Monitoring Harmful Algal Blooms (HABs) on Cayuga Lake in 2019

Nathaniel Launer
Outreach Coordinator, Cayuga Lake HABs Program Coordinator
Community Science Institute

What are Harmful Algal Blooms (HABs)?

Although commonly referred to as algae, the organisms that form these blooms are actually **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!

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 part of what makes a bloom **harmful**.

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

There are many different taxa of cyanobacteria.

H: Harmful

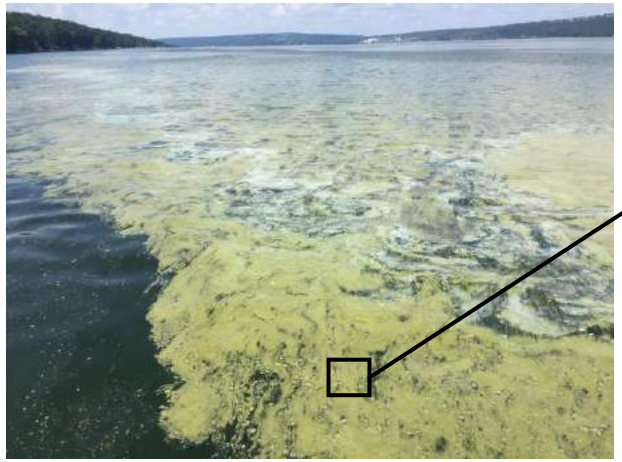
- Toxins, economic, aesthetic, ecological

A: Algal

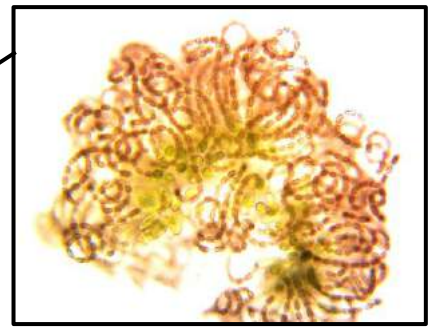
- Freshwater HABs refer to cyanobacteria. Not true algae.

B: Bloom

- Proliferations of cells, dense concentrations



Microcystis – Produce the toxin microcystin. Have the highest population growth rates at water temperatures between X and X and have the highest rate of toxin production at a water temperature of 20° C



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

Blooms

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

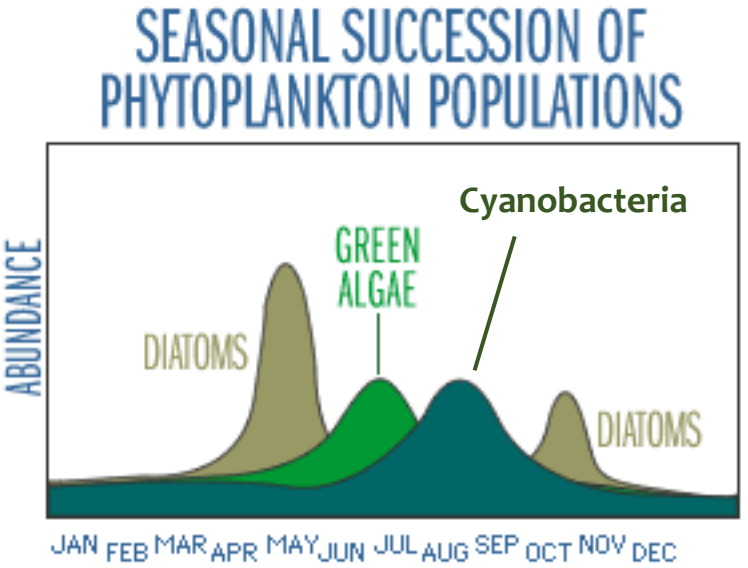
This is different than the modest population growth that occurs seasonally

The factors that promote this **rapid population growth** are still under study. There is general scientific consensus that…

- Cyanobacteria growth increases at higher water temperatures.

- High nutrient concentrations of phosphorus and nitrogen, have been shown to promote cyanobacteria growth.

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



However these factors may be more lake specific than scientists originally thought…

Background

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

In **2014** there were **2** suspicious bloom notifications and **1** bloom was confirmed to be cyanobacteria by the New York State Department of Environmental Conservation (NYSDEC).

In **2017** the NYSDEC received **27** suspicious bloom notifications, confirmed **5** cyanobacteria blooms, and identified **3** blooms to have high toxin levels.

- A CSI Water and Community Event was held in Fall 2017 to discuss the emerging threat to water quality

In **2018**

- The Cayuga Lake Harmful Algal Bloom Monitoring Program was developed
- NYS DEC Published the Cayuga Lake HABs Action Plan

In its first monitoring season the Cayuga Lake HABs Monitoring Program confirmed **40** cyanobacteria blooms, **23** of which were found to have high toxin levels.

The Cayuga Lake HABs Monitoring Program

The Cayuga Lake HABs Monitoring Program was designed and implemented by the Community Science Institute (CSI), the 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 is a partnership of these organizations and a network of dedicated volunteers who monitor sections of shoreline around the lake and report their observations.

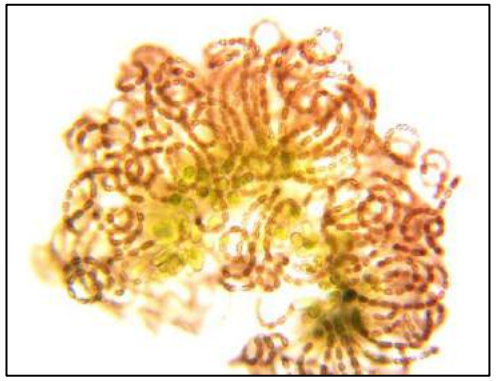
- If no bloom is observed during their survey, the volunteer(s) file a No Bloom Report
- If a bloom is observed, volunteers are trained to report the bloom, collect a sample, and transport it to the CSI lab in Ithaca for analysis.

Testing Bloom Samples at CSI Lab

The ability to test bloom samples at a local certified lab is a **unique** strength of Cayuga Lake's program.

At CSI lab bloom samples are analyzed to…

1. Determine which cyanobacteria are present in the bloom sample



2. Determine the concentration of microcystin toxin

0.3 µg/ L in drinking water

4.0 µg/ L in surface water used for recreation

These values were set by the EPA and are used by the Department of Health of many states including New York for **water**

EPA recently raised the surface water recreation safe guidance value to **8 µg/ L**

Always avoid contact with any suspicious bloom regardless of reported microcystin concentration

Cyanobacteria may produce a variety of other toxic compounds for which labs do not have a certified test method for.

3. Determine the concentration of Total Chlorophyll a as a measure of bloom density

This measurement helps confirm that the density of cyanobacteria sampled in the water is large enough to be considered a bloom.

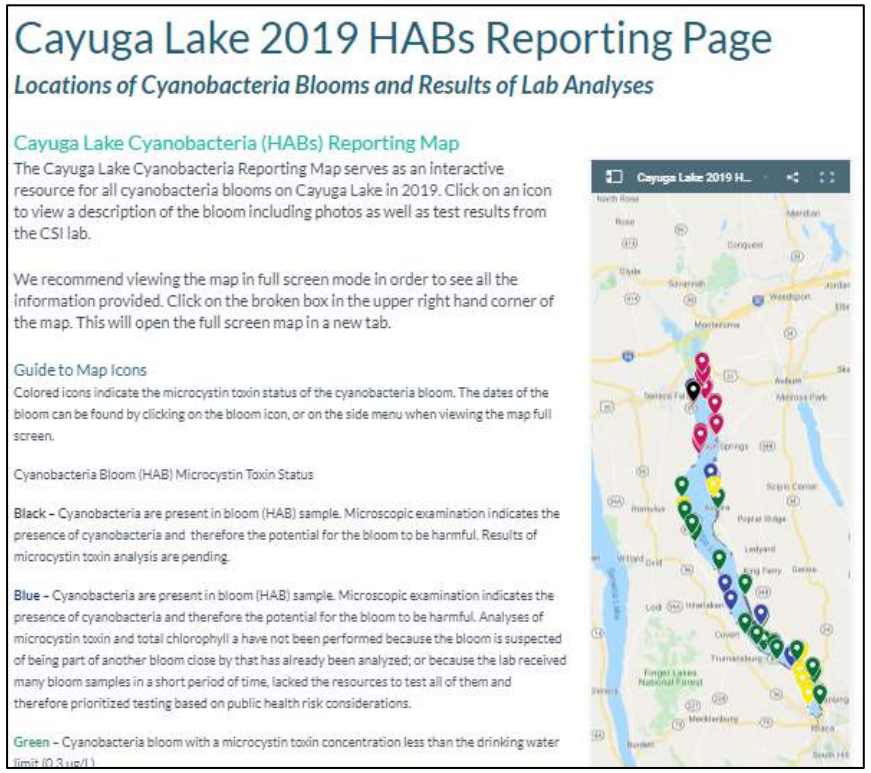
Understanding the concentration of Total Chlorophyll also helps further our understanding of bloom intensity.

Reporting HABs on Cayuga Lake

The Cayuga Lake HABs Reporting Page

All bloom reports and results of bloom analysis are reported on CSI's website in **near to real-time** to provide quick hazard warnings and alerts to all who use Cayuga's waters.

The Cayuga Lake HABs Reporting Page



Cayuga Lake 2019 HABs Reporting Page

Locations of Cyanobacteria Blooms and Results of Lab Analyses

Cayuga Lake Cyanobacteria (HABs) Reporting Map

The Cayuga Lake Cyanobacteria Reporting Map serves as an interactive resource for all cyanobacteria blooms on Cayuga Lake in 2019. Click on an icon to view a description of the bloom including photos as well as test results from the CSI lab.

We recommend viewing the map in full screen mode in order to see all the information provided. Click on the broken box in the upper right hand corner of the map. This will open the full screen map in a new tab.

Guide to Map Icons

Colored icons indicate the microcystin toxin status of the cyanobacteria bloom. The dates of the bloom can be found by clicking on the bloom icon, or on the side menu when viewing the map full screen.

Cyanobacteria Bloom (HAB) Microcystin Toxin Status

Black – Cyanobacteria are present in bloom (HAB) sample. Microscopic examination indicates the presence of cyanobacteria and therefore the potential for the bloom to be harmful. Results of microcystin toxin analysis are pending.

Blue – Cyanobacteria are present in bloom (HAB) sample. Microscopic examination indicates the presence of cyanobacteria and therefore the potential for the bloom to be harmful. Analyses of microcystin toxin and total chlorophyll a have not been performed because the bloom is suspected of being part of another bloom close by that has already been analyzed; or because the lab received many bloom samples in a short period of time, lacked the resources to test all of them and therefore prioritized testing based on public health risk considerations.

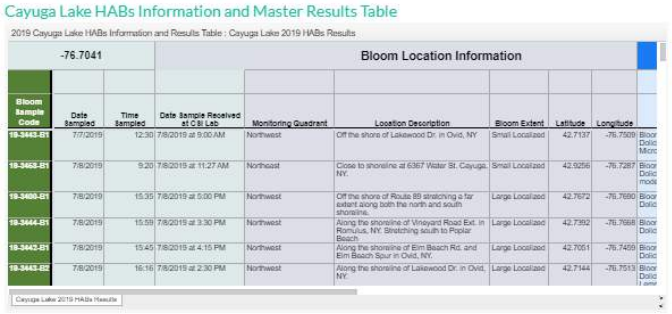
Green – Cyanobacteria bloom with a microcystin toxin concentration less than the drinking water limit (0.3 ug/L)

Cayuga Lake 2019 H...

View on CSI's website at www.communityscience.org

Interactive reporting map

Complete table of bloom results to date



Cayuga Lake HABs Information and Master Results Table

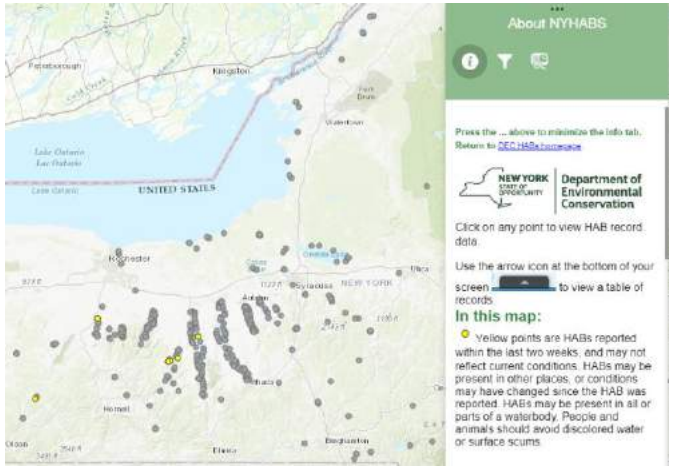
2019 Cayuga Lake HABs Information and Results Table : Cayuga Lake 2019 HABs Results

-76.7041					Bloom Location Information				
Bloom Sample Code	Date Sampled	Time Sampled	Date Sample Received at CSI Lab	Monitoring Quadrant	Location Description	Bloom Extent	Latitude	Longitude	
19-3443-E1	7/7/2019	12:30	7/8/2019 at 9:00 AM	Northwest	Off the shore of Lakewood Dr. in Ovid, NY	Small Localized	42.7137	-76.7509	Bloom Dolic Micro
19-3453-E1	7/8/2019	9:20	7/8/2019 at 11:27 AM	Northeast	Close to shoreline at 6367 Water St. Cayuga, NY.	Small Localized	42.9256	-76.7287	Bloom Dolic
19-3455-E1	7/8/2019	15:35	7/8/2019 at 5:00 PM	Northwest	Off the shore of Route 89 stretching a far extent along both the north and south shoreline.	Large Localized	42.7672	-76.7690	Bloom Dolic mode
19-3444-E1	7/8/2019	15:59	7/8/2019 at 3:30 PM	Northwest	Along the shoreline of Vineyard Road Ext. in Romulus, NY. Stretching south to Poplar Beach.	Large Localized	42.7392	-76.7668	Bloom Dolic
19-3442-E1	7/8/2019	15:45	7/8/2019 at 4:15 PM	Northwest	Along the shoreline of Elm Beach Rd. and Elm Beach Spur in Ovid, NY.	Large Localized	42.7051	-76.7459	Bloom Dolic
19-3443-E2	7/8/2019	16:16	7/8/2019 at 2:30 PM	Northwest	Along the shoreline of Lakewood Dr. in Ovid, NY.	Large Localized	42.7144	-76.7513	Bloom Dolic Lyngb

Cayuga Lake 2019 HABs Results

CLWN Weekly Updates to the Public

Report to NYHABs State-wide Reporting System



Cayuga Lake Watershed Network

CSI

Discover CAYUGA LAKE

The 2019 Monitoring Season – A Community Effort

Increased shoreline coverage to 47%

This year staff at all four state parks around Cayuga Lake participated in the program, as well as staff from Camp Barton and Camp Comstock.

24 new volunteers joined the program

17 new monitoring zones were created

Volunteers patrolled the route of the Women Swimmin' Fundraiser to ensure a HABs free swim!

Updated our online reporting page to be more viewer friendly





Monitoring HABs on Cayuga Lake in 2019

In 2018 CSI confirmed 40 cyanobacteria blooms reports on Cayuga Lake

This year, CSI confirmed **67** cyanobacteria blooms reports

Year	Confirmed Bloom Reports	Shoreline Monitored
2014	1	
2015	0	
2016	3	
2017	5	
2018	40	30%
2019	67	47%

The Cayuga Lake Harmful Algal Bloom Monitoring Program

Historic records retrieved from the Cayuga Lake HABs Action Plan published by the NYSDEC in 2018

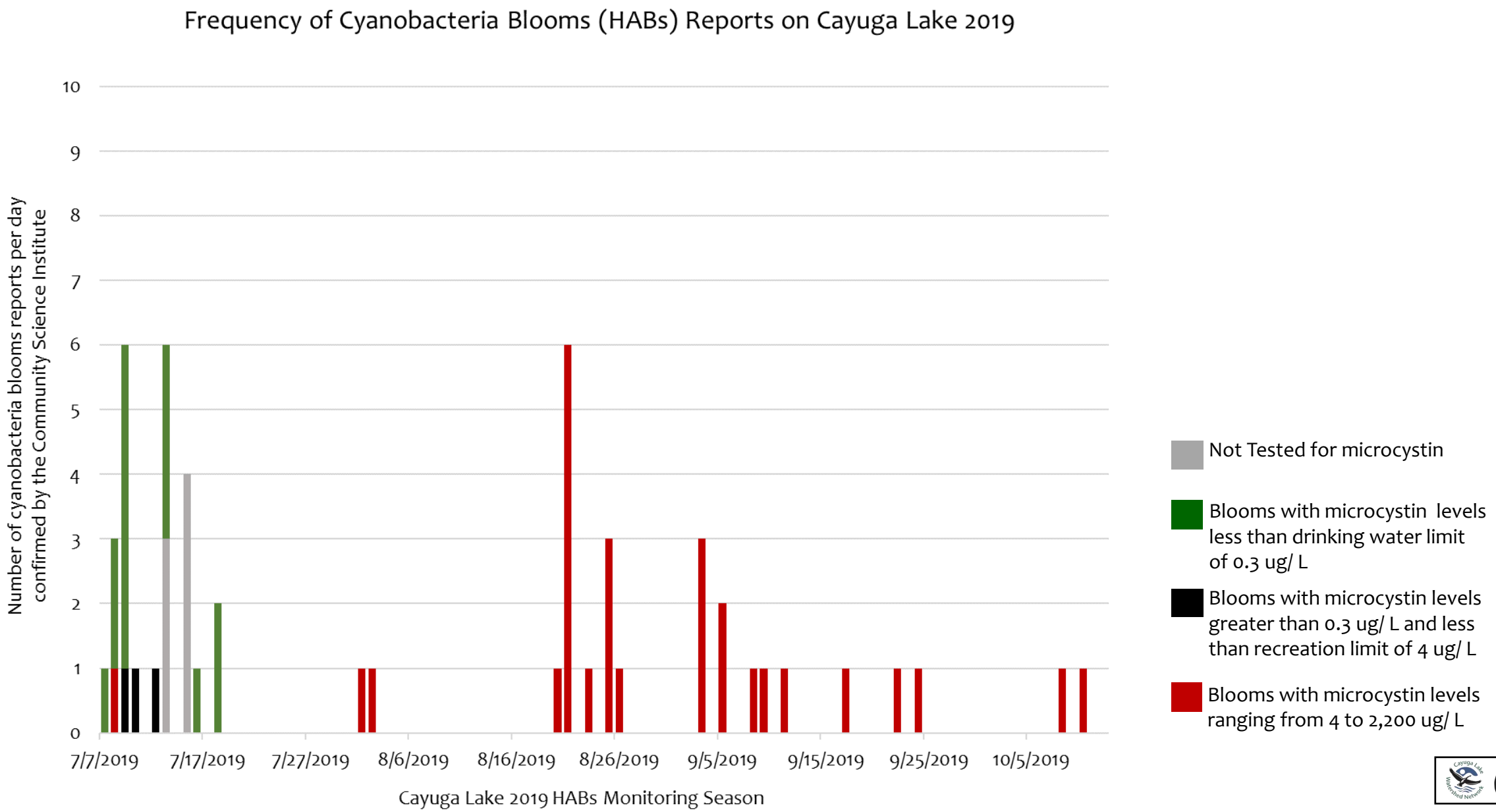
Monitoring HABs on Cayuga Lake has systematically improved in the last two years

- the awareness and understanding of HABs has increased as well

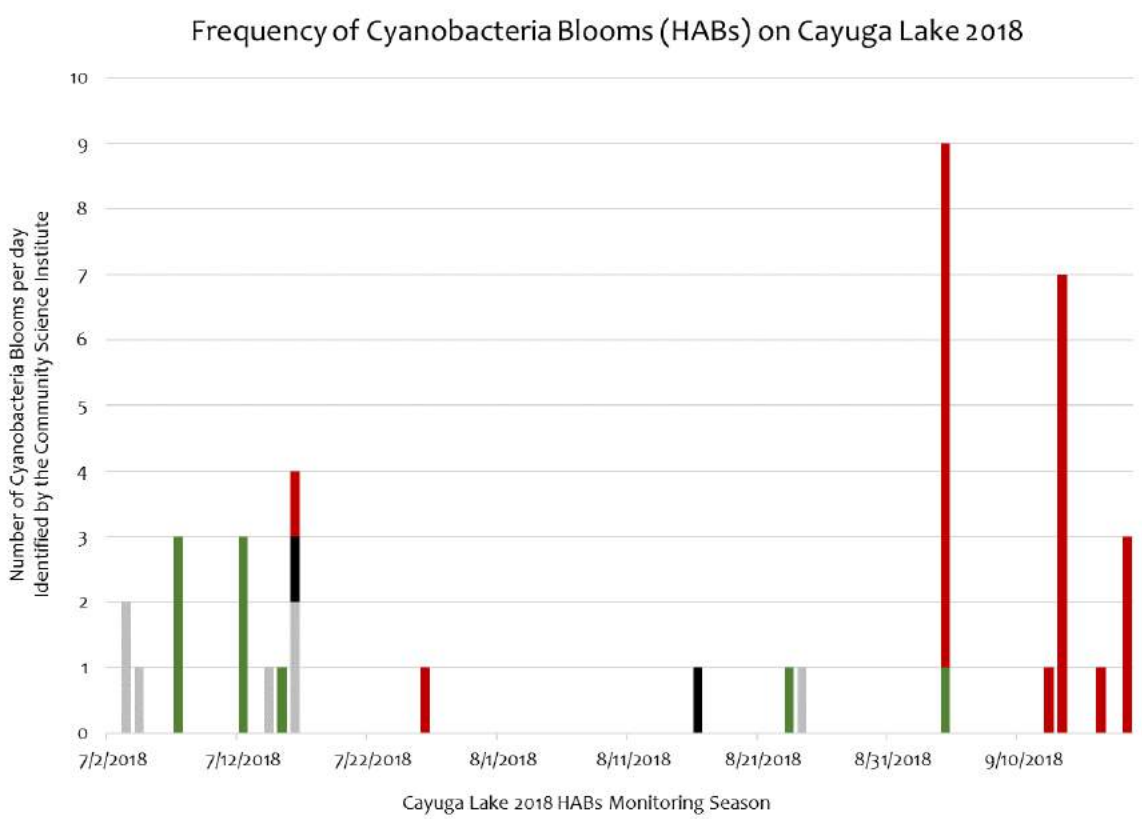
Have HABs occurrences increased on Cayuga Lake?

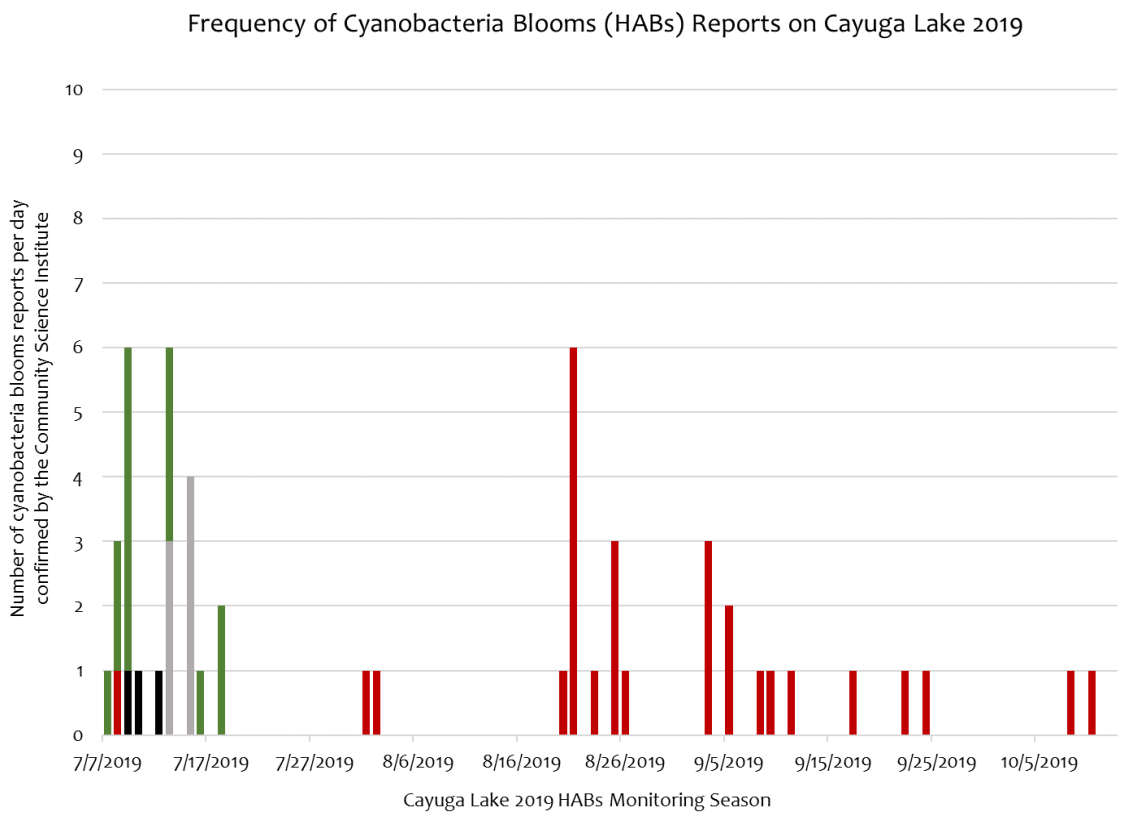
HABs **may** have increased on Cayuga Lake in recent years, the awareness of the issue has increased, **and** we are better at identifying and reporting blooms.

When did HABs occur on Cayuga Lake in 2019?



Two Years of Monitoring HABs on Cayuga Lake





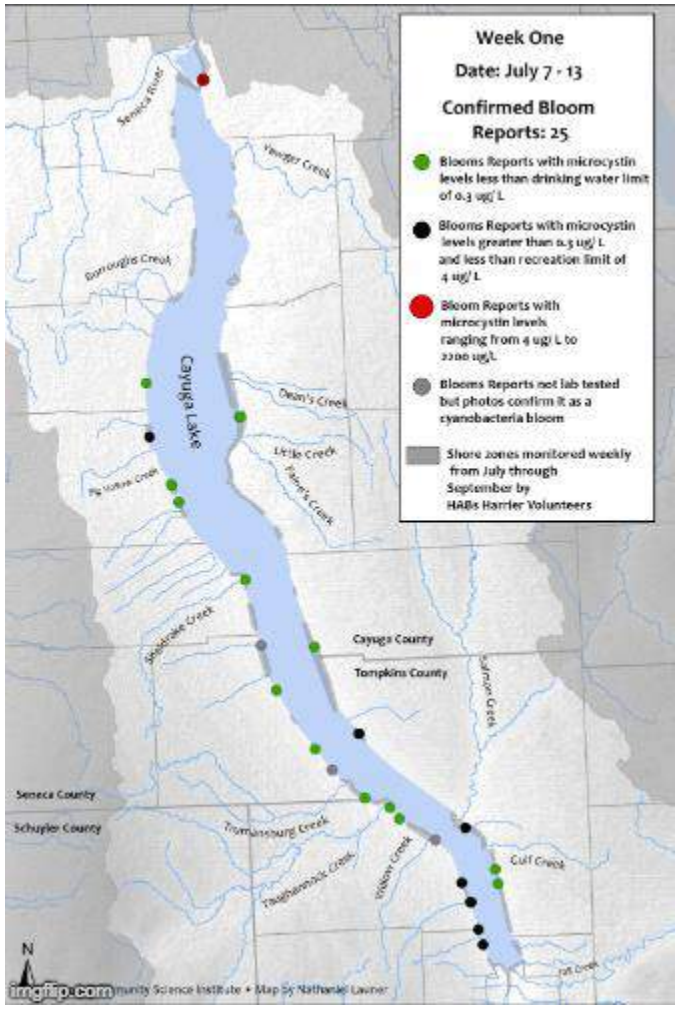
	Confirmed Bloom Reports 2018
July	16
August	3
September	21
October	0

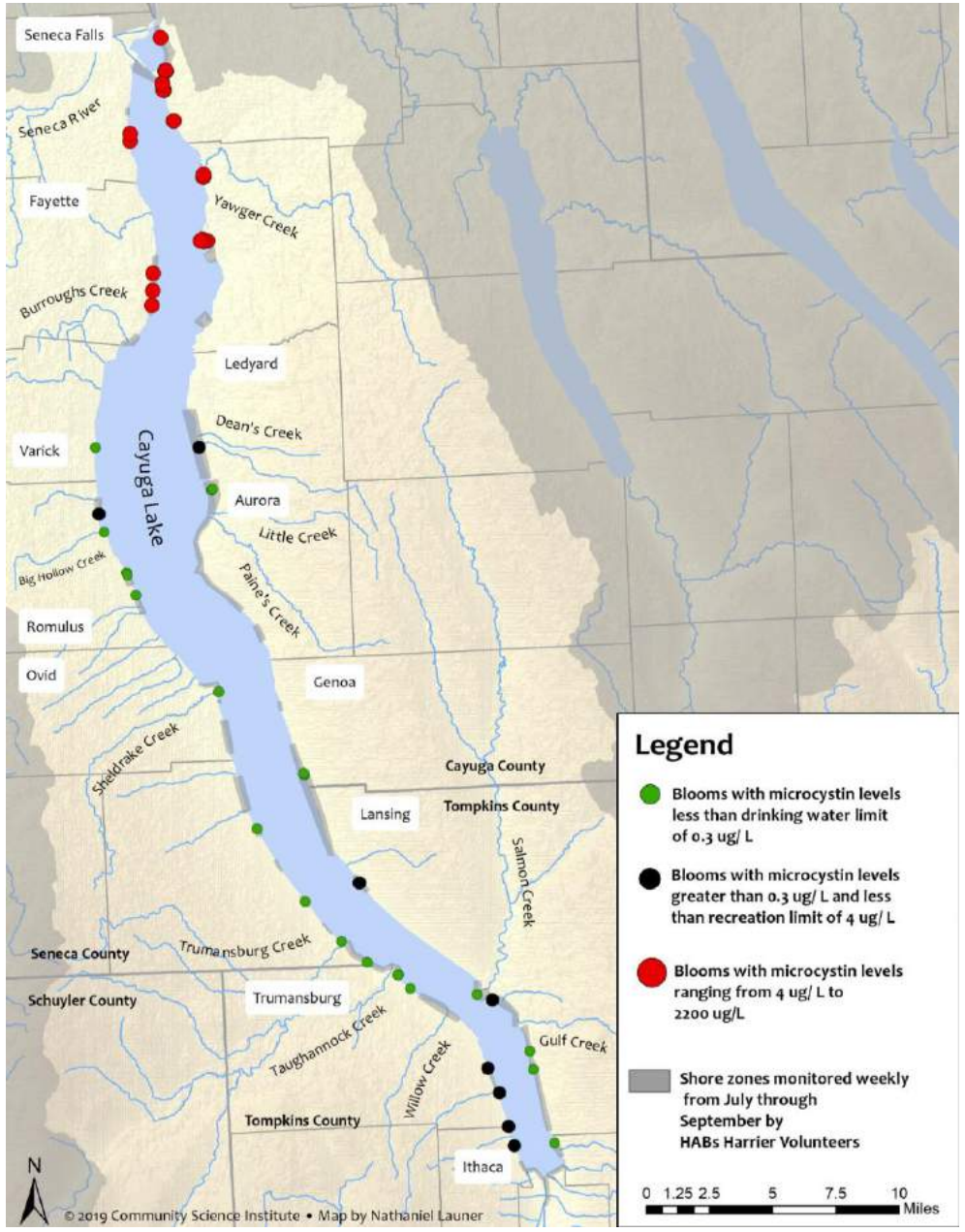
	Confirmed Bloom Reports 2019
July	40
August	14
September	11
October	2

Where did HABs occur on Cayuga Lake in 2019?

In 2019 all blooms with microcystin toxin levels above safe guidance values occurred within **8 miles** of the northern end of the lake.

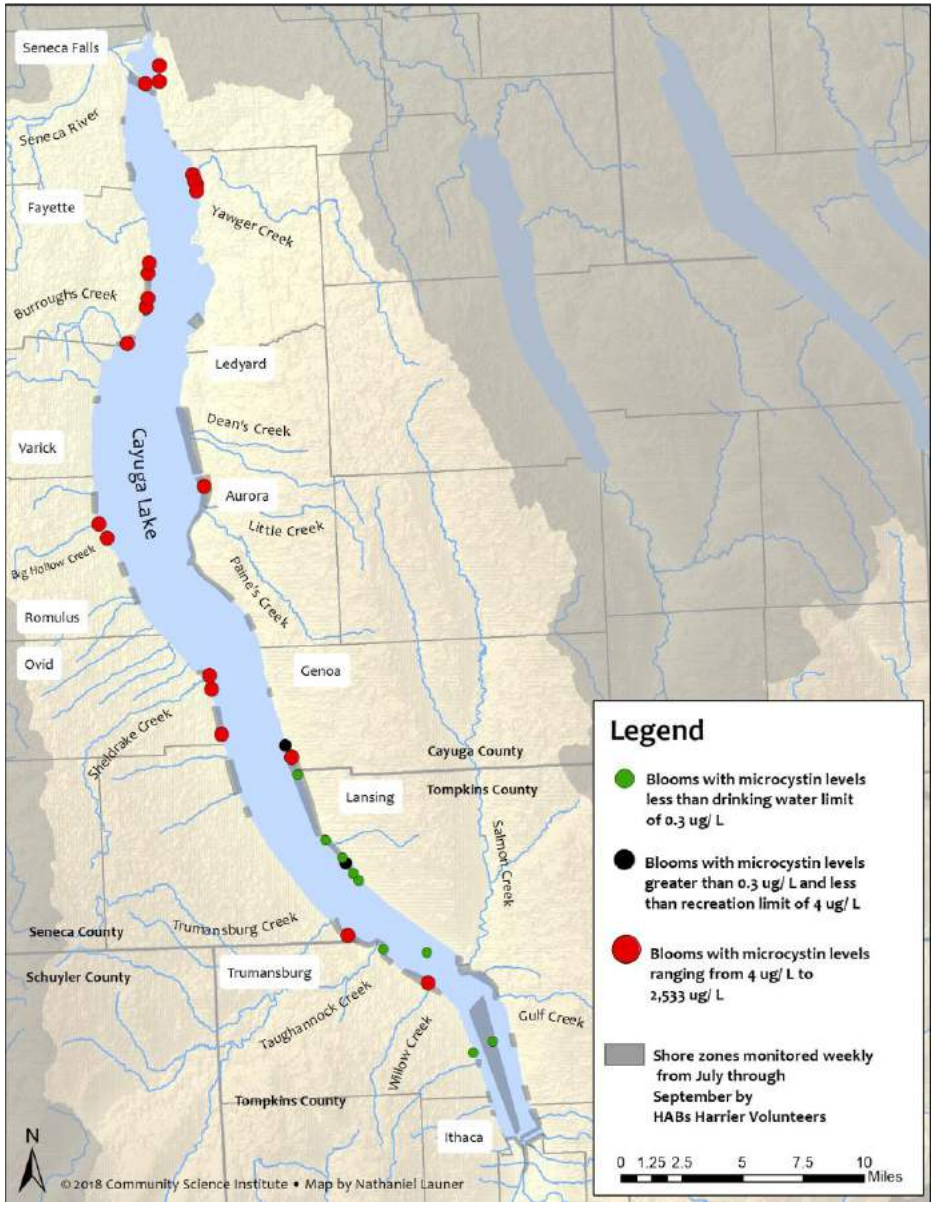
Time-lapse of 2019 Monitoring Season



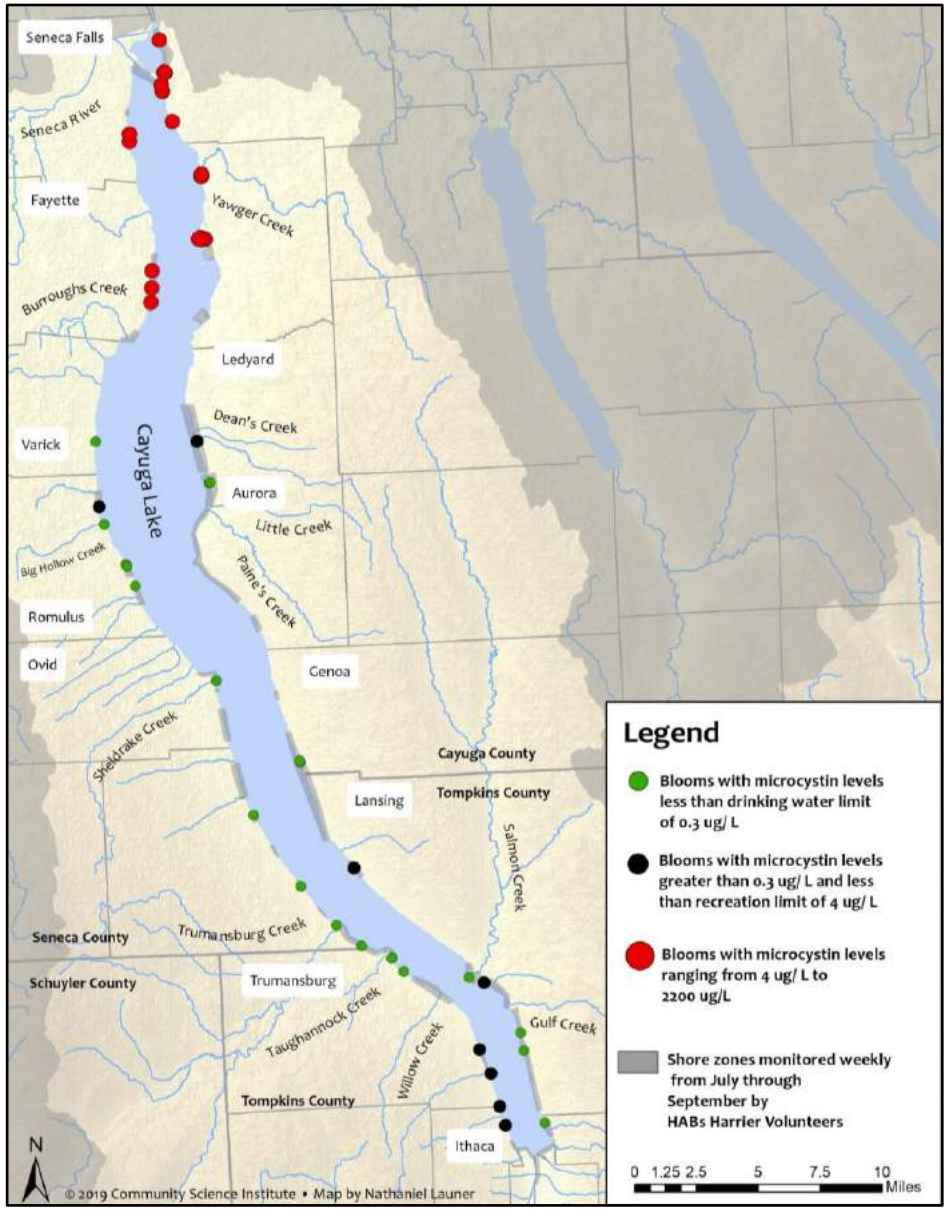


Two Years of Monitoring HABs on Cayuga Lake

2018 Monitoring Season

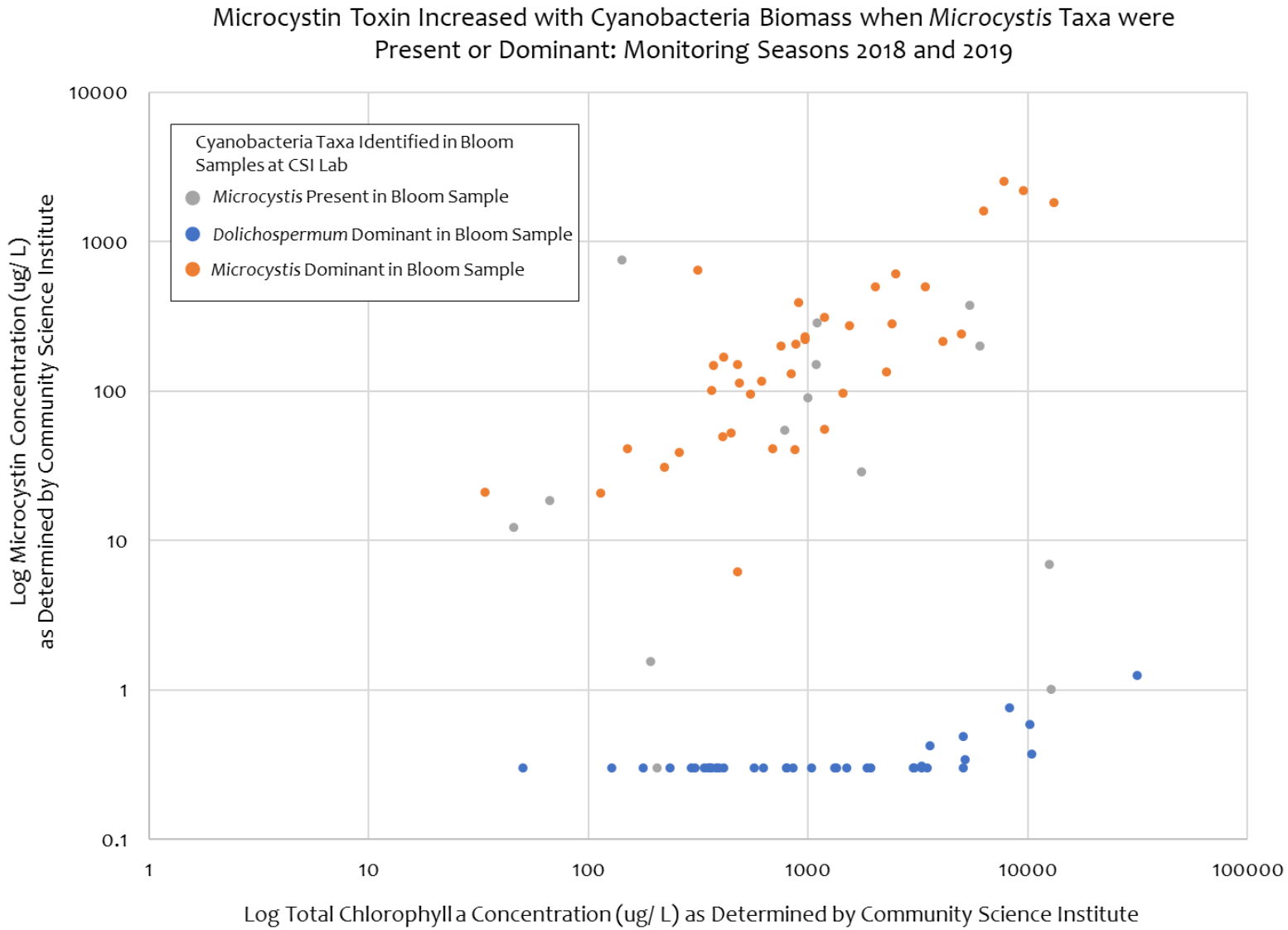


2019 Monitoring Season



Microcystin Toxin Concentrations of Blooms on Cayuga Lake

Two years of bloom data reinforces the idea that microcystin toxin concentrations of blooms on Cayuga Lake are associated with the type of cyanobacteria that forms the bloom.



What have we learned?

Blooms that occur in the northern end of Cayuga Lake in late summer have higher concentrations of microcystin and are dominated by *Microcystis.* Blooms that occur in the southern end of Cayuga Lake in early summer have low concentrations of microcystin and are dominated by *Dolichospermum.*

Blooms are not necessarily worse in the northern end of Cayuga Lake.

- The range of Total chlorophyll a concentrations seem to be generally the same for all tested bloom reports on Cayuga Lake

- There are many other toxic compounds cyanobacteria produce for which no regulatory standards or safe guidance values have yet been set, and no certified tests exist.

- All cyanobacteria blooms can have an impact on ecosystem health and the economy and impair water use.

The Cayuga Lake HABs Monitoring Program is improving our understanding of blooms and water quality on Cayuga Lake. This understanding is essential for informing long-term, sustainable management strategies.

The program is also increasing the awareness of cyanobacteria blooms and the risks they present, our ability to manage that risk, identify and report blooms, and to make safe decisions on how to interact with the lake.

Thank you!

This important program wouldn't be possible without the support of the dedicated volunteers and caring community around Cayuga Lake!

How can you help?

Volunteer to monitor HABs on Cayuga Lake!
Email **info@communityscience.org** or **programs@cayugalake.org** if you are interested

Donate to become a member of our organizations to help support the nonprofit work that we do to our lakes and streams.

Get involved with the many local efforts to protect clean water.