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Nutrient Concentration for Cyanotoxins at Turnbull



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Objectives

The purpose of this study is to analyze the cyanobacteria at the Turnbull National Wildlife Refuge (TNWR) near Cheney, Washington, USA, including:

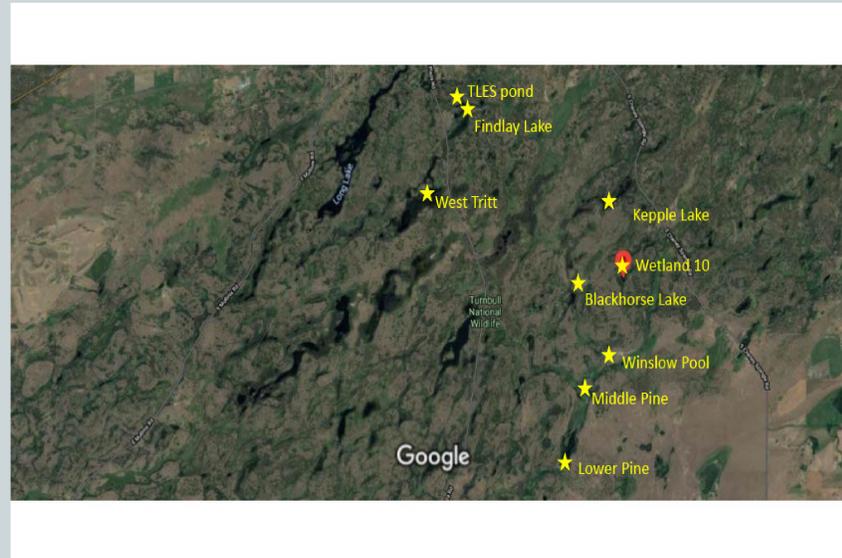
- Abundance of planktonic cyanobacteria
- Presence of the cyanotoxin microcystin
- Is abundance of cyanobacteria correlated with nitrogen or phosphorus concentrations or other indicators of eutrophication?

Background

Cyanobacteria are oxygen-producing bacteria that use light energy to convert CO₂ into biomass. Excess growth of cyanobacteria has been a problem for drinking water and aquatic ecosystems due to eutrophication, rising CO₂ levels, and warming. Anthropogenic sources of nutrients such as agricultural run-off and discharge from wastewater treatment provide cyanobacteria with resources to produce & release toxins. The most common toxin produced by freshwater cyanobacteria is microcystin, which can cause organ damage, respiratory failure, skin irritation and fever.

We will analyze the cyanobacteria in wetlands of the Turnbull National Wildlife Refuge (TNWR) near Cheney, Washington, USA. Human nutrient inputs from grazing, septic systems, and wheat cultivation have contributed runoff into the TNWR watersheds. The wetlands in TNWR provide habitat for 113 species including waterfowl and amphibians (Davidson et al.). With the increase in nutrient concentration, there has been an overabundance of primary producers, decreased biological diversity, algal blooms (some toxic), low dissolved oxygen, episodic anoxia, loss of vascular plant life, and fish kills (Davidson et al).

Research Site



Methods

Samples: Water was collected from 9 TNWR wetlands monthly in July, August and September, 2020 (see map) by Lucy Roussa, Seth McCollough, and Camille McNeely.

Nutrients: We will determine concentrations of nitrate, ammonium, total nitrogen, orthophosphate, and total phosphorus. Nutrients will be measured with an Alpkem 3 flow analyzer. Total nitrogen and total phosphorus will be determined following an alkaline persulfate digestion.

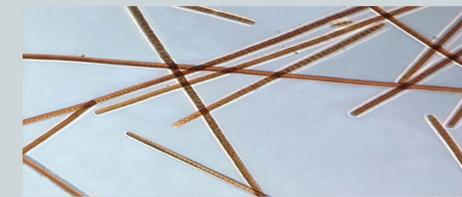
Chlorophyll a: Chlorophyll a is an indicator of the total abundance of algae. A Turner Trilogy fluorometer was used to determine in-vivo fluorescence of chlorophyll for each sample.

Phycocyanin: Phycocyanin is a pigment unique to cyanobacteria and an indicator their abundance. Phycocyanin concentrations were determined by extraction of filtered samples in a potassium phosphate buffer followed by spectrophotometry, according to the methods of Horvath et al.

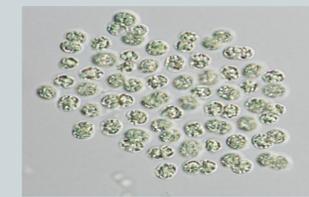
Microcystins analysis: We will be using a QuantiPlate™ Kit for Microcystins to find the concentration of microcystins in each sample. This is an ELISA-based test.

Hypotheses

1. *Planktothrix* and *Mircocystis* will be the most common potentially toxic cyanobacteria taxa found
2. At least some wetlands will contain measurable concentrations of microcystin
3. Cyanobacteria will be most abundant under high nitrogen conditions
4. Cyanobacteria abundance will be positively correlated with indicators of eutrophication such as high pH, highly variable DO, and high chlorophyll concentrations

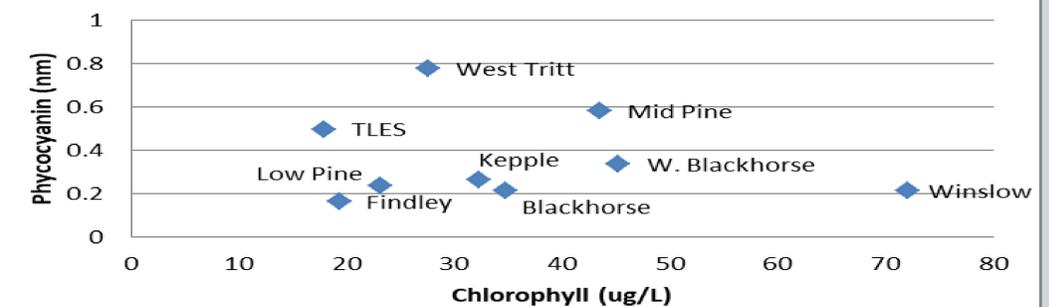


Planktothrix agardhii



Microcystis aeruginosa

Phycocyanin vs. Chlorophyll (7/21 - 8/5)



References

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Expected Outcome

We expect to find evidence of microcystin toxins in the various bodies of water around Turnbull. Depending on the concentrations of toxins in the water will help us determine whether or not it is safe for people's pets to drink from the water.