Algae 101

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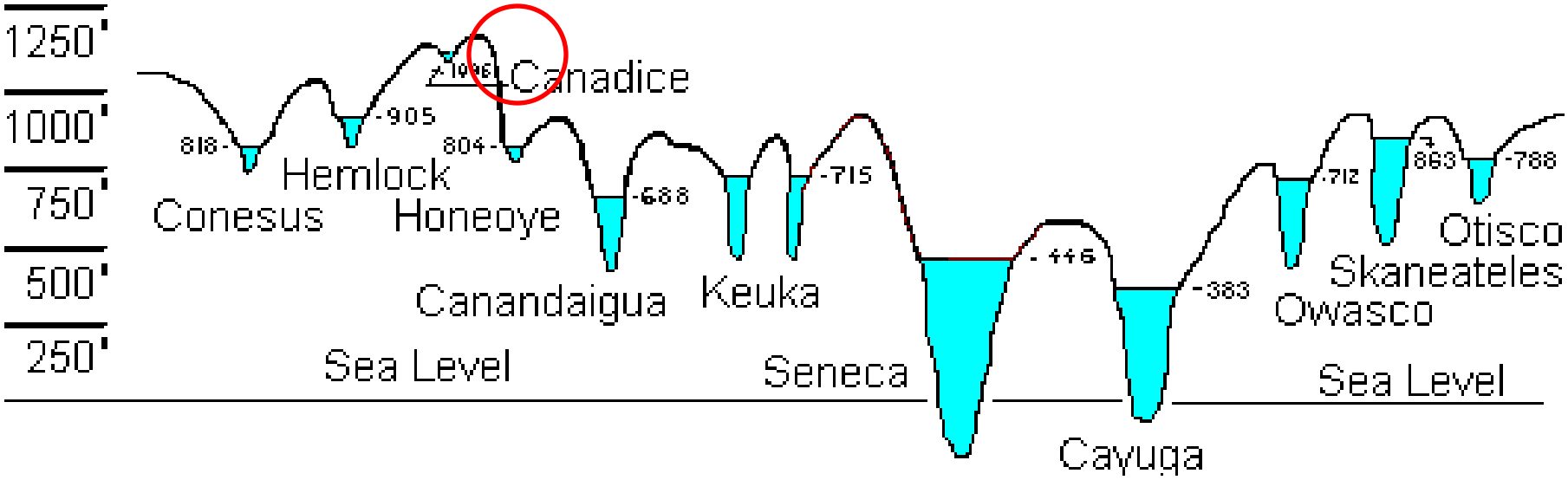
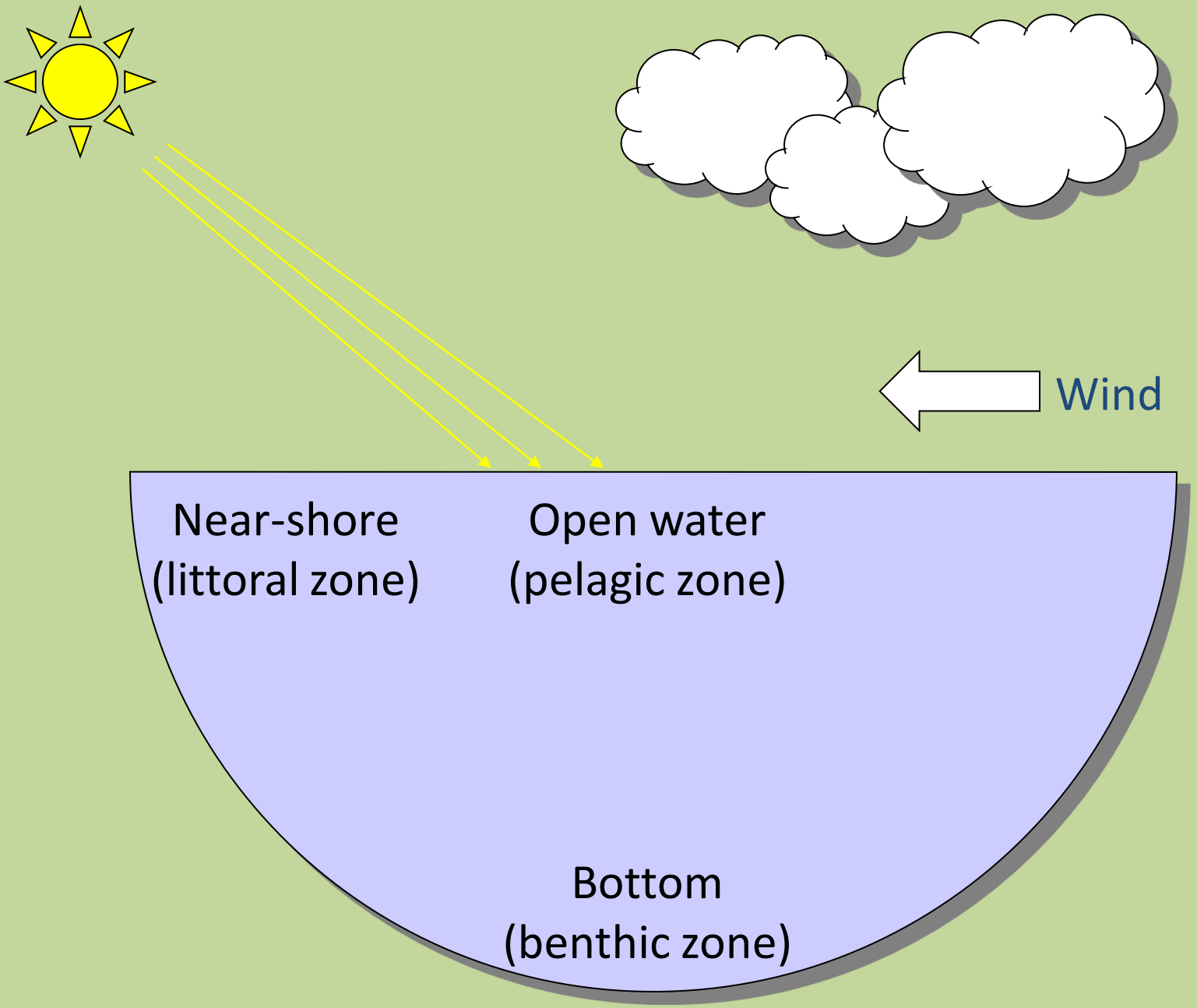
A 20 Minute Introduction to a Complex Topic

- what are algae?
- how are they classified?
- what are the roles of algae in the lake ecosystem?
- what may trigger algal blooms?
- what are harmful algal blooms (HAB's)?
- is Honeoye Lake alone?



A lake ecosystem is composed of many zones



Open Water (Pelagic Zone)

contains many drifting, microscopic organisms

Phytoplankton

(also known as algae)

Zooplankton

(water fleas, copepods, rotifers)

How are algae classified?

- Algal groups may be distinguished by their cellular organization and by their unique combination of photosynthetic pigments. All algae have chlorophyll *a*, but other pigments are different.
  - Green algae
  - Diatoms
  - Golden brown algae
  - Blue-green algae (also known as cyanobacteria

Within algal groups, individual species are classified based on their appearance

- Single celled, filamentous or colonial
- Cell shapes, types and sizes
- Special features

What is the fundamental role of algae in a lake ecosystem?

- Algae are the basis of lake food webs

- There are many types of algae commonly found in the freshwaters of New York
- Some algae cluster together and form blooms

What may trigger an algal bloom?

NUTRIENTS

Nutrients (N,P)
from the watershed
or the lake bottom.

LIGHT

WARM TEMPERATURE

Water > 60˚ F

Algal GROWTH

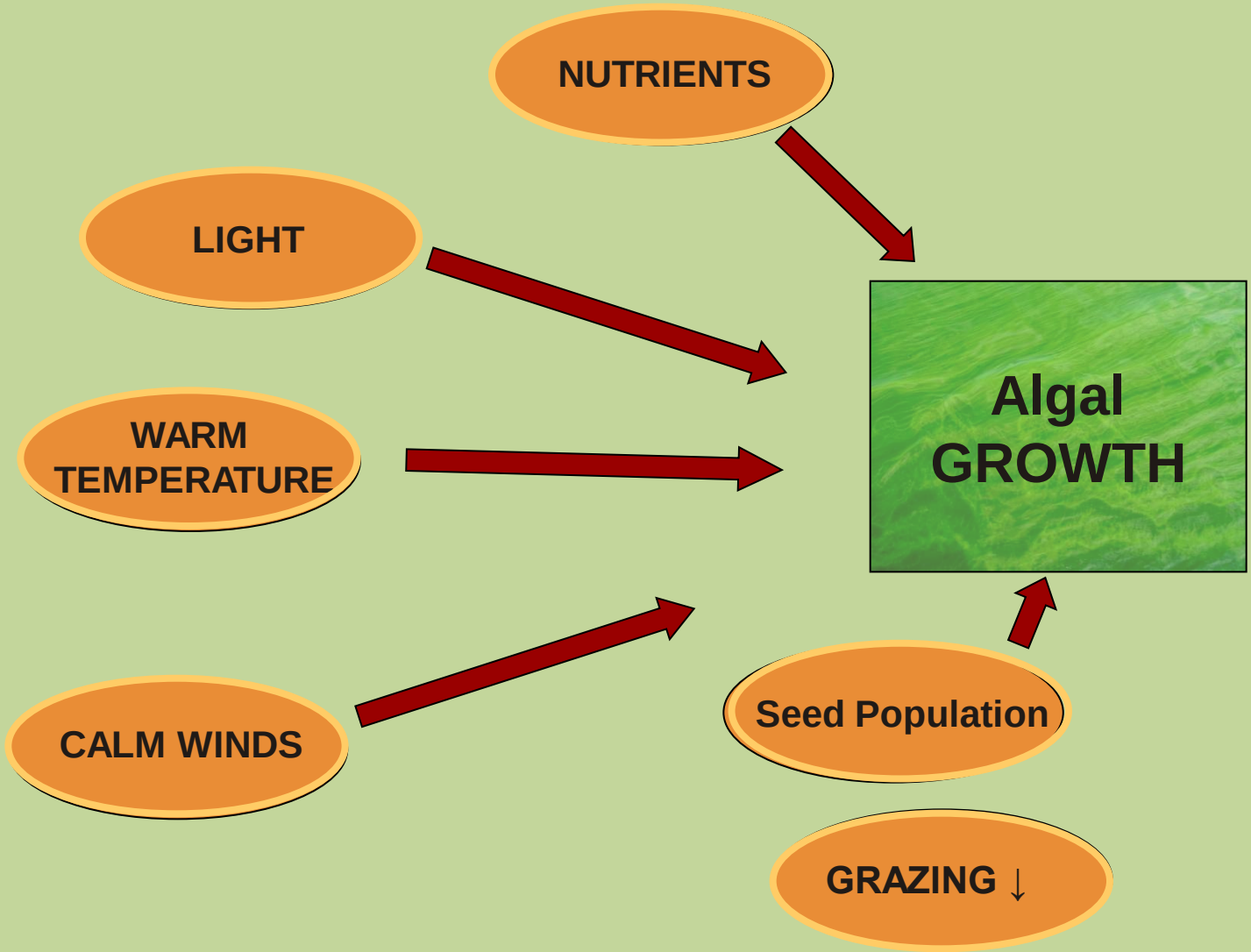
CALM WINDS

Seed Population

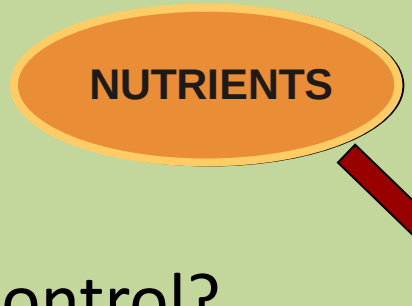
GRAZING ↓

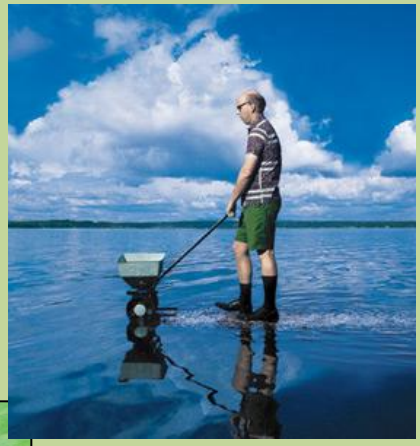
<u>Not</u> a perfect storm but expected with current climate change science

What can we do about algal blooms?



What can we manage nutrients?



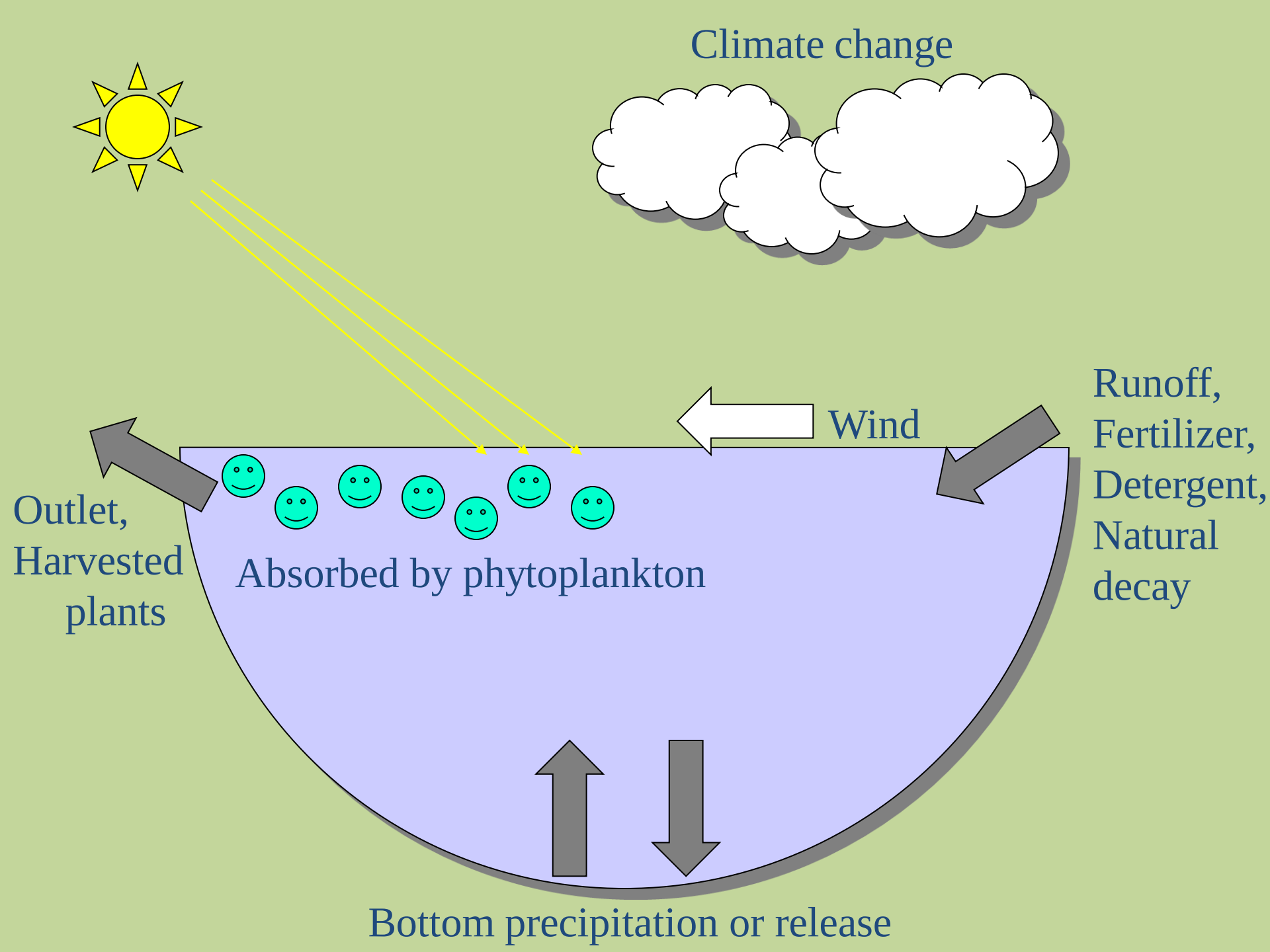


What can we control?

- Failing septic system
- Streambank erosion
- Forest run-off
- Lawn fertilization
- Fertilizer application times,
  beware of storm events
- Biologically absorbed nutrients
  in the aquatic plants

Dynamic Phosphorus Cycle in Honeoye Lake

- Increases in phosphorus
  - Internal loading of “legacy” phosphorus
  - External loading from watershed and atmosphere
- Decreases in phosphorus
  - Temporarily bound with iron in deep bottom substrate, but can be released under conditions of low dissolved oxygen
  - Removed in mechanically harvested plants
  - Lost downstream through lake outlet
- What is the role of nitrogen as a nutrient?


Climate change
Wind
Runoff,
Fertilizer,
Detergent,
Natural
decay
Outlet,
Harvested
plants
Absorbed by phytoplankton
Bottom precipitation or release

Honeoye Lake Algal Bloom in the 1940's

Notice the open farmland in the watershed

75 years ago!

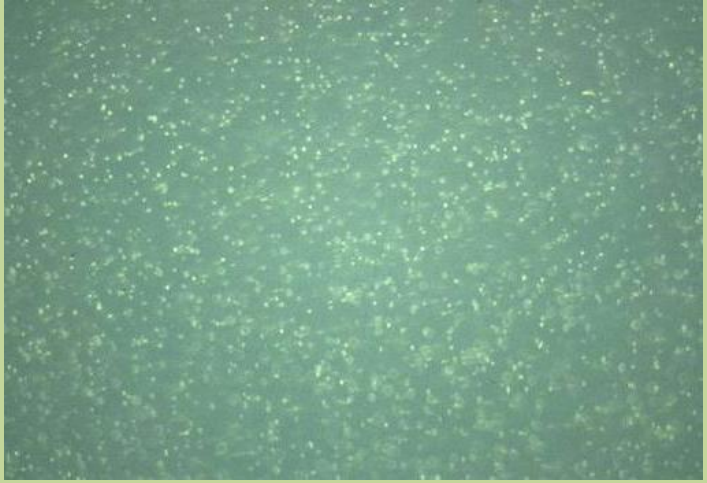
Sandy Bottom Beach Closed by Blue-green Algae Bloom

August 29, 2010

Images by
Steve Barnhoorn

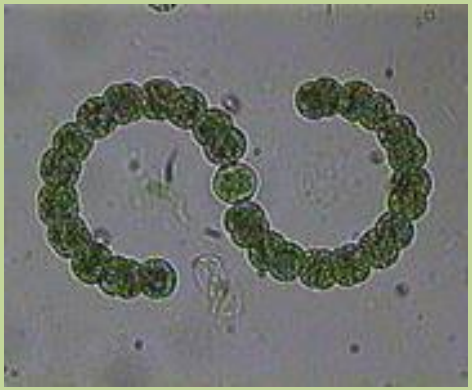
What are blue-green algae?

- Also known as cyanobacteria
- Primitive, single celled organisms that can grow as filaments, chains or loose colonies
- Often surrounded by a gelatinous matrix
- Naturally present in lakes and streams, usually in low numbers
- May form large scum layers, blankets and mats across the water surface

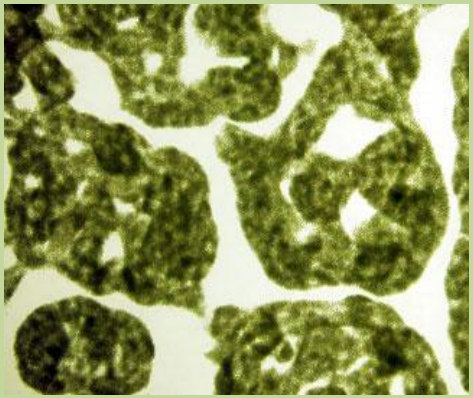


Gleotrichia

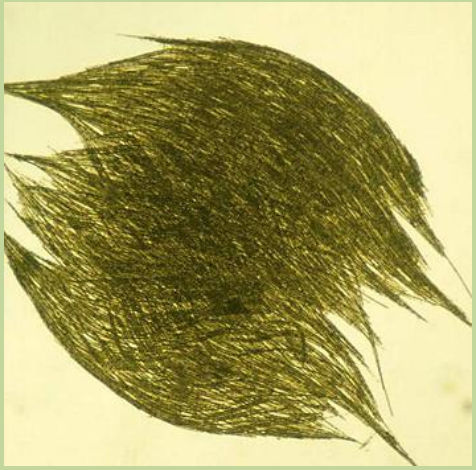
Anabaena



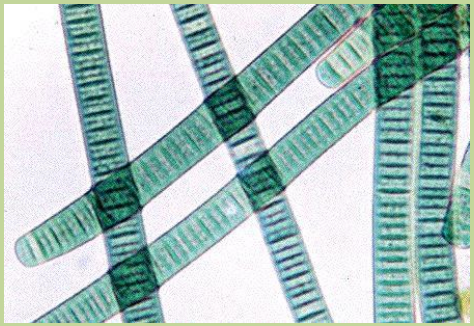
Microcystis



Aphanizomenon



Oscillatoria



Blue-green algae are arguably the most successful group of micro-organisms on the earth, present 4.6 billion years ago.

They are genetically diverse, occur across all latitudes, and in common as well as extreme environments.

Why have blue-green algae become more common in recent years?

Physical, chemical and biological conditions in the lake have changed in ways that allow cyanobacteria to dominate the phytoplankton community!

Microcystis bloom
Southwest Shores
Honeoye Lake
October 6, 2010

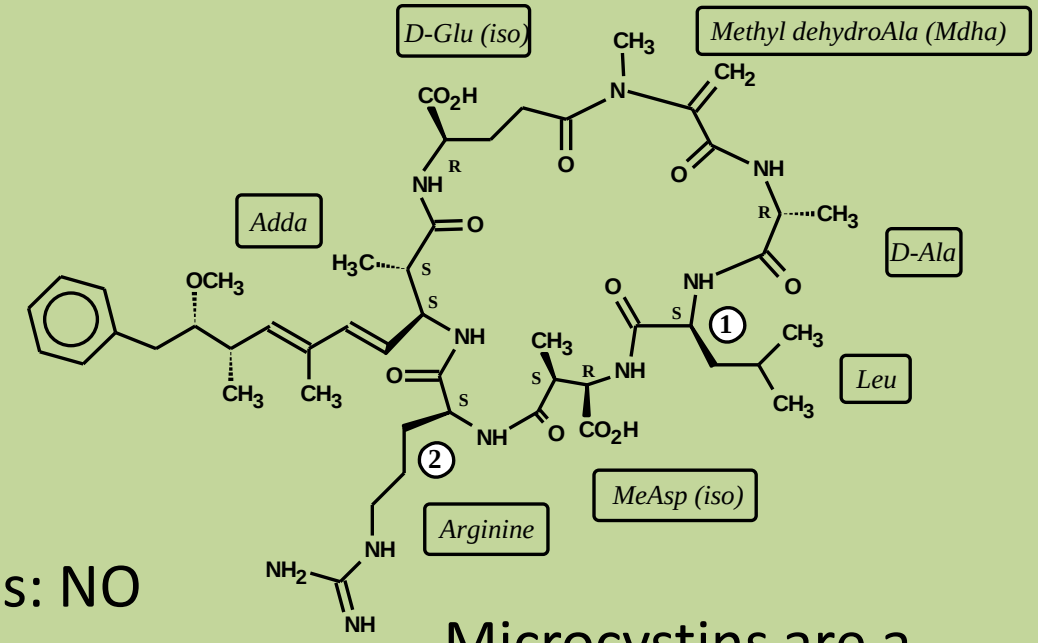
Why be concerned with blue-green algae?

- May cause taste and odor problems in drinking water
- Blooms of cyanobacteria disrupt normal lake ecology, and large amounts of dissolved oxygen are consumed from the water when they are decomposed
- Some strains produce toxins that can be harmful if found in significant concentrations

Does Honeoye Lake have a history of harmful algal blooms (HAB's)?

Yes:

- Hepatotoxins: YES
- Neurotoxins: NO
- Other toxins: NO
  - Alzheimer's-like agents: NO



Microcystins are a toxic peptides made by blue-green algae

What is a harmful concentration?

1 -1.5 µg/L is the advisory level for drinking water

20-100 µg/L microcystin for recreational contact

Is Honeoye Lake alone?

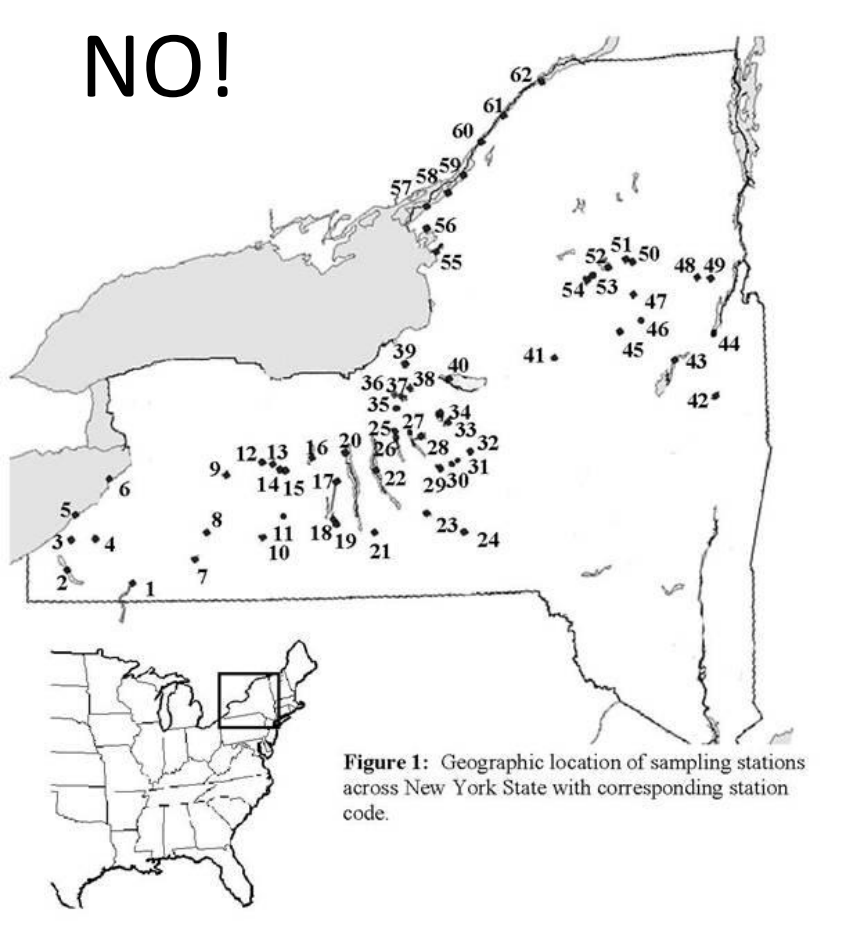


Figure 1: Geographic location of sampling stations across New York State with corresponding station code.

- Microcystins are very abundant in NYS lakes
  - Half of the samples tested have the potential
  - About 10-15% of samples are at levels of concern.
- Neuro-toxins occur but are very rare (< 1-5%)
- Other toxins are rarer
- Many species can make these toxins (not just *Microcystis*)

- potential ≠ production

Hotto et al., 2007

What about other Finger Lakes?

Lake	AvgTP	AvgChl *a*	BGA Blooms?
Canandaigua	6	1	2015 north end
Canadice	8	3	No reports recent years
Cayuga	10	4	one BGA site? 2015; little BGA < 2015
Conesus	22	8	Periodic reports 2014-2015, some reports < 2015
Hemlock	10	3	No reports recent years
Honeoye	24	8	Persistent reports 2008-2015; fewer reports 2015
Keuka	8	3	No reports recent years (some Cladophora 2015)
Otisco	13	5	No reports recent years
Owasco	12	4	Persistent blooms 2014-2015, some reports< 2014
Seneca	10	2	blooms summer 2015, some reports <2015
Skaneateles	4	1	No reports recent years

Source: Scott Kisbaugh, NYS DEC

When did blooms occur in 2015?

Lake	First Report	Last Report	Duration	Peak BGA	Peak Toxin
Canandaigua	9/1/15	9/24/15	23 days	192 µg/L	49 µg/L
Conesus	7/22/15	10/9/15	6 days	-	-
Honeoye	7/27/15	10/8/15	20 days	1377 µg/L	8 µg/L
Owasco	9/2/15	10/4/15	32 days	4516 µg/L	792 µg/L
Seneca	8/17/15	10/7/15	14 days	10406 µg/L	<1 µg/L

Source: Scott Kisbaugh, NYS DEC

Questions?

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