Introduction

- Lakes have physical, chemical, and biological differences in their responses to climate change.
- Secchi disk depth, temperature, water chemistry are water quality indicators.
- Northwest Montana Lakes Network (NMLN) monitors ~ 41 lakes.
- 1992 – 2022
  - Citizen science volunteers measured Secchi disk depths and temperature June and August
  - Whitefish Lake Institute staff collect samples for water chemistry
- Modeled seasonal and annual variability in measurements
- across years, and among months while accounting for lake-specific variation in seasonal and annual trends.

Methods

Data Collection
- Citizen Science volunteers for NMLN
  - ~ 49 volunteers since 2011.
  - Trained at Whitefish Lake Institute
  - Take Secchi disk depth and temperature measurements at their assigned lake twice a month
  - Submits data through online data submission (WQI form).
- Statistical Analysis using Rstudio©:
  - Year (continuous) and Month (categorical) as fixed effects explanatory variables and fixed effects
  - Filtered month – June, July, August
  - 5+ years of data
  - Linear Mixed Models
  - Random effect of lake
  - Analysis of Variance (ANOVA) to determine statistical significance of fixed and random effects, as well as their interactions
  - Plotted predictions of best model against observed data

Results

- Figure 1. Secchi disk depth across years for June.
- Figure 2. Temperature across years for June
- Figure 3. Total phosphorus concentrations across years for July
- Figure 4. Chlorophyll a concentrations across years for July

Discussion

- Summary of findings across years
  - Water clarity ↓
  - Temperature ↑
  - Total phosphorus ↑
  - Total nitrogen ↓
  - Chlorophyll a ↑
- Next steps
  - Perform a comprehensive analysis on the spatiotemporal effects of climate change on lakes using Trophic Status Indicators (TSIs)
  - Publish paper

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