Muskoka
WATERSHED COUNCIL
ALGAE MONITORING PROGRAM

It's not your grandfather's Mary Lake anymore:
Let's talk about Algae

July 2 2022

Dr. Peter Sale

We live in a changing world

- For 10,000 years, we lived in a dependable world
- We developed agriculture and civilization
- We became far more abundant and our small changes to the planet became much bigger
- We replaced natural systems with farms, highways and urban centres (75% of the land surface)

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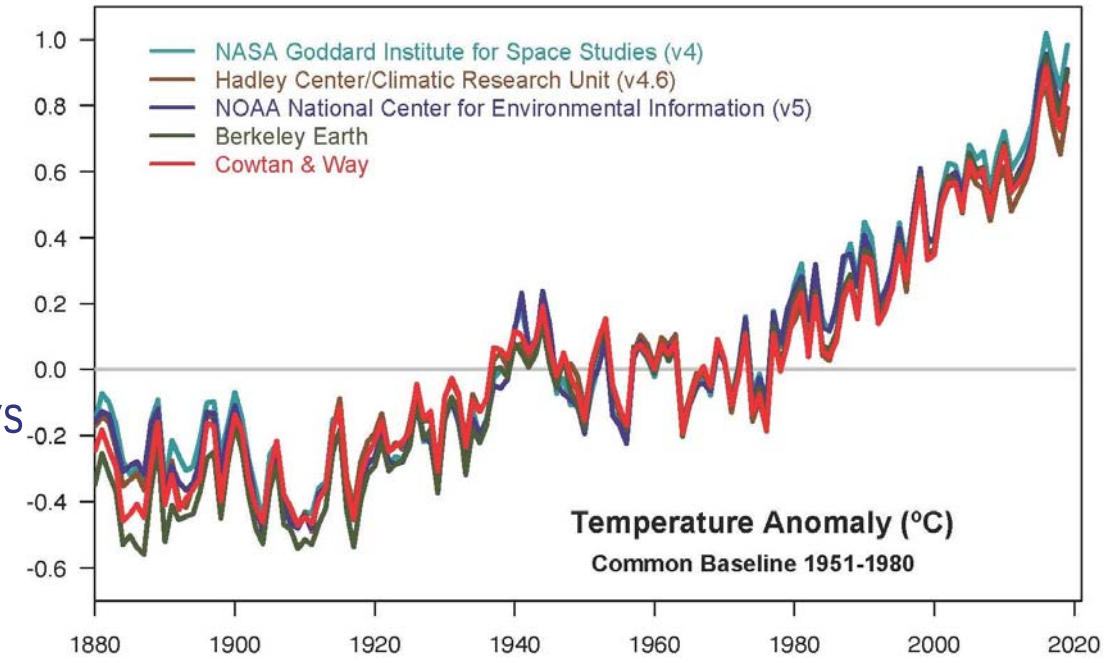
We live in a changing world

- We even began to change the atmosphere
- Our changes are causing the climate to change
- And the changing climate is changing our world in many ways
- Climate change may be making conditions especially good for algae



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The issue we face

- Algae are present in every lake in Muskoka
- They are essential - the base of the lake food web
- Algal populations are like all populations – when conditions are good, they become more abundant
- Sometimes they get super-abundant and we complain there is an algal bloom

2019 Lake Erie – image © David J Ruck

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The issue we face

- Algal blooms can be noxious, can cause fish kills, and can be toxic – mostly they are none of these
- In the best of all possible worlds, we'd like algae to be present, but never forming blooms
- Climate change may be making conditions especially good for algae

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What are Algae?

- Three Categories of Algae in our lakes
  1. Midwater Phytoplankton
  2. Benthic Periphyton
  3. A Few Benthic Macroalgae

- Each is composed of many, only distantly related species

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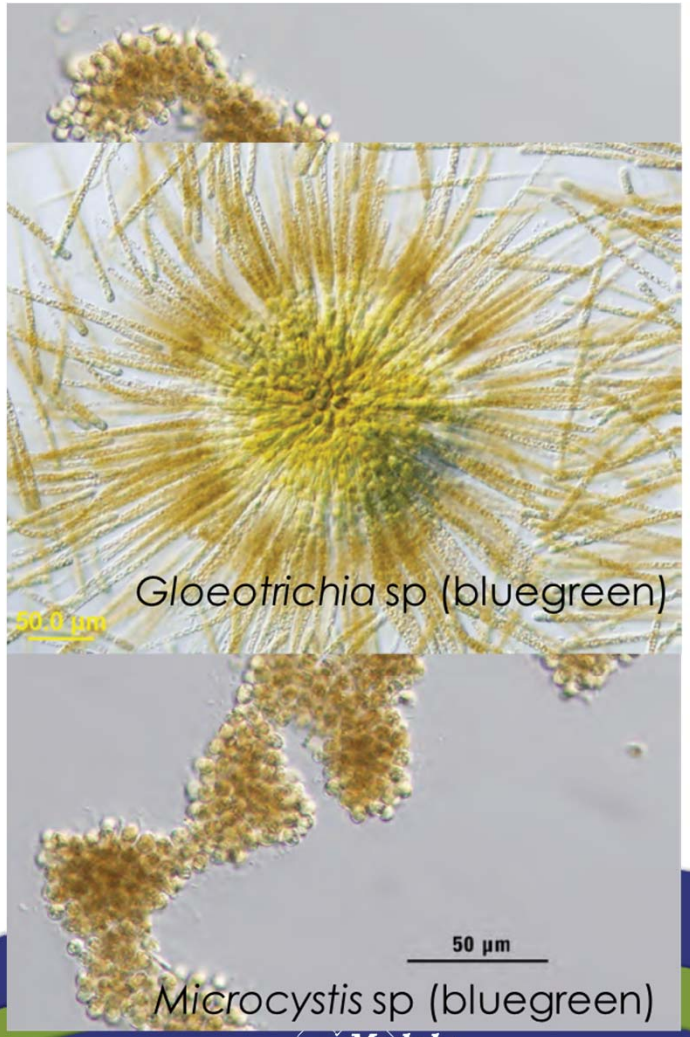
What are Algae?

1. Cyanophyta or Blue-green algae
   a type of bacteria – cyanobacteria



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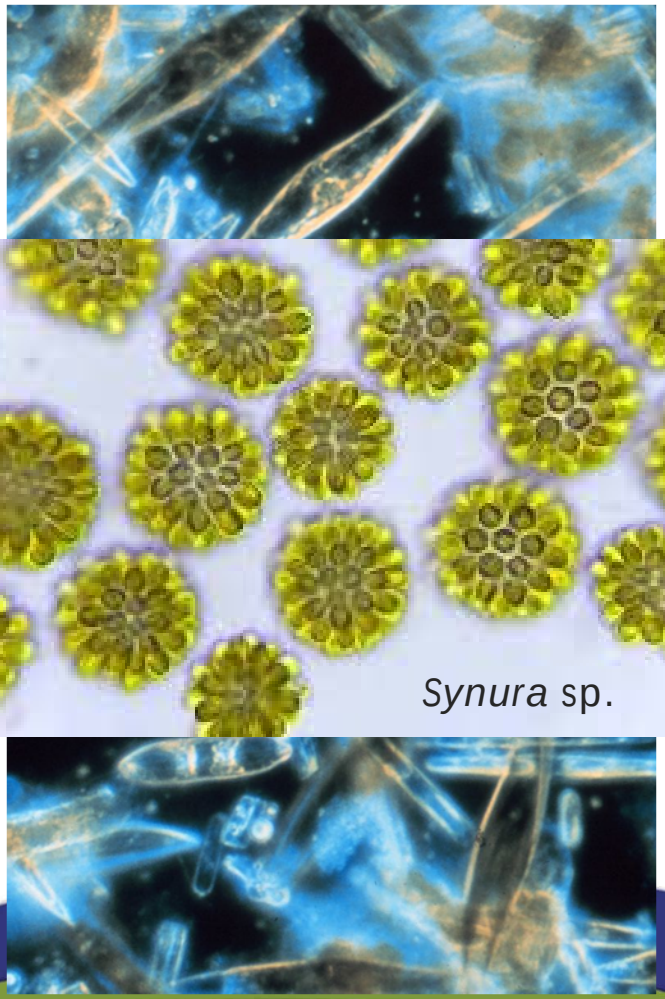

Synura sp.

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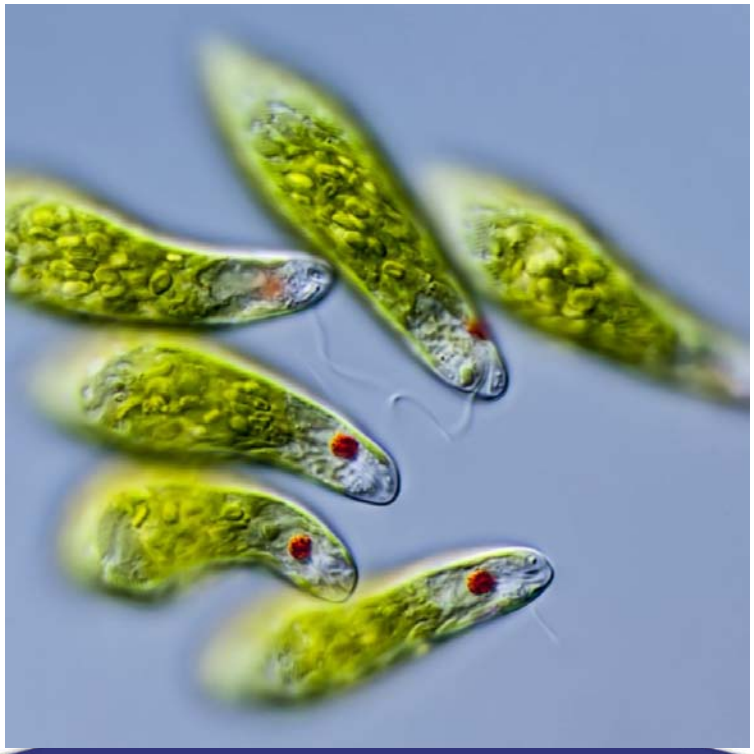

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   motile, flagellum, sometimes no chlorophyll
5. A number of other groups as well

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What are Algae?

Important major taxonomic groups

1. Cyanophyta – p
2. Chlorophyta – e
   – motile or non-m
   – *Chara* is 'roote
3. Chrysophyta – e
   – Diatoms non-m
   – Chrysophytes r
4. Euglenophyta –
   – motile, flagellu
5. All can be phyto
   periphyton

The biological differences among phytoplankton species are way bigger than the differences between you and a frog or a fish or an earthworm!

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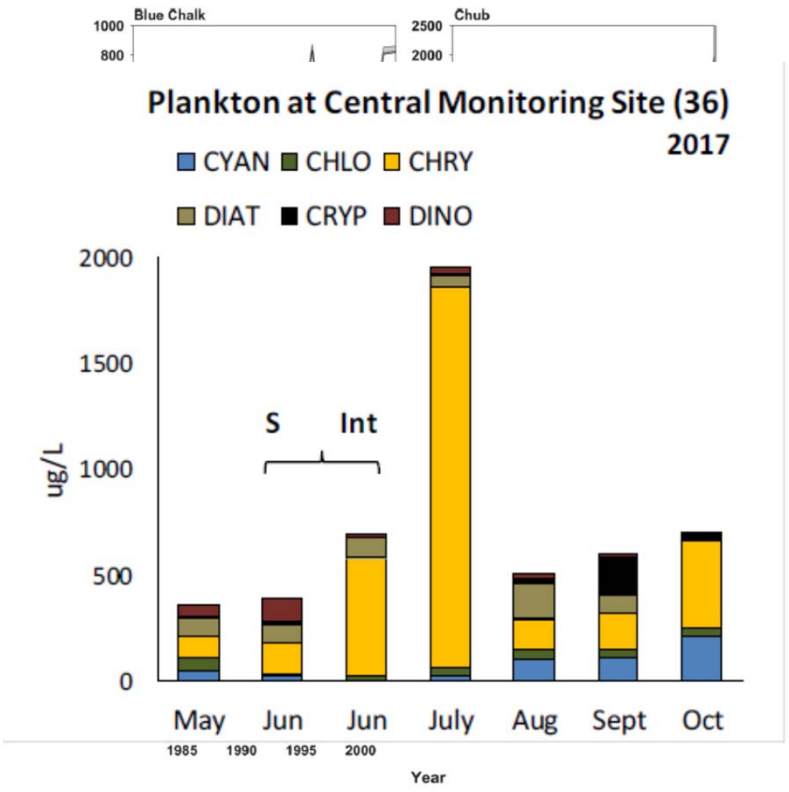
Diverse community

- Several very different groups
- Many species within each
- Very different responses to
  - Seasonal cycle
  - Prevailing weather
  - Nutrient availability
- Algal community interacts with the zooplankton community, the grazers
  - Also a diverse community
  - With variable responses



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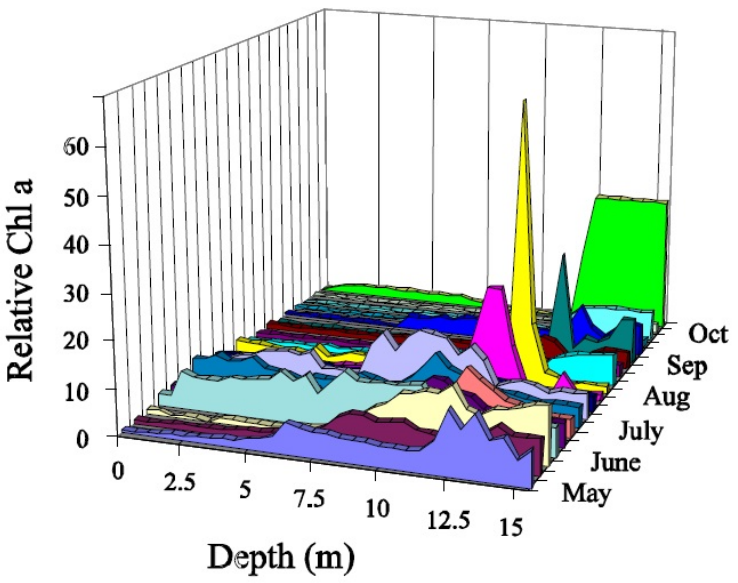
Diverse community

- Several very different groups
- They have limited, but variable, control over position in water column
- Often will aggregate at the thermocline
  - Sampling strategy needs to sample where they are!
  - "2x Secchi depth" is an approximation
- Different taxa distribute differently



DESC data from Plastic Lake

Are blooms becoming more common?

- Warming may enhance growth of populations directly
- Warming may enhance release of nutrients from sediments
- Warming may reduce grazing by zooplankton
- Something else might be doing something that enhances algal growth

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Maybe we should start at the beginning?

- How much algae is in our lakes?
- How does this vary through the season?
- Are all lakes showing the same patterns?
- Are the abundances changing as climate change advances?

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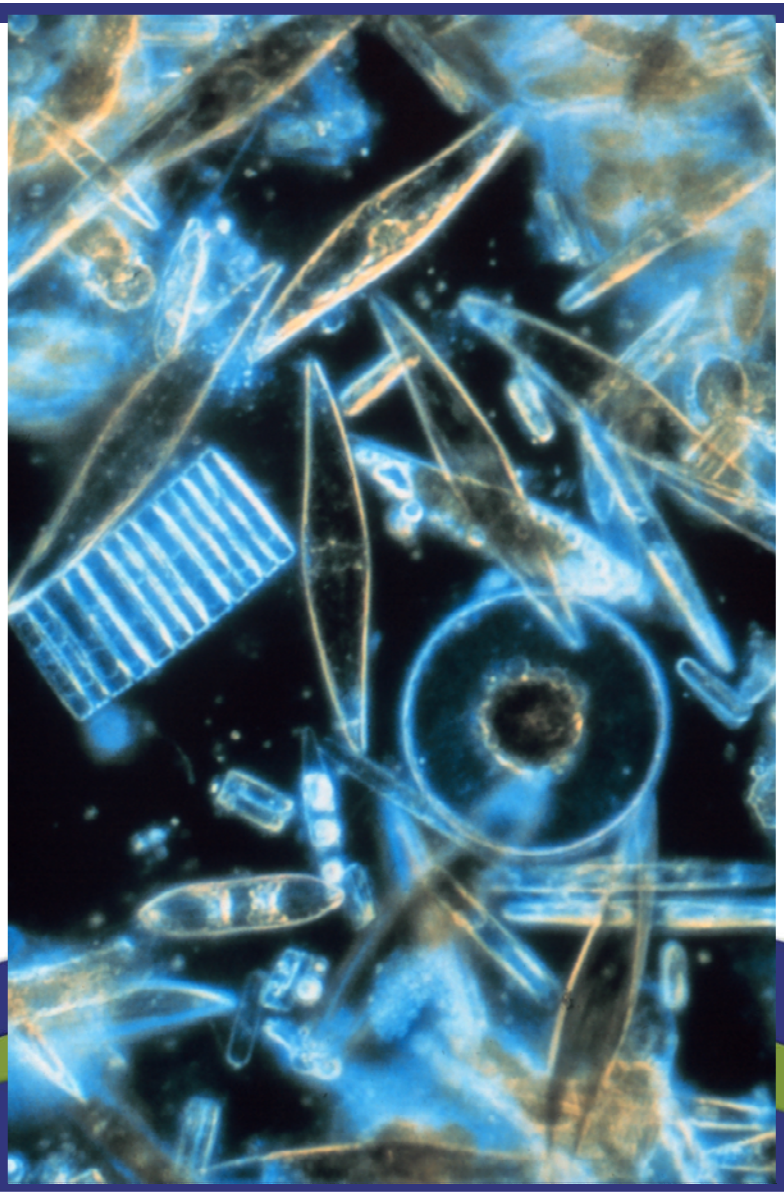
Ways of analyzing phytoplankton

- Count individuals in a sample
  - Microscopic
  - Lots of species present
  - Time consuming approach
- Measure amount of Chl *a*
  - Extraction and HPLC
  - Pools all taxa with Chl *a*
- Measure fluorescence of Chl *a*, other pigments, directly
  - Less accurate
  - Can be done in the field
- Fluorescence methods will not distinguish among taxa

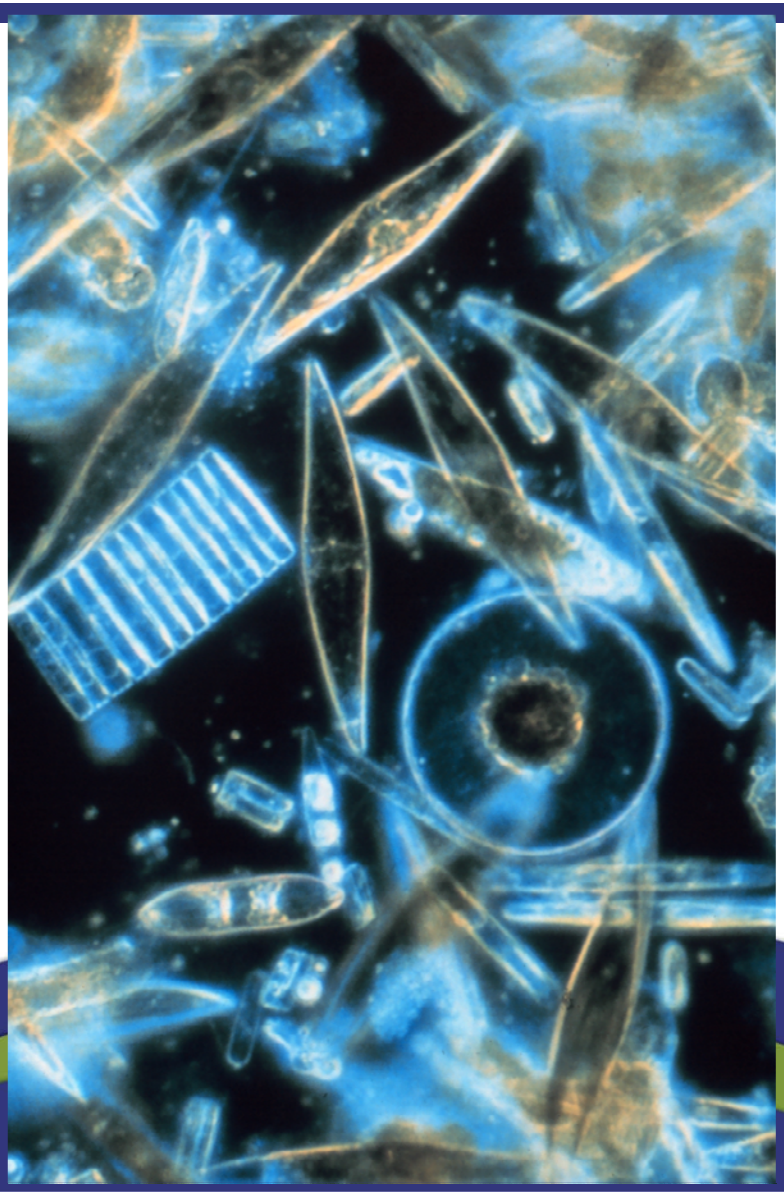
Rationale for this project

- Trying to build a picture of an inherently highly variable system
- Not feasible to track single phytoplankton species routinely
- We are using fluorescence because it permits separately tracking cyanophytes from other algae (Phycocyanin)
- Variability means cannot discern any trends for several years (need multiple years and lakes)
- Must standardize methods



Conclusions

- Individual species may respond differently to any water quality factor
- Responses lead to changes in abundance, pattern of fluctuating abundance is due to sum of causal factors acting on that species
- Peak algal abundances (blooms) at different times or places may be due to different species and different causes
- Long-term goal – to discover patterns of bloom formation in Muskoka lakes




Thank You