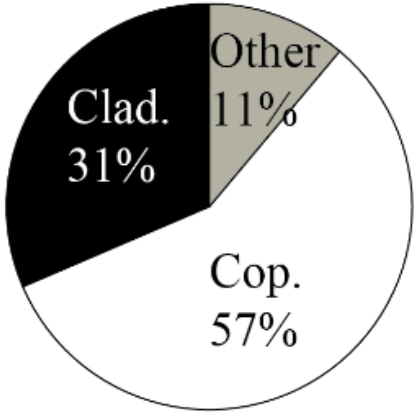
Falls Lake vs other southeast reservoirs

Median Values	Falls Lake	SE U.S. reservoirs
Chlorophyll *a*	27	12
Zoo. Biomass	31	36
Zoo. Biomass: Chlorophyll *a*	1.3	2.3

Falls Lake
Summer Biomass

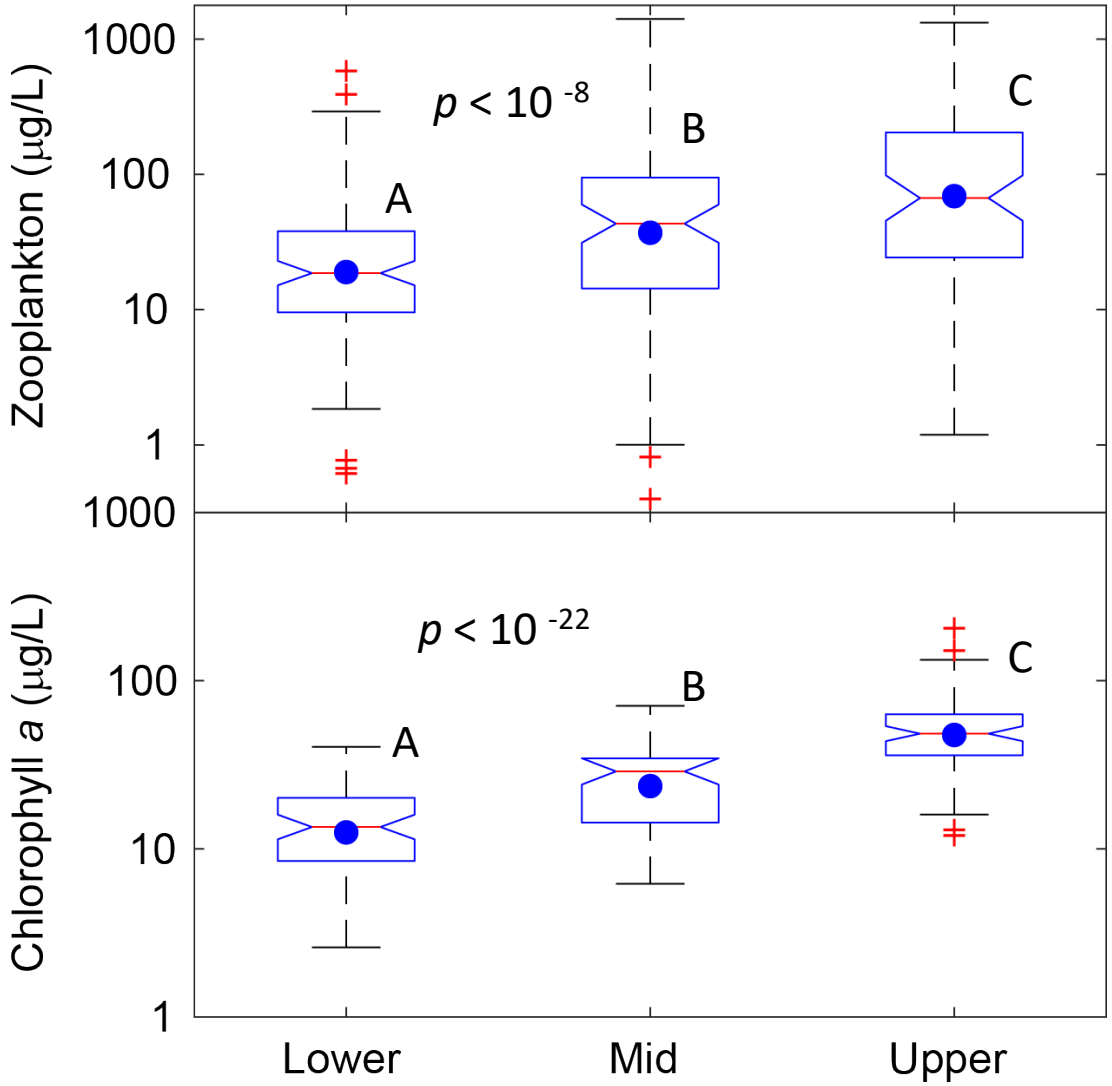


S.E. Reservoirs
Summer Biomass

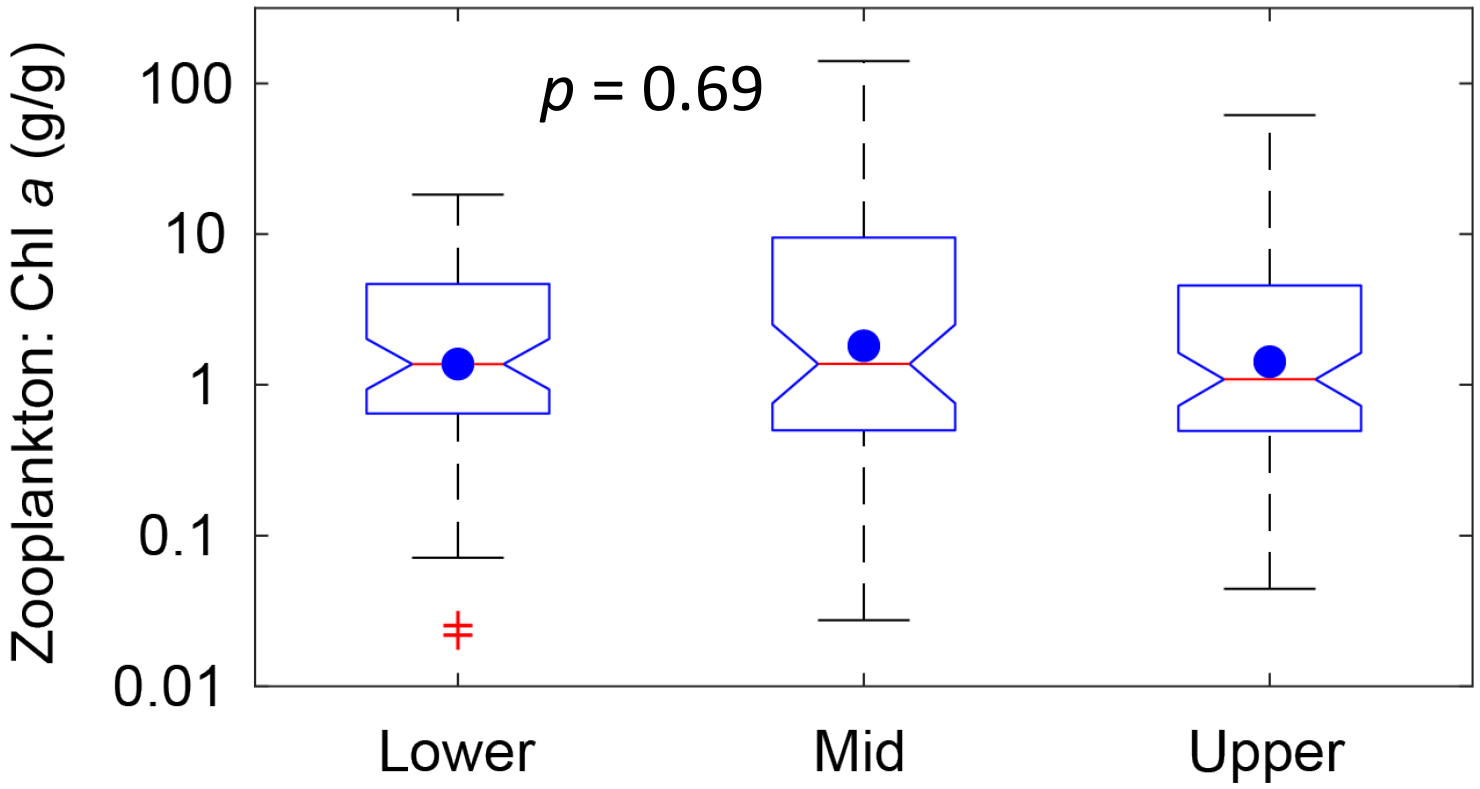


Insect larvae are excluded

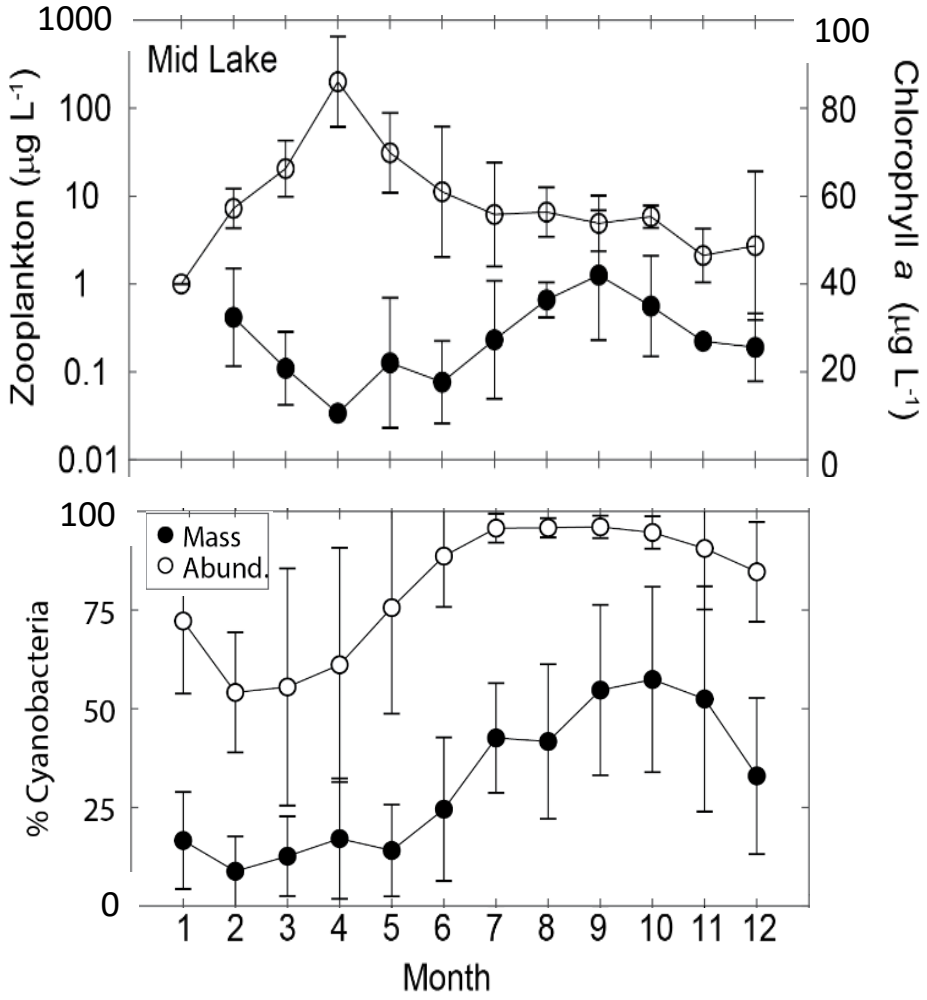
Spatial variation across the trophic gradient in Falls Lake indicates phytoplankton/ zooplankton coupling



No decline in trophic coupling between zooplankton and phytoplankton across the trophic gradient in Falls Lake



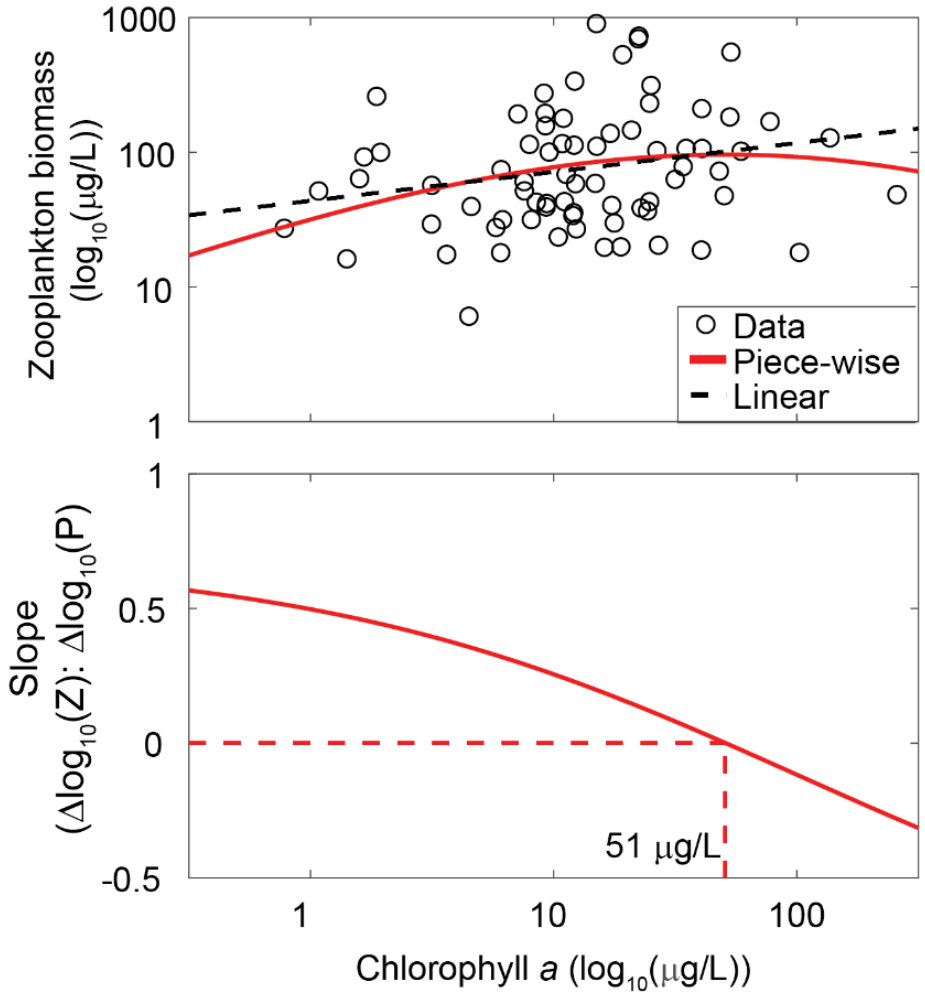
High zooplankton: Chl *a* in spring, low zooplankton: Chl *a* in summer



Possible causes- planktivorous fish/ midge larvae more likely than inedible cyanobacteria

Summer might be a bad time to assess trophic transfer via Z:P ratios

Chl *a* threshold for Southeast U.S. reservoirs



Similar to threshold identified for shallow lakes (< 4 m) across the U.S.

But, relationship is very weak-other drivers important for zooplankton

Conclusions/ Implications

1) Zooplankton: Chl *a* in Falls Lake is about half the average of other southeast reservoirs. Possible reasons: high % cyanobacteria, fish and midge larvae

2) Failed to identify strong zooplankton: Chl *a* patterns across the trophic gradient in Falls Lake- higher trophic levels may obscure response

3) A region-specific threshold of 51 $\mu g\ L^{-1}$ Chl *a* was calculated. Confidence in this threshold is low

4) Don't recommend pursuing a site specific Chl *a* standard based on zooplankton: Chl *a* relationships