

The 2021 Cayuga Lake HABs Monitoring Season

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A widespread bloom in the Village of Cayuga on September 16th, 2021.
The bloom was reported and sampled by volunteer Holly Davidson.

The 2021 HABs Monitoring Season

We partnered with over **90 ‘HABs Harrier’ volunteers**, collectively **monitoring roughly 57% of the shoreline**.

We documented **102 blooms** on the shoreline of Cayuga Lake between June 29 and October 14, 2021.

- This year was stood out due to the occurrence of widespread bloom events and many ‘late season’ blooms.

Stocked brochure holders with HABs Information and Reporting Guide brochures lakewide including at all NY State Parks, East Shore Park in Ithaca, Salt Point Natural Area, and Harris Park in the Village of Cayuga.

We tested **all** bloom samples for **microcystin toxin** – a **unique strength** of Cayuga’s HABs Monitoring Program!



Drone photo of an open water bloom in the north end on August 26. Photo by Bill Hecht.



HABs Identification and Reporting brochures stocked at East Shore Park in Ithaca.



A bloom reported in the swimming area at Myers Point on July 19 by Harrier Xander Jackson.

July 19 – 20th Widespread Bloom Event

Thirteen blooms were reported in the southern end and main lake, all of which were reported to be **very widespread**.

This widespread bloom event followed intense and **persistent rainstorms during the previous week**. These rainstorms may have constituted a **huge ‘loading event’** in which **nutrients and sediment were loaded** into the lake in large quantities, potentially **supporting a large biomass** of cyanobacteria.



Panoramic photo of a widespread bloom on Lansing Station Rd. by James Gosset. The bloom was formed by *Dolichospermum* type cyanobacteria and had a microcystin concentration of 1.75 ug/L. It was reported by numerous lakeshore residents along over a mile of shoreline.



A drone photograph taken of a widespread bloom that extended from Myers Park, along Bolton Point Rd. all the way south to East Shore Park in Ithaca. The bloom was reported and sampled by multiple HABS Harrier volunteers. It was also formed by *Dolichospermum* and had a microcystin concentration of 0.82 ug/L.



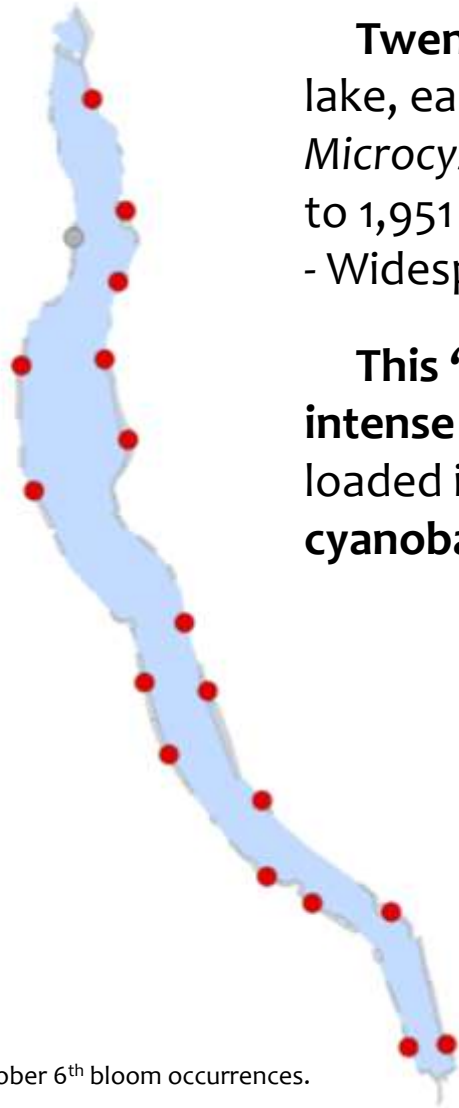
Map of July 19 – 20th bloom occurrences.

October 6th Widespread/ 'Lakewide' Bloom Event

Twenty-one blooms (18 determined to be distinct blooms) were reported at locations around the lake, each of which were **very widespread and dense**. Every bloom was formed by mostly by *Microcystis* type cyanobacteria and had high microcystin toxin concentrations ranging from 6.62 ug/L to 1,951 ug/L.

- Widespread/ lakewide blooms were reported on Seneca Lake and Canandaigua Lake that day as well.

This '**lakewide**' bloom event occurred on a day when there was '**no wind**' on the lake, following **intense rainstorms** during the days prior. This observation again supports the idea that nutrients loaded into the lake during intense rainstorm events **support the growth of a large biomass of cyanobacteria that can form into blooms if facilitated by weather conditions in the following days.**



Map of October 6th bloom occurrences.



Widespread bloom near Poplar Beach Rd. in Romulus. The bloom was reported to be over a mile in extent. It was formed by *Microcystis* and had a microcystin toxin concentration of 1,418 ug/L.

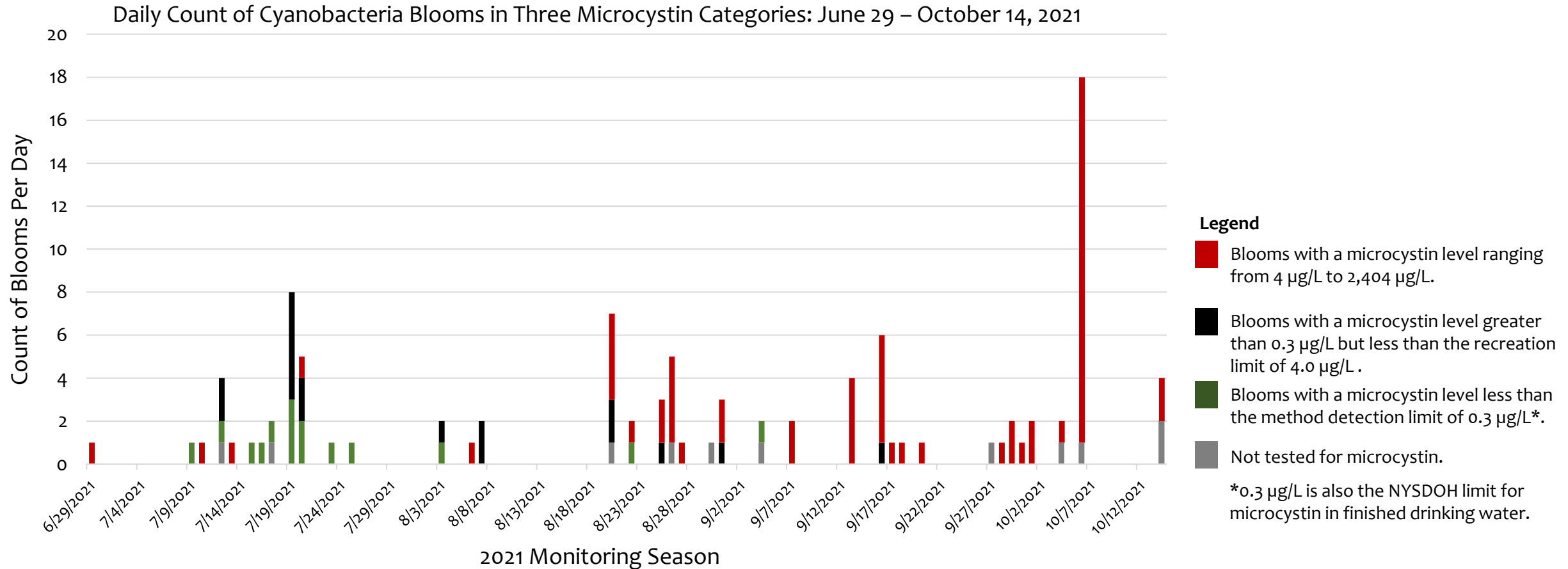


Widespread bloom near Canoga and Seneca Falls. Unfortunately, the bloom could not be sampled.

When Did HABs Occur in 2021?

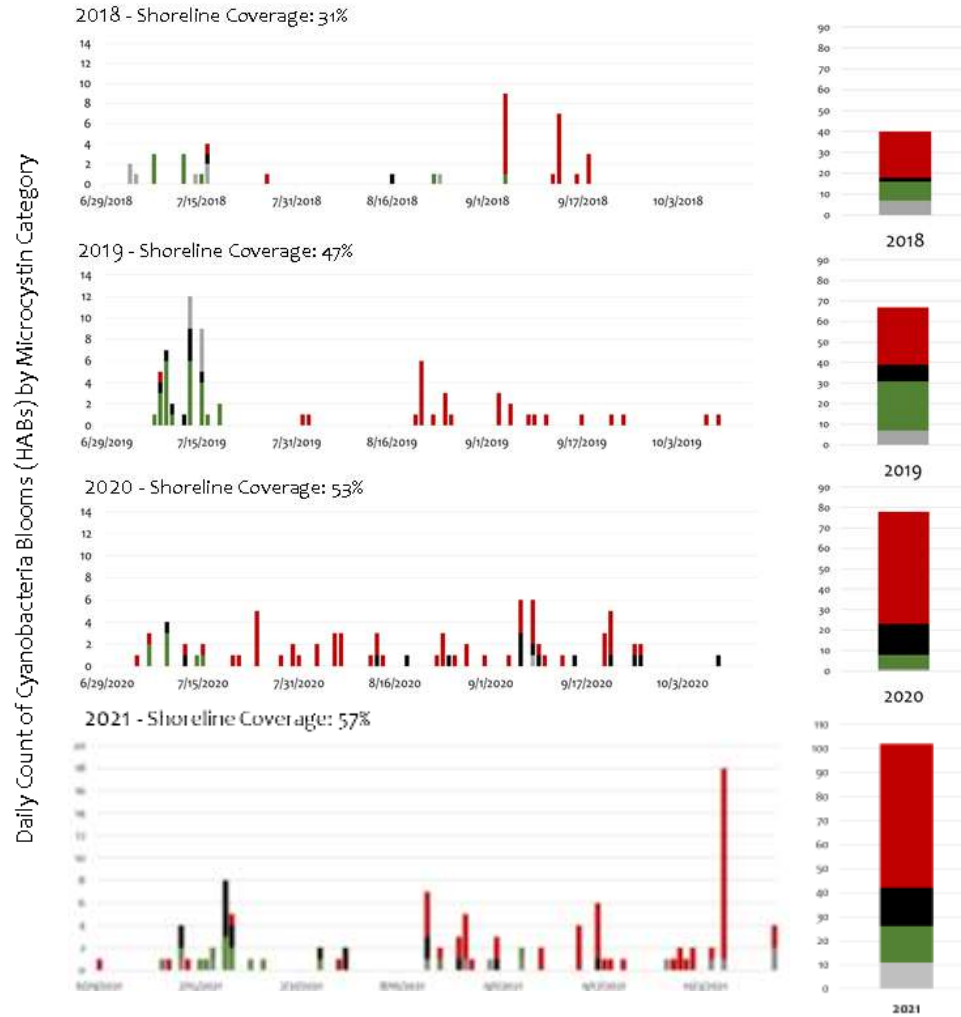
Blooms occurred during **37 'bloom days'** this summer, just **two more** than last year, yet we documented 24 more blooms – the number of blooms observed on the two widespread bloom days accounts for much of this increase.

There was a substantial increase in the number of 'late season' blooms – 26 occurred in October this year!



Multi-Year Patterns: Temporal Patterns

Daily Counts and Annual Totals of Cyanobacteria Blooms (HABs) in Three Microcystin Categories in 2018, 2019, 2020, and 2021



The temporal pattern of bloom occurrences in 2021 was closer to that of 2018 and 2019. The season transition from low-toxin *Dolichospermum* blooms to high-toxin *Microcystis* blooms occurred again.

- In 2021 there was a slight lull in bloom activity, similar to 2018 and 2019.
- In 2021 the frequent occurrence of “low toxin” *Dolichospermum* type blooms in early July was similar to the pattern of 2019 bloom occurrences.
- In 2021, there were 26 blooms in October! Only one bloom occurred in October in 2020, two in 2019, and none in 2018.

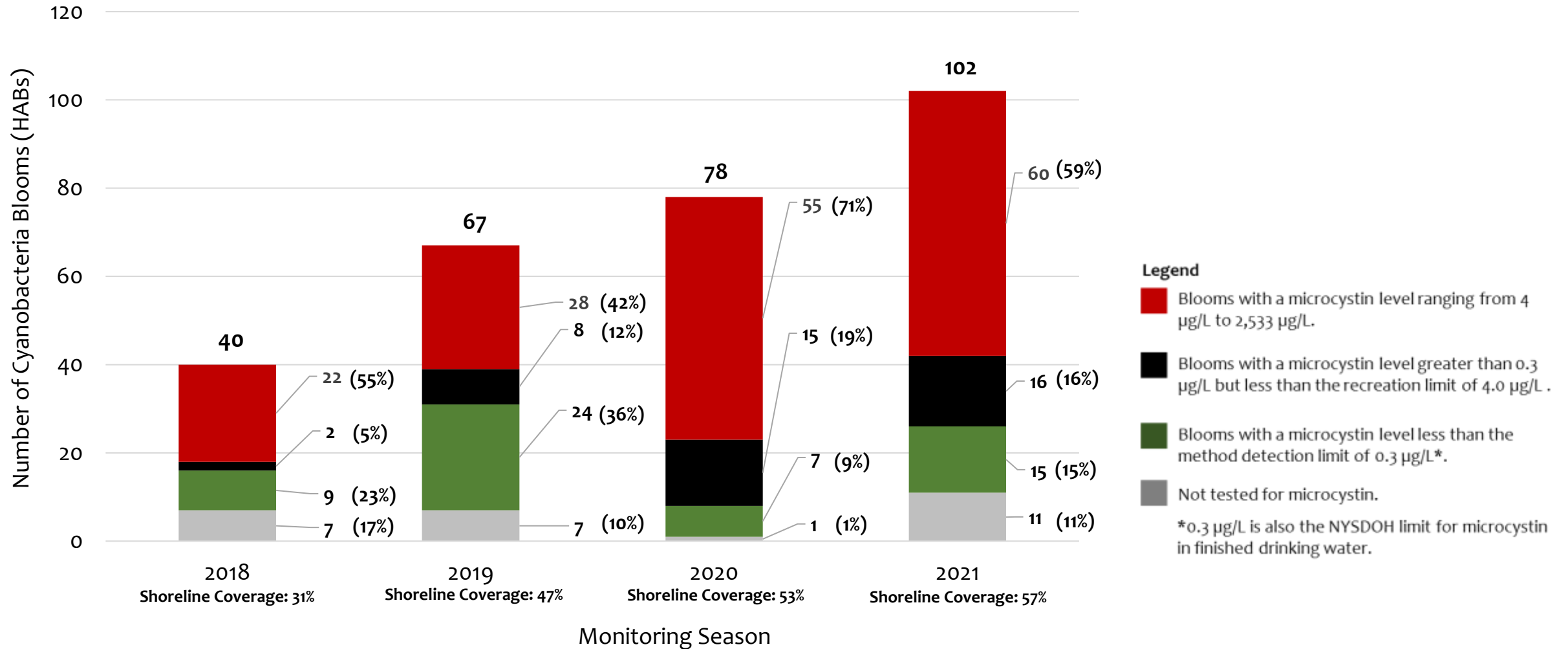
Legend

- Blooms with a microcystin level ranging from 4 µg/L to 2,533 µg/L.
- Blooms with a microcystin level greater than 0.3 µg/L but less than the recreation limit of 4.0 µg/L.
- Blooms with a microcystin level less than the method detection limit of 0.3 µg/L*.
- Not tested for microcystin.

*0.3 µg/L is also the NYSDOH limit for microcystin in finished drinking water.

Multi-Year Patterns: Tracking “High” Microcystin Blooms

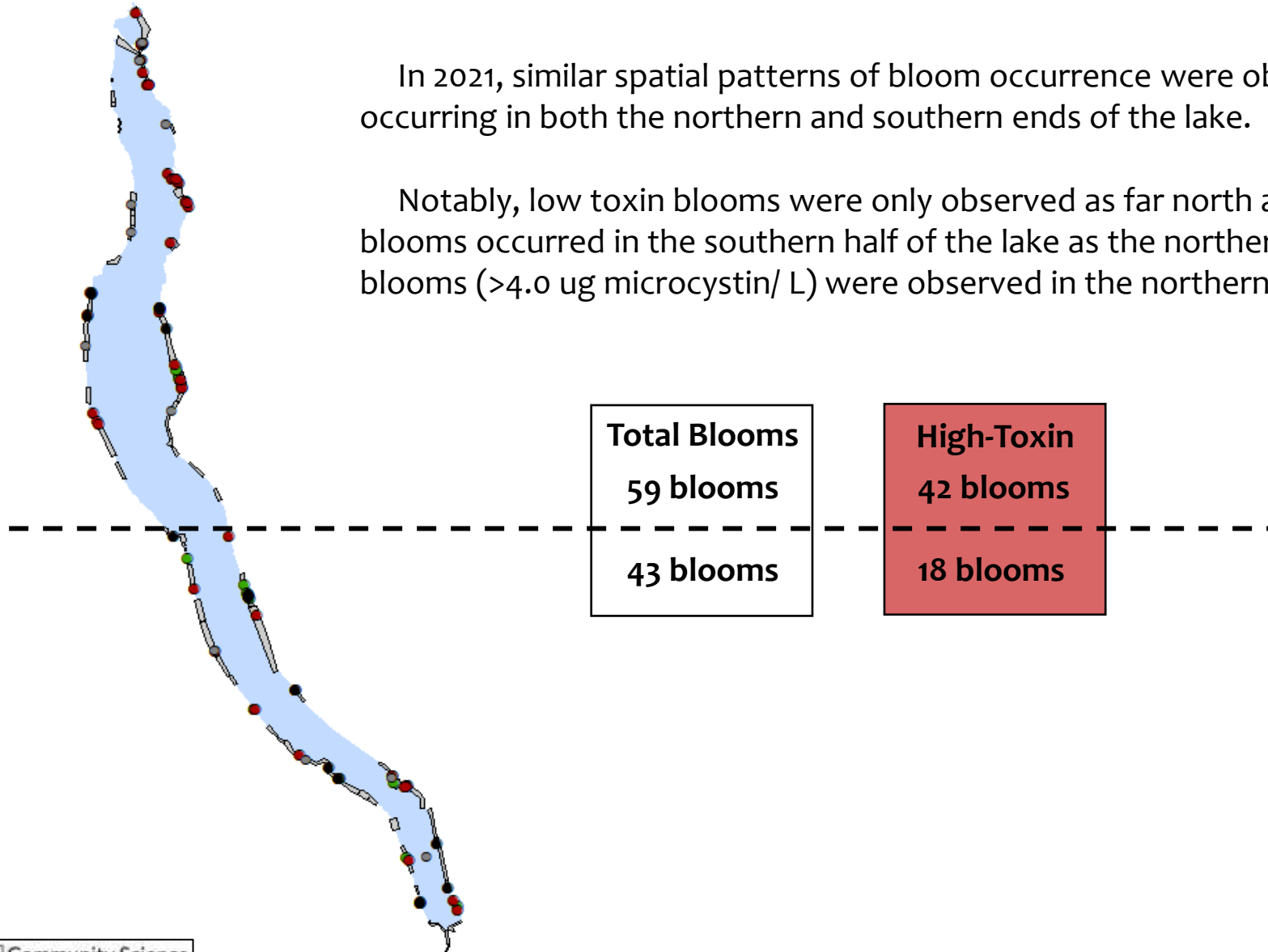
Annual Count of Cyanobacteria Blooms (HABs) on Cayuga Lake in Three Microcystin Categories:
2018, 2019, 2020, and 2021 Monitoring Seasons



Where Did HABs Occur in 2021?

In 2021, similar spatial patterns of bloom occurrence were observed as in 2020, with high toxin blooms occurring in both the northern and southern ends of the lake.

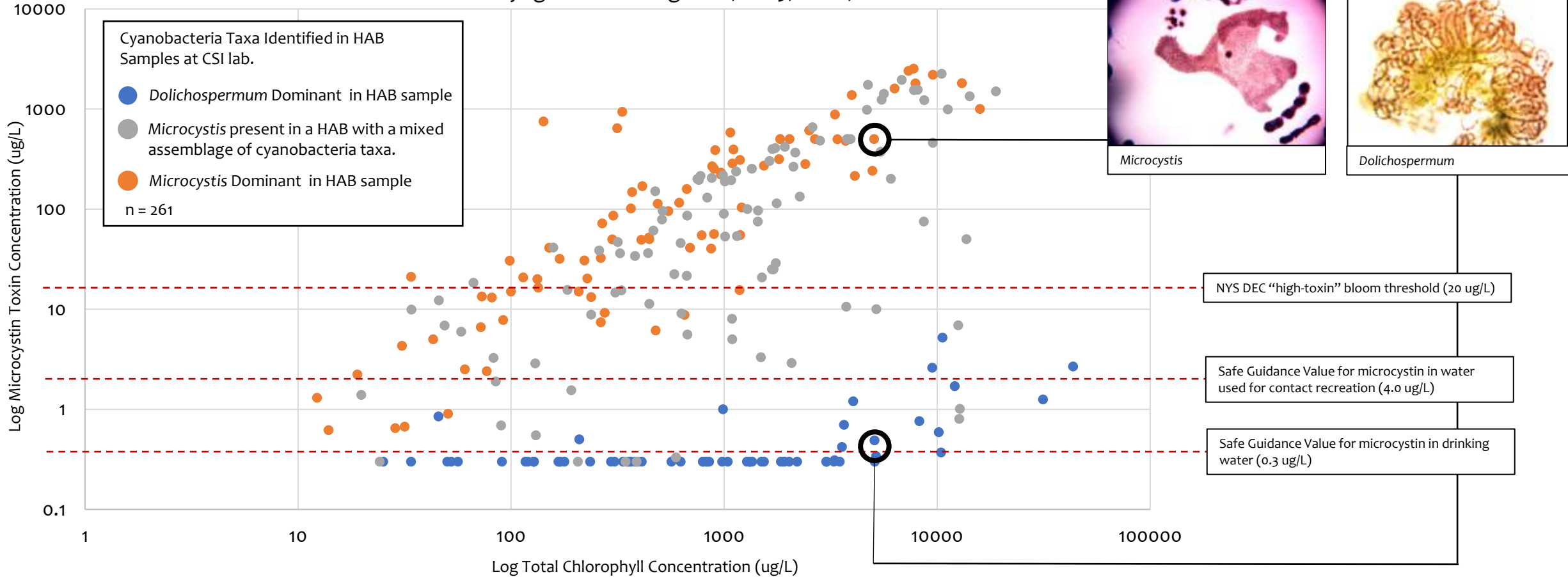
Notably, low toxin blooms were only observed as far north as Aurora. While nearly the same number of blooms occurred in the southern half of the lake as the northern half, over twice the number of high toxin blooms (>4.0 ug microcystin/ L) were observed in the northern half of the lake than the southern half.



Multi-Year Patterns: Taxa Associated Microcystin

Four years of bloom data reinforces the finding that the microcystin toxin concentrations of blooms on Cayuga Lake are associated with the type of cyanobacteria that form the bloom.

Microcystin Toxin Concentration Increased with Bloom Biomass when Microcystis was Present or Dominant in HABs on Cayuga Lake during 2018, 2019, 2020, and 2021

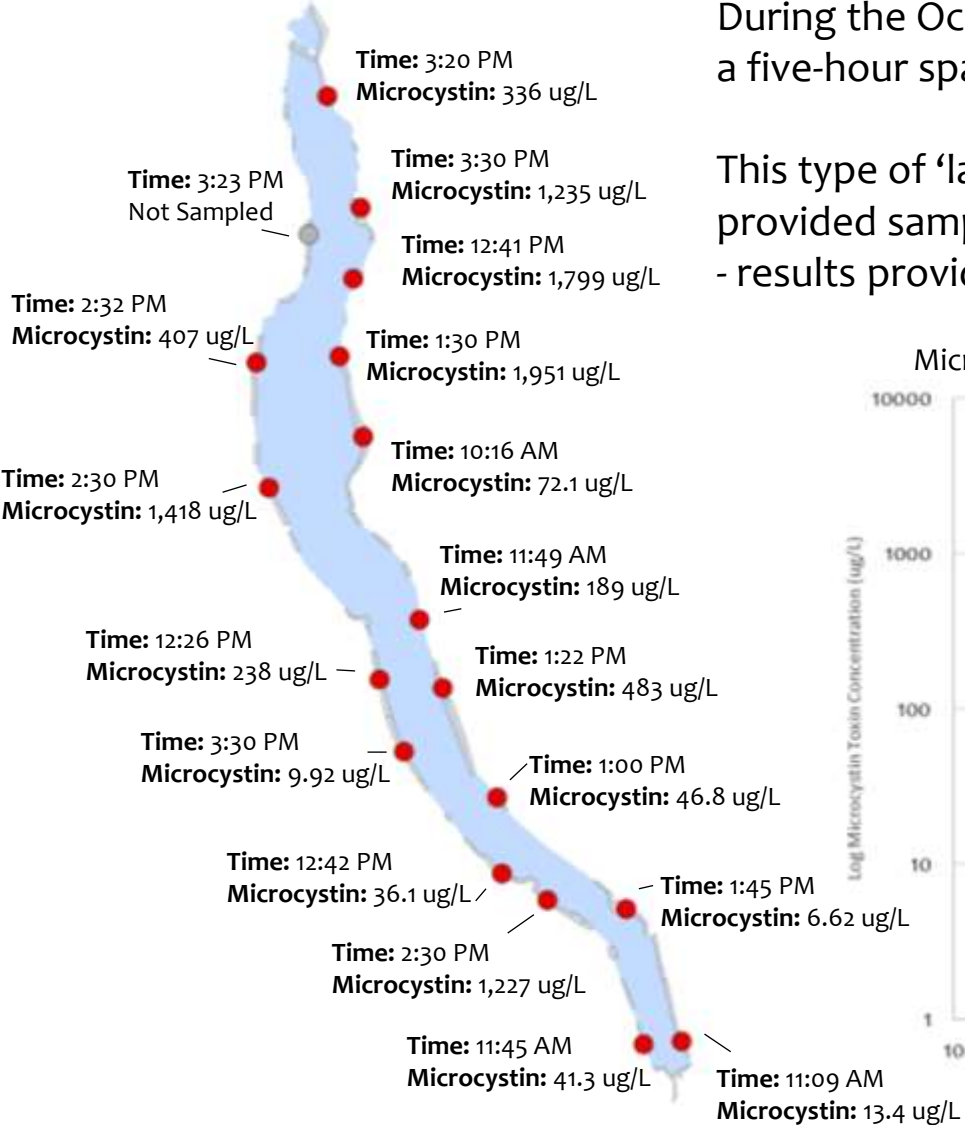


Taxa Associated Microcystin: A Unique Data Collection Opportunity

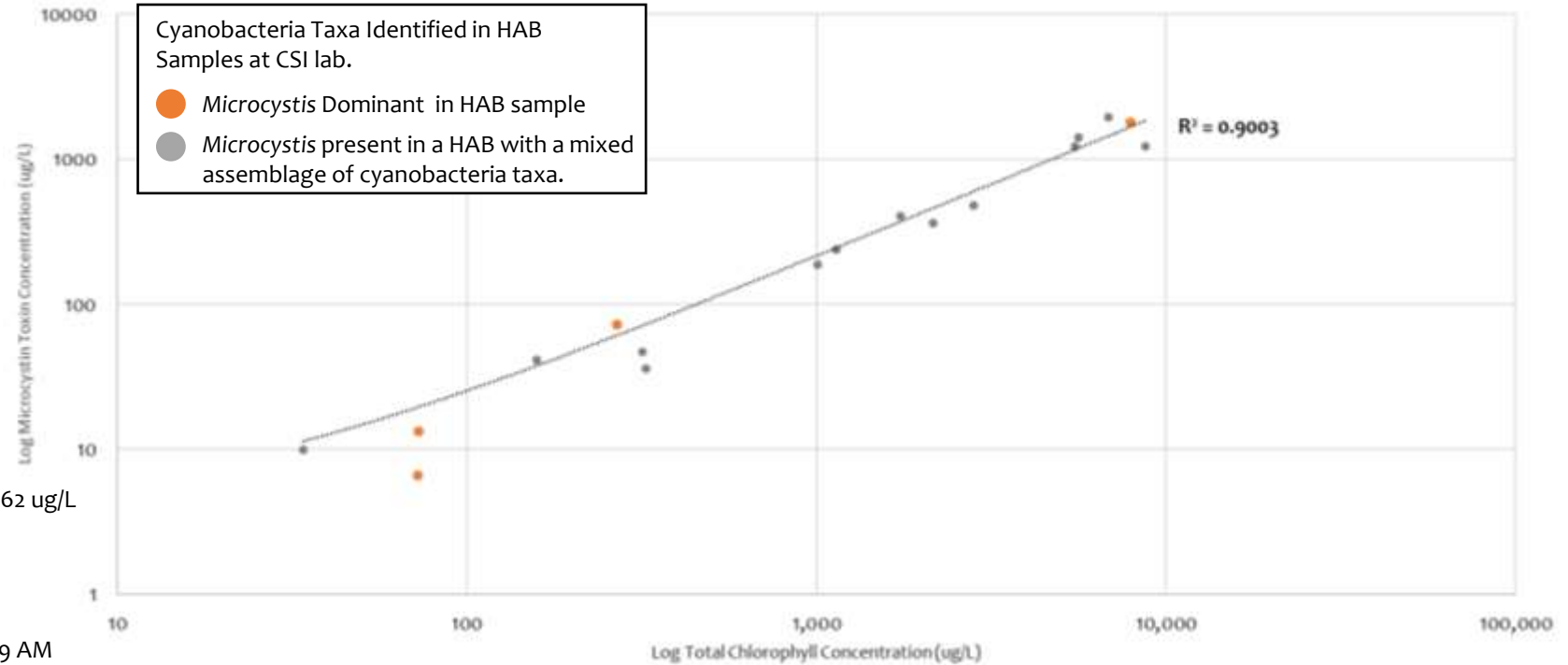
October 6th 'Lakewide' Bloom Event

During the October 6th bloom event, 17 samples were collected of blooms around the lake within a five-hour span of time.

This type of 'lakewide' sampling event was a unique data collection opportunity because it provided samples of blooms occurring during the same weather conditions, at the same time.
- results provide additional validation of association between density on toxin

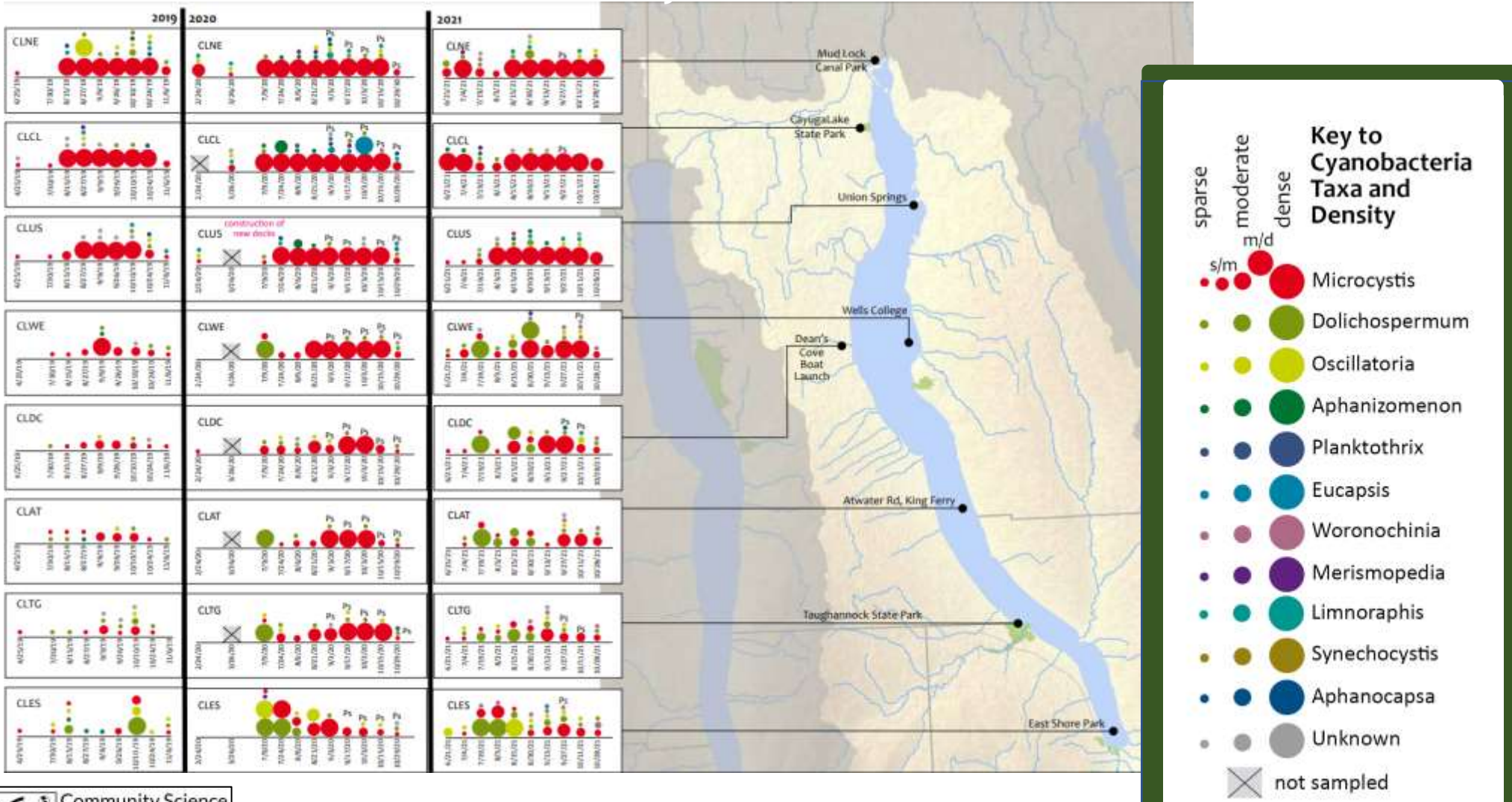


Microcystin Toxin Concentration Increased with Bloom Biomass during October 6, 2021 'Lakewide' Bloom Event



Monitoring Phytoplankton Populations

Phytoplankton survey results reflect the HAB events that occur each summer, with the potential to forecast when the densities of cyanobacteria in Cayuga Lake are great enough to facilitate the formation of a bloom.



Review

There was a substantial increase in the annual count of HABs on Cayuga Lake. Much of this increase may be attributed to the widespread bloom days and the many more blooms that occurred in October this year.

Here on Cayuga Lake, the concentration of microcystin toxin in a bloom seems to be strongly associated with the density of the bloom when *Microcystis* type cyanobacteria are present or dominate a bloom. Since it seems that *Dolichospermum* type cyanobacteria tend to form blooms early in the summer in the southern half of the lake and *Microcystis* type cyanobacteria tend to form blooms later in the summer in the northern half of the lake, high-toxin blooms mostly occur during late summer in the northern half of the lake.

These findings can be used to inform data-driven risk management outreach, such as mid-season public health alerts regarding HABs. Risk management strategies and our understanding of HABs ecology could be further informed by phytoplankton studies.

Continued monitoring will allow us to develop long-term HABs datasets for Cayuga Lake, allowing us to answer questions such as whether the number of blooms is increasing each year, whether a greater number of high-toxin blooms are occurring each year, and where blooms are most likely to occur on the lake.

Thank you!

This important program wouldn't be possible without the support of our funders, and the dedication and care of our volunteers around Cayuga Lake!

How can you help?

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

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

Get involved with the many local efforts to protect clean water such as [Lake Friendly Living!](#)



A widespread bloom on Powers Rd. in King Ferry on October 6th, 2021. The bloom was reported and sampled by volunteer Dorothy Ainsworth.