

The Effects of Temperature, Nutrients, and Their Interactions on *Microcystis auerginosa* and *Anabaena flos aquae* Cultures

Cortney Borer, Ashleigh Pilkerton¹, and Dr. Annika Walters^{2, 1}

¹Wyoming Cooperative Fish and Wildlife Research Unit
Department of Zoology and Physiology, University of Wyoming

²United States Geological Survey



HARMFUL ALGAL BLOOMS

A threat to summer fun and to your health



What Are They?

Also known as harmful cyanobacterial blooms, these are toxic blooms of algae that appear in lakes, reservoirs, and other bodies of water.





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Why Should I Care?

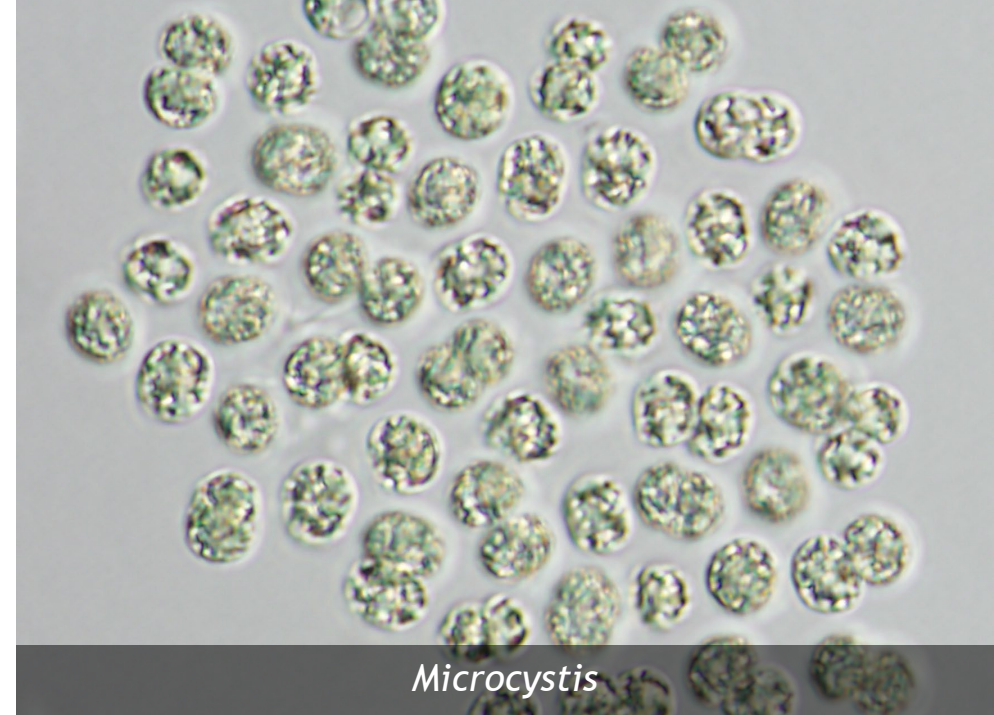


These blooms can be highly toxic and can cause severe illness in both humans and in pets. They also harm aquatic ecosystems and can cause illness in wildlife.



What are Cyanobacteria?

- ▶ Photosynthetic bacteria.
- ▶ Also known as blue-green algae.
 - ▶ They are not technically algae though.
- ▶ Prefer to grow in waters that are slow-moving and nutrient-rich.
- ▶ Picked the species *Microcystis aeruginosa* and *Anabaena* for this experiment.
 - ▶ Prevalent species in Wyoming blooms.



Microcystis



Anabaena

Introduction

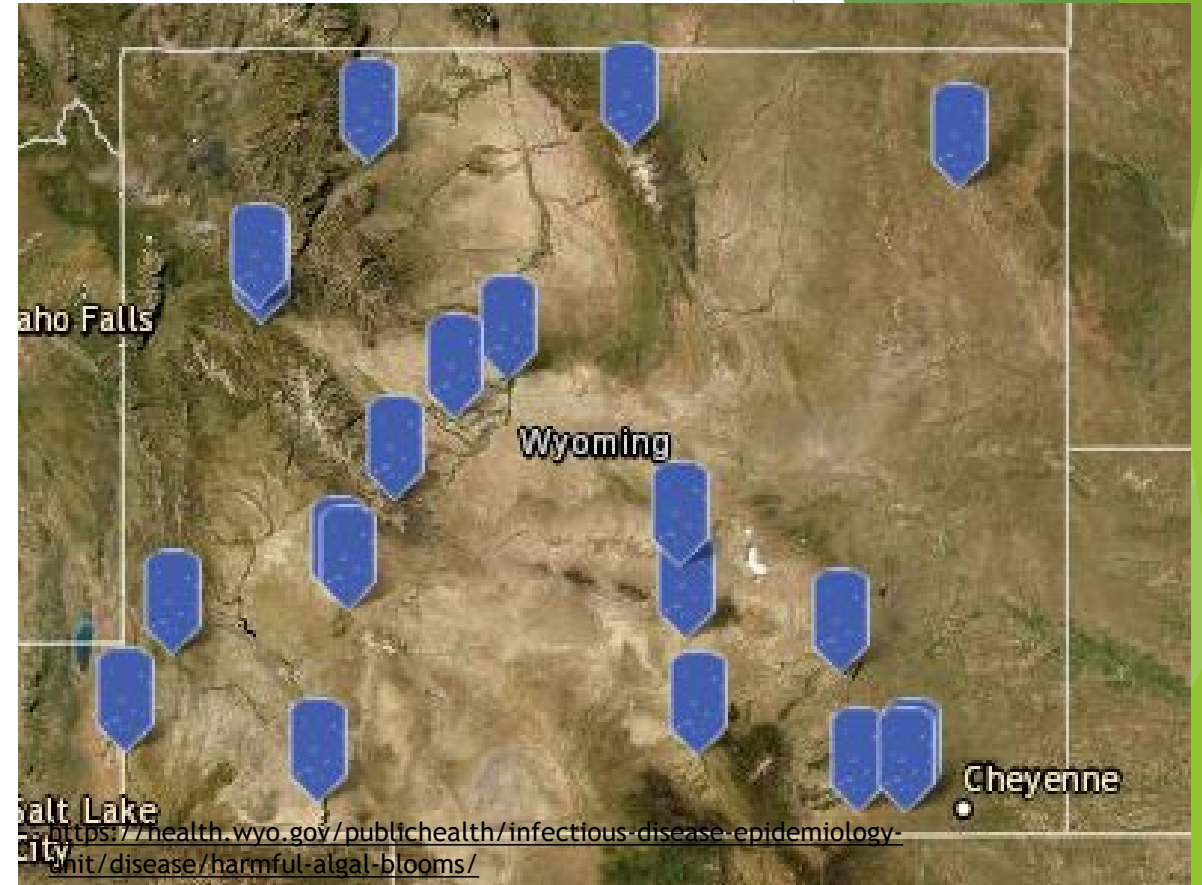
Nutrients suspected to play a large part in determining growth of blooms.

- Nitrogen (N) and phosphorous (P) are essential nutrients.
- Increase in nutrients tends to increase bloom sizes.

Temperature also shown to have a significant effect.

- Higher temperatures have been shown to increase bloom size, generally.

Extensive research has been done, but little specific to Wyoming.



Goals and Hypotheses

- ▶ This research aims to explore how temperature and nutrient levels affect the growth of cyanobacteria, specifically in Wyoming.
 - ▶ Use temperatures and nutrient levels based on environmental conditions present in Wyoming.
- ▶ Hypothesize that higher temperatures and higher nutrient levels will lead to more growth for both species.

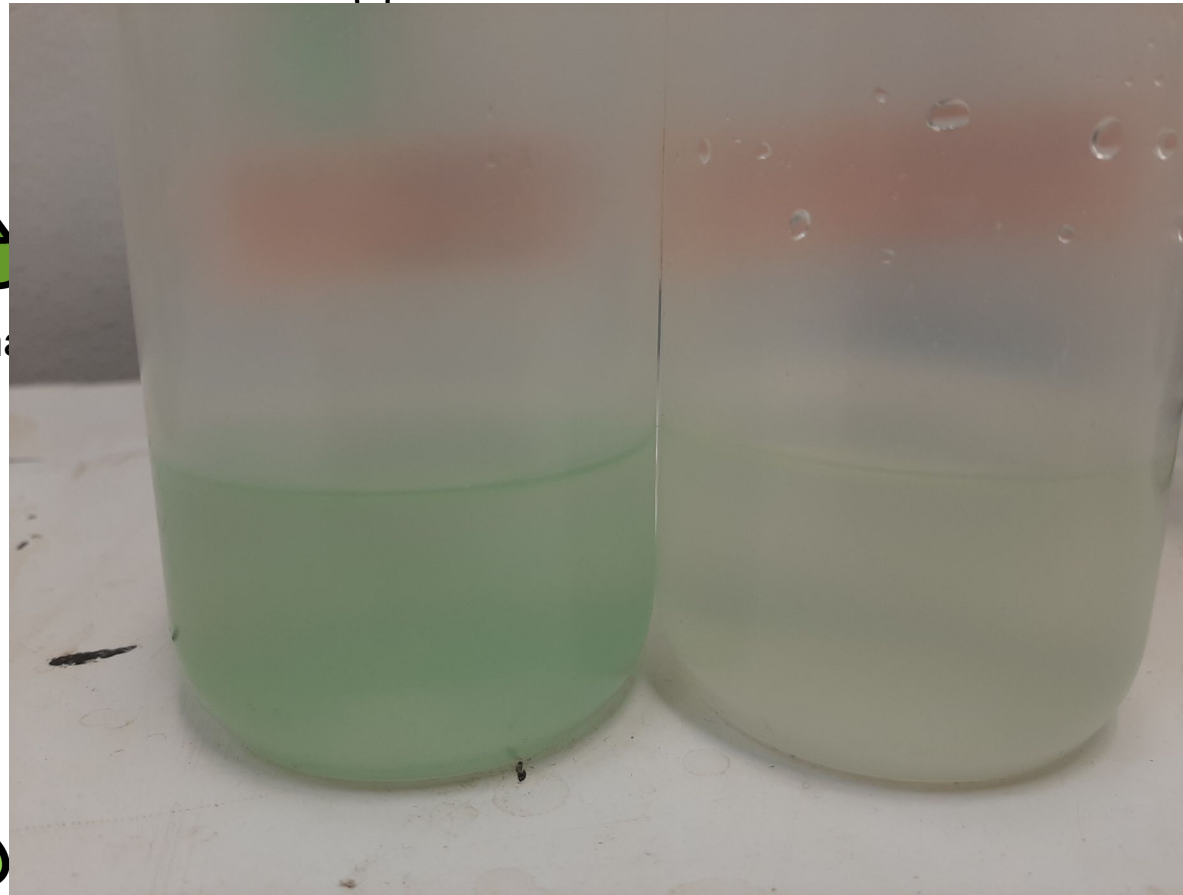
Methods



Anabaena



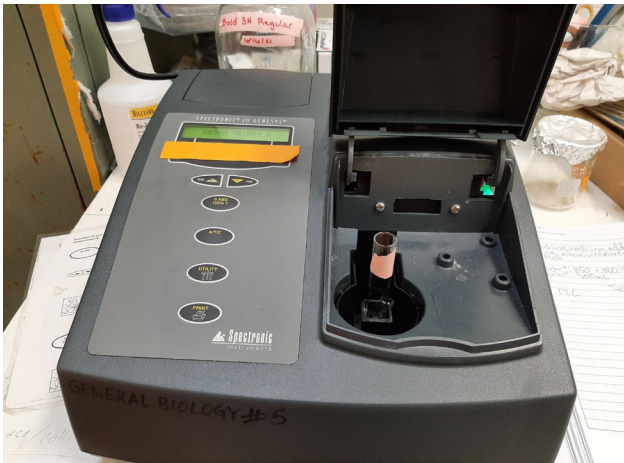
Microcystis



Nitrogen and
Phosphorous

1. Measure samples using absorbance taken at 665nm
2. Get estimated cell counts using a standard curve and compare
3. Repeat experiment to test hypothesis with altered environmental conditions

Methods



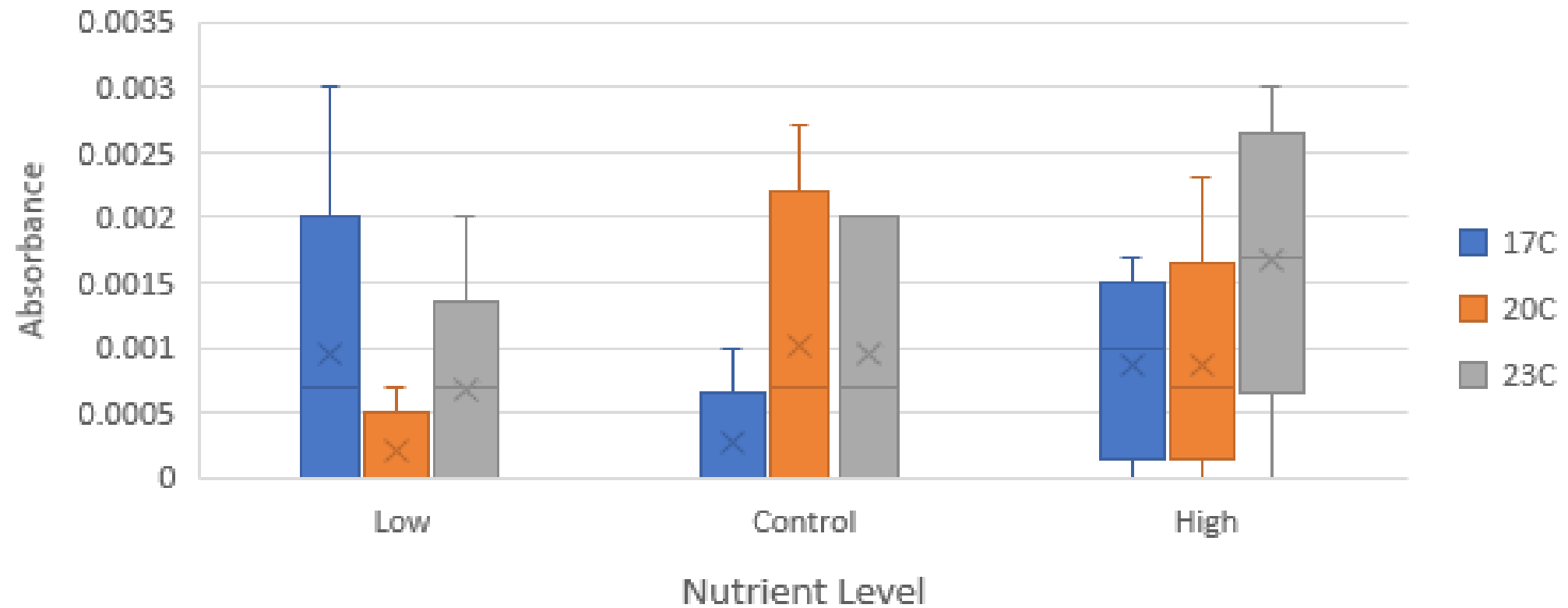
- ▶ Each experiment ran for two weeks.
- ▶ Temperature-regulated static baths used to control temperature.
- ▶ Modified a medium recipe to get high and low nutrient conditions.
- ▶ Samples taken twice a week to measure absorbance.

Results of Round 1

- ▶ No statistically significant differences found in either species.

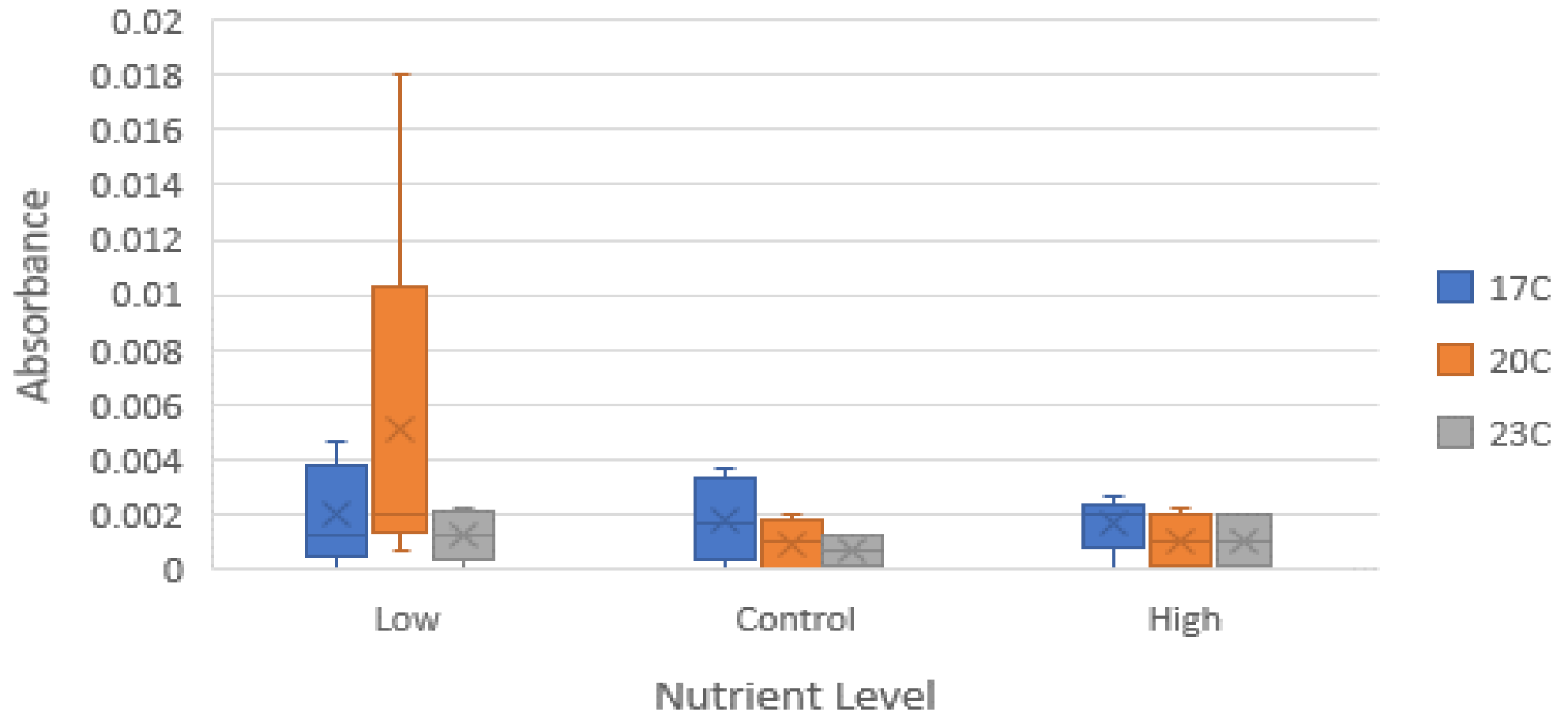
Microcystis

Interaction Between Temperature and Nutrient Levels in *Microcystis* Culture Measured in Absorbance Levels



Anabaena

Interaction Between Temperature and Nutrients in *Anabaena* Culture Measured in Absorbance Levels

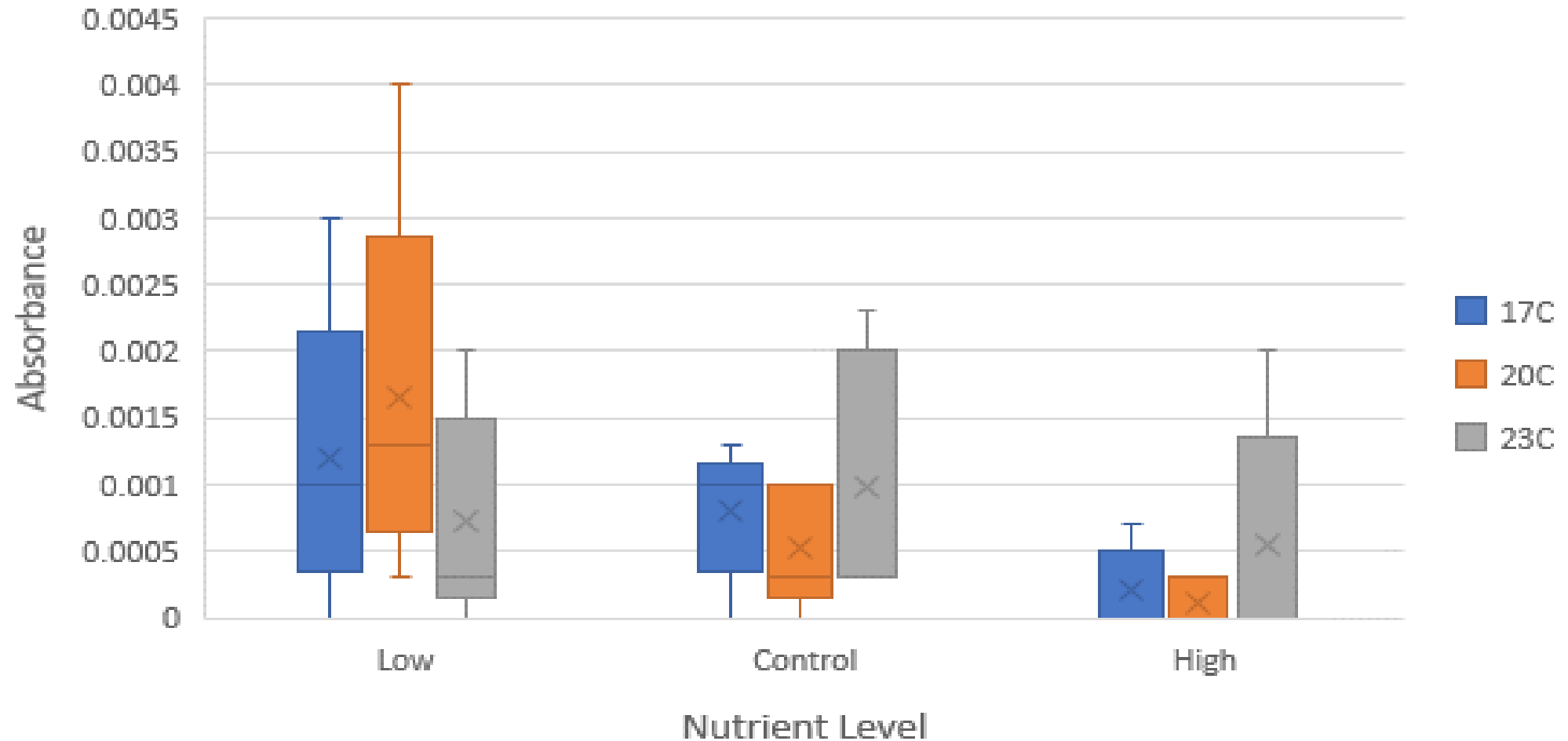


Results of Round 2

- ▶ Analysis of Variance showed a significant difference in the nutrient treatments in *Microcystis* cultures.
 - ▶ The higher nutrient level had a significantly lower mean than the other two nutrient conditions.
- ▶ There was a significant interaction between temperature and nutrients in *Anabaena* cultures.
 - ▶ At the control and high nutrient levels, absorbance is negatively correlated with temperature.

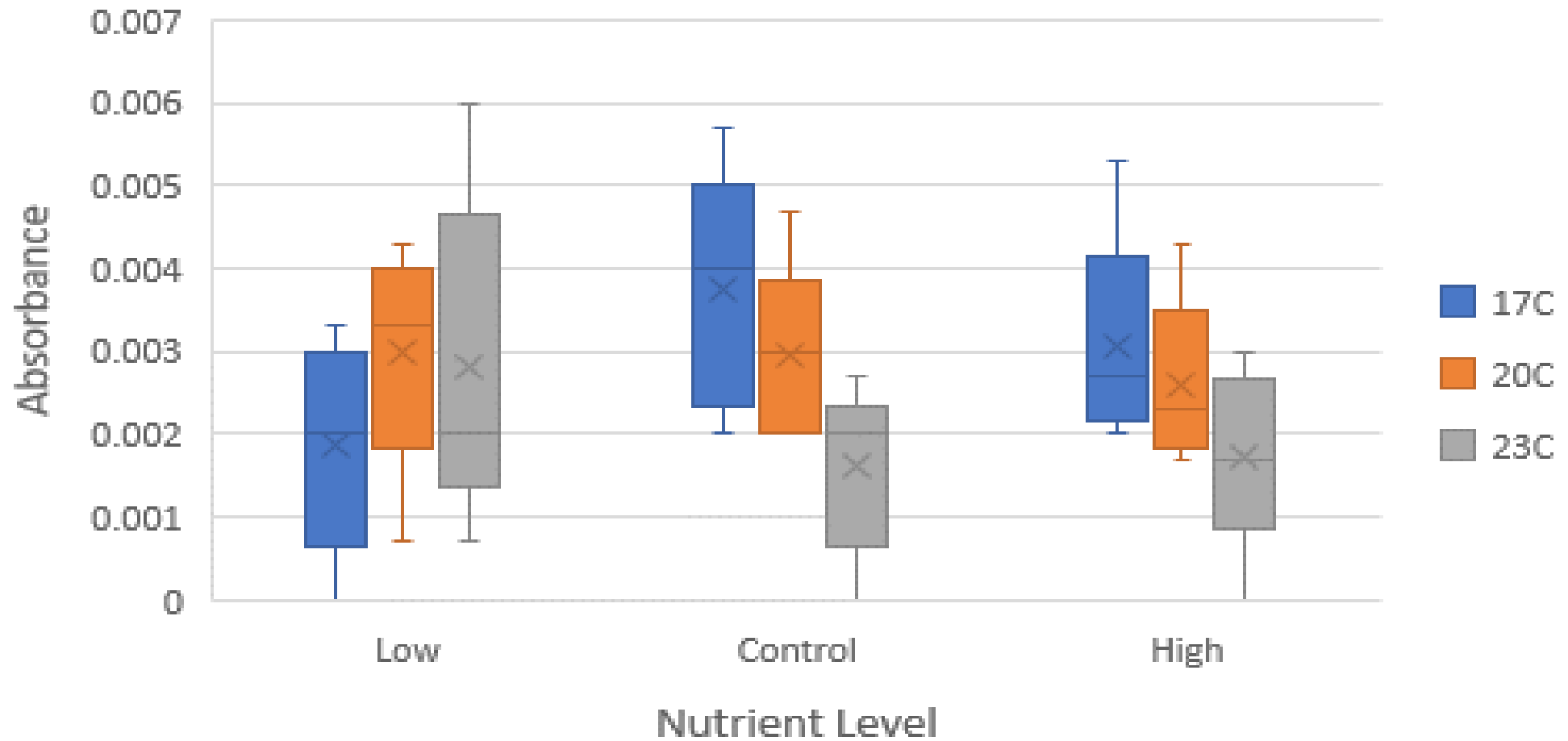
Microcystis

Interaction Between Temperature and Nutrient Levels in *Microcystis* Culture Measured in Absorbance Levels



Anabaena

Interaction Between Temperature and Nutrients in *Anabaena* Culture Measured in Absorbance Levels



- ▶ No significant results in the first round.
- ▶ Second round showed a significant temperature effect in *Microcystis* and a significant interaction between temperature and nutrients in *Anabaena*.
- ▶ Confounding variables can influence results.
 - ▶ Lacked an ingredient in the first round.
 - ▶ Spectrophotometer lacked sufficient accuracy.
- ▶ Use different methods of gathering data.

Discussion

Management Implications

- ▶ Use this research as a jumping-off point.
 - ▶ Explore nutrients and temperature separately.
 - ▶ Use more extreme values than we did for changes in nutrients and temperature.
- ▶ Climate change, mainly rising temperatures, has been shown to influence these species.
- ▶ More work can be done into exploring the significance of each factor in blooms in Wyoming which will inform management plans in the future.

TRIO



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Questions