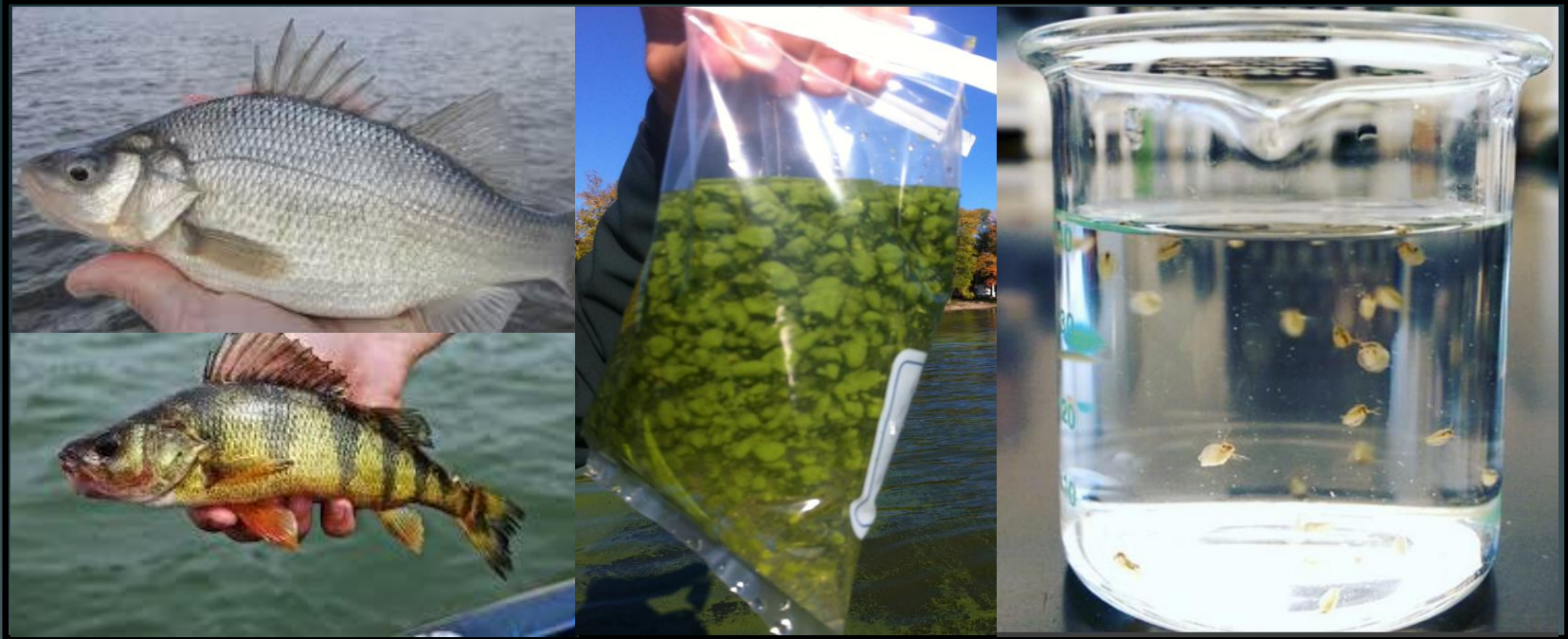


Impacts of cyanobacteria on fish essential fatty acids (EFA)



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Q1. Lake Biological Interactions

Cyanobacteria decrease the quality of food for fish



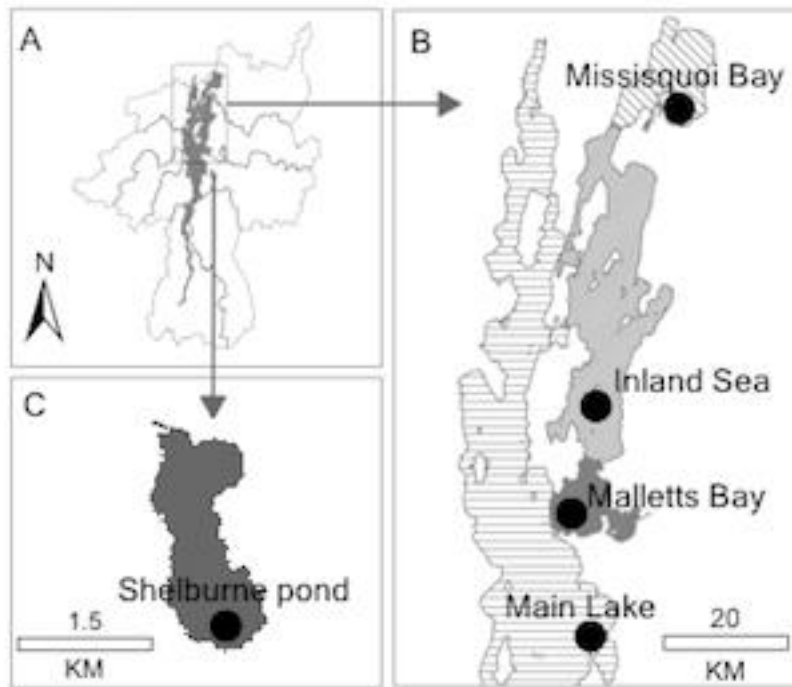
Normal bloom



BGA bloom



Evaluation of EFA across gradients of cyanobacteria prevalence



Malletts Bay

Low nutrient levels

Main Lake

Inland Sea

Missisquoi Bay

Shelburne Pond

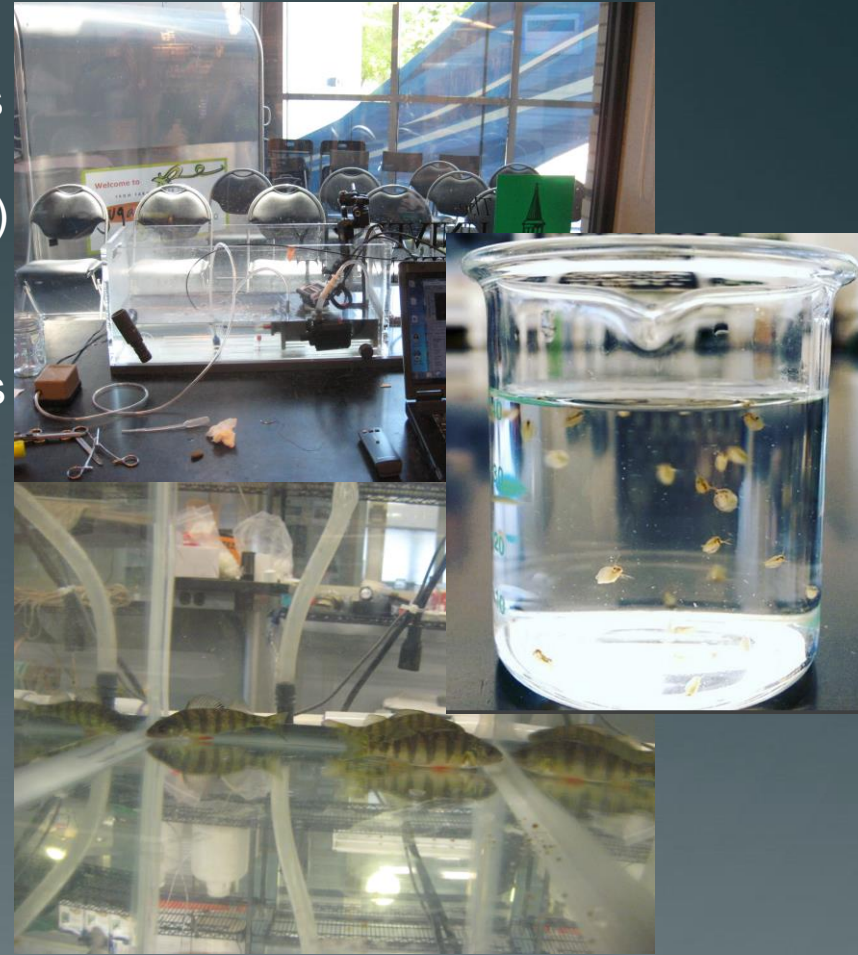
High nutrient levels



Laboratory multi-trophic level pilot study to confirm trends

Study Design and Goals:

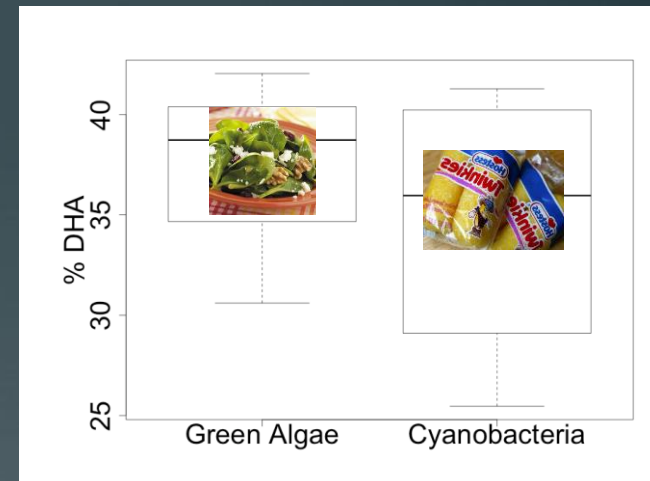
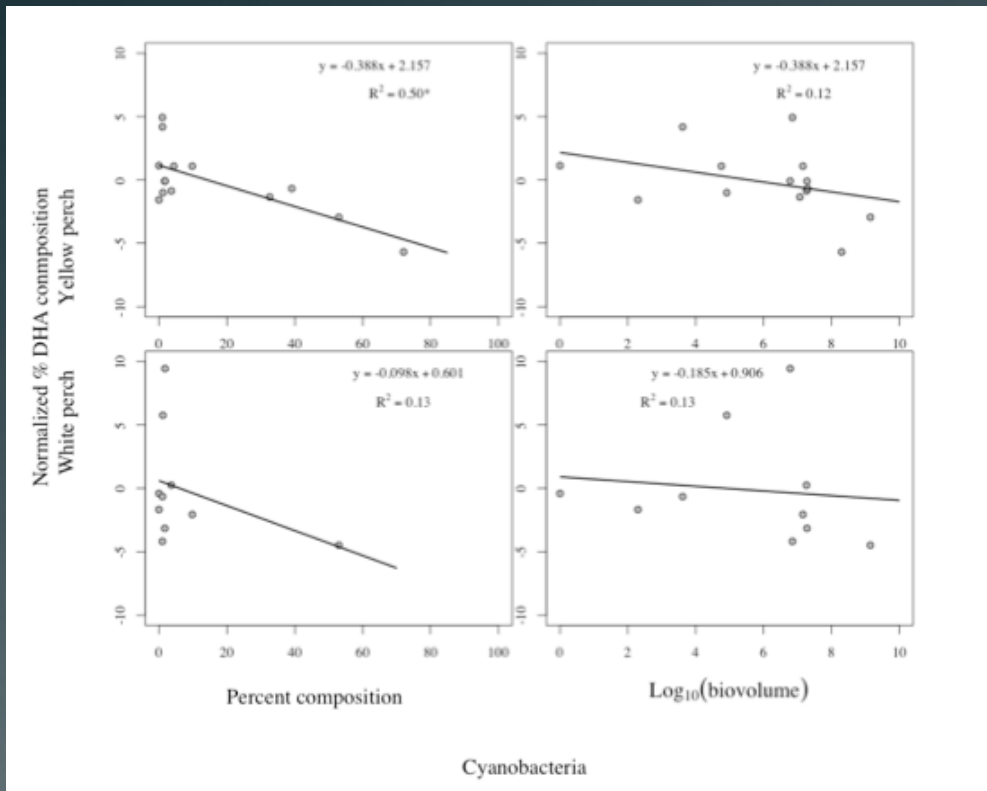
- Pilot Study after 2 weeks of *Daphnia* diets
 - *Daphnia magna* fed either a monoculture of *Microcystis* (BGA, n=6) or *Scenedesmus* (GA, n=6)
- All fish were sampled from separate tanks in a connected flow-through system.
- To test the impacts of cyanobacteria based diets on higher trophic level organisms and look for physiological evidence of essential fatty acid deficiency (EFAD)



Lake-wide trends showing decreased long-chain EFA supported by laboratory studies

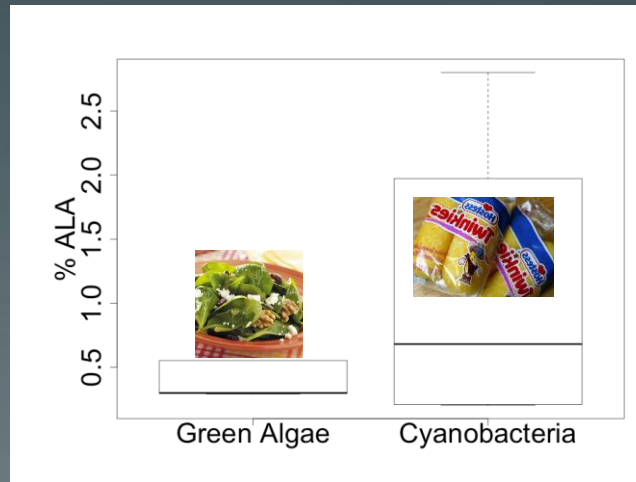
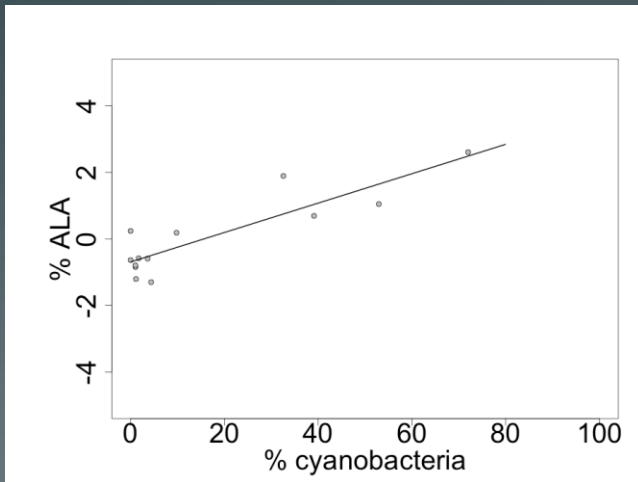
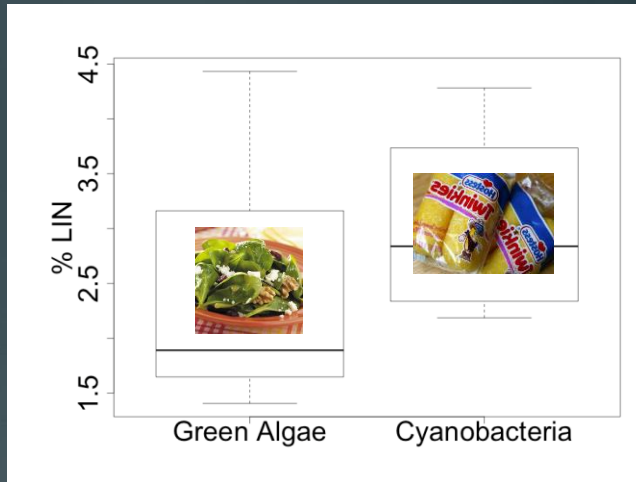
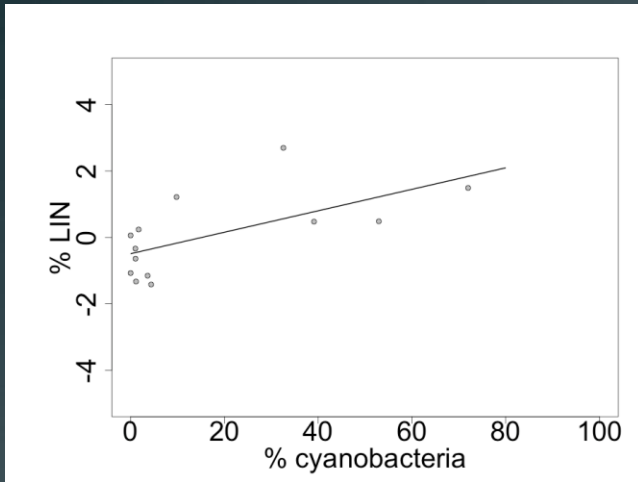
Field data from Lake Champlain

Lab study

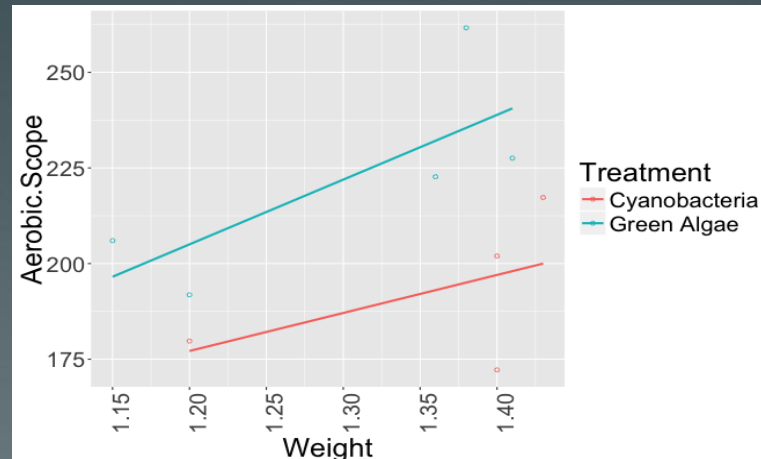
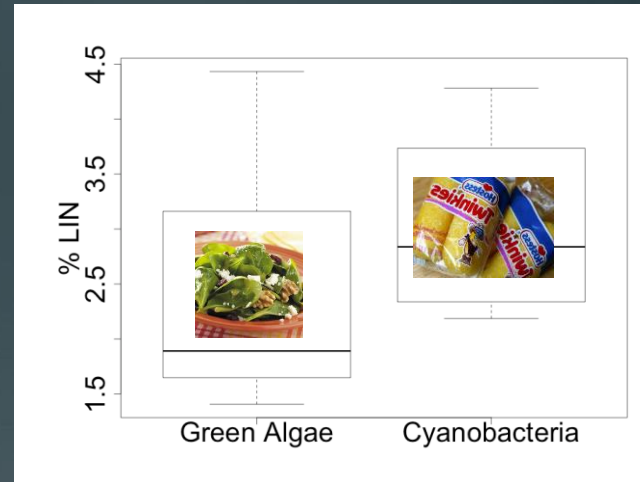
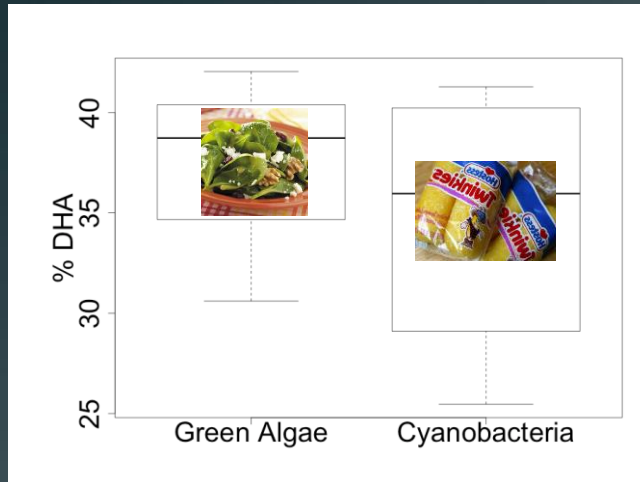


Gearhart, T. A., K. Ritchie, E. Nathan, J. D. Stockwell & J. Kraft. Alteration of EFA in secondary consumers across a gradient of cyanobacteria. *Hydrobiologia*. In Review

Increased rate of short-chain fatty acids in both field and lab studies



Lab studies show decreased physical fitness of fish fed cyanobacteria based diet



Further research

- Repeat expanded experiment with Zebrafish – In progress
 - Evaluating changes in fatty acid composition, identify indicators of essential fatty acid deficiency (EFAD)
 - Determine physiological consequences of EFAD, such as reduced swim capability, or decreased gonadal development
 - Establish duration of EFAD before physiological consequences appear
 - Continue to look for other indicators of metabolic stress and EFAD in wild populations
 - Evaluate importance of zooplankton grazing and selectivity on EFA trophic transfer
-

What do these changes mean for us?

- Potential changes in fish community composition – as different species are able to avoid EFAD through metabolic or dietary differences
- Data suggests that fish are still utilizing cyanobacteria based food sources, increasing the risk of microcystin toxin
- Decreased fish quality for consumers – a local high quality food source

