

Analysis Tutorial Prospectus

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1. Title

Which comes closest? Comparing chlorophyll-*a* and phytoplankton composition as predictors of cyanotoxins in U.S. Lakes

2. Research questions

- I. Which biological indicators chlorophyll-*a* (chl-*a*) concentration, total phytoplankton biovolume, or cyanobacterial abundance best predict the presence and concentration of cyanotoxins in U.S. lakes?
- II. Does cyanobacterial biovolume serve as a more reliable predictor of cyanotoxin presence than chl-*a* in large-scale lake datasets like the National Lakes Assessment (NLA)?
- III. How does the predictive power of chl-*a* compare to that of specific cyanobacterial genera or taxa (i.e. PTOX species) in forecasting cyanotoxin occurrence?

3. Objectives

- I. To determine whether chl-*a*, a commonly used proxy for algal biomass¹⁻⁵, is a sufficient indicator of cyanotoxin risk compared to more taxonomically resolved phytoplankton data.
- II. To evaluate and compare the predictive strength of chl-*a* concentration, total phytoplankton biovolume, and cyanobacterial abundance for the presence and concentration of cyanotoxins in U.S. lakes.
- III. To identify potential thresholds of biological indicators (such as chl-*a* and cyanobacterial biovolume) that are associated with elevated cyanotoxin levels.

4. Approach

I plan to use publicly available data from the U.S. EPA's National Lakes Assessment (NLA), focusing on year 2022 where both cyanotoxin measurements and biological indicators are available. My approach will include the following stages: (1) data acquisition and preprocessing (where I will download, compile relevant datasets, and extract variables of interest); (2) variable selection and categorization (where I will generate summary variables such as total phytoplankton biovolume, cyanobacterial biovolume, and abundance of potentially toxigenic (PTOX) cyanobacteria species⁶); (3) statistical analysis (where I will use exploratory data analysis to examine patterns and correlations among key variables, and then perform regression models to determine the predictive power of each biological indicator); (4) interpretation of results (where I will state which biological indicators most reliably predict cyanotoxin levels and discuss briefly the implications for monitoring programs in the U.S.).

5. Selected References

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