The Relationship Between Aerators and Microcystin: A Comparison Between Two Ponds

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Introduction

- Cyanobacterial blooms are a natural occurrence in surface waters that are becoming a global problem exacerbated by anthropogenic nutrient loading to water bodies .
- Cyanobacteria produce cyanotoxins such as microcystin, which can be extremely harmful to aquatic life within the lake as well as to the surrounding organisms.
- Aerators are a unique way to control the growth of phytoplankton or alleviate eutrophication. Lots of conflicting results with this.

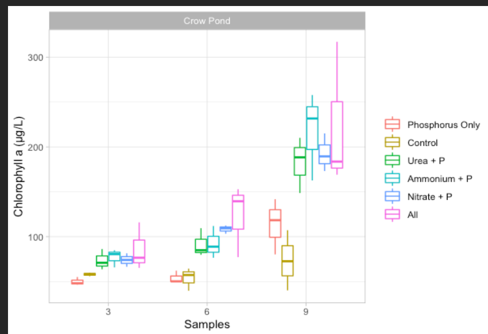
METHODS

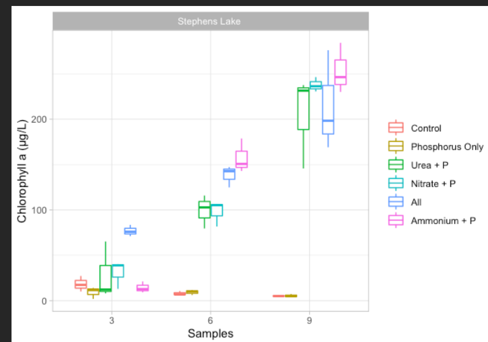
- Nutrient addition experiments were conducted in Missouri at Crow Pond, a non-aerated pond, and Stephen's Lake, an aerated pond.
- Nutrient enrichments of NO_3^-, P, NH_4^+, Urea and an enrichment with all the treatments were added to the lake water
- Lake water was collected into 1 L cubitainers and was incubated under ambient light and temperature for nine days to allow for the growth of phytoplankton.

RESULTS

Parameter	Crow Pond	Stephens Lake
Landscape	Under developed	Urban
GPS	38°89'37.5" N; -91°73'76.9" W	38°95.0'97.7"N; -92°30.7'54.6"W.
Z_{max} (m)	3.409	5.345
Z_{mix} (m)	3.404	Isothermal
pH	7.09	5.62
SRP (mg/L)	NA	0.019
TP (mg/L)	0.113	0.103
Urea (mg/L)	0.2442	0.1372
NO_3^- (mg/L)	0.025	0.005
TN (mg/L)	1.79	1.42
NH_4^+(mg/L)	0.025	0.007

Aeration **alleviates** microcystin concentration by limiting **cyanobacterial HABs.**





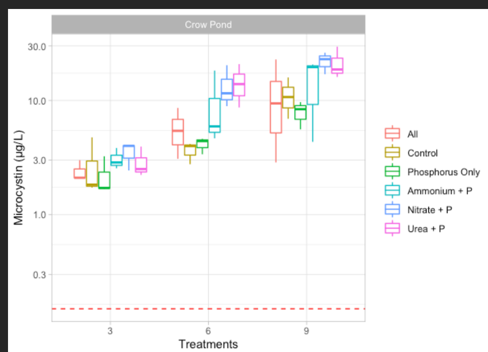


Table 1. Post hoc test comparisons of treatments of Chl-a for Crow Pond using dunn's test. All values are p-values. Values were deemed significant if p <= alpha/2.

	All	Ammonium + P	Control	Nitrate + P	Phosphorus + P
Ammonium + P	0.4093	-	-	-	-
Control	0.0089*	0.0047*	-	-	-
Nitrate + P	0.5	0.4093	0.0089*	-	-
Phosphorus	0.0332	0.0195*	0.2962	0.0332	-
Urea + P	0.3511	0.2703	0.0234*	0.3511	0.0731

Table 2. Post hoc test comparisons of treatments of microcystin for Crow Pond using dunn's test. All values are p-values. Values were deemed significant if p <= alpha/2.

	All	Ammonium + P	Control	Nitrate + P	Phosphorus + P
Ammonium + P	0.2962	-	-	-	-
Control	0.4695	0.2703	-	-	-
Nitrate + P	0.0462	0.1257	0.0393	-	-
Phosphorus	0.2962	0.1422	0.3232	0.0113*	-
Urea + P	0.0843	0.2001	0.0731	0.3798	0.028

Table 3. Post hoc test comparisons of treatments of Chl-a for Stephen's Lake using dunn's test. All values are p-values. Values were deemed significant if p <= alpha/2.

	All	Ammonium + P	Control	Nitrate + P	Phosphorus + P
Ammonium + P	0.2337	-	-	-	-
Control	0.0392	0.0064*	-	-	-
Nitrate + P	0.3369	0.3798	0.0146*	-	-
Phosphorus	0.0332	0.0052*	0.4695	0.012*	-
Urea + P	0.4695	0.2109	0.0462	0.3095	0.0392

Table 4. Post hoc test comparisons of treatments of microcystin for Stephen's Lake using dunn's test. All values are p-values. Values were deemed significant if p <= alpha/2.

	All	Ammonium + P	Control	Nitrate + P	Phosphorus + P
Ammonium + P	0.3361	-	-	-	-
Control	0.0273	0.0095*	-	-	-
Nitrate + P	0.4088	0.4238	0.0156*	-	-
Phosphorus	0.072	0.0298	0.3222	0.0453	-
Urea + P	0.1882	0.3222	0.0025*	0.2566	0.0095*

Conclusions

- **Chl-a and microcystin concentrations were significantly different throughout the experiment.**
- **There was a response to the nutrient enrichments, particularly observant in Stephen's Lake.**
- **Data supports aeration being a useful tool for controlling cyanobacteria HABs primarily by shifting the phytoplankton communities.**

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