Algal Ecology

Harmful Algal Bloom Workshops
Sauk Centre, Mankato, & St. Paul
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Howard Markus, Ph.D., P.E.
MPCA

Algal Ecology

- What are algae?
- What kinds of algae are there?
- What are the nutrient requirements of algae?
- Plants – phytoplankton – major habitats
- Literature lake algal sequence vs Mn lake algal sequence
- More on BGA and special attributes that enable them to bloom so successfully?
- Examples of BGA and some recent incidents
- Why is BGA toxicity hard to predict

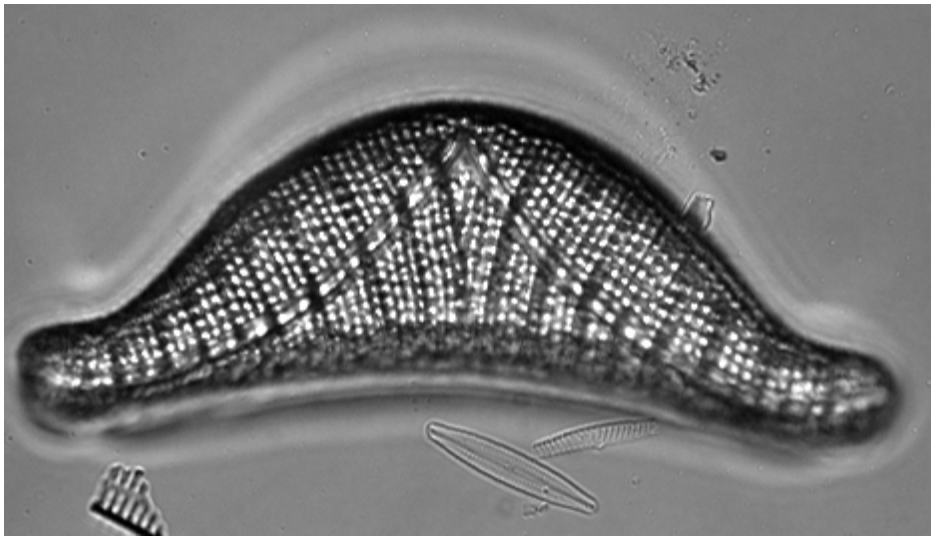
What are algae?

- algae generally are small to microscopic plants, but some marine brown algae can grow very large
- algae have a world-wide distribution and can be found in water, soils, and the air
- algae photosynthesize during the day and respire 24/7

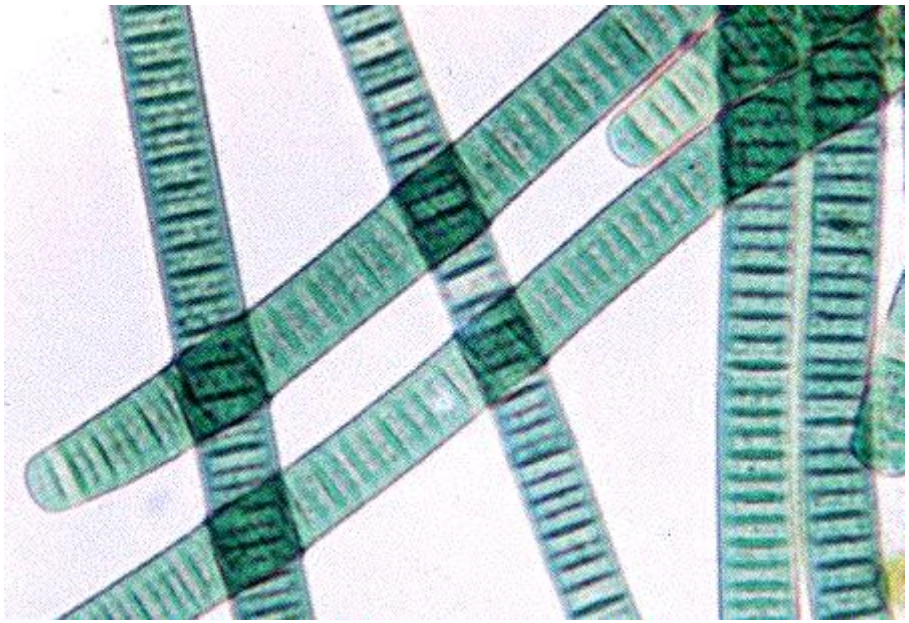
What kinds of algae are there?

- most common types are diatoms, blue-green algae, green algae, dinoflagellates, and chrysophytes

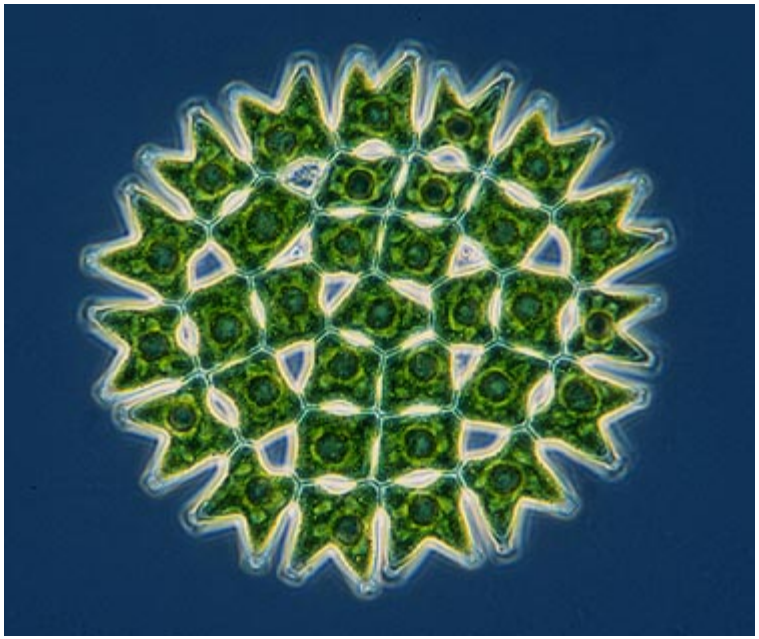
Diatoms [Bacillariophyceae]



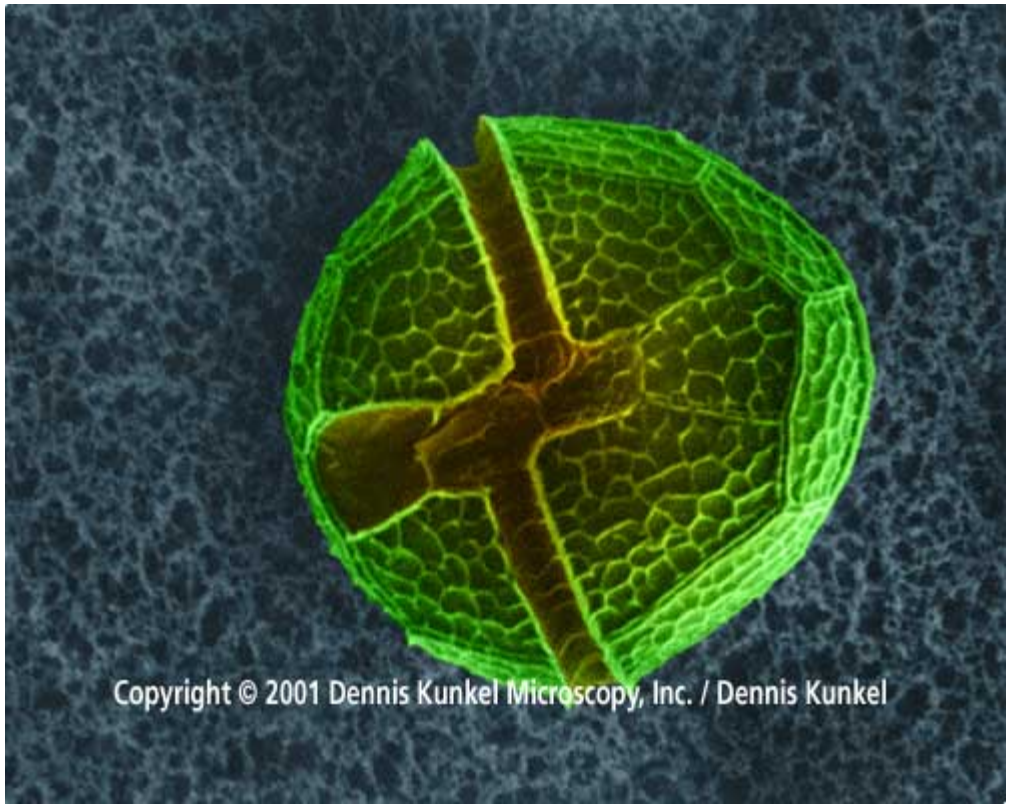
Bluegreen Algae [Cyanobacteria]

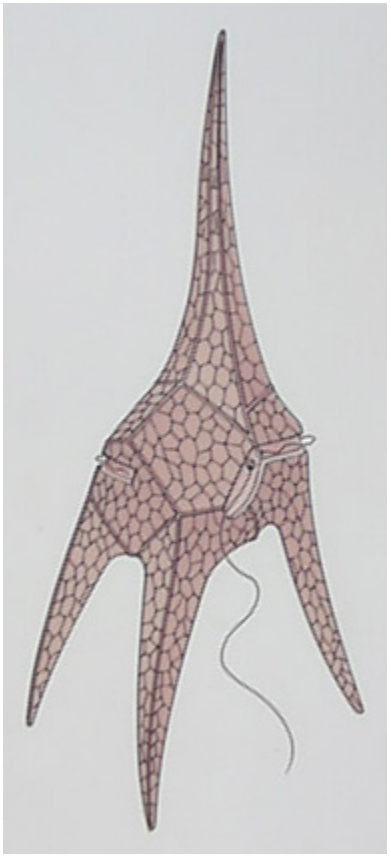


Green Algae [Chlorophyta]



Dinoflagellates [Pyrrhophyta]

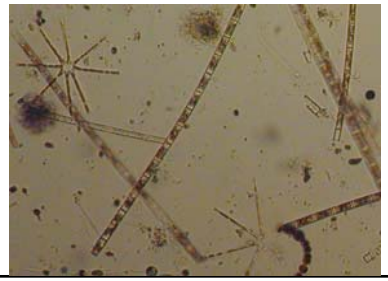


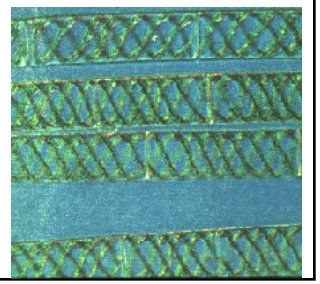


Yellow-brown algae [Chrysophyta]

Plants – phytoplankton – major habitats

- Algae
  - Phytoplankton (float freely in the water)
  - Periphyton (attached to aquatic vegetation, rocks, wood and other substrates)
  - Benthic algae (grow on the lake bottom/sediments); also sometimes called periphyton

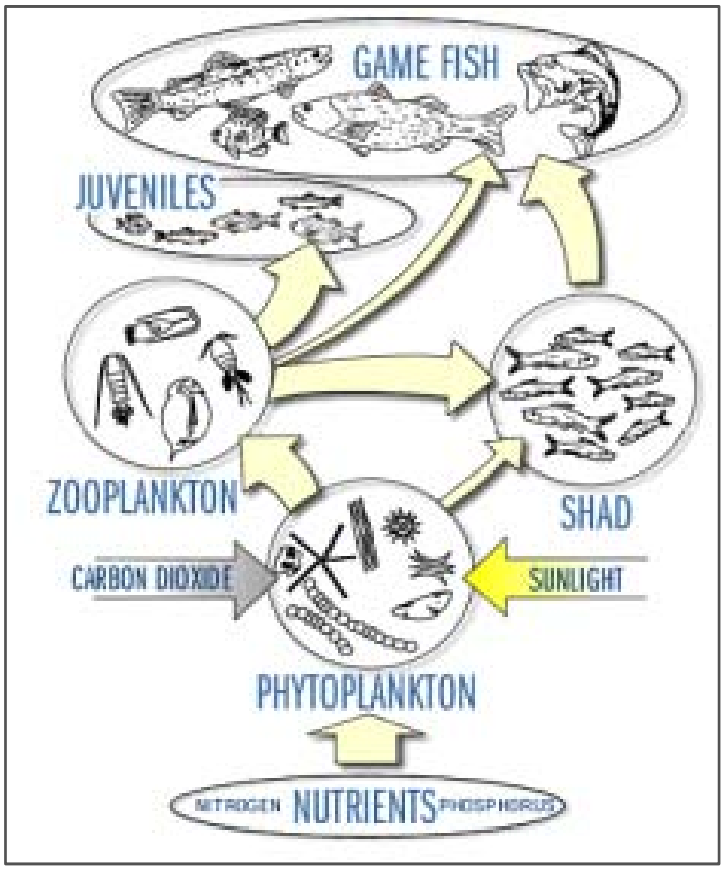


What are the nutrient requirements of algae?

- Algae are plants, so they need CO_2 & H_20, plus nutrients like phosphorus and nitrogen
- diatoms have an added requirement, silica, because of their outer case

How do algae fit into the food web?

Food Web



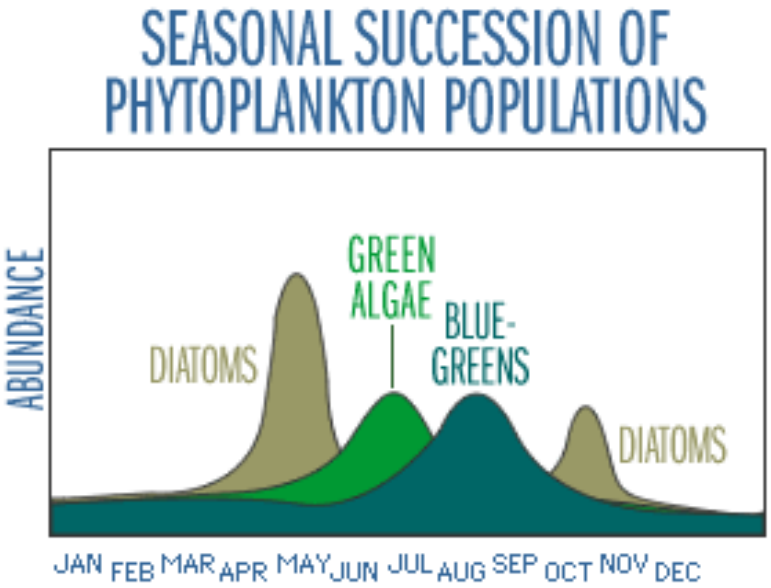
Light

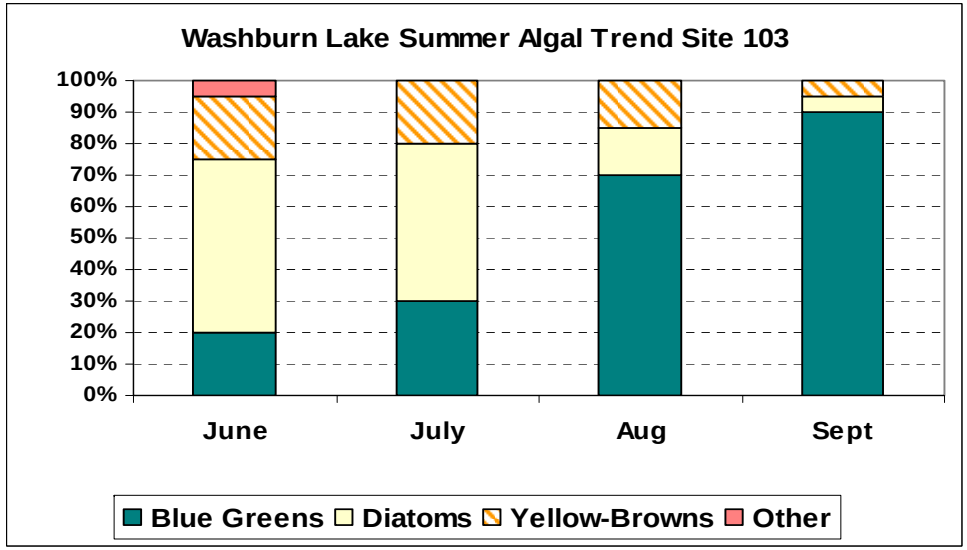
Literature lake algal sequence vs Mn lake algal sequence

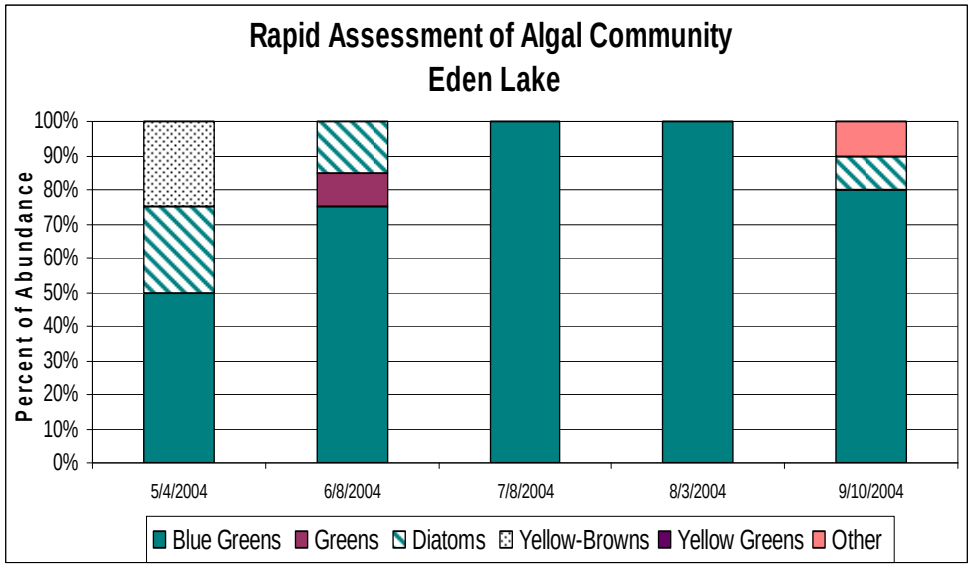
- The ‘literature’ refers to a classical lake algal seasonal sequence: diatoms to greens to blue-greens to diatoms

- In Minnesota lakes, we have found the green algae step to be very diminished

Seasonal Trends



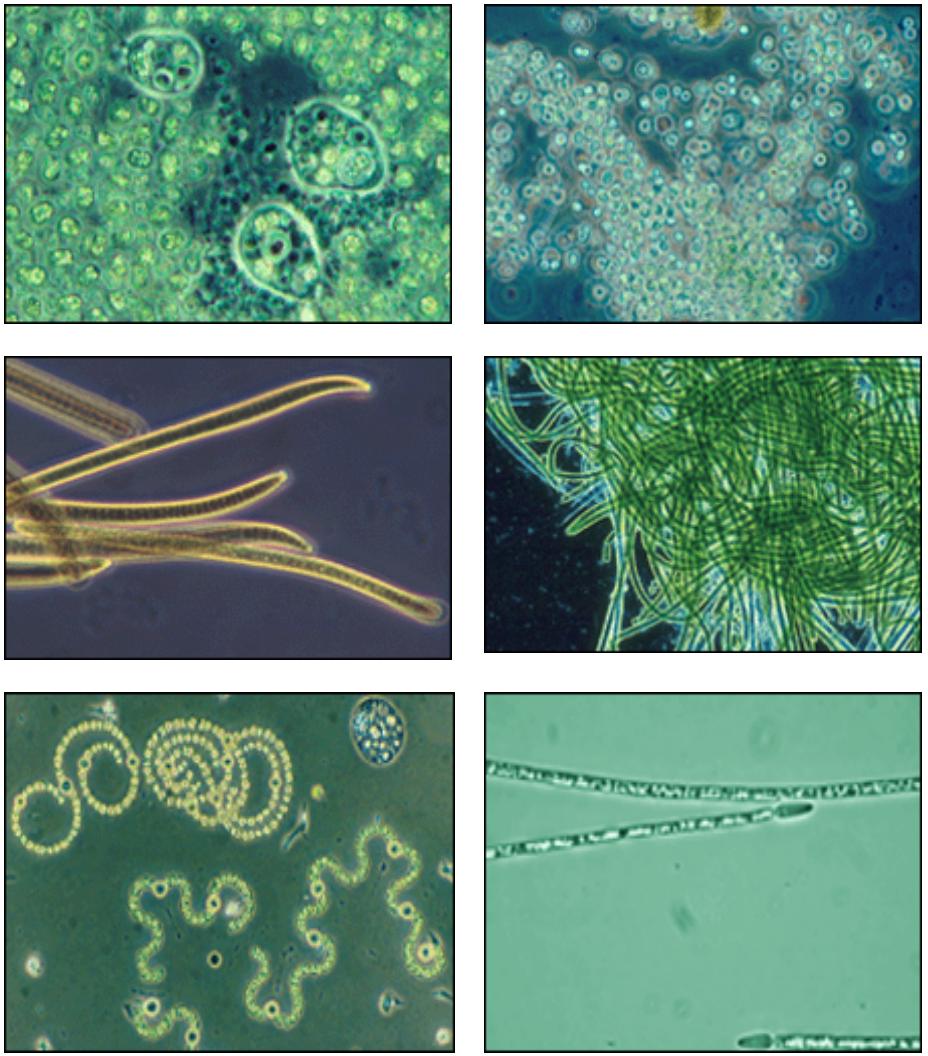




Blue Greens

- Unicellular, (non-N_2 fixing)
  *Microcystis**, *Gomphosphaeria*
- Filamentous, non-heterocystous (mostly non-N_2 fixing)
  *Lyngbya**, *Oscillatoria**
- Filamentous, heterocystous (N_2 fixing) *Anabaena**, *Aphanizomenon**, *Cylindrospermopsis**, *Nodularia**

* Contains Toxic strains

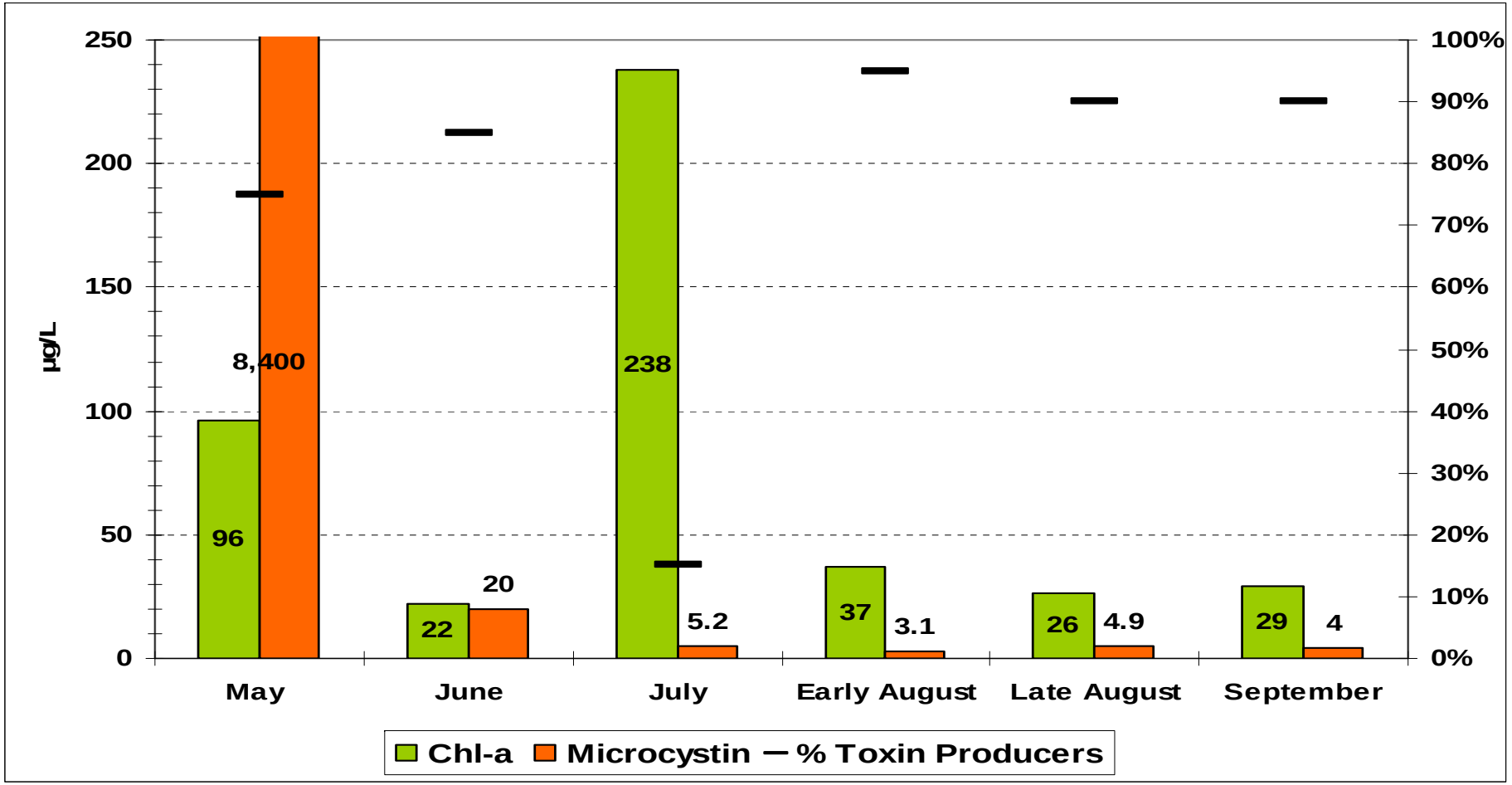


Hans Paerl, UNC

What are the special attributes of Blue-green algae that enable them to bloom so successfully?

- nitrogen fixation
- buoyancy
- iron fixation

Complexity in predicting toxic conditions



Blue-green Algal toxicity

- Cyanobacteria can produce a wide array of neurotoxins, liver toxins, cell toxins and skin irritants. In addition, many genera, such as *Anabaena*, can produce multiple toxins.
- The rest of the Workshop will discuss this in greater detail