Ecology of Cyanobacteria in Lakes

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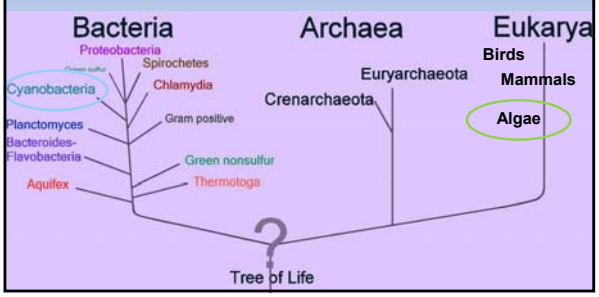
What cyanobacteria are not:

- NOT Infectious Pathogens
- NOT Invasive Species

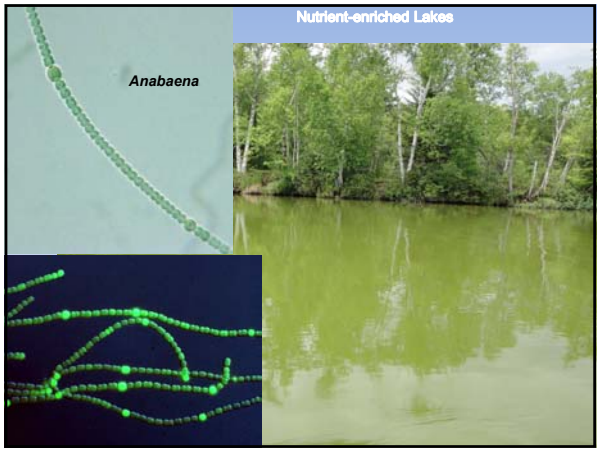
What Cyanobacteria are:

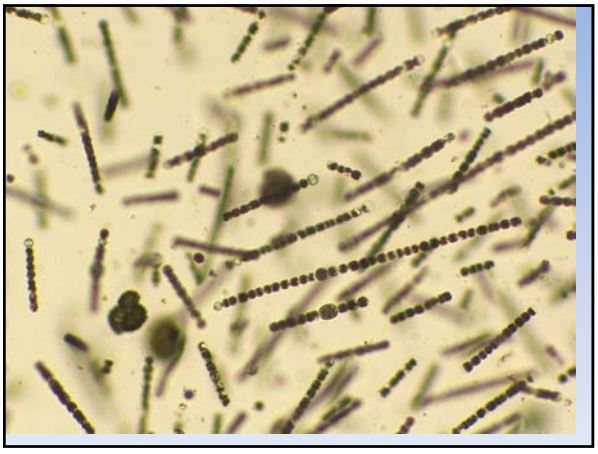
- **Integral** and **natural** components of aquatic ecosystems
- **Successful** and often promoted by human activities
- **Ancient**, and thus deserving of respect

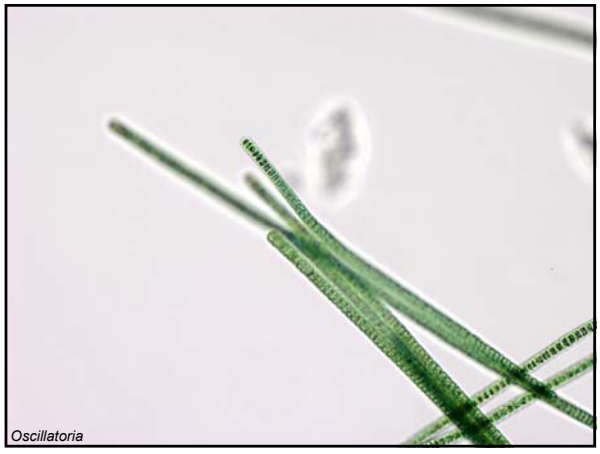
Blue-Green Algae or Cyanobacteria?

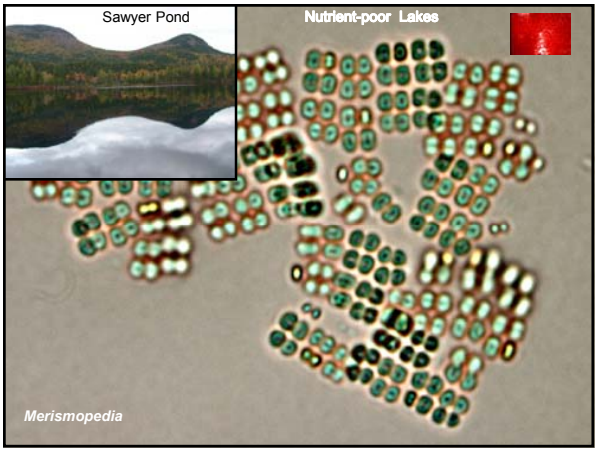


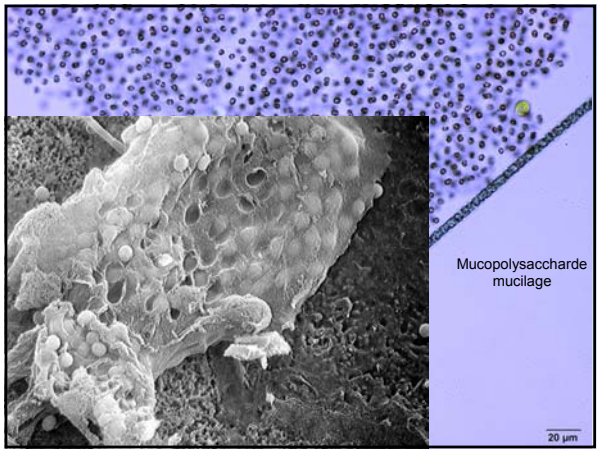
Cyanobacteria Diversity

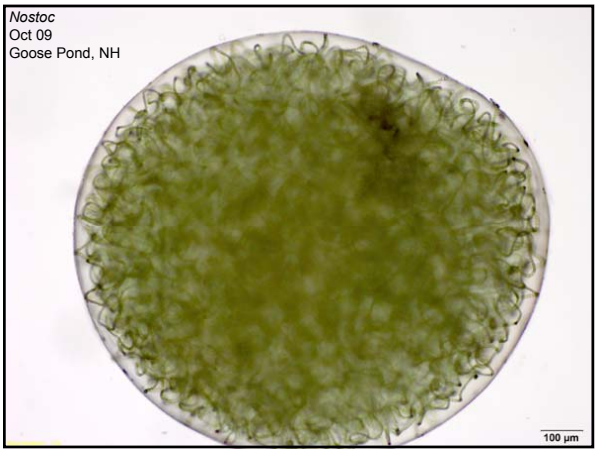

Nutrient-enriched Lakes
Anabaena

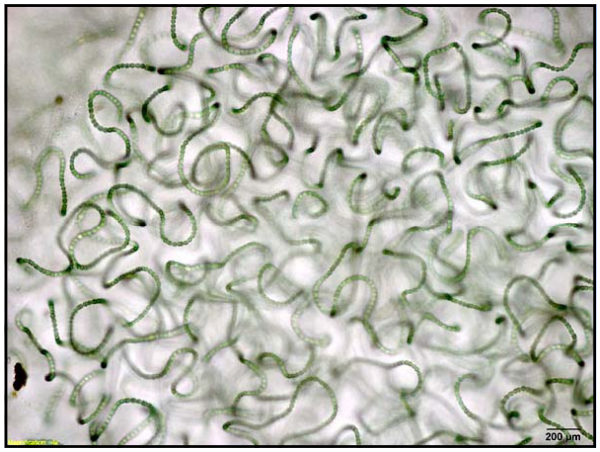



Oscillatoria


Sawyer Pond
Nutrient-poor Lakes
Merismopedia


Mucopolysaccharde
mucilage
20 µm


Nostoc
Oct 09
Goose Pond, NH
100 µm



Planktonic cyanobacteria as Competitors

Cyanobacteria Dominance

Nutrients (high levels of phosphorus followed by low)

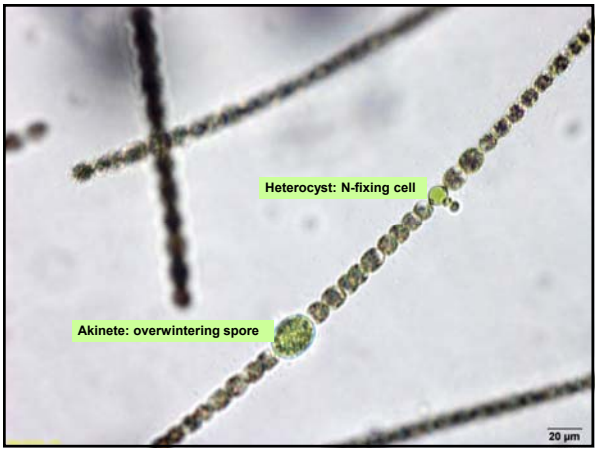
Warm Temperature

Thermocline Stability (increase w/ temp)

Low Light (low water clarity)

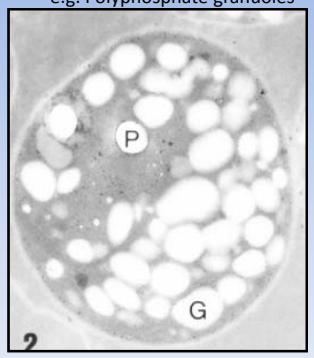
Why are Cyanobacteria so Successful?

- Environmental adaptations



Nutrient storage:

e.g. Polyphosphate granuoles



Antennal Pigments Phycobillins, e.g. Phycocyanin: low light adaptation

Why are Cyanobacteria so Successful?

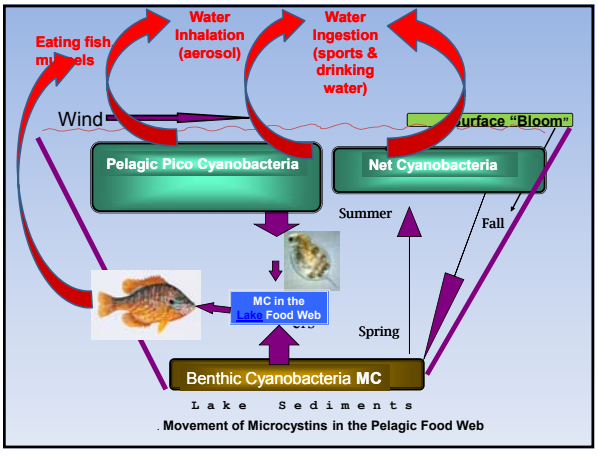
- Environmental adaptations
- Chemical warfare

Important Cyanotoxins :

	Name	Effect	Reaction t	Comments
1.	Microcystins	Hepatotoxin	Hours-Days	acute/chronic
2.	Nodularins	Hepatotoxin	Hours-Days	estuaries, brackish
3.	Cylindrospermopsin	Hepatotoxin	Hours-Days	invasive
4.	Anatoxin *a*	Neurotoxin	Fast acting (min)	pets & birds
5.	Saxitoxin	Neurotoxin	Fast acting (min)	cf. red tide
6.	BMAA	Neurotoxin	Fast/Long-term?	Neurological Disorders

Life History

Planktonic/Meroplanktonic Cyanobacteria



Movement of Microcystins in the Pelagic Food Web

Food Web Interactions

Lakes of the Northeast

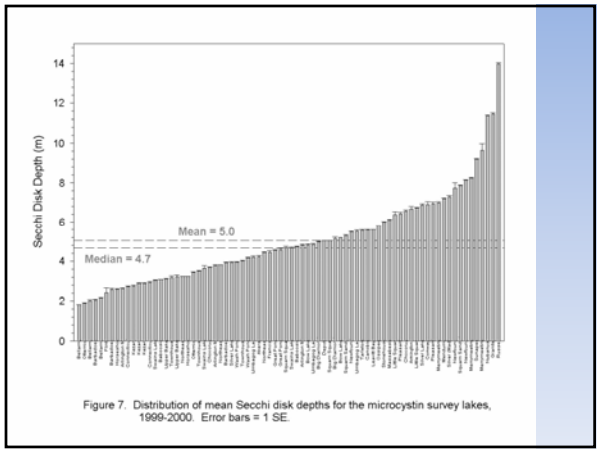
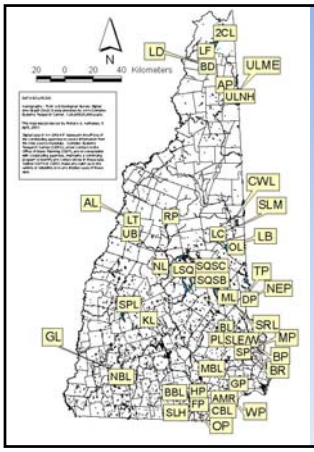


Figure 7. Distribution of mean Secchi disk depths for the microcystin survey lakes, 1999-2000. Error bars = 1 SE.

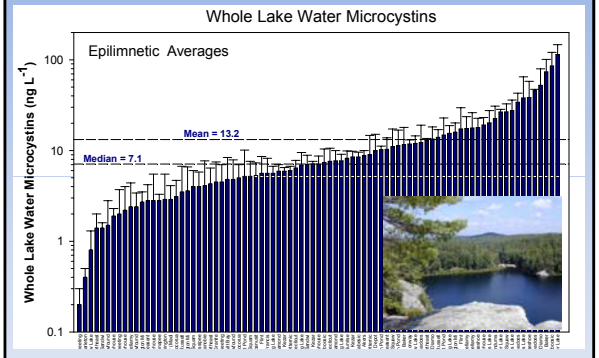
Are there microcystins in the food web?



What kinds of lakes in NH have toxic cyanobacteria?

Finding:

Cyanobacteria toxins were found in **all** NH study lakes (62), from the most pristine to the most polluted



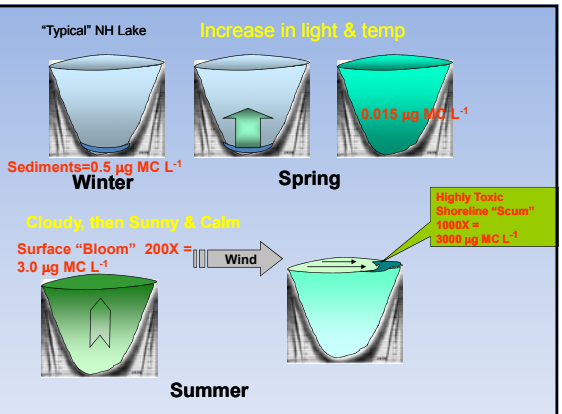
Finding:

There was a significant trend of **increasing microcystins** with **increasing phosphorus** concentration

Conclusion:

Reducing phosphorus loading is one way to reduce the toxic cyanobacteria in a lake

CyanoBlooms: how do they occur?



Needed: Better Understanding of

- Bloom ecology: Causes, spatial and temporal distributions of cyanoblooms
- **Toxicity of "Invisible" Pico-cyanbacteria (<2 um** and movement through food web; potential role in human illness

Thanks!

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