Predicting Seasonal and Spatial Onset of cHABs in Polymictic Reservoirs

Aaron Krivchenia[1], Matthew Pierce[1], Benjamin Carone[2], Michael Grove[1], Courtney Richmond[1], Nathan Ruhl[1]

1: Department of Biological Sciences, Rowan University, Glassboro New Jersey, USA 08028
2: Department of Molecular & Cellular Biosciences, Rowan University, Glassboro New Jersey, USA 08028

Background:

- Cyanobacterial Harmful Algal Blooms (cHABs) are increasing in frequency and can produce cyanotoxins that harm humans, pets, and wildlife
- Agricultural runoff can lead to eutrophication, decreasing water quality and ecosystem health
- Field-based fluorometric methods are problematic due to abiotic and biotic interferences
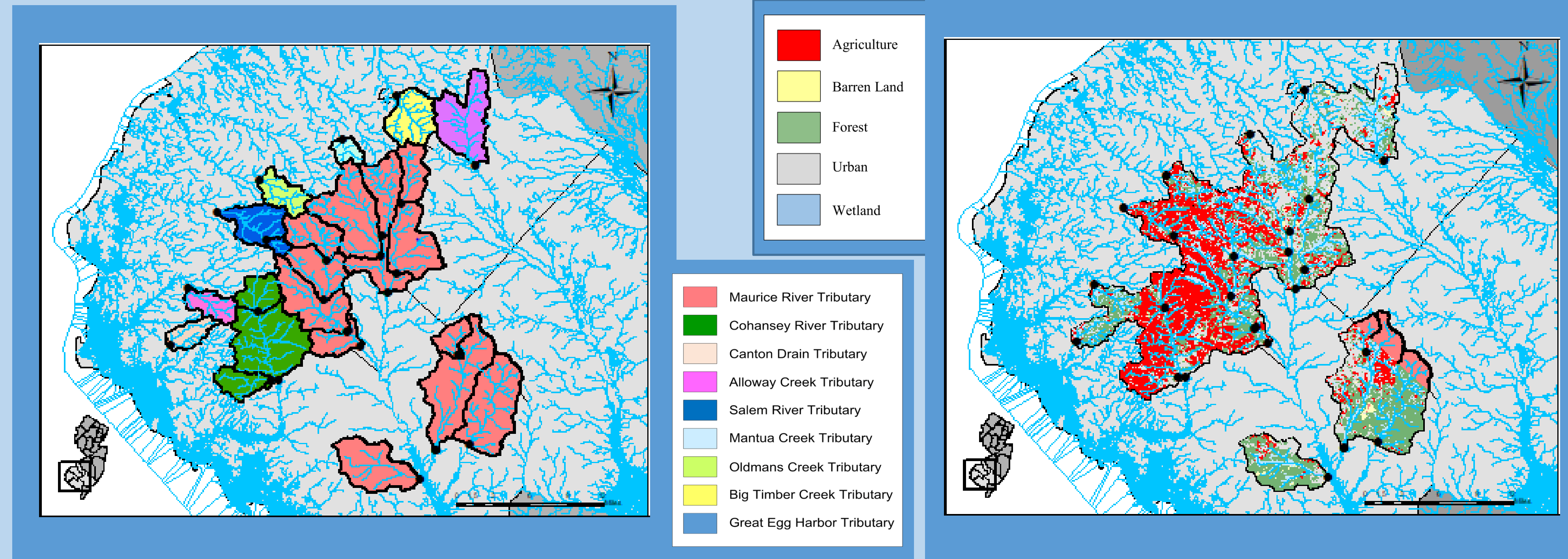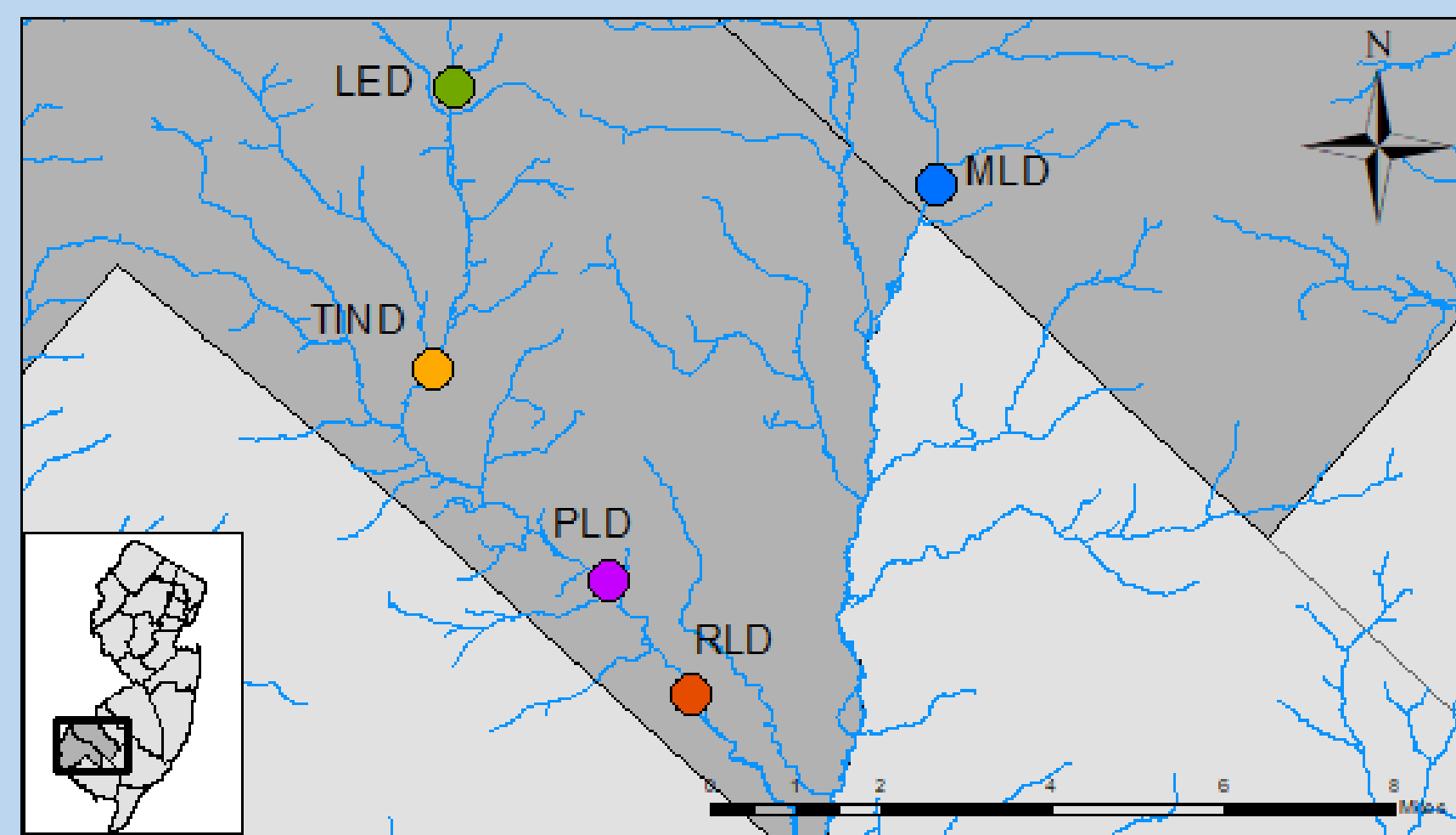

Figure 1: cHAB occurring at Elmer lake August 2019

Figure 2: (Left) Five sites sampled weekly summer 2019 for temporal data. (Center) Watersheds of reservoirs sampled summer of 2019. (Right) Land usage surrounding the 26 sampling sites.

GIS Methods:

- Watershed delineations obtained through USGS StreamStats
- Land-use data obtained from NJ Bureau of GIS
- Maps made in ArcGIS

Sampling Methods:

- Temporal samples collected from 5 reservoirs weekly during summer 2019
- Spatial samples collected from 26 reservoirs during a 3-day period in summer 2019
- Water quality testing using multi-parameter sonde and handheld instruments
- Samples preserved for lab analysis

Molecular Methods:

- Absorbance readings taken for 200uL subsamples
- Using molecular methods of DNA extraction cyanobacterial densities will be measured
- Densities will be quantified using a new qPCR protocol on raw water samples
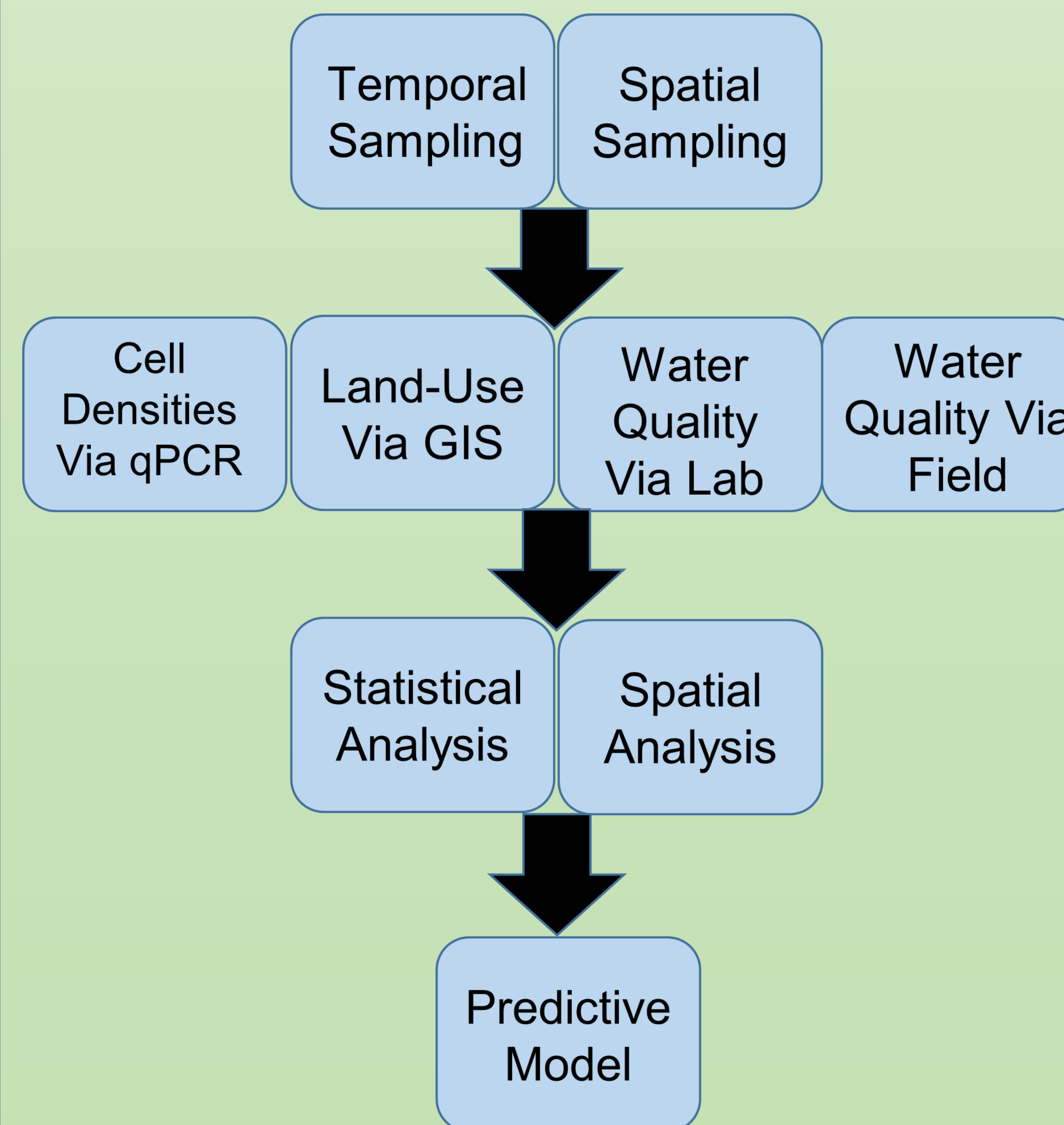- Ct values correlate to cell densities

Figure 3: Conceptual diagram of methodological approach to predictive model for cHABs.
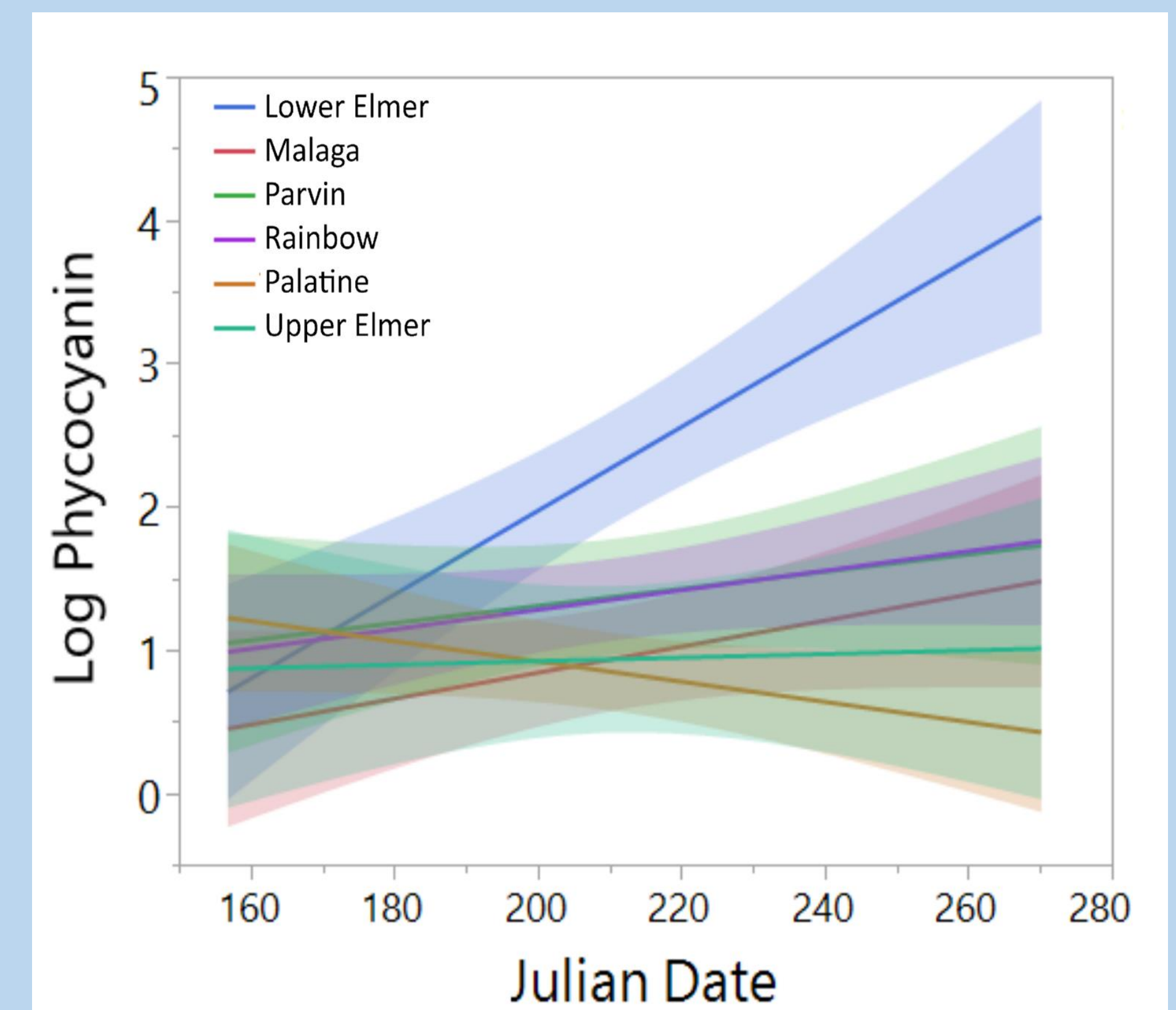

Figure 4: Linear regression of seasonal phycocyanin levels by Julian date with a 95% confidence interval. Lower Elmer becomes significantly different from the other lakes mid-June.

Preliminary Results:

- Planned data reduction techniques (principle components analysis (PCA), variance inflation factor (VIF), screening, elastic-net regression) as needed
- Multivariate predictive model to follow data reduction using multiple regression, ordination, discriminant analysis as appropriate