



It's going to be a bad year\* for algae blooms in area lakes

**Warning issued after potentially toxic blue-green algae found in Oneida Lake**

**CAUTION**

**Livestock producers beware: Watch for toxic blue-green algae**

**Watch the Water as Algae Bloom Season Approaches**

**Veterinarians warn dog owners about dangers of blue-green algae**

**DANGER LAKE CLOSED KEEP OUT OF LAKE**

**Dexter Reservoir users warned about blue-green algae levels**

**BLUE-GREEN ALGAE DETECTED IN NINE KANSAS LAKES**

**Heat and algae cut county tourism in half**

**Grand Lake blue-green algal scare could cause long-term economic damage**

**Pig peril – boars asphyxiated by algae**

## Harmful Algae Blooms in Rhode Island's (fresh) Waters

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Elizabeth Scott, RI DEM

RI Land and Water Summit  
March 8, 2014

## Presentation Outline

- What are (harmful) algae?
- Why are they growing so bloomin' well?
- What are their impacts?
- Options for treatment?
- Blooms in Rhode Island
- RI's response to the issue

Melville Pond, Portsmouth RI

## What Are Algae?

- Simple photosynthetic plants.
- Like all plants, algae have **chlorophyll**, which is a pigment used to make food.
- Algae are an important & necessary part of the food web in aquatic ecosystems and are eaten by many simple animals and some fish.

*Gloeotrichia echinulata*

USGS

## What is an Algal Bloom?

- Extremely high cell densities (70,000 to 1,000,000+ cells per milliliter)
- Dominated by a single or a few species
- Visible accumulation of algae

**It's green and yucky**

Slack's Pond, Smithfield - J. Sawyers

Idaho - cyanobacteria bloom - F. Wilhelm

USGS

### What Types of Algae Cause Blooms?

ALL types of algae can cause harmful algal blooms under the right conditions.

**Euglena**  
Photo courtesy of T. Bennett

**Cyanobacteria**  
Photo courtesy of L. Green

**Golden Algae**  
Photo courtesy of EDWP

**Green Algae**  
Photo courtesy of N. Clercin

**Thalassiosira**  
Photo courtesy of N. Clercin

**USGS**

### Cyanobacteria – Blue Green Algae

Prokaryotic photosynthetic bacteria  
 ~3.5 billion years of evolution  
 Amazing diversity of life forms and habitats  
 Many can fix nitrogen  
 Resting spores, also quite mobile  
 Produce over 80 known toxins

Yawgoo Pond Oct 2005

**Anabaena "Annie"**

Heterocyst

Akinete

**Aphanizomenon "Fannie"**

**Microcystis "Mike"**

<http://cfb.unh.edu/phycokey/phycokey.htm>

30 mi (50 km)

Excess Phosphorus & Nitrogen Are the Leading Cause of Cyanobacteria Blooms

Bryan Milstead slide

### Nitrogen & Phosphorus Sources

Agriculture

Meat

Sewage

Septage

Emissions

Lawns

Bryan Milstead slide

### CLIMATE CHANGE seems to favor blue-green blooms

- Warmer average **temperature** of surface water limits mixing and increases growth rates; cyanos like it **hot**.
- More **intense storms** produce more **runoff**, add more nutrients; cyanos prefer high nutrient levels, esp P.

However, erratic inputs, fluctuating winds, and variable oxygen loss lead to less predictable conditions.

1890 1910 1950 1970 1980 1990

H. Paerl

WRS

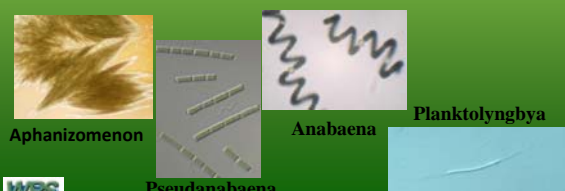
**Although excess nutrients are the leading cause of cyanobacteria blooms, other factors can play a major role**

- Size, shape, depth, residence time,
- Sunlight, rain, wind, wind direction,
- Limited mixing,
- Seasonal loss of oxygen in bottom waters,
- Nutrient cycling from sediment into water,
- Water residence time




### Surface Bloom Formations

- Starter population usually from upstream or sediment.
- Population starts small, grows into bloom over 3-4 weeks
- Water column nutrients/light control bloom severity




Aphanizomenon      Pseudanabaena      Anabaena      Planktolyngbya




### Mid-Depth Bloom Formation

Moves into upper water layer:

- Starter population normally from sediment, rises to near thermocline (mid-depth)
- Growth at depth depends on high efficiency of light use but capitalizes on generally higher nutrient levels




Planktothrix      Synura      Chryso-sphaerella




### Bottom Bloom Formation

Bottom growth of planktonic forms followed by synchronized rise into the upper water layer:

- Resting stages germinate on sediment surface, grow in place to fully formed colonies.
- Gas vesicles form synchronously and create buoyancy; colonies float to surface quickly.




Anabaena      Gloeotrichia      Microcystis




### Bottom Filamentous Blooms

Filamentous blue-greens (and green algae) mats form, trap gases, float to surface as mats or "chunks."



Oscillatoria      Plectonema



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