

Patterns of Cyanobacteria Populations and HABs along the Cayuga Lake Shoreline

CSI's Cayuga Lake HABs Monitoring Program has been conducted for three summers, 2018-2020, with the goal of collecting data to manage HABs risk.

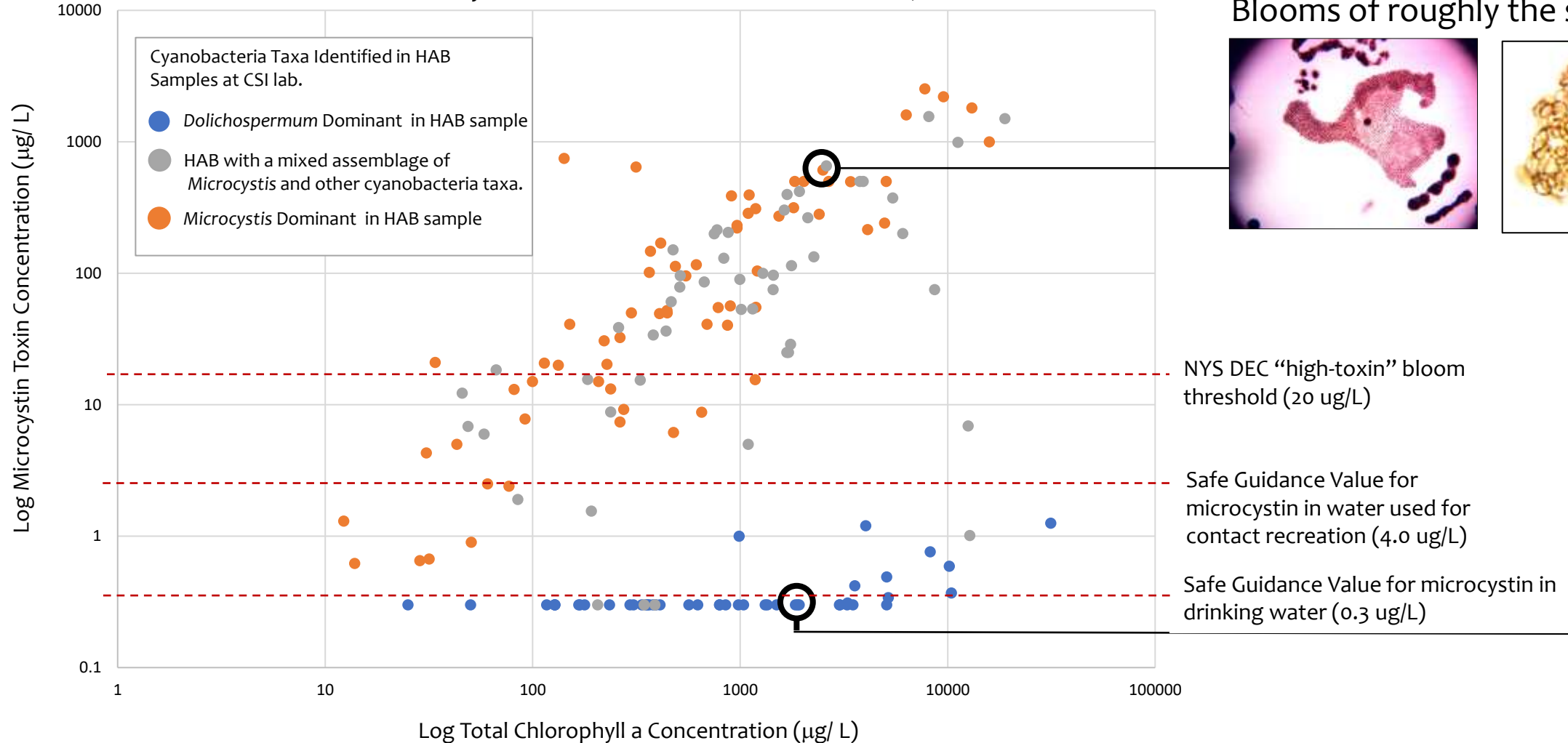
Monitoring is conducted along two separate tracks:

- **Public health**: Collecting and analyzing shoreline **blooms (HABs)** for cyanobacteria taxa, chlorophyll a and microcystin toxin; and
- **Cayuga Lake ecology**: Estimating the relative abundance of **non-bloom** cyanobacteria populations at eight shoreline locations around Cayuga Lake.

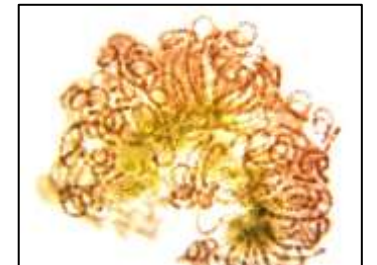
Three-Year Pattern: Microcystin Toxin is Associated with *Microcystis*

Three years of bloom data reinforce the idea that the microcystin toxin concentrations of blooms on Cayuga Lake are associated with one specific type of cyanobacteria that forms the bloom.

Microcystin Toxin Concentration Increased with Cyanobacteria Bloom (HABs) Sample Biomass when *Microcystis* was Dominant or Present in HABs, 2018 - 2020

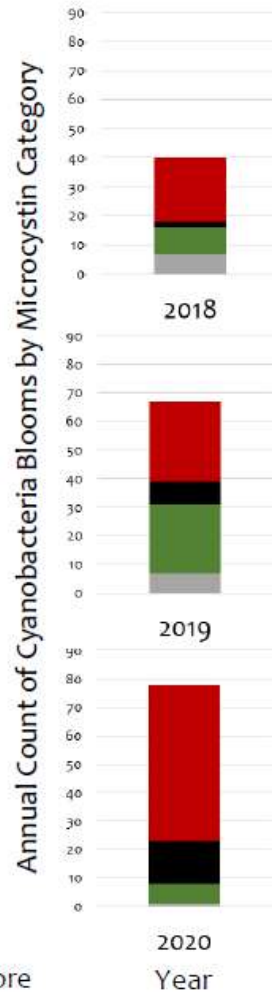
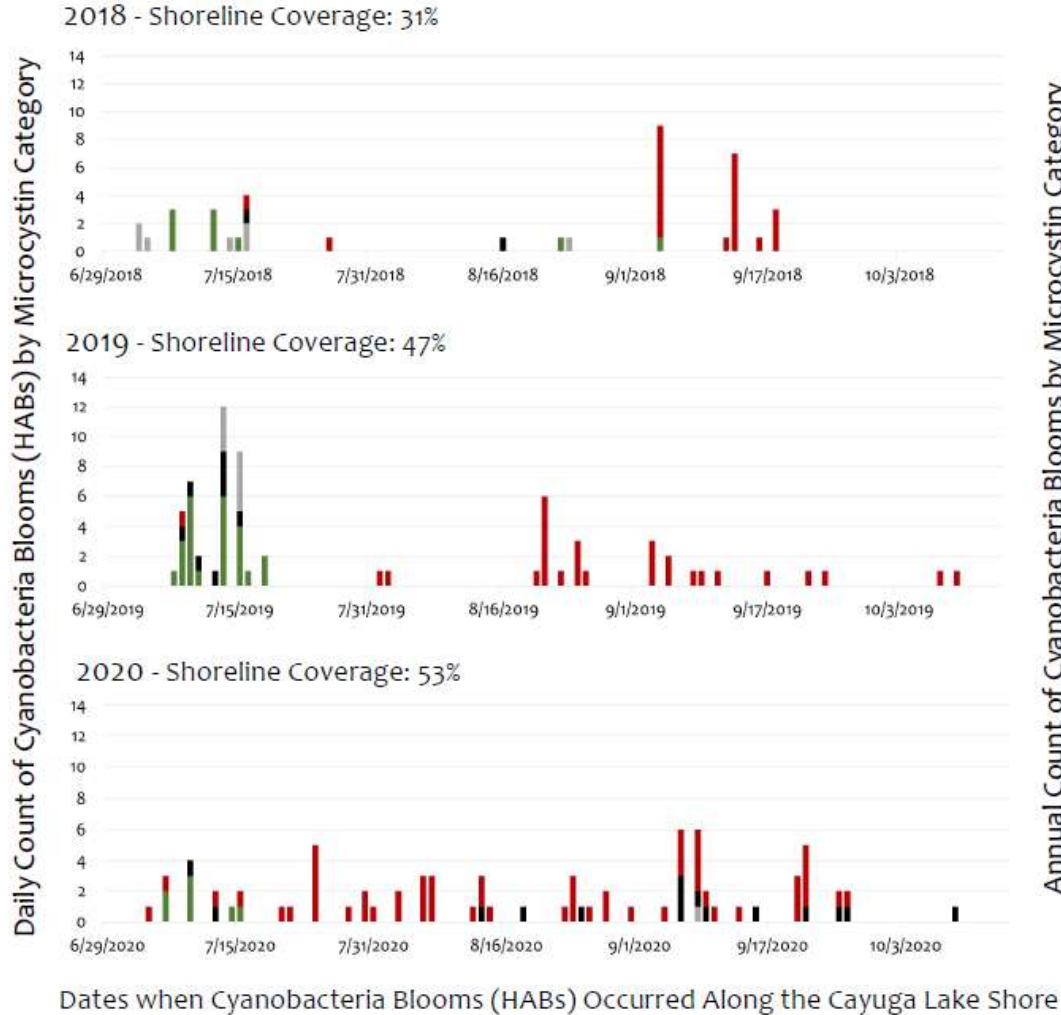


Blooms of roughly the same density



Changing Pattern: Timing and Frequency of HABs Occurrence

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



Legend

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

The temporal pattern of “high” microcystin blooms was different in 2020 compared to 2018 and 2019.

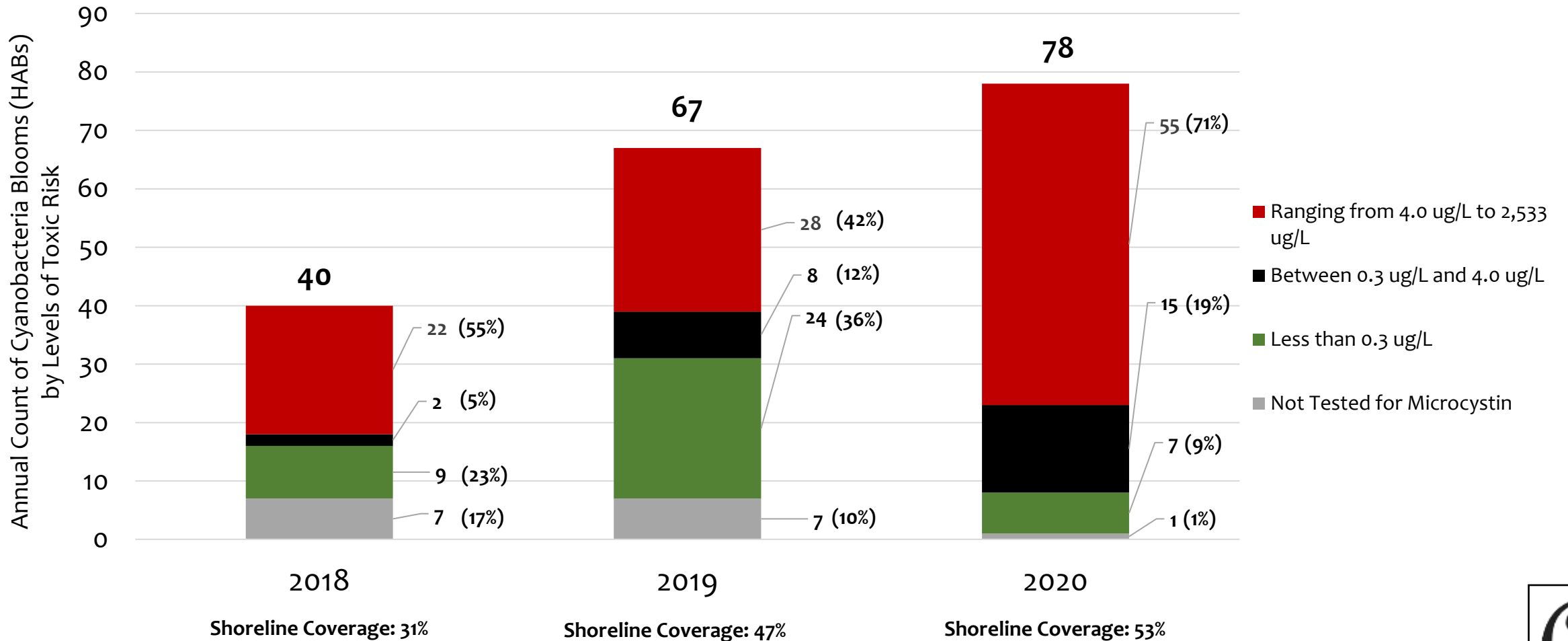
- In 2020 blooms occurred continuously throughout the summer.
- “High” microcystin blooms began occurring in early July

*0.3 $\mu\text{g/L}$ is also the NYSDOH limit for microcystin in finished drinking water.



Changing Pattern: More “High” Microcystin Blooms in 2020

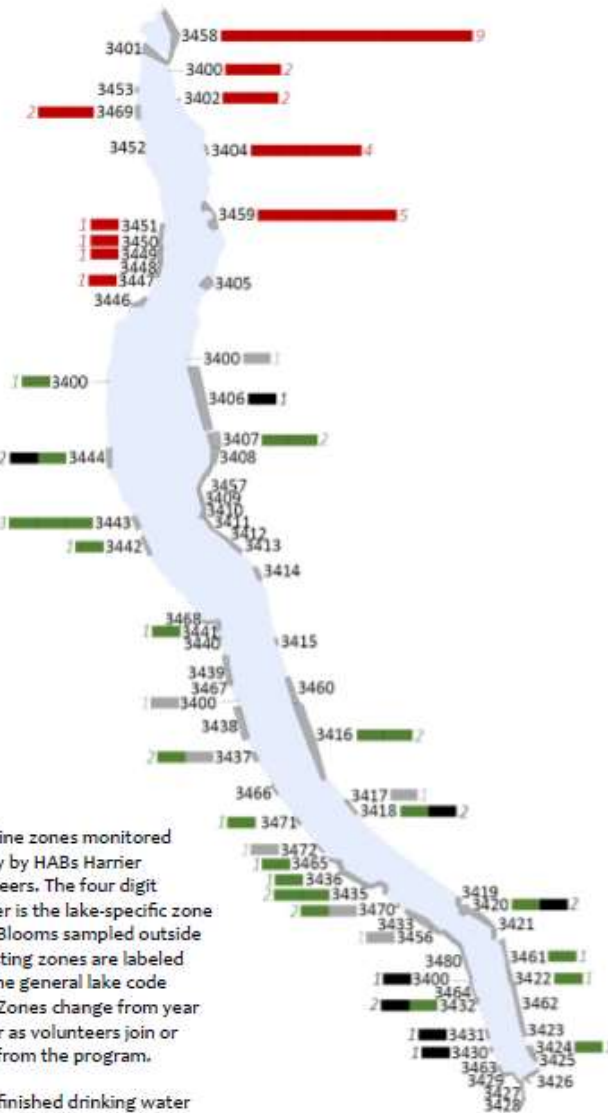
Annual Count of Cyanobacteria Blooms (HABs) on Cayuga Lake shoreline at Three Levels of Toxic Risk from Microcystin



Changing Pattern: Greater Distribution of “High Microcystin HABs

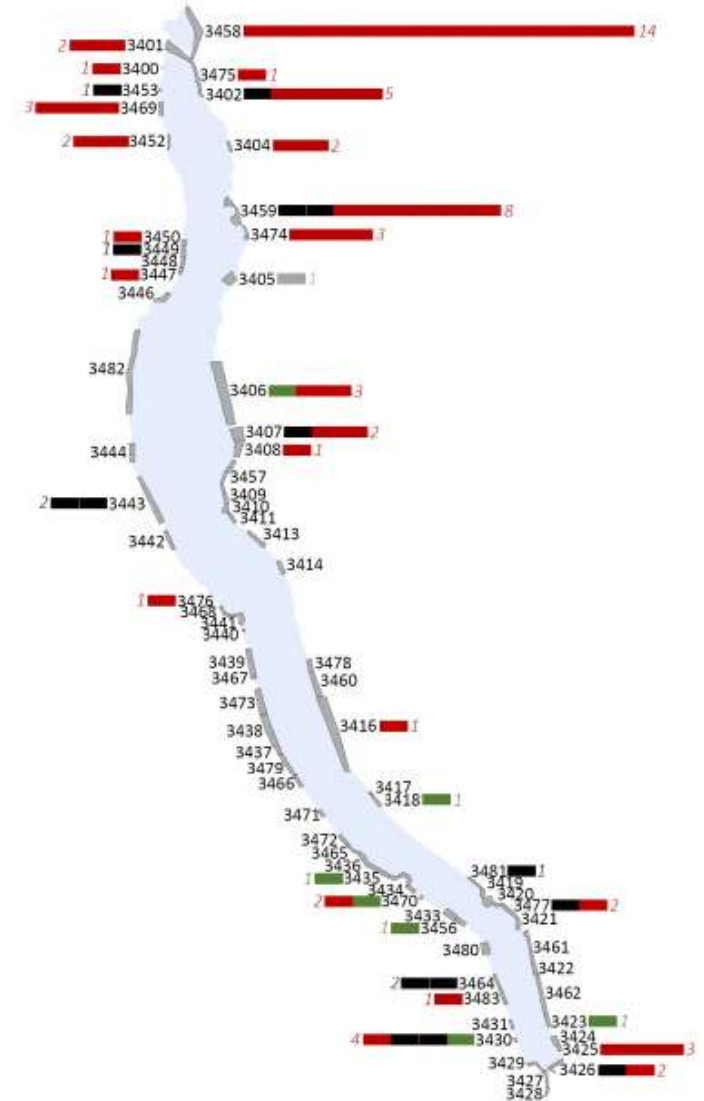
Annual Count of HABs for each Monitoring Zone by Microcystin Category in 2019

Figure 4a. The distribution of “high” microcystin blooms was characterized by a cluster along approximately 25 miles of northern shoreline in Cayuga and Seneca Counties.



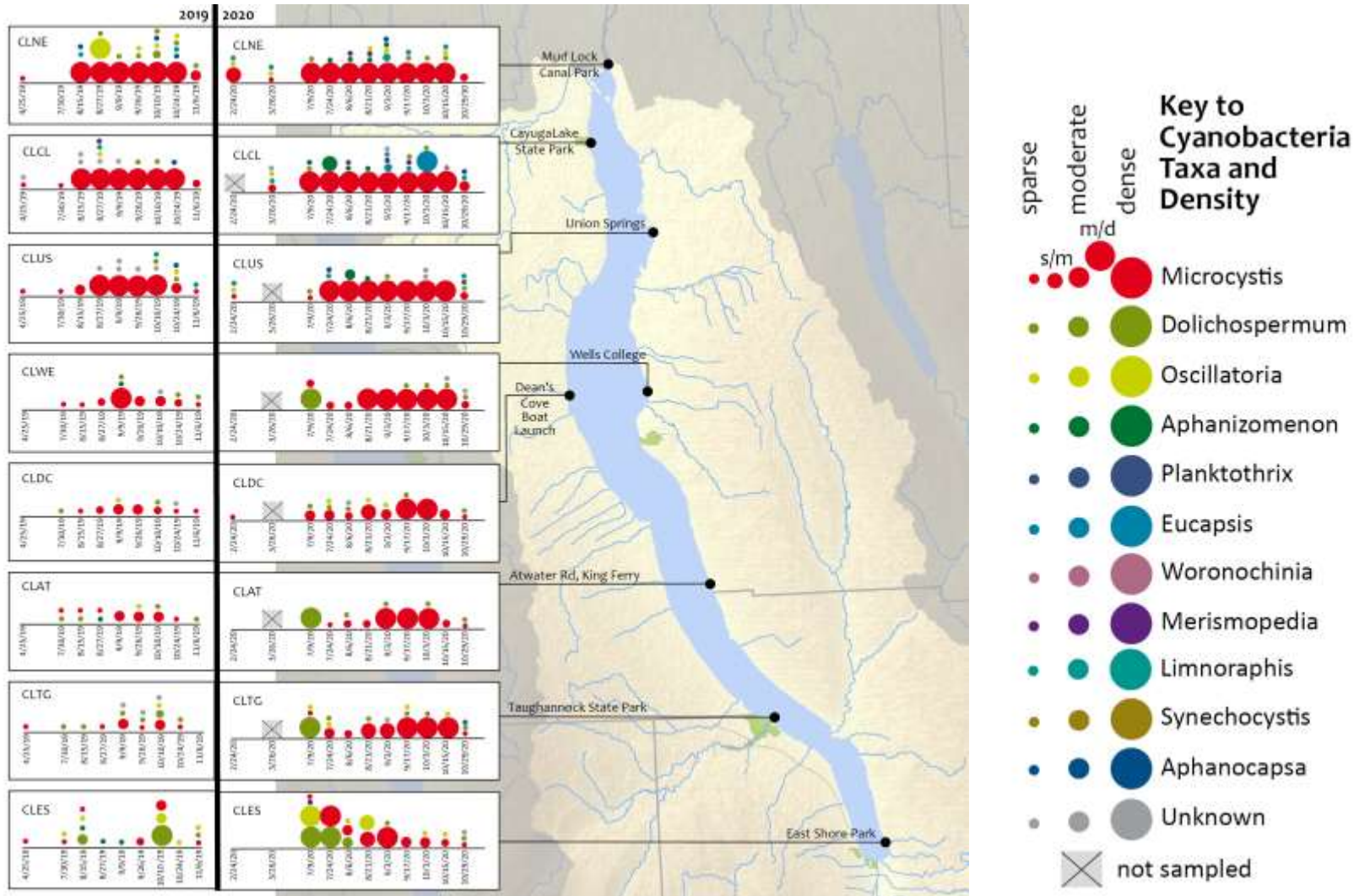
Annual Count of HABs for each Monitoring Zone by Microcystin Category in 2020

Figure 4b. “High” microcystin blooms were recorded along the southern 75 miles of shoreline in addition to a large cluster in the north.



Changing Pattern: Taxa Density and Distribution

Results from the Cayuga Lake Phytoplankton Project show dense *Microcystis* populations to be more widely distributed around Cayuga Lake in 2020 than in 2019. More dense *Microcystis* populations around the lake are consistent with a greater number of “high” microcystin, *Microcystis* dominant blooms.



Review

During the past three years, all cyanobacteria blooms on Cayuga Lake with “high microcystin” levels exceeding the recreation limit were dominated by, or contained significant concentrations of, the genus *Microcystis*.

A large number of “high microcystin” blooms tend to occur each year in the northern quarter of Cayuga Lake – from Union Springs to the outflow at the northern marshes.

In 2020 we also observed a number of “high microcystin” blooms around the southern three-quarters of the lake, consistent with the observation there of an increase in dense *Microcystis* populations.

For context: The Cayuga Lake HABs Monitoring Program fulfills many of the recommended monitoring actions in Section 13.6 of the [Cayuga Lake HABs Action Plan](#) published by NYSDEC in 2018. Our community-led effort serves as a model HABs monitoring program. It is one of the few programs to continue to test levels of microcystin toxin following NYSDEC’s withdrawal of support for microcystin testing. Our HABs reporting system is one of the fastest and most comprehensive in New York State.

