

Monitoring Harmful Algal Blooms on Cayuga Lake

By Nathaniel Launer, *Outreach Coordinator*
Cayuga Lake Harmful Algal Bloom Monitoring Program Coordinator



Community Science Institute



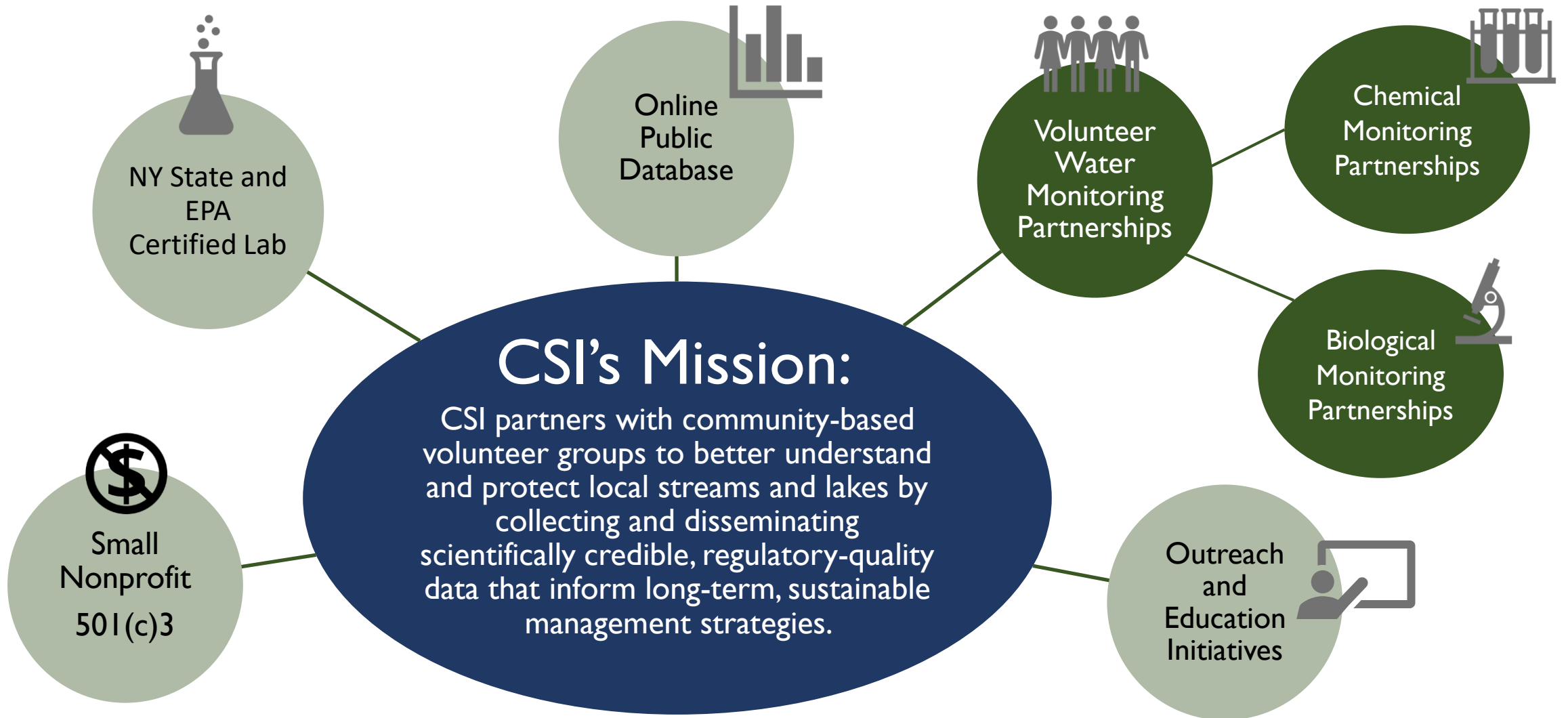
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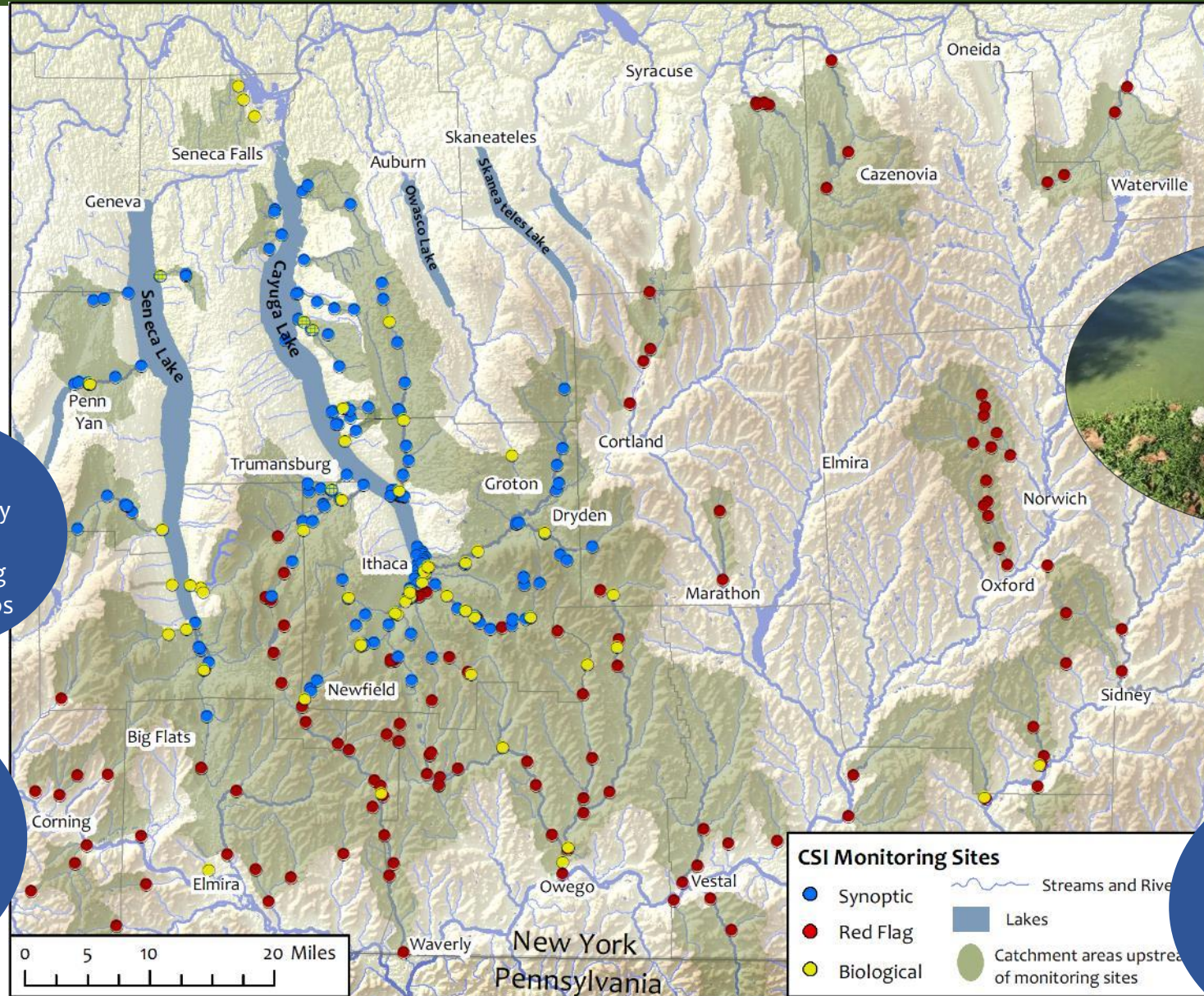
Volunteer Water Quality Monitoring Partnerships

87,000
measurements
of lake and
stream water
quality data



12 +
Community
Stream
Monitoring
Partnerships

Identifying
where water
quality can
improve, and
where it is
good



75
Volunteers
participated in
the first year of
the HABs
Monitoring
Program



Over 150
volunteer
water
quality
monitors

Long-term
datasets can
reveal water
quality
trends

Community Science Institute



What are Harmful Algal Blooms (HABs)?

Commonly referred to as algae, the organisms that form these blooms are actually **cyanobacteria**.

Cyanobacteria are a natural part of the aquatic community in lakes, ponds, and oceans around the world.

Cyanobacteria produce natural **chemical compounds** whose purposes are poorly understood, and some of these compounds are toxic to humans and other animals. This is what makes a bloom **harmful**.

Certain conditions can promote **cyanobacteria** population growth, and rapid growth can lead to the formation of a bloom.

H: Harmful

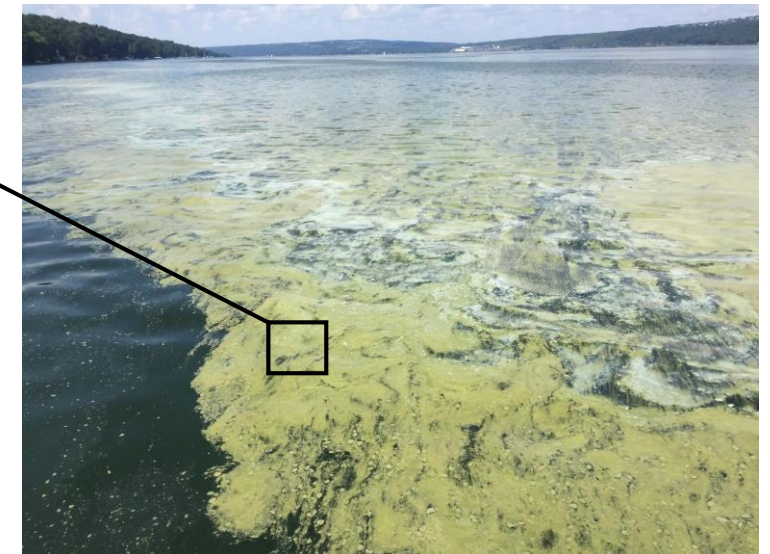
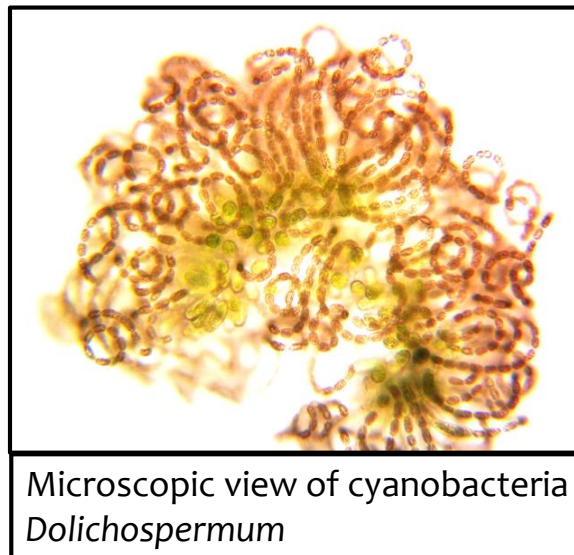
- Toxins, economic, aesthetic, ecological

A: Algal

- Freshwater HABs refer to cyanobacteria. Not true algae.

B: Bloom

- Proliferations of cells, dense concentrations

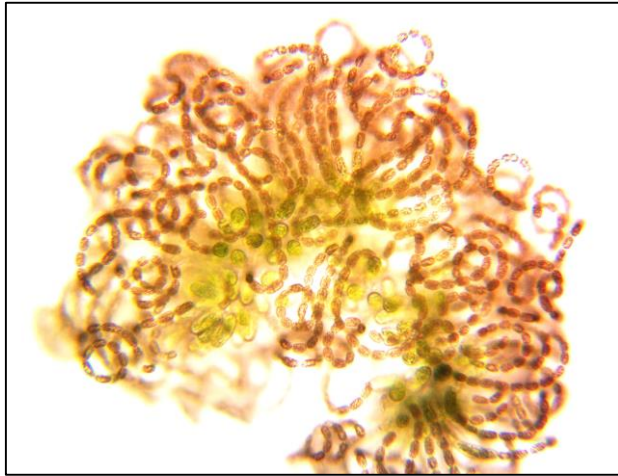


Cyanobacteria

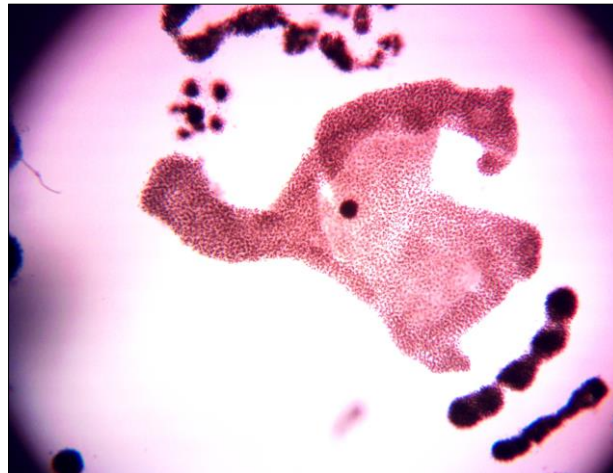
Cyanobacteria are ancient organisms, dating back **3.5 billion** years ago.

- they are the oldest known **oxygen producing organisms**, responsible for our current oxygen rich atmosphere!

There are many different taxa of cyanobacteria.



Dolichospermum – Can fix nitrogen from the atmosphere into a bio-available form. Also can produce the microcystin toxin.



Microcystis – Produces the toxin **microcystin**, for which the EPA set health advisories for drinking water and non-potable water that have been adopted by the New York State Department of Health as safe limits.

Safe Drinking Water Limit – **0.3 ug/ L** of microcystin

Safe Recreation Limit – **4 ug/ L** of microcystin

Blooms

Cyanobacteria are present in the lake as a **natural** part of the aquatic community.

Blooms are the **rapid growth of cyanobacteria populations**, concentrated to a local area.

The factors that promote this **rapid population growth** are still under study. We do know that...

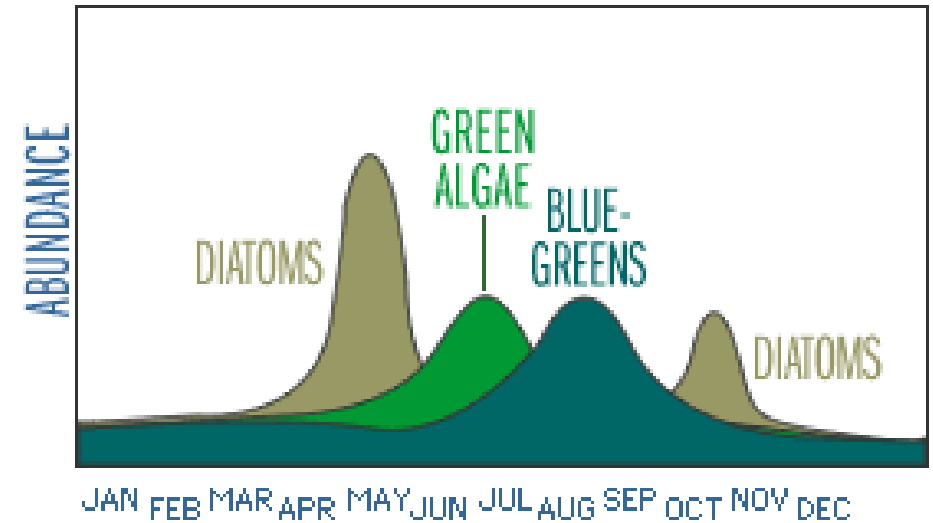
Cyanobacteria growth increases at higher water temperatures.

High nutrient inputs, specifically phosphorus and nitrogen, have been shown to promote cyanobacteria growth.

Still, calm, and stratified waters facilitate the formation of blooms.

However...

SEASONAL SUCCESSION OF PHYTOPLANKTON POPULATIONS



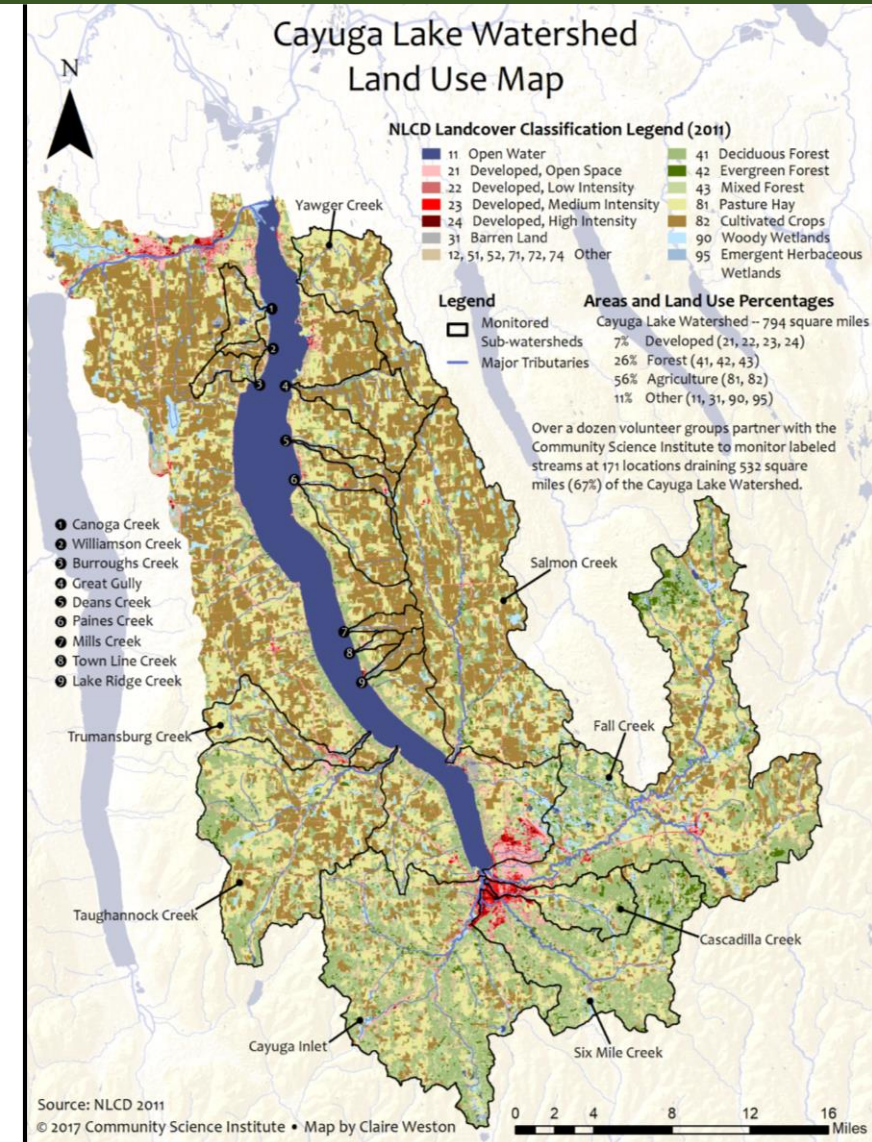
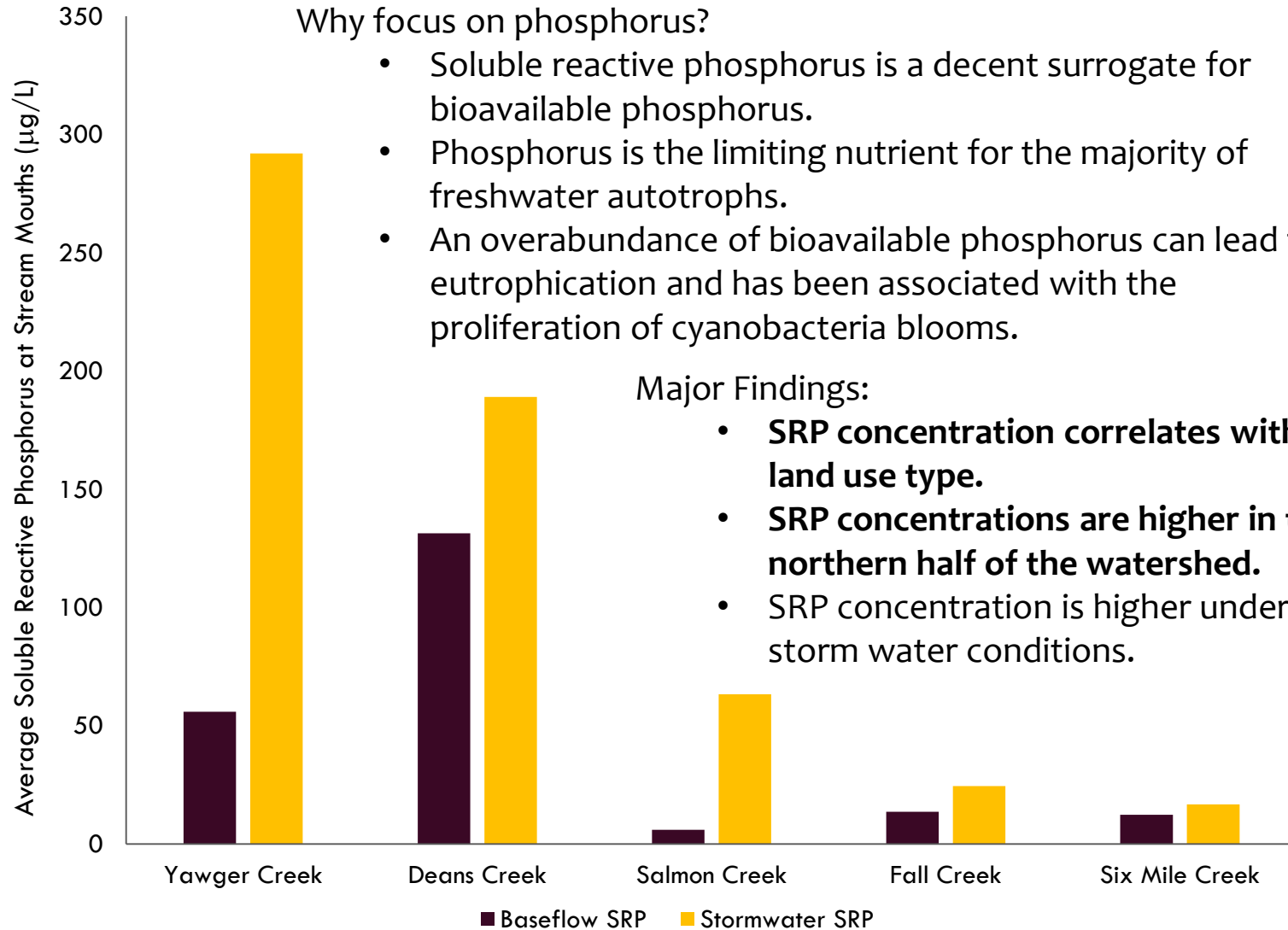
The Role of Nutrients – A Factor we can control

Why focus on phosphorus?

- Soluble reactive phosphorus is a decent surrogate for bioavailable phosphorus.
- Phosphorus is the limiting nutrient for the majority of freshwater autotrophs.
- An overabundance of bioavailable phosphorus can lead to eutrophication and has been associated with the proliferation of cyanobacteria blooms.

Major Findings:

- **SRP concentration correlates with land use type.**
- **SRP concentrations are higher in the northern half of the watershed.**
- SRP concentration is higher under storm water conditions.



HABs on Cayuga Lake

There is little documentation of bloom reports on Cayuga Lake in the past. However...

In **2014** there were only **2** suspicious bloom notifications and **1** bloom was confirmed to be cyanobacteria by the NYSDEC.

In **2017** the NYSDEC made **27** suspicious bloom notifications, confirmed **9** cyanobacteria blooms, and identified **3** blooms to have high toxin levels.

The Cayuga Lake Harmful Algal Bloom Monitoring Program was formed.

In **2018** the Cayuga Lake Harmful Algal Bloom Monitoring Program documented **40** confirmed cyanobacteria blooms, **23** of which were identified to have high toxin levels.

It is impossible to say how much of this increase is due to improved monitoring. Nevertheless, it appears that the frequency of blooms is increasing on Cayuga Lake.



Cayuga Lake HABs Monitoring Program

The Cayuga Lake HABs Monitoring Program is operated by a consortium of three organizations: Community Science Institute (CSI), Cayuga Lake Watershed Network (CLWN), and Discover Cayuga Lake (DCL).



The purpose of the program is to:

1. Provide timely information and hazard warnings to the users of Cayuga Lake
2. Develop information about the occurrence of HABs, which may be useful in future responses and long-term mitigation of cyanobacteria blooms on Cayuga Lake.

The program receives no funding from the state, and is entirely supported by local municipalities, donations, and grants.



www.communityscience.org
info@communityscience.org

Volunteer Driven Program

HABs Harriers attend a cyanobacteria identification and sampling training, provided by CSI and the NYSDEC prior to the monitoring season.

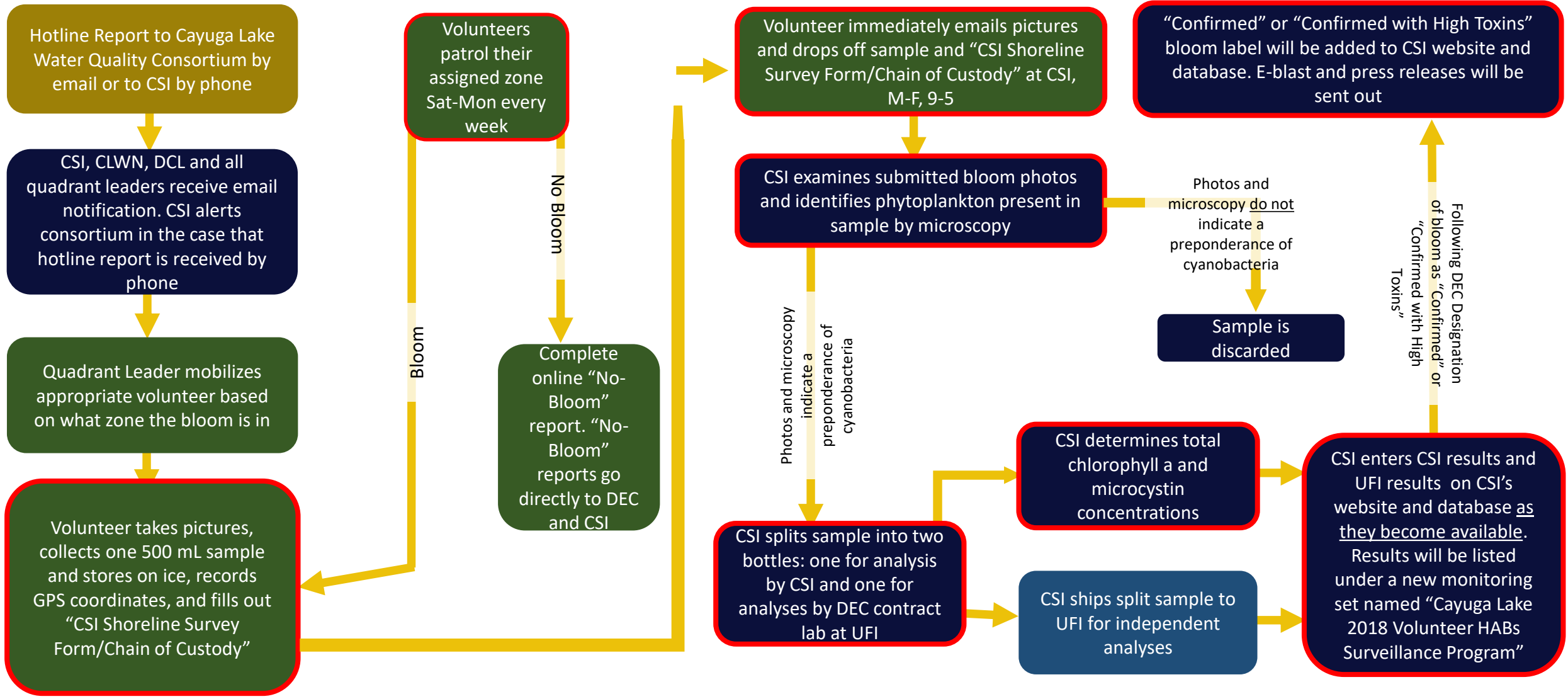
The program works through a lake-wide network of volunteers, titled HABs Harriers, who monitor sections of the shoreline every week from July through October.

If a volunteer observes a suspicious bloom, they record the location, take pictures, and collect a sample to be transported to the Community Science Institute lab for analysis.



Over 75
volunteers
in the first
year!





Bloom Analysis at our local lab

The Cayuga Lake HABs Monitoring Program is unique because volunteers bring suspicious bloom samples directly to the Community Science Institute lab in Ithaca.

Here at the lab, suspicious bloom samples undergo three analyses:

1. Determination of microcystin toxin concentration using EPA Method 546
2. Determination of Total Chlorophyll-a concentration (a measure of bloom biomass).
3. Microscopic analysis to determine the cyanobacteria taxa present in the bloom.

\$200

funds the
analysis of one
cyanobacteria
bloom

Community Science Institute is able to produce results for these analysis as fast as **a week** to the **same-day** a suspicious bloom is reported. This turnaround of results is **much faster** than HABs monitoring programs on other lakes that have to send samples to a third-party lab and await results.

These results will help develop our **understanding of cyanobacteria blooms on Cayuga Lake**, useful for **future response** and **long-term mitigation**.



What did we find in 2018?

The Cayuga Lake HABs Monitoring Program helped to inform a few essential questions about HABs on Cayuga Lake including:

When do cyanobacteria blooms occur on Cayuga Lake?

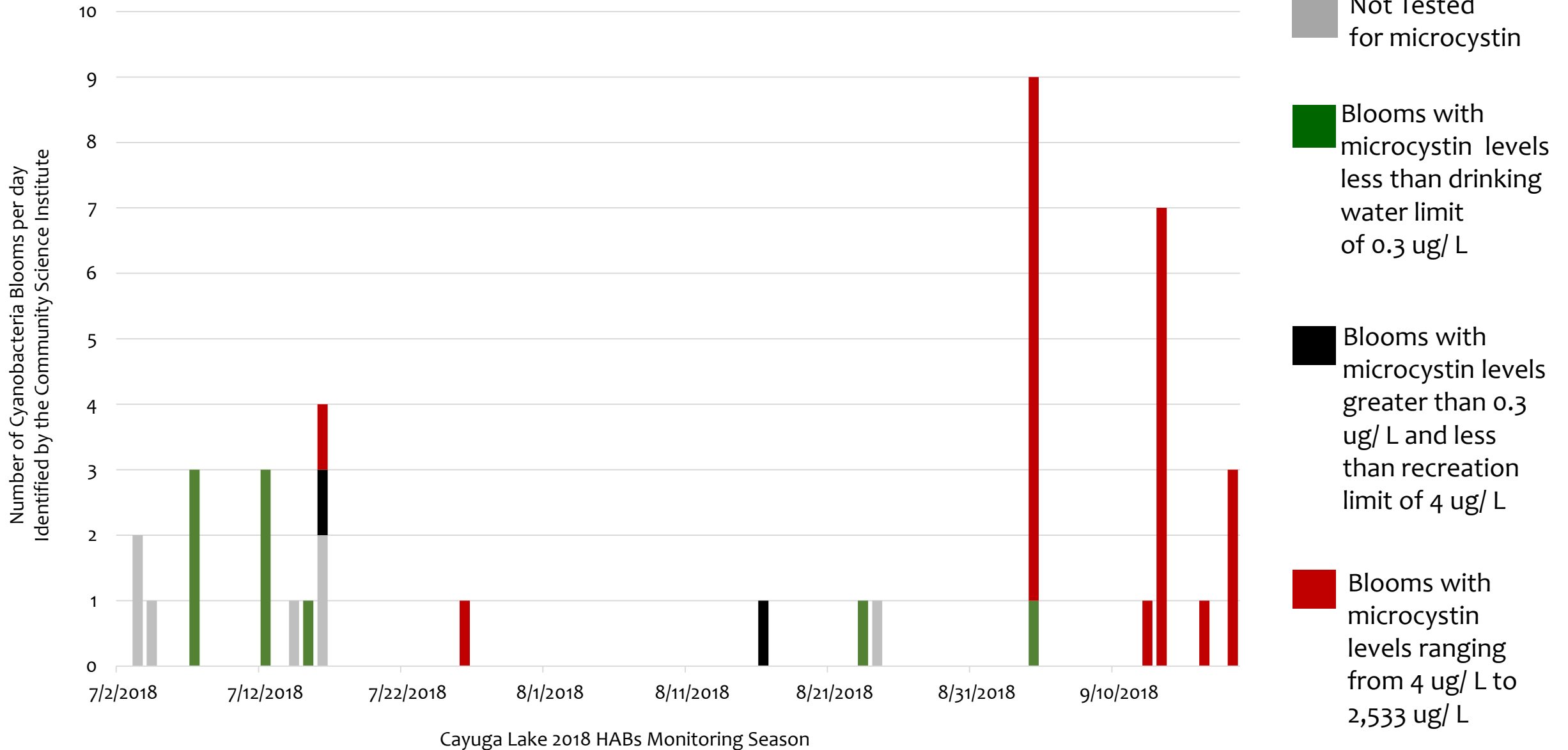
Which cyanobacteria genera are associated with microcystin toxin?

When do blooms have the highest toxin levels?

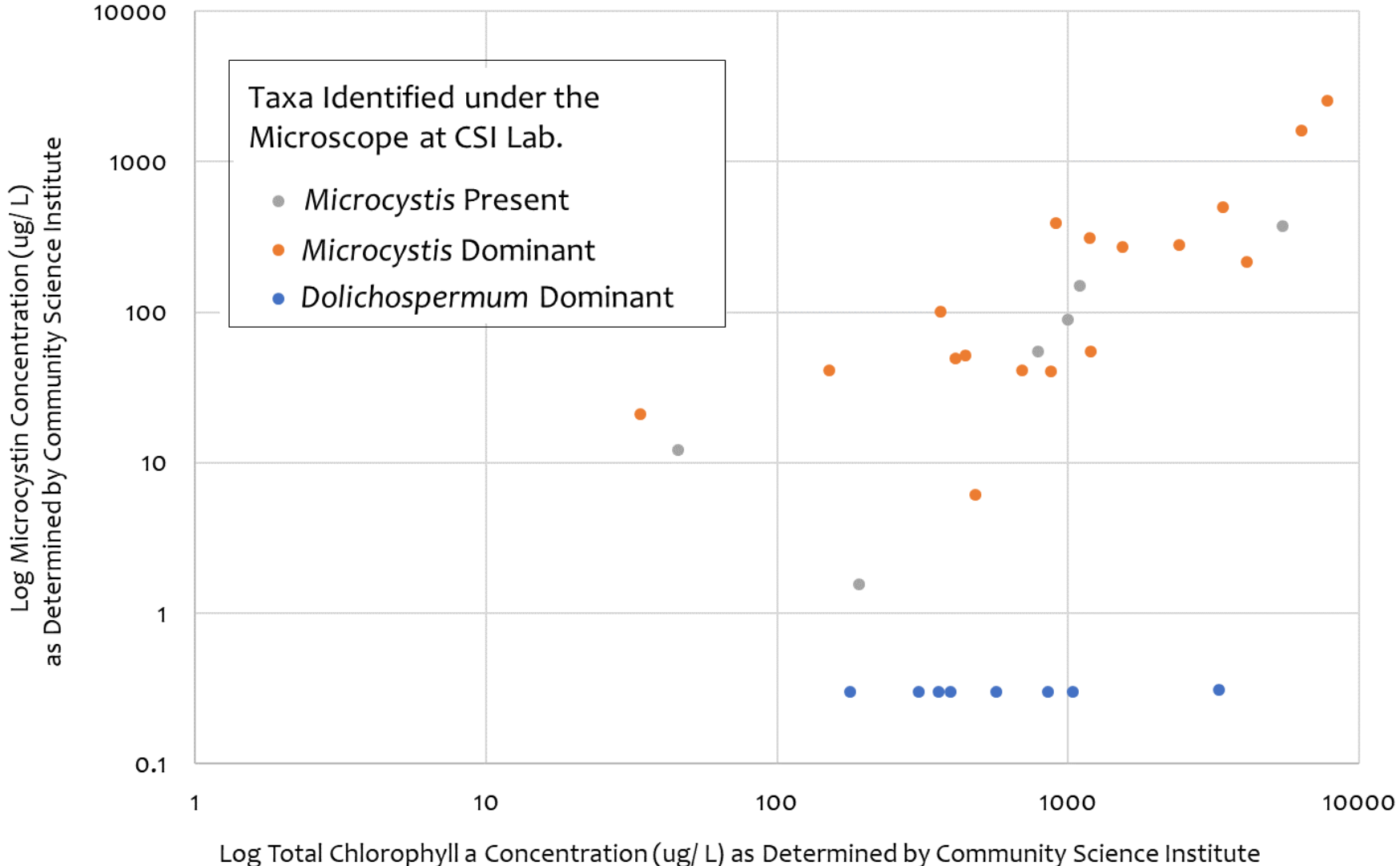
Where do blooms occur?

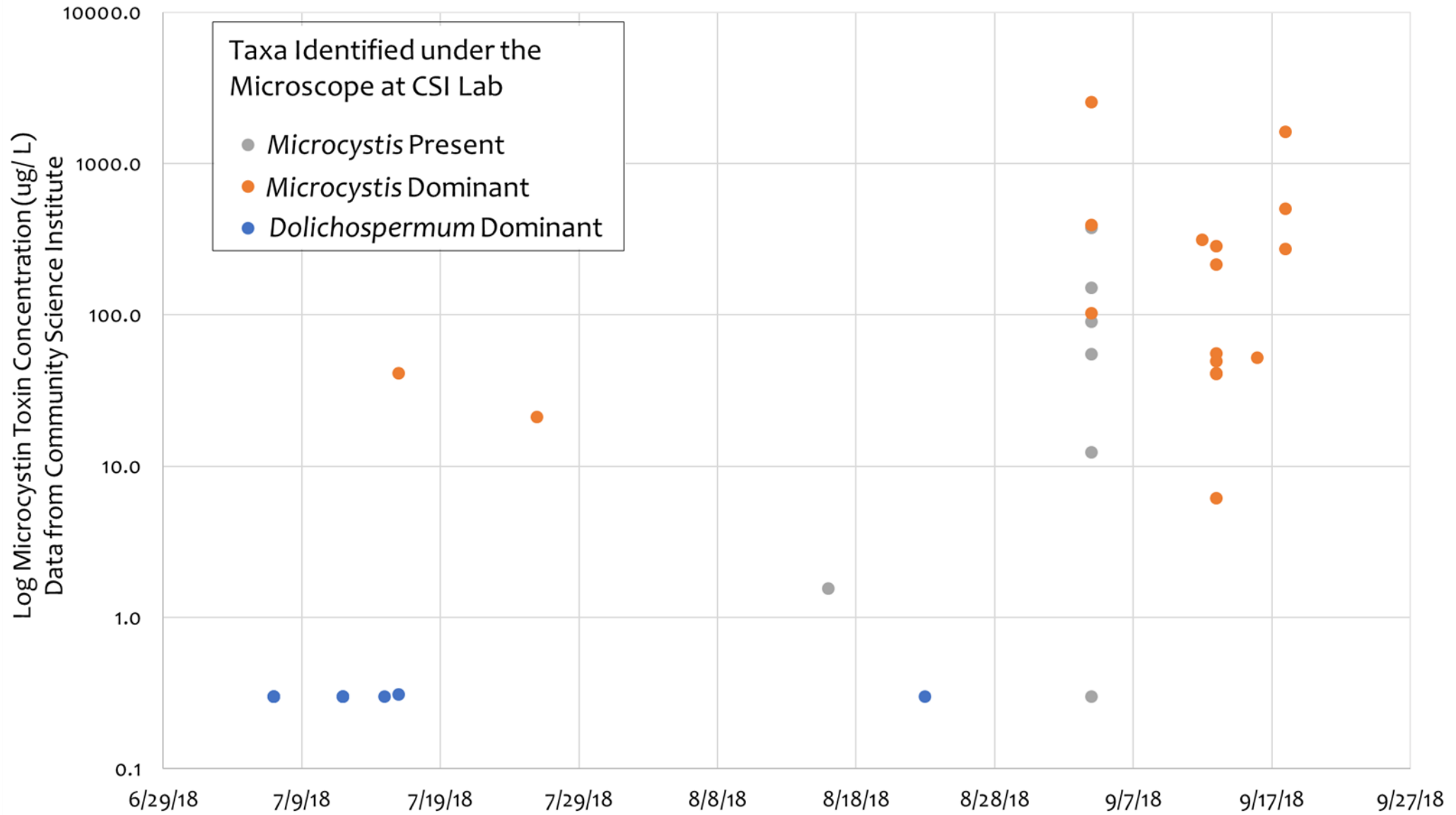


Frequency of Cyanobacteria Blooms (HABs) on Cayuga Lake 2018



Microcystin Toxin Increased with Cyanobacteria Biomass when *Microcystis* Taxa were Present or Dominant





Cayuga Lake 2018 HABs Monitoring Season



Northwestern Quadrant

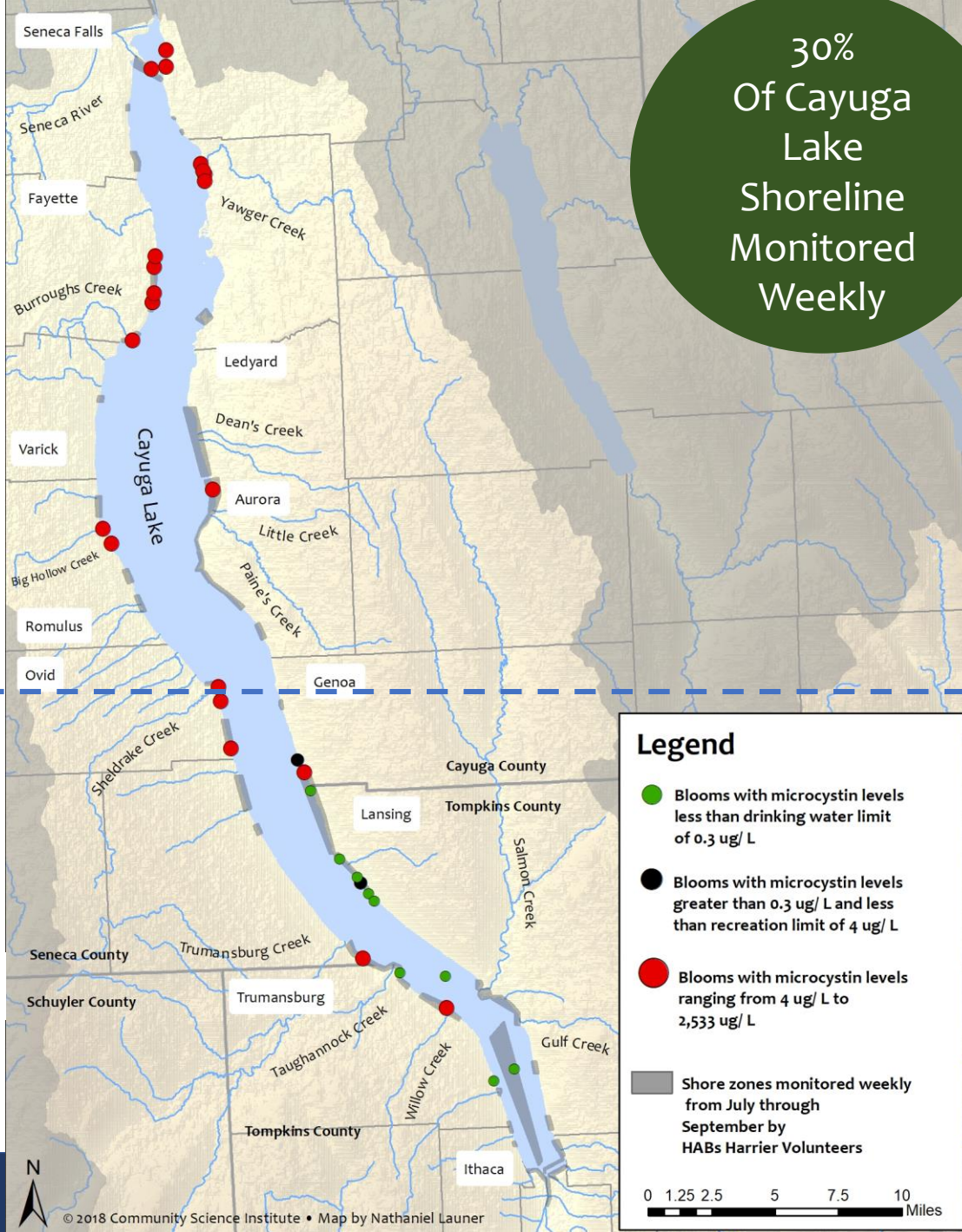
Northeastern Quadrant

Southwestern Quadrant

Southeastern Quadrant

30%
Of Cayuga Lake
Shoreline
Monitored
Weekly

Sheldrake Point



Occurrence of confirmed cyanobacteria blooms on Cayuga Lake appeared to increase in 2018 compared to the previous year, though much of this may be due to improved monitoring efforts.

Nearly all blooms on Cayuga Lake in 2018 with toxin levels above state drinking water and recreation limits contained the cyanobacteria *Microcystis*.

Toxin levels in blooms that occurred in September were much higher than those of blooms in July or August in 2018.

On Cayuga Lake in 2018, 77% of the blooms with microcystin concentrations above 4 ug/ L occurred in the northern half of the lake.

Monitoring is essential for

1. Assessing the risk that cyanobacteria blooms may or may not present.
2. Data collection to support risk management



We Need Your Help This Summer Protecting Cayuga Lake from Harmful Algal Blooms (HABs)!



Who can volunteer?

- Anyone! Lake shore homeowners and avid boaters and anglers are especially encouraged to participate.

What does being a HABs Harrier entail?

- Attend a two hour HABs identification and sampling workshop in June.
- Survey assigned length of shoreline once a week, mid-July through September.
- Collect HABs samples and transport them to CSI lab for further analysis.
- Be available to respond to HABs sightings reported by members of the public

Volunteer a few hours of your time each week this summer to be a HABs Harrier

or

Donate to help fund bloom analysis and extensive staff time



Community Science Institute
info@communityscience.org
607-257-6606



Cayuga Lake Watershed Network
programs@cayugalake.org
607-319-0475



Discover Cayuga Lake
(607) 327-5253