

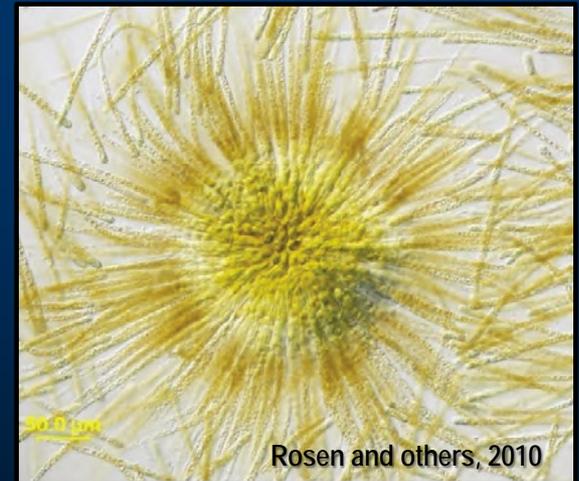
# Real-time HABs

Mac A Cherry

Cooperator meeting June, 3 2015

# Definition

- Cyanobacteria are true bacteria, but have chlorophyll-*a* like algae
  - Structurally the cyanobacteria are bacteria-like, but .....
  - Functionally they are algae-like
  - Also referred to as blue-green algae



Rosen and others, 2010

*Gloeotrichia echinulata*

# Cyanobacteria community composition

- Between 2,000 – 8,000 different species exist on earth
  - Many have not described yet
  - Some believe 3.5 bi. yr. old
- Common genera
  - Aphianizomenon
  - Anabaena
  - Cylandrospermopsis
  - Microcystis

# What Types of Toxins Do Cyanobacteria Produce?

- **Hepatotoxins (liver toxins)**

- Common toxins: microcystins, cylindrospermopsins
- Acute symptoms of exposure: Vomiting, Diarrhea, Fever, Cramps

- **Neurotoxins (brain toxins)**

- Common toxins: anatoxins, saxitoxins
- Acute symptoms of exposure: Paralysis, Seizure

- **Dermatotoxins (skin toxins)**

- Common toxins: lipopolysaccharides, lyngbyatoxin
- Acute symptoms of exposure: Irritation to eyes, ears, throat; Rashes; Skin Lesions

# What is a bloom?

The definition of a “bloom” is *somewhat* subjective:

- Algae that have extremely high cell densities (20,000 to 100,000 cells per milliliter)
- Proliferation of algae is dominated by a single or a few species
- There is a visible accumulation of algae

# What Causes Algal Blooms?

Factors influencing the occurrence of algal blooms include:

- Nutrients (N & P)
- Water Clarity (Sediment)
- Circulation Patterns
- Hydrology
- Climate and Weather
- Biological Community Interactions



**In general, blooms indicate an ecosystem is imbalanced**

# What makes a bloom *Harmful*?

- **Ecologic Concerns**

- Low dissolved oxygen
- Food-web disruption

- **Economic Concerns**

- Loss of recreational revenue
- Taste and odor
- Added drinking water treatment costs

- **Public Health Concerns**

- Allergic reactions
- Toxicity



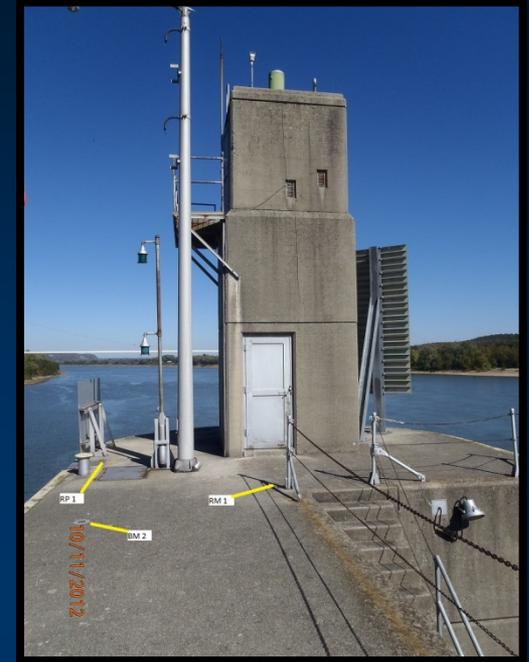
Kansas – cyanobacterial bloom

# Historical reports of Cyanotoxin dog poisonings

<u>As of</u>	<u>Total Sick Cases</u>	<u>Total Fatal Cases</u>
1920	1	0
1950	1	7
1980	10	36
2000	23	125
2012	45	215

# Planned science

- What
  - Real-time HAB data collection
- Where
  - 1 lake (Rough River or Nolin)
  - 2 locations
    - Drinking water intake
    - Tributary
- When: ASAP



# Planned science

- Parameters of interest:
  - Water temperature
  - pH
  - Dissolved oxygen
  - Specific conductance
  - Turbidity
  - Cyanobacteria
  - Chlorophyll



Photos: YSI.com/M.A.Cherry

# Chlorophyll sensor

- Chlorophyll is bound in cell walls of cyanobacteria and other organisms
- Sensor detects the fluorescence from chlorophyll with the *in situ* method
- Specs
  - Range = 0 to 400  $\mu\text{g/L}$
  - Resolution = 0.1  $\mu\text{g/L}$  Chl



# Cyanobacteria sensor

- Phycocyanin sensor designed for freshwater environments
- Not sensitive to interferences from chlorophyll, turbidity, or dissolved organics
- Detects phycocyanin, a pigment found in cyanobacteria, by the in-vivo fluorometry technique
- Specs
  - Range = 0 – 280,000 cells/mL
  - Resolution = 1cell/mL



# World Health Organization HAB health Guidelines

Relative Probability of Acute Health Effects (Advisory Level)	Microcystin –LR (ug/L)	Total Cyanobacteria (cells/mL)
Low	<10	<20,000
Moderate	10-20	20,000 - 100,000
High	20-2,000	100,000 - 10,000,000
Very High	>2,000	>10,000,000

Chorus, I., and Bartram, J., eds., 1999, Toxic cyanobacteria in water: London, WHO, E &

FN Spon, 416 p

### Chlorophyll, total, water, fluorometric, 650-700 nanometers, in situ sensor, micrograms per liter, Depth 12 ft

Most recent instantaneous value: 0.80 05-28-2015 11:00 CDT



Add up to 2 more sites and replot for "Chlorophyll, total, water, fluorometric, 650-700 nanometers, in situ sensor, micrograms per liter, Depth 12 ft"

[?](#) Add site numbers [Note](#)

Enter up to 2 site numbers separated by a comma. A site number consists of 8 to 15 digits

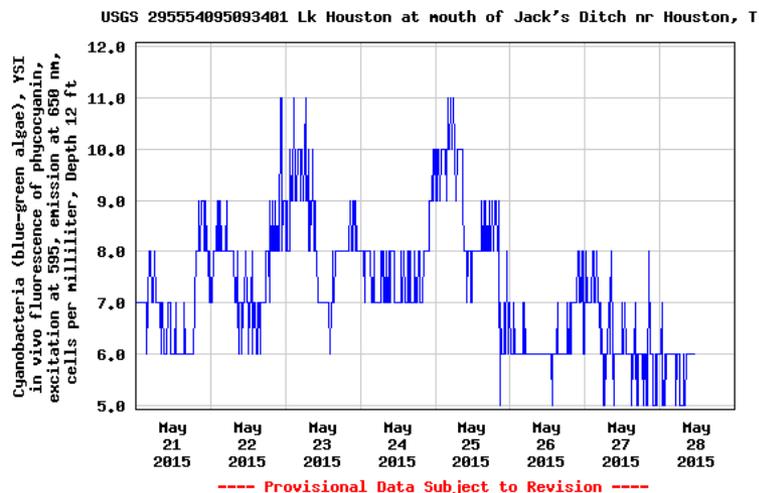
GO

Units = µg/L

Create [presentation-quality](#) graph. P62361 DD31 A(1)

### Cyanobacteria (blue-green algae), YSI in vivo fluorescence of phycocyanin, excitation at 595, emission at 650 nm, cells per milliliter, Depth 12 ft

Most recent instantaneous value: 6 05-28-2015 11:00 CDT



Add up to 2 more sites and replot for "Cyanobacteria (blue-green algae), YSI in vivo fluorescence of phycocyanin, excitation at 595, emission at 650 nm, cells per milliliter, Depth 12 ft"

[?](#) Add site numbers [Note](#)

Enter up to 2 site numbers separated by a comma. A site number consists of 8 to 15 digits

GO

Units = cells/mL

Create [presentation-quality](#) graph. P95202 DD45 A(1)

# What's next.....

- Discrete samples
- More lakes
- Profiling
- Surrogate-based models



Milford Lake, September 2011  
Photo courtesy of E. Looper, USGS

# Questions

