Effects of cyanobacteria on quagga mussel (*Dreissena rostriformis bugensis*) reproduction

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Dreissenid - Cyanobacteria Interaction

- Alter nutrient and phytoplankton dynamics
- Dreissenid may enhance cyanobacteria blooms through selective feeding
- Cyanobacteria can produce harmful toxins

Climate | Sep. 26, 2016 01:44PM EST

Toxic Algae Blooms Set Historic Records From Coast to Coast

Tap Water Ban for Toledo Residents

By EMMA G. FITZSIMMONS AUG. 3, 2014

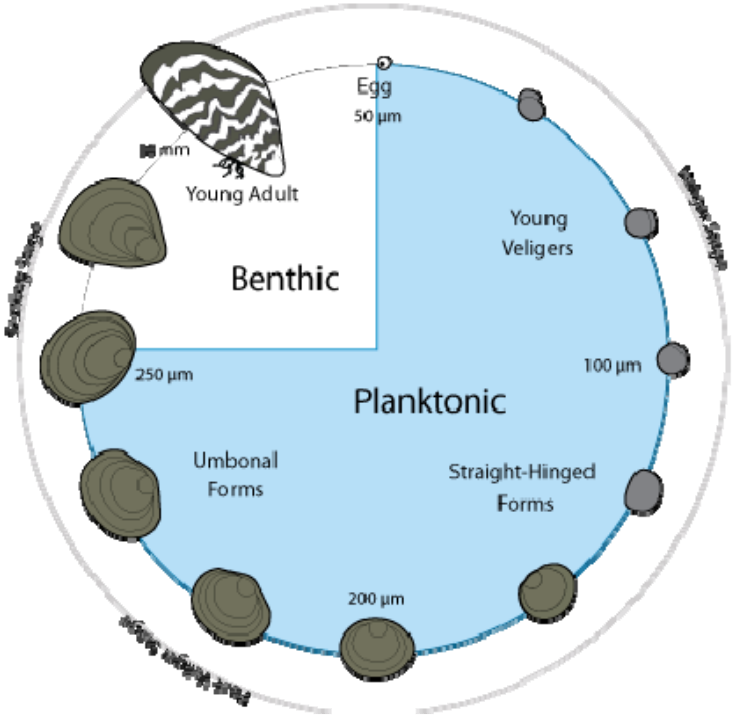
The New York Times

Dreissenid - Cyanobacteria Interaction

- Dreissenids can persist in lakes with cyanobacteria blooms
- Continuous exposure to *Microcystis* and toxins may physiologically impair mussels, potentially increasing the effectiveness of control methods

Dreissenid Background

- Are broadcast spawners
- Spawn from April-September
- May rely on phytoplankton cues for spawning
- Nutritious algae may stimulate while cyanobacteria could hinder reproduction



www.100thmeridian.org

Objective

Determine the effects of cyanobacteria on dreissenid reproduction

(spawning, fertilization, and sperm vitality)

Methods

- Mussels were collected from the Detroit River

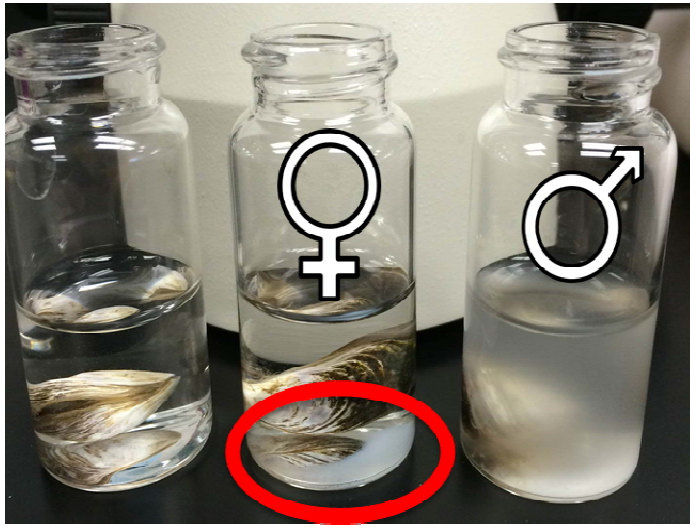
- Tested 13 cyanobacteria cultures (8 species)
  - *Anabaena flos-aquae*
  - *Aphanizomenon flos-aquae*
  - *Dolichospermum lemmermanii*
  - *Gloeotrichia echinulata* (2 cultures)
  - *Lyngbya woolei*
  - *Microcystis aeruginosa* (5 cultures)
  - *M. wesenbergii*
  - *Planktothrix suspensa*

Methods

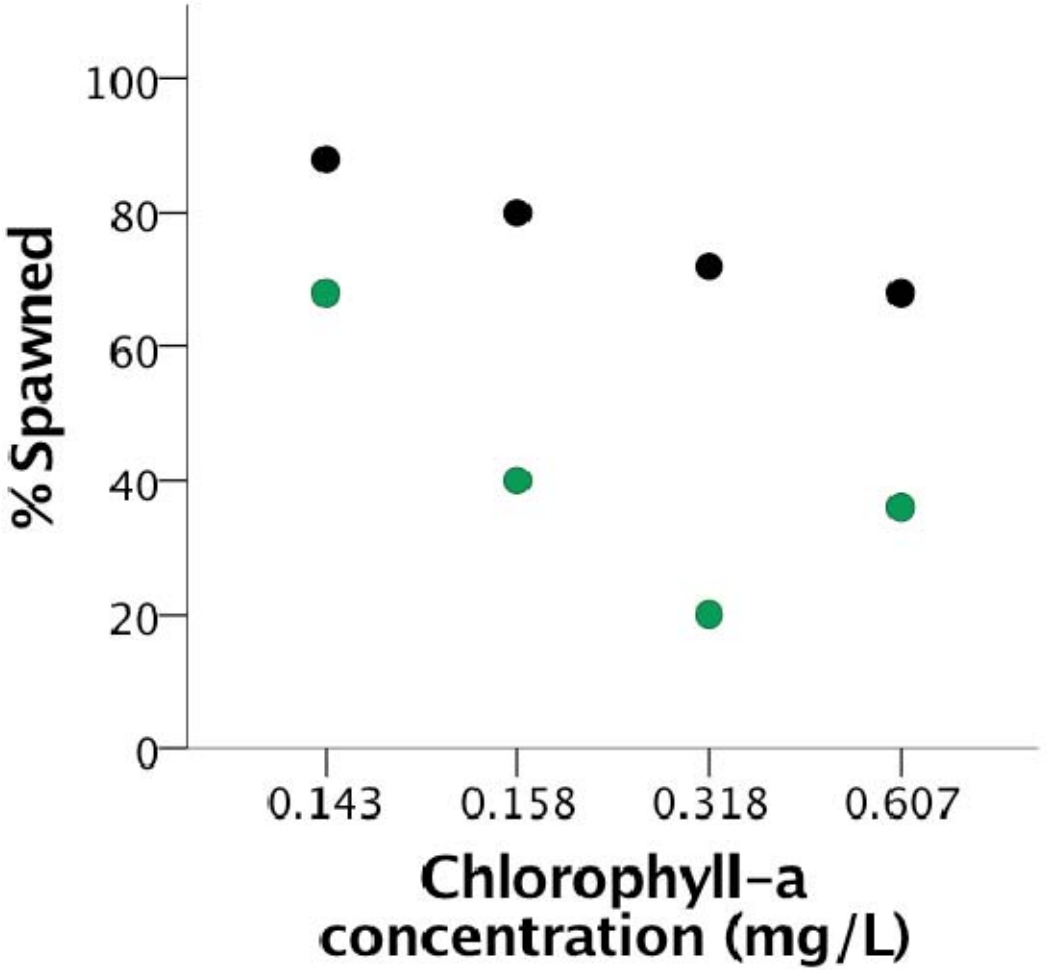
- **Spawning Assessment:** Individual mussels were placed into vials and 1 x 10^{-3}M 5-HT serotonin was added to induce spawning

- **Fertilization Assessment:** After inducing spawning, sperm and eggs were collected and placed in well plates. Fertilization was monitored microscopically and quantified

- **Sperm Vitality:** After inducing spawning, sperm was collected and placed in well plates where distance, velocity, and acceleration were quantified microscopically using image-tracking software



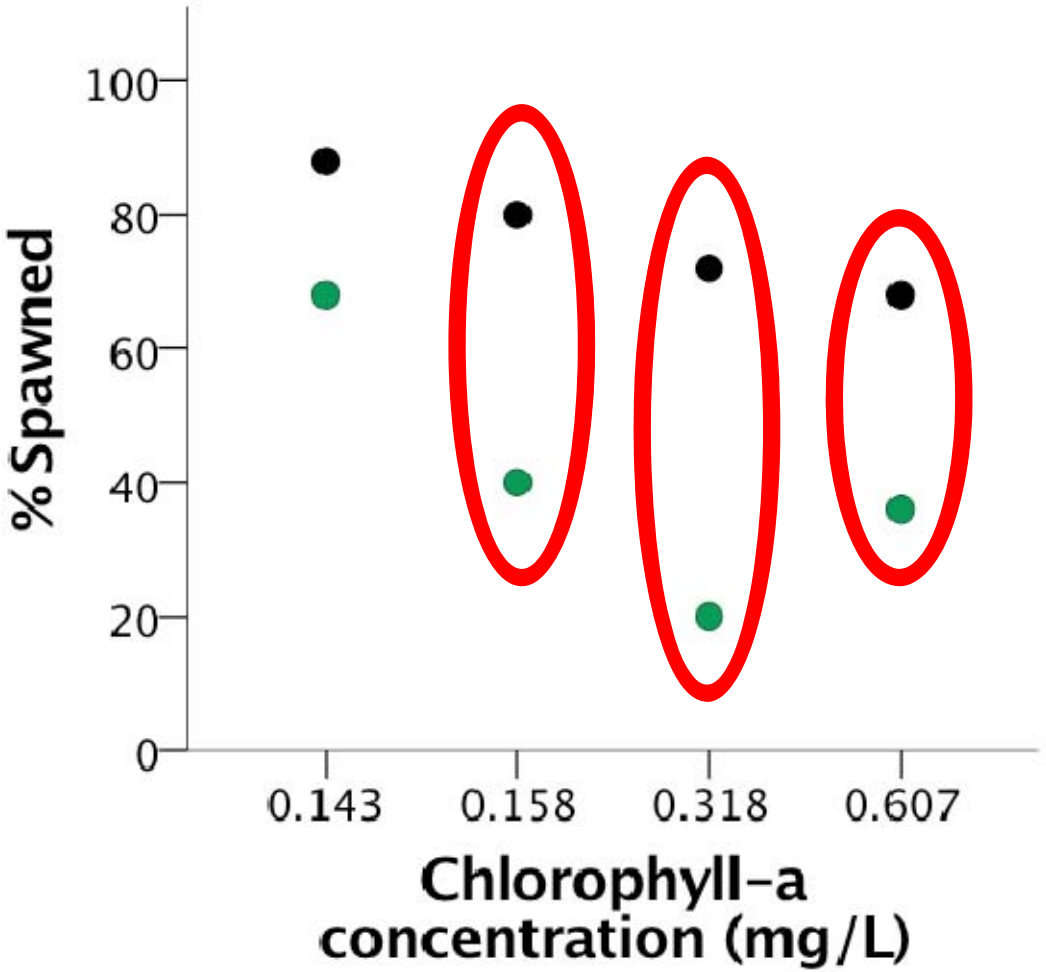
Results – Spawning



- **Control**
- ***Aphanizomenon flos-aquae***

Fisher's Exact Test

Results – Spawning

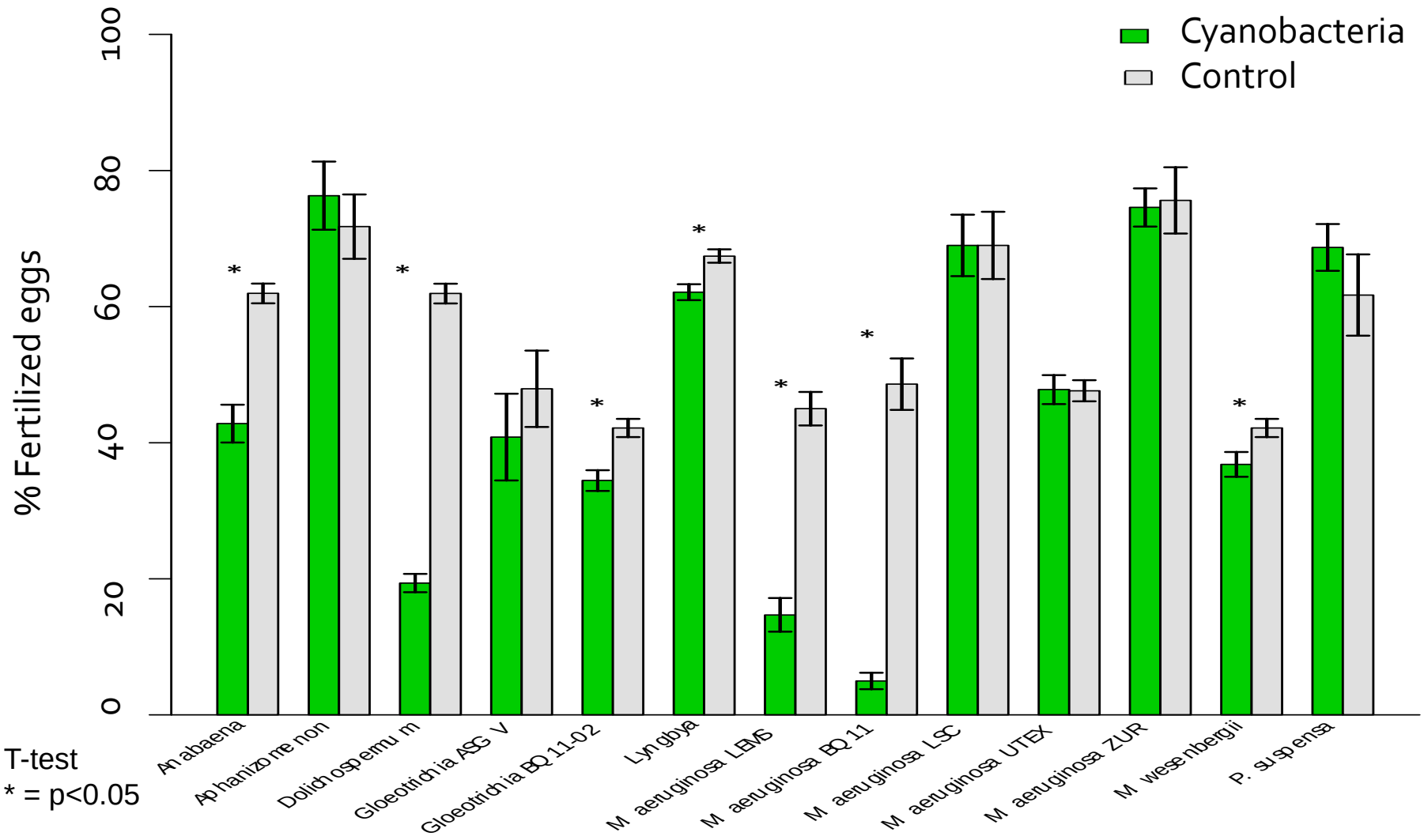


Control

Aphanizomenon flos-aquae

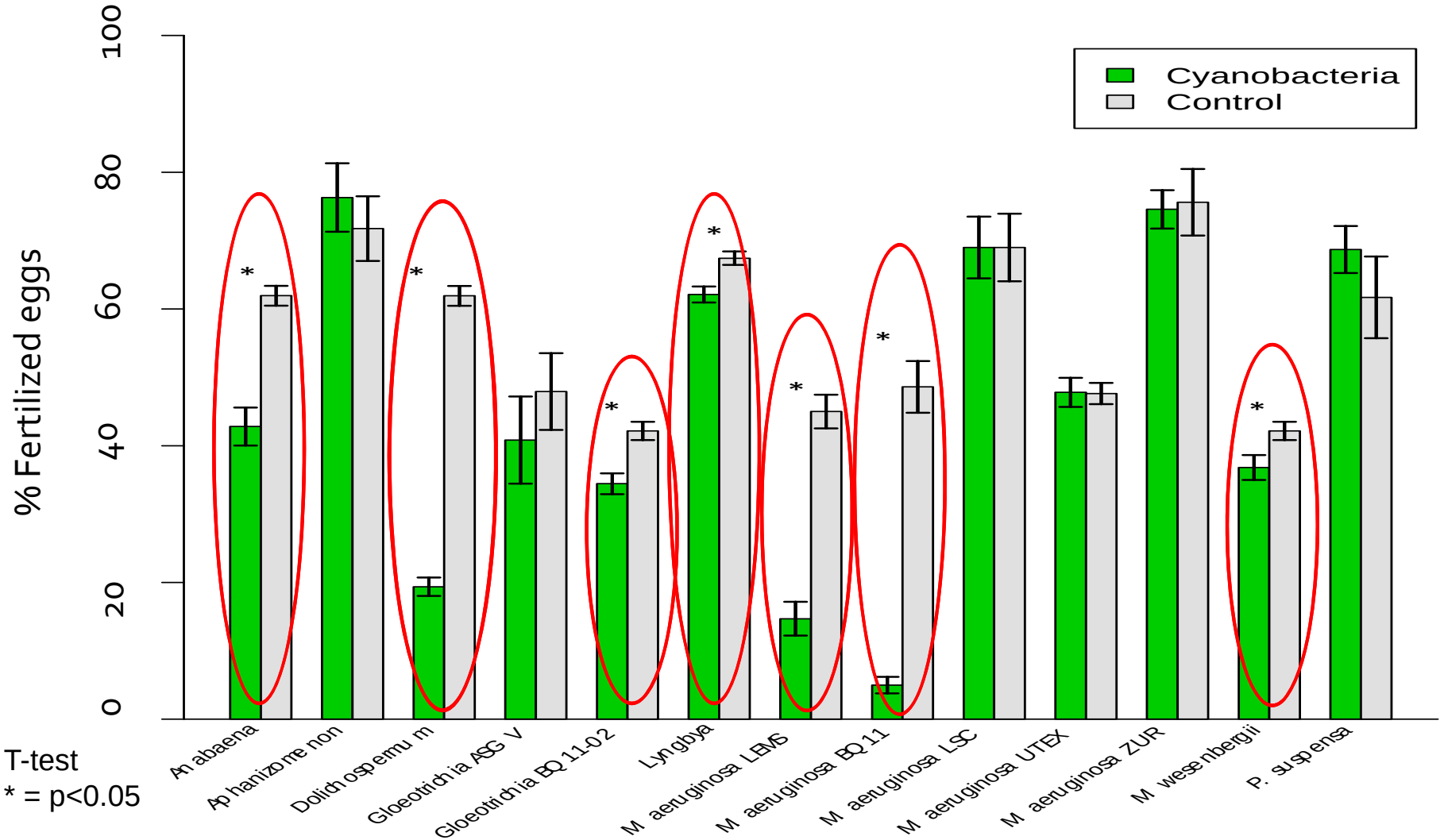
Fisher's Exact Test;
red circles = $p<0.05$

Results – Fertilization



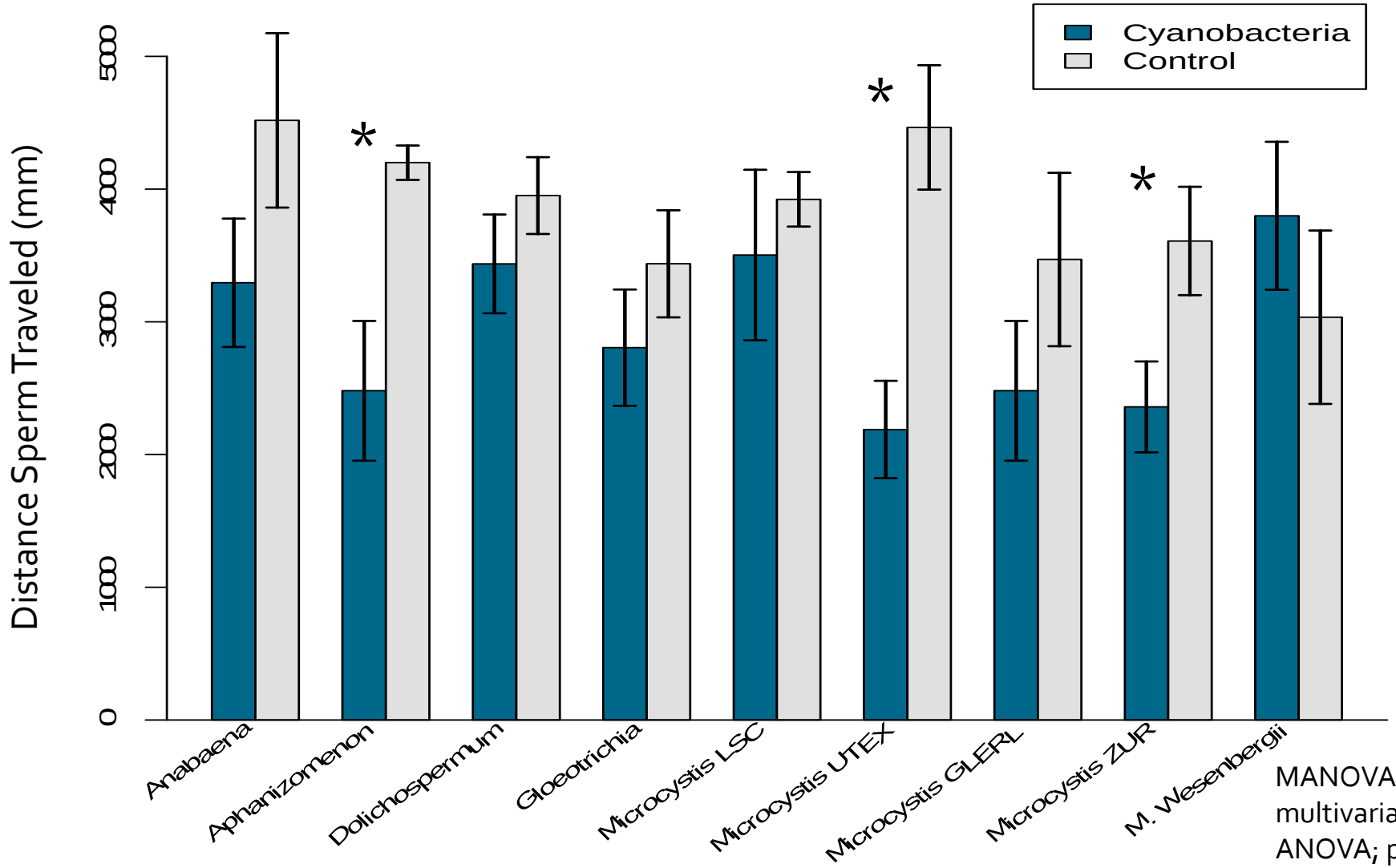
T-test
* = p<0.05

Results – Fertilization



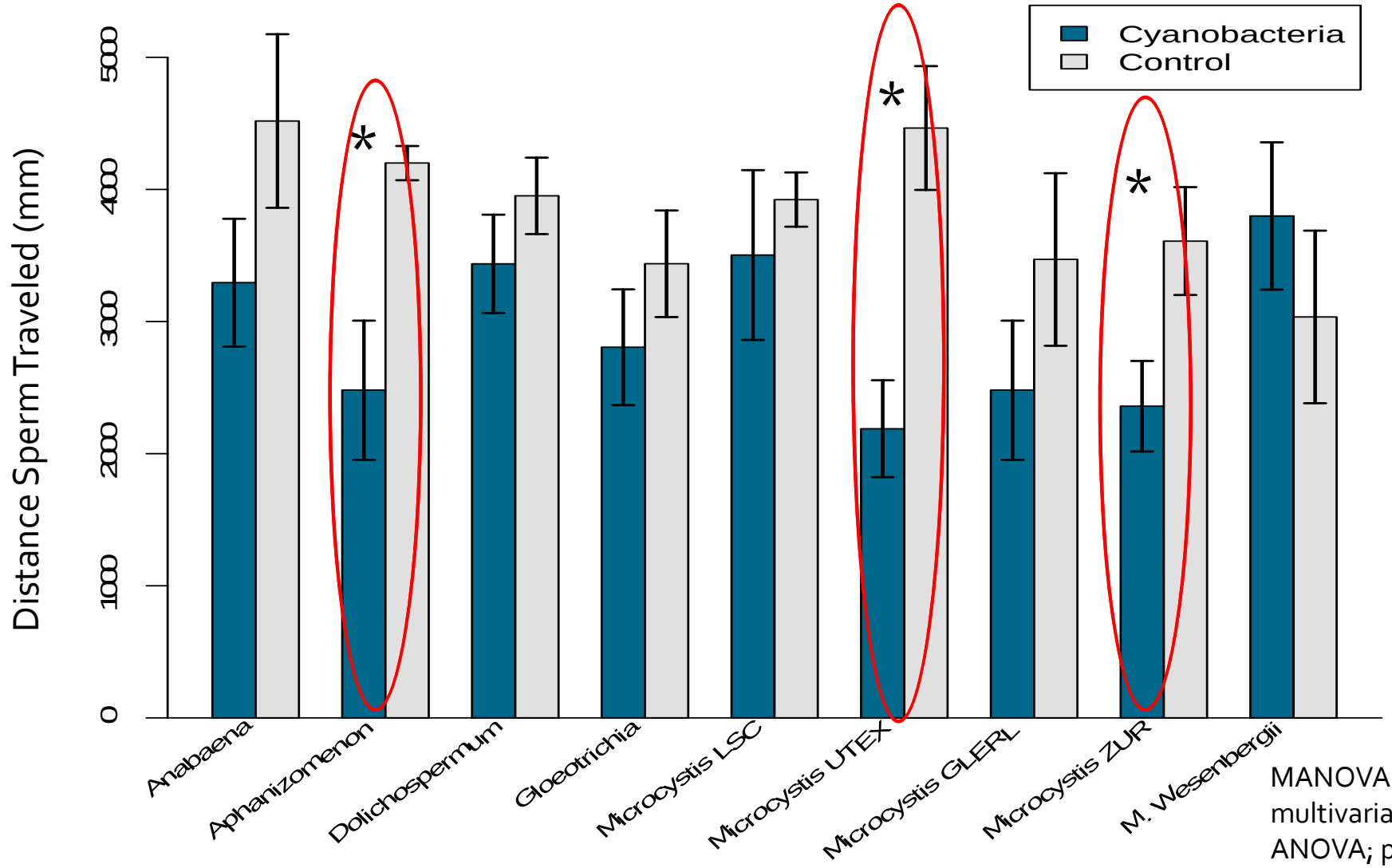
T-test
* = p<0.05

Results – Sperm Distance



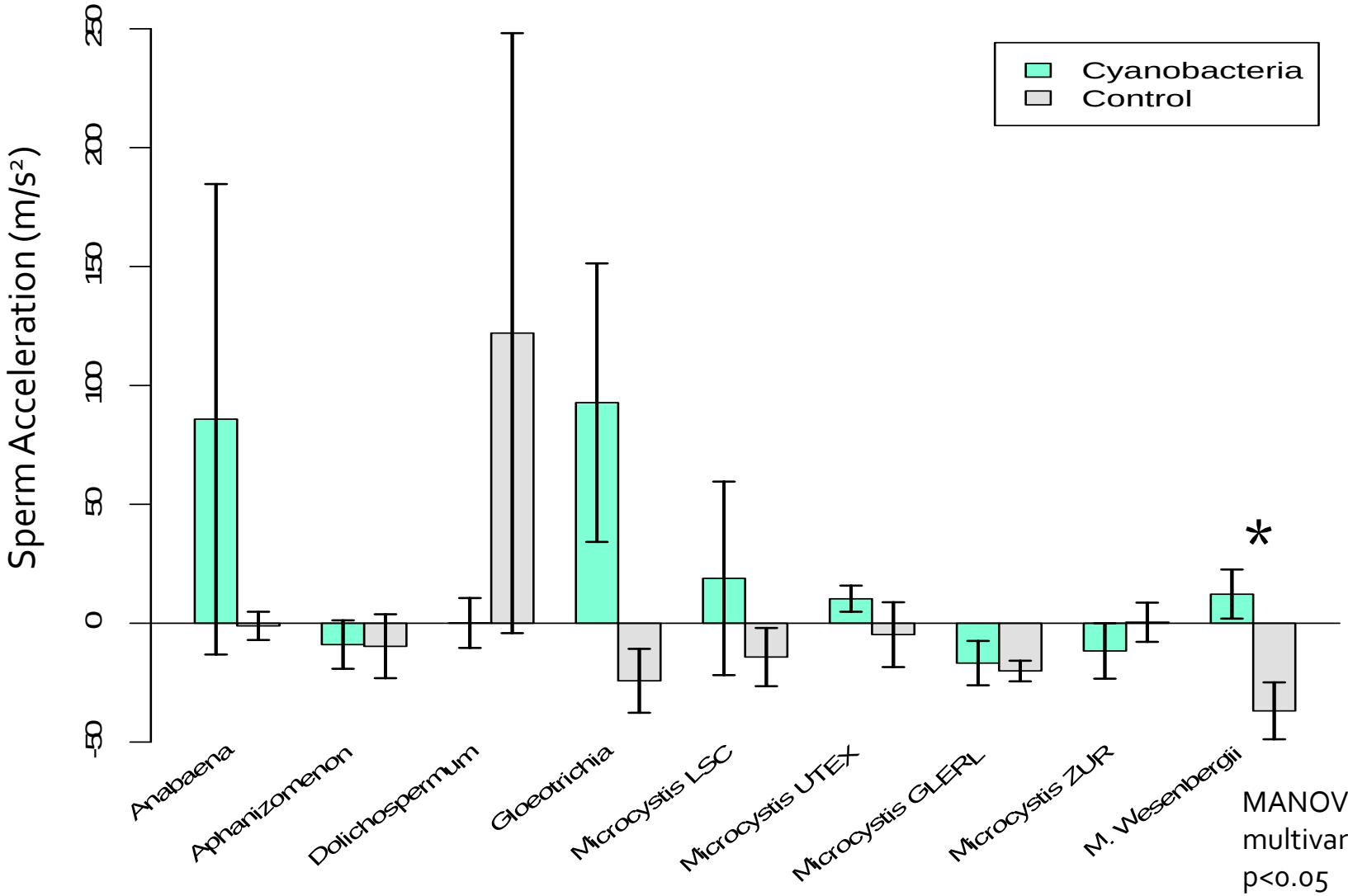
MANOVA w/ multivariate ANOVA; $p<0.05$

Results – Sperm Distance



MANOVA w/ multivariate ANOVA; $p<0.05$

Results – Sperm Acceleration



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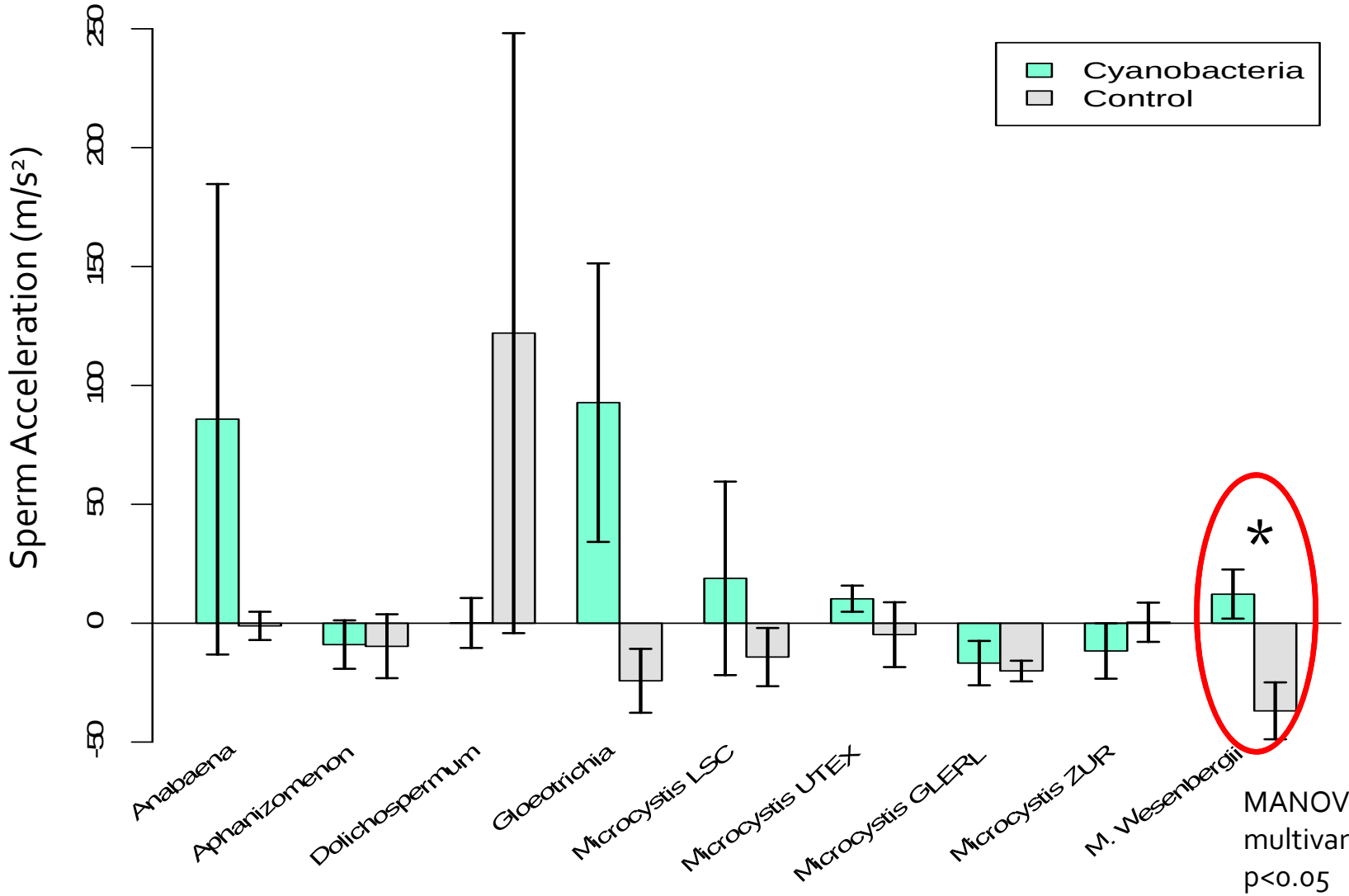
Results – Sperm Acceleration



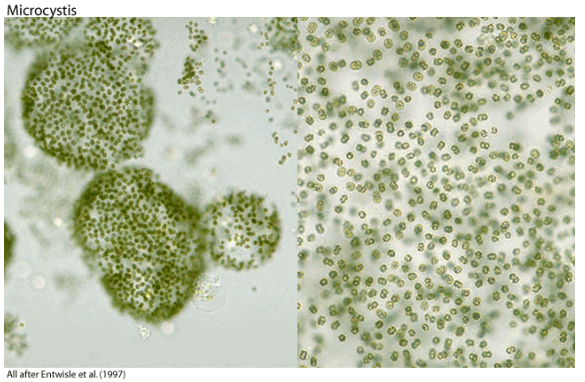
MANOVA w/ multivariate ANOVA; $p<0.05$

Results Summary

- Fertilization – 7 cultures have an effect
- Spawning – *Aphanizomenon flos-aquae* inhibits at ≥ 0.158 mg/L chlor-a
- Sperm motility
  - Distance and velocity impacted by *Aphanizomenon flos-aquae* and two *Microcystis aeruginosa* cultures
  - Acceleration impacted by *M. wesenbergii*

Conclusions

- Cyanobacteria impacts spawning and fertilization in lab studies
- Results can be used to enhance population model estimates
- A chemical tool for reducing dreissenid reproduction might be derived from cyanobacteria to be used in tandem with other control efforts



Microcystis aeruginosa

Aphanizomenon flos-aquae

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