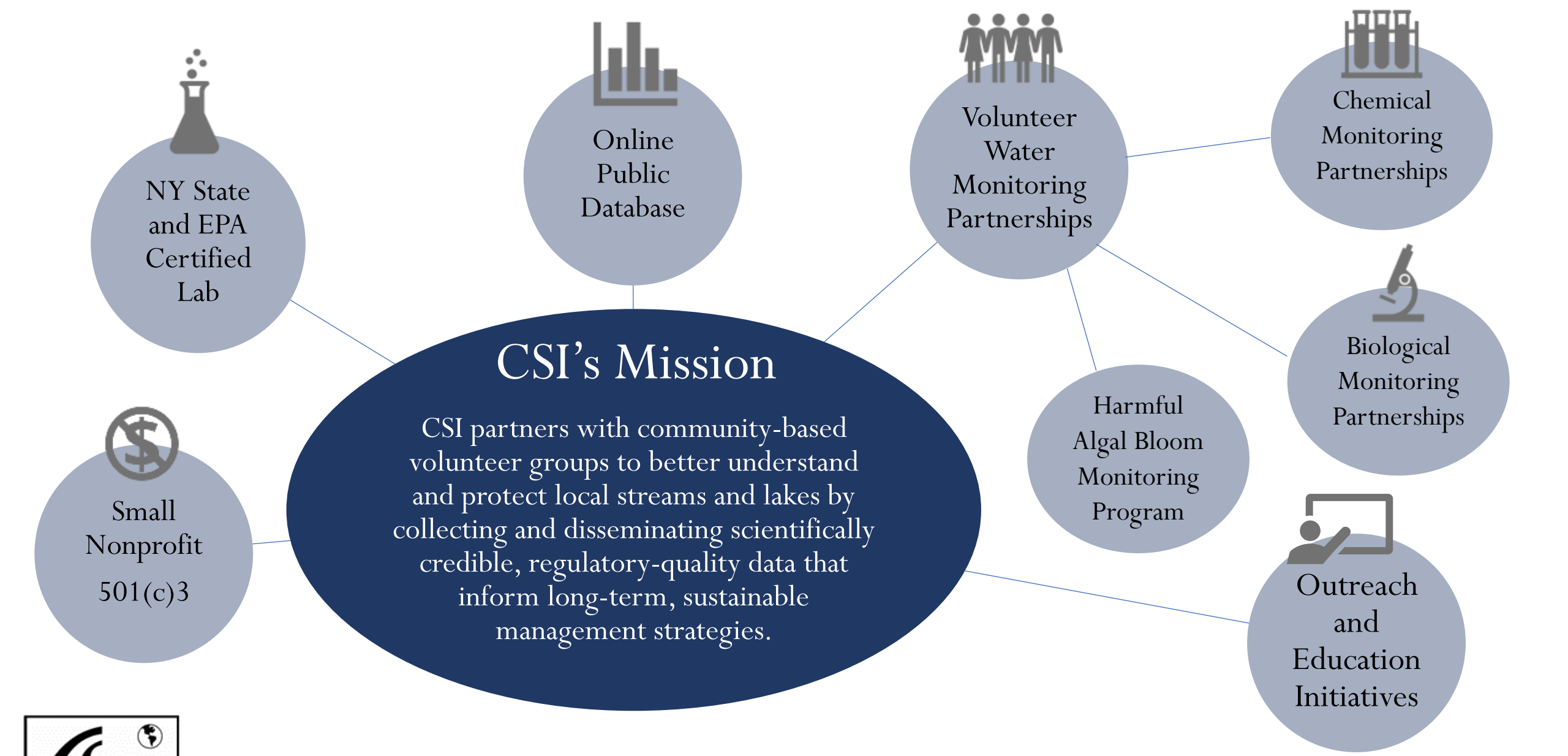
Monitoring Regional Water Quality with Community Partnerships

By Nathaniel Launer, *Outreach Coordinator, Cayuga Lake HABs Monitoring Program Coordinator*



The Community Science Institute

Our Certified Lab

Community Science Institute lab is certified by the New York State Department of Health-Environmental Laboratory Approval Program (NYSDOH-ELAP) under National Environmental Laboratory Accreditation Conference (NELAC) guidelines.

The lab is certified in potable and non-potable methods to test for chemical and microbiological parameters of water quality.

Our community monitoring partnership programs are guided by a Quality Assurance Project Plan.

Maintaining a certified lab is hard work!

- Quality assurance and quality control measures are extensive
- Inspections are rigorous
- Quality Assurance Project Plans must be updated regularly

So why make the effort?

1. Certified data can be used for regulatory purposes and to help guide and inform management decisions.

2. Certification allows CSI to address the communities' potable water testing needs.

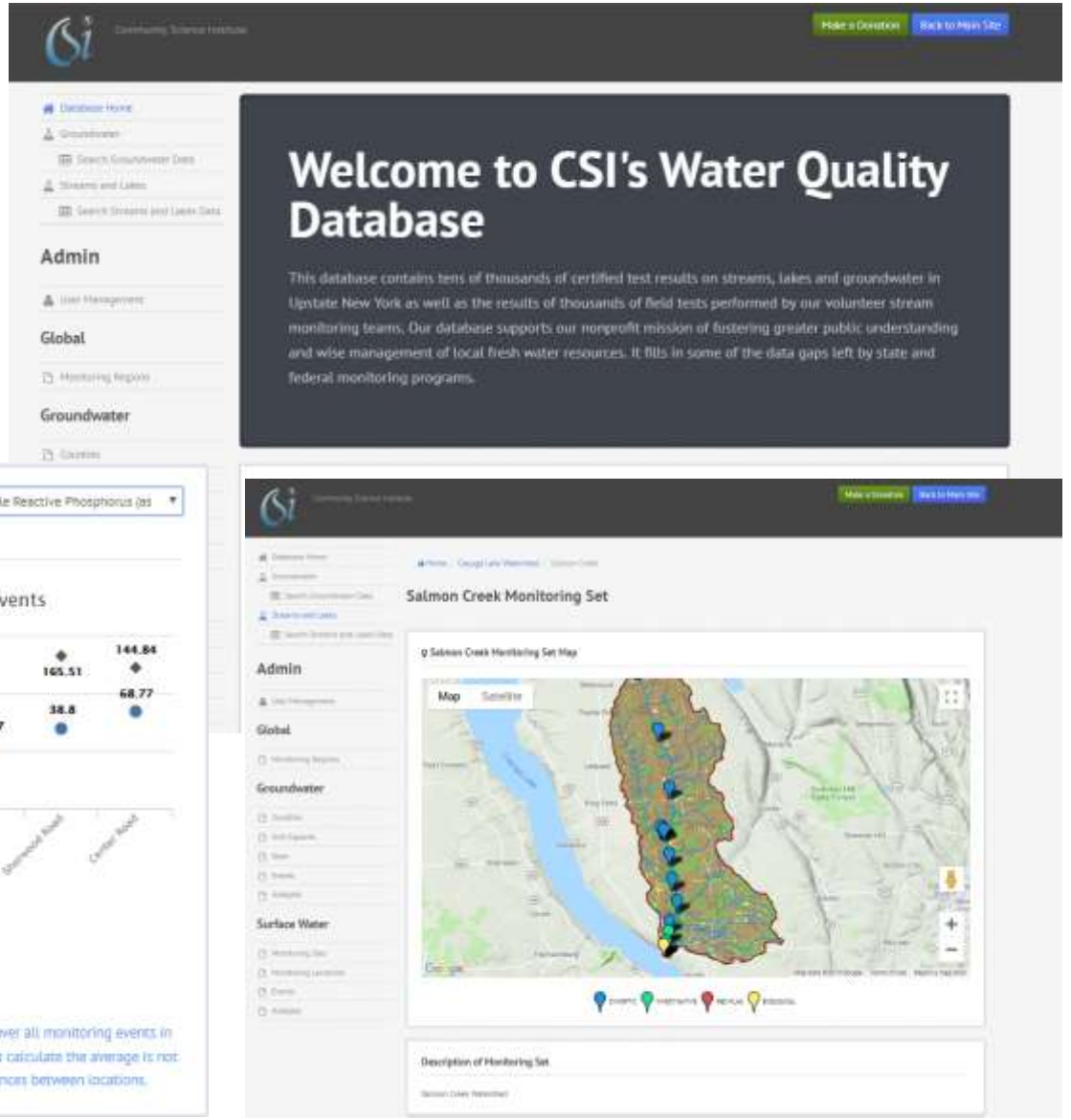
Online Public Database

All data that we collect with our volunteer partnerships is archived in CSI's online public database. It can be accessed free of charge at **database.communityscience.org**

- The data can be easily viewed or downloaded

The database currently has over 87,000 regulatory quality measurements of water quality.

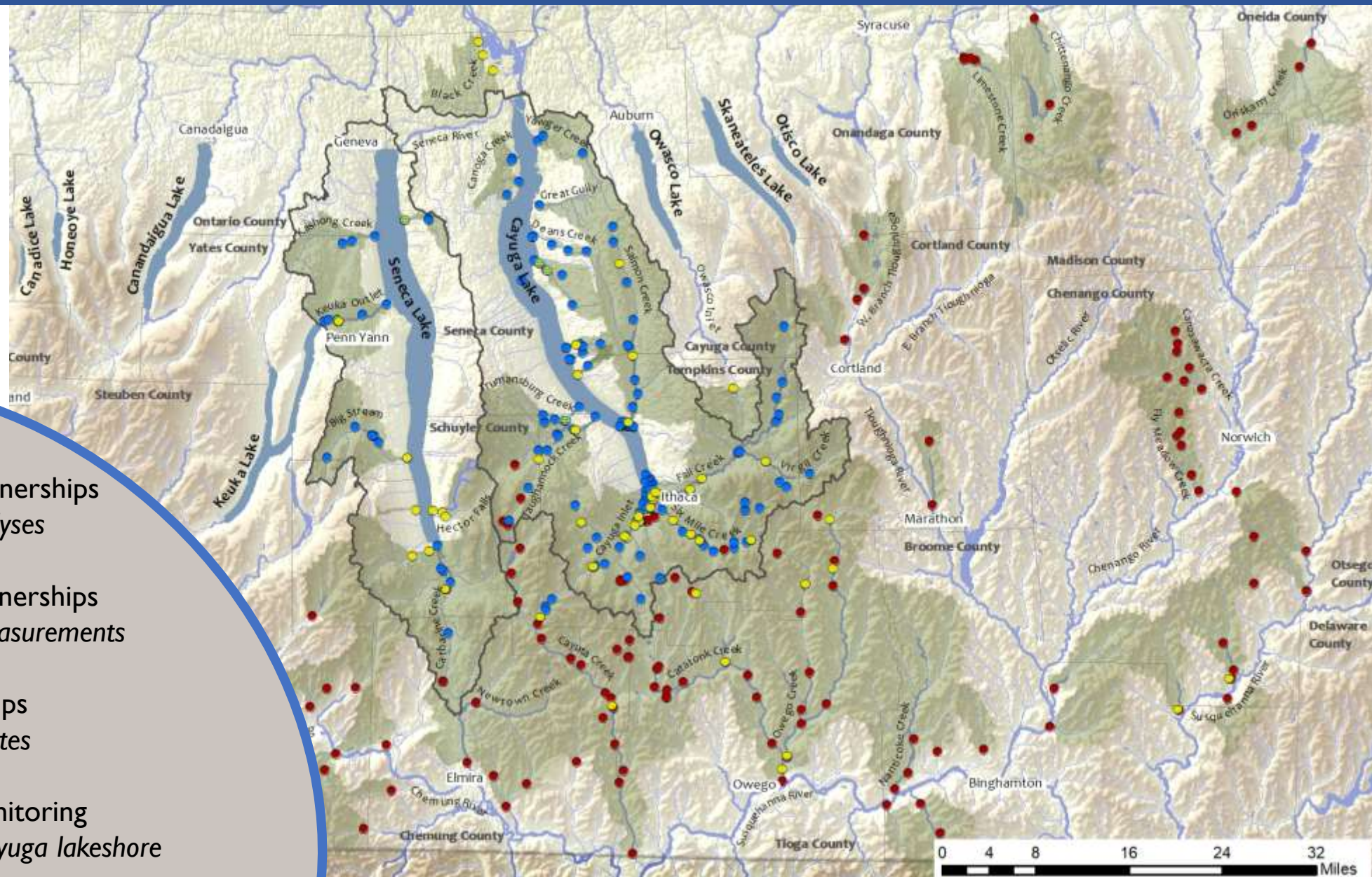
The purpose of the public database is to disseminate scientifically credible results to the public, to local and regional stakeholders, and to government agencies in order to improve water resource understanding and management.



Where do we monitor?

Four Volunteer-led Water Monitoring Programs

- Synoptic Sampling
- Red Flag Monitoring
- Biomonitoring
- Harmful Algal Bloom Monitoring



- Synoptic Monitoring Partnerships
  Certified laboratory analyses
- Red Flag Monitoring Partnerships
  Quality-assured field measurements
- Biomonitoring Partnerships
  Benthic macroinvertebrates
- Harmful Algal Bloom Monitoring
  Monitoring zones on Cayuga lakeshore

Synoptic Stream Monitoring

Synoptic Sampling partnerships produce continuous long-term data sets that inform ongoing water resource management by local and regional governments while simultaneously empowering citizens to become stewards of their local streams.

Synoptic Sampling Process

Sample

Water samples are collected by teams of volunteers three to four times a year including once under storm water conditions. Sampling of a single stream occurs in a single day to get a "snap-shot" of water quality.

Transport to CSI Lab

Volunteers bring samples to CSI's certified lab and complete a chain of custody.

Certified Lab Analysis

Samples are analyzed by CSI staff using certified methods.

Online Database

Test results are entered into CSI's online public database.

www.database.communityscience.org

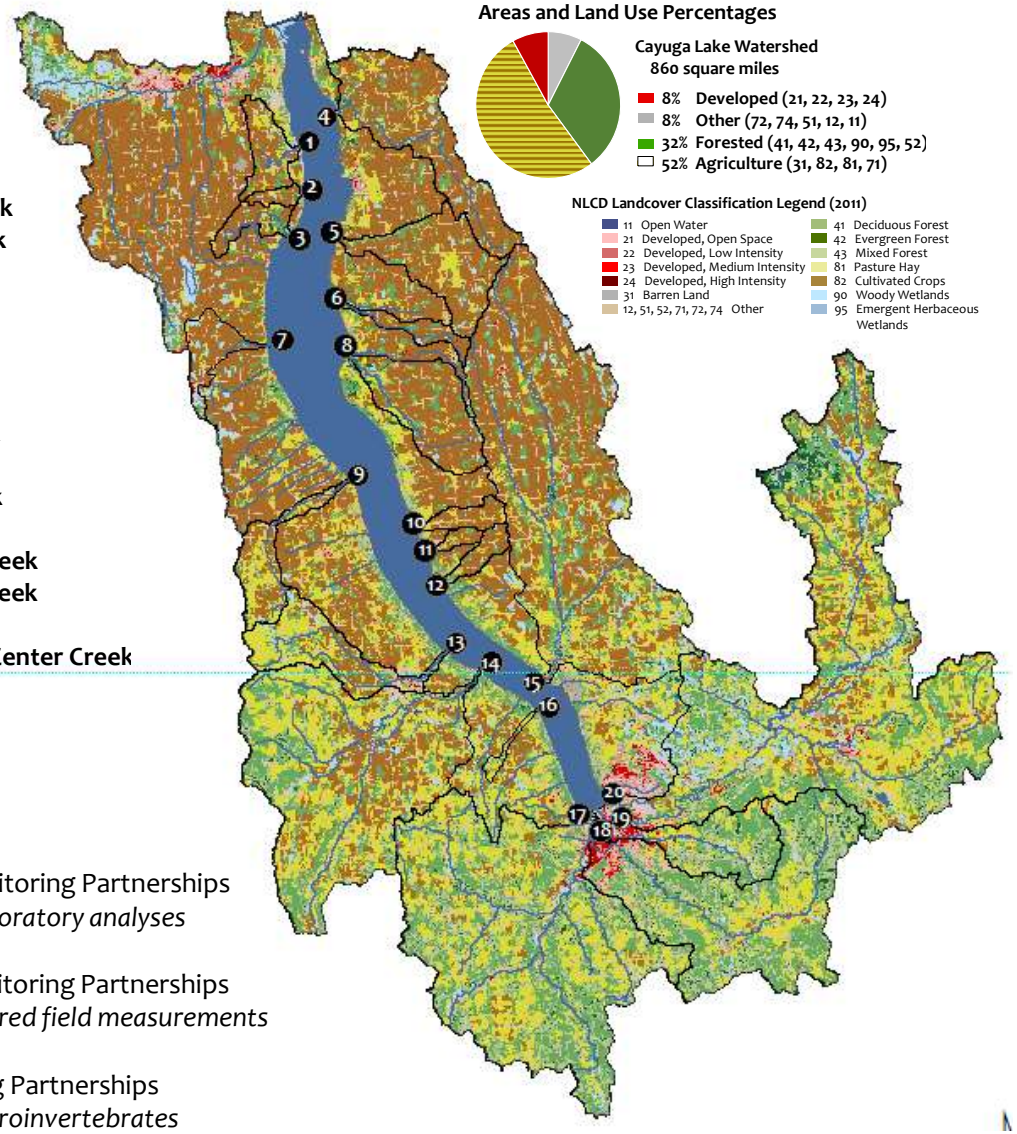
The primary focus of the program is to monitor nutrients, sediment, and pathogenic bacteria to build long-term datasets of regulatory quality data for each watershed and to identify sub-watersheds and catchment areas that may be contributing disproportionately to pollutant loading.

Certified laboratory analysis of the following analytes:

- Total Phosphorus
- Soluble Reactive Phosphorus
- TC/ E.coli
- Total Nitrogen
- Total Suspended Solids
- Turbidity
- pH
- Temperature
- Total Kjeldahl nitrogen,
- Alkalinity
- Chloride
- Conductivity
- Total hardness
- Sulfate

Monitoring Nutrients - Cayuga Lake watershed

Monitored Sub-Watersheds in the Cayuga Lake Watershed



Synoptic Monitoring Partnerships
Certified laboratory analyses

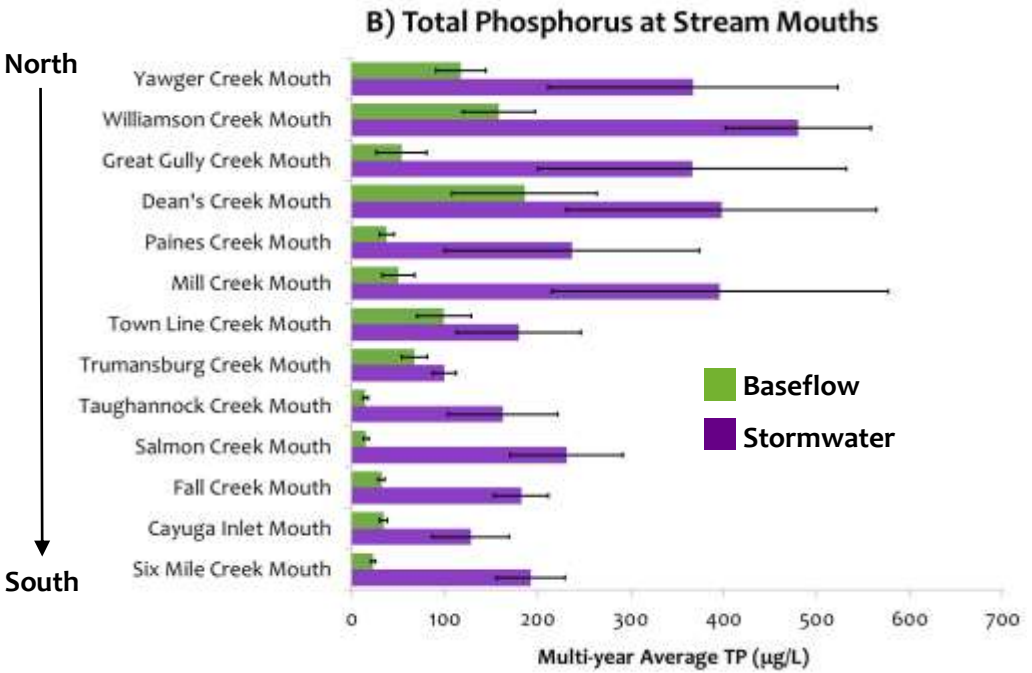
Red Flag Monitoring Partnerships
Quality-assured field measurements

Biomonitoring Partnerships
Benthic macroinvertebrates

Identify sub-watersheds and catchment areas that may be contributing disproportionately to pollutant loading.

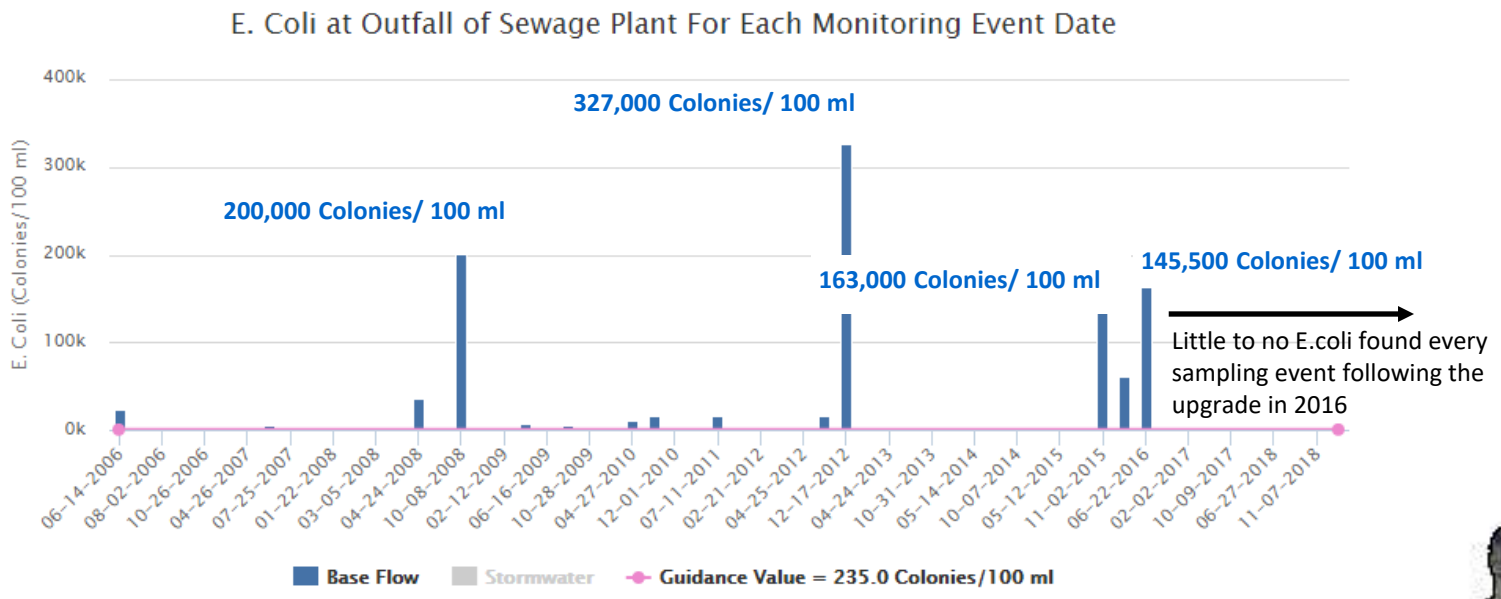
Obtain nutrient loading estimates that are sufficient to focus and inform watershed management efforts.

Average Total Phosphorus concentrations at the Mouth of Each Monitored Sub-watershed under Base Flow and Stormwater Conditions



Monitoring E.coli - A Clean-Up Success Story for CSI Data

Outfall of Sewage Plant Timeline Graphs



Description

Downstream of Lake St Bridge; Outfall pipe is located behind the Trumansburg Creek Sewage Treatment Plant; sample the effluent coming out of outfall pipe

Rationale

What is water quality of plant effluent and how does it impact Trumansburg Creek?

Details

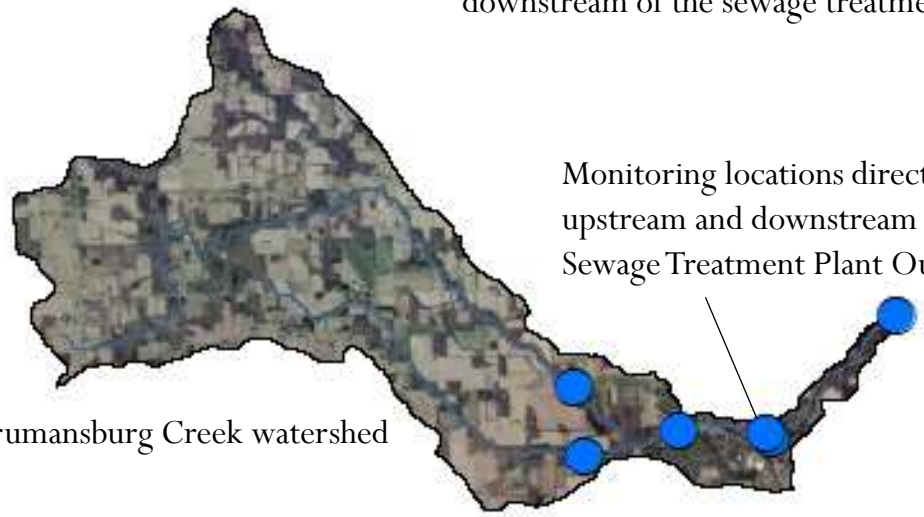
Latitude, Longitude	N 42.5406, W -76.6498
Location Type	SYNOPTIC
Miles from stream mouth	0.56

Stream monitoring on Trumansburg creek showed elevated levels of E.coli bacteria immediately downstream of the Village of Trumansburg Sewage Treatment Facility.

- continued monitoring verified these results and helped build evidence that wastewater effluent was out of compliance.

In 2016 CSI board members wrote to the NYSDEC reporting the findings. The NYSDEC confirmed the report with separate investigative sampling of the effluent. The report initiated a $6.2 million dollar upgrade of the treatment facility.

- since spring of 2017, E.coli has not been measured in detectable levels in Trumansburg Creek downstream of the sewage treatment facility.



Monitoring locations directly upstream and downstream of the Sewage Treatment Plant Outfall.

Cut-out map of the Trumansburg Creek watershed

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Watershed Management Plans - Seneca Lake 9E Plan

Map of Seneca Lake watershed and tributary locations monitored by SLPWA in collaboration with CSI

1. Catharine Creek
2. Glen Eldridge Creek
3. Big Stream
4. Keuka Outlet
5. Kashong Creek
6. Reeder Creek

In 2013 Seneca Lake Pure Waters Association (SLPWA) began collaborating with CSI to monitor the water quality of tributaries to Seneca Lake and collect data on the 14 different water quality parameters that are measured through our Synoptic Stream Monitoring Program.

Now, nearly a decade later, with CSI's help SLPWA has built long-term comprehensive water quality datasets for six major tributaries.

These datasets are now being used as the foundation of a model upon which the Seneca-Keuka Nine Element (9E) Watershed Management Plan is being created.

Here at CSI, we are very excited and proud that data we helped collect and produce is being used for such an important purpose.

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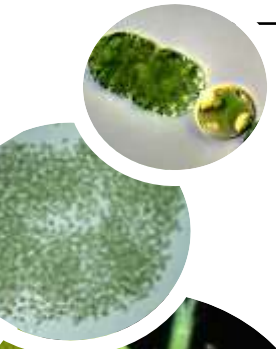
Harmful Algal Bloom Monitoring

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 report the bloom, collect a sample, and transport it to the CSI lab in Ithaca for analysis.

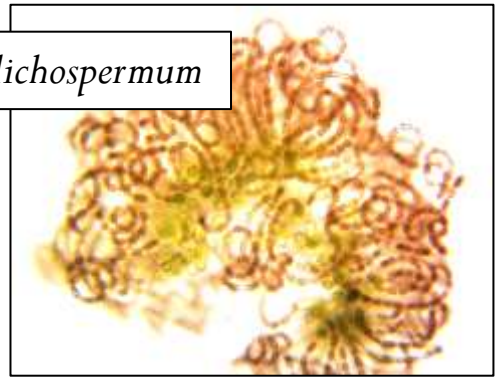
Testing Bloom Samples at CSI Lab

The ability to test bloom samples at a local certified lab is a **unique** strength of Cayuga Lake's program.
- fast and detailed information about bloom toxin levels is highly valuable to local risk management decision makers.

At CSI lab bloom samples are analyzed to…

1. Determine which cyanobacteria are present in the bloom sample

Dolichospermum



Microcystis

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 as action limits by the New York State Department of Health.

Always avoid contact with any suspicious bloom!

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

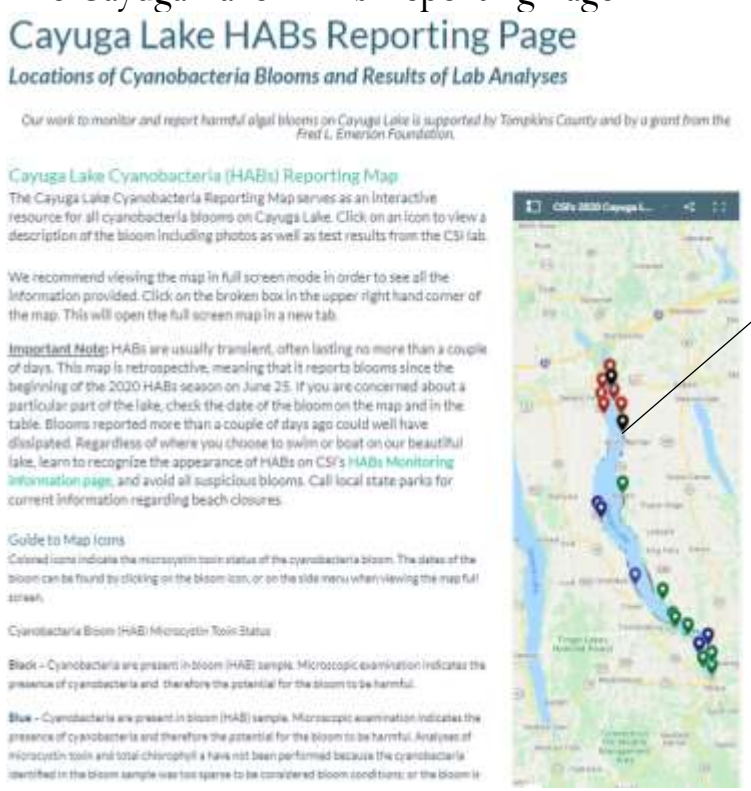
Understanding the concentration of Total Chlorophyll helps us understand bloom density. This is useful when making decisions about what qualifies as a bloom and in comparing bloom intensities.

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 HABs Reporting Page

Locations of Cyanobacteria Blooms and Results of Lab Analyses

Our work to monitor and report harmful algal blooms on Cayuga Lake is supported by Tompkins County and by a grant from the Fred L. Emerson Foundation.

Cayuga Lake Cyanobacteria (HABs) Reporting Map

The Cayuga Lake Cyanobacteria Reporting Map serves as an interactive resource for all cyanobacteria blooms on Cayuga Lake. 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.

Important Note: HABs are usually transient, often lasting no more than a couple of days. This map is retrospective, meaning that it reports blooms since the beginning of the 2020 HABs season on June 25. If you are concerned about a particular part of the lake, check the date of the bloom on the map and in the table. Blooms reported more than a couple of days ago could well have dissipated. Regardless of where you choose to swim or boat on our beautiful lake, learn to recognize the appearance of HABs on CSI's HABs Monitoring information page, and avoid all suspicious blooms. Call local state parks for current information regarding beach closures.

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.

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 cyanobacteria identified in the bloom sample was too sparse to be considered bloom conditions; or the bloom is

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

Interactive reporting map

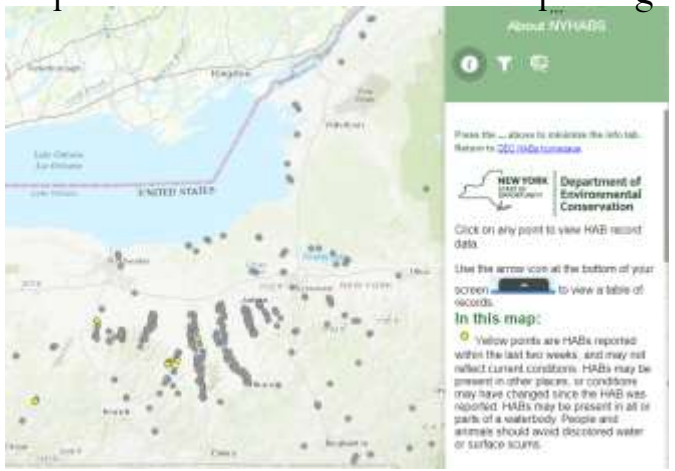
Complete table of bloom results to date

Cayuga Lake HABs Information and Master Results Table

Bloom Location Information

CLWN Weekly Updates to the Public

Report to NYHABs State-wide Reporting System



The 2020 Monitoring Season

Over **90 HABs Harrier** volunteers participated in the program this year!

With **83 monitoring zones**, over **53%** of lake shoreline was monitored weekly, including State Parks, municipal lakefront parks, natural areas, and other public shoreline.

HAB Information and Reporting Guide brochures installed at **six** lakefront parks. More to be installed ahead of the 2021 season.

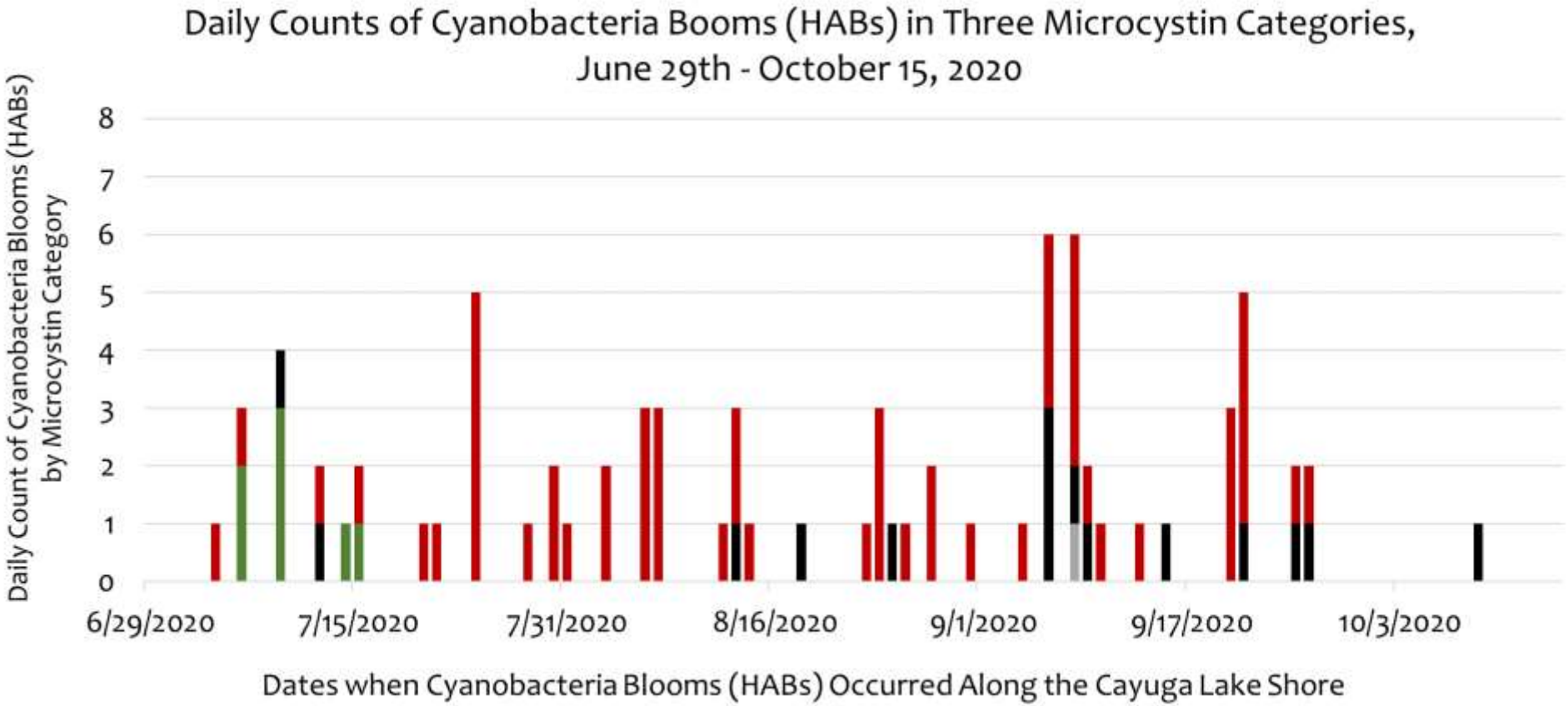
Over 40,000 views of our Cayuga Lake HABs Reporting Page.

Bill Ebert collecting a late summer bloom sample

HABs Information and Reporting Guide installed at Harris Park in the Village of Cayuga

Widespread bloom near Union Springs

When did HABs Occur in 2020?

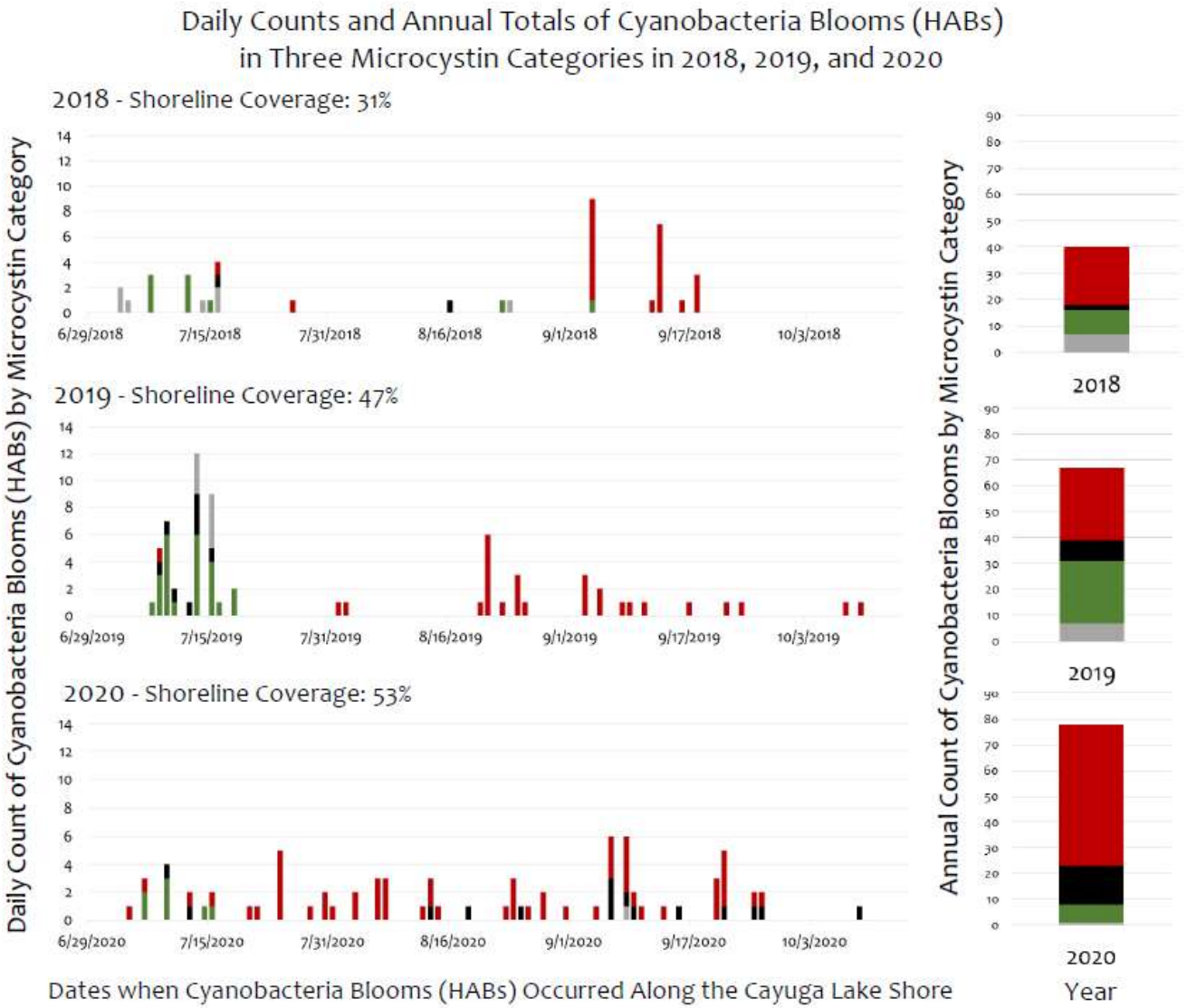


Legend

- Blooms with a microcystin level ranging from 4 µg/L to over 1,500 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: Temporal Patterns



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

Legend

Blooms with a microcystin level ranging from 4 µg/L to 2,533 µg/L.

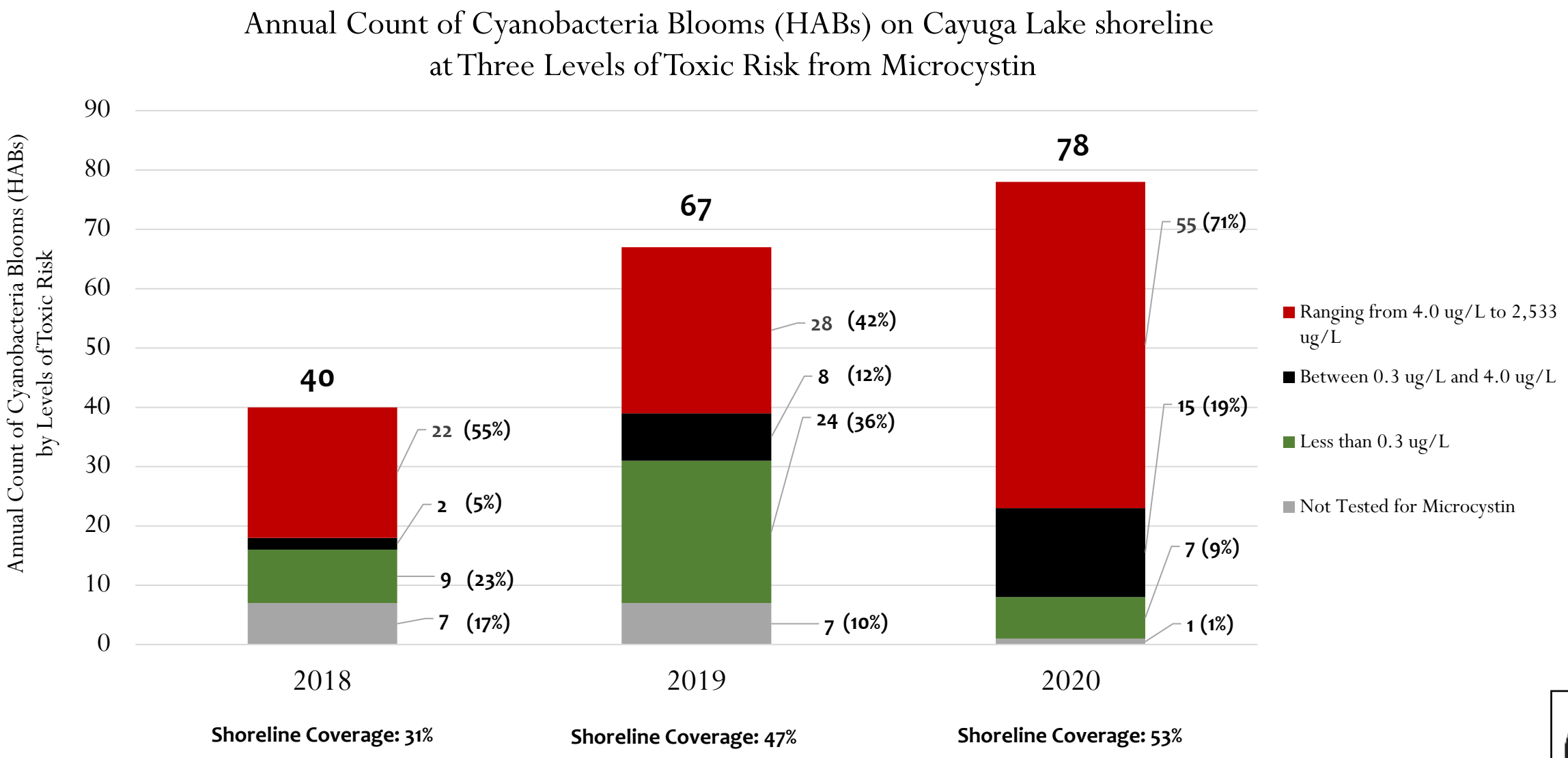
Blooms with a microcystin level greater than 0.3 µg/L but less than the recreation limit of 4.0 µg/L .

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.

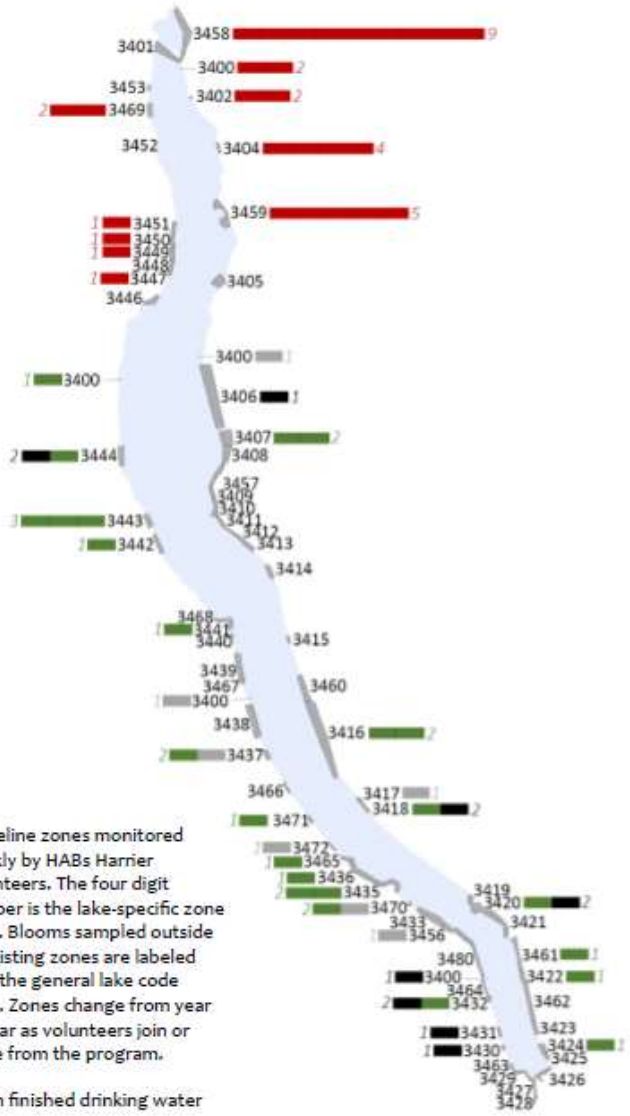
Multi-Year Patterns: An Increase of "High" Microcystin Blooms



Multi-Year Patterns: Spatial Patterns

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.



Map Legend

Microcystin Categories

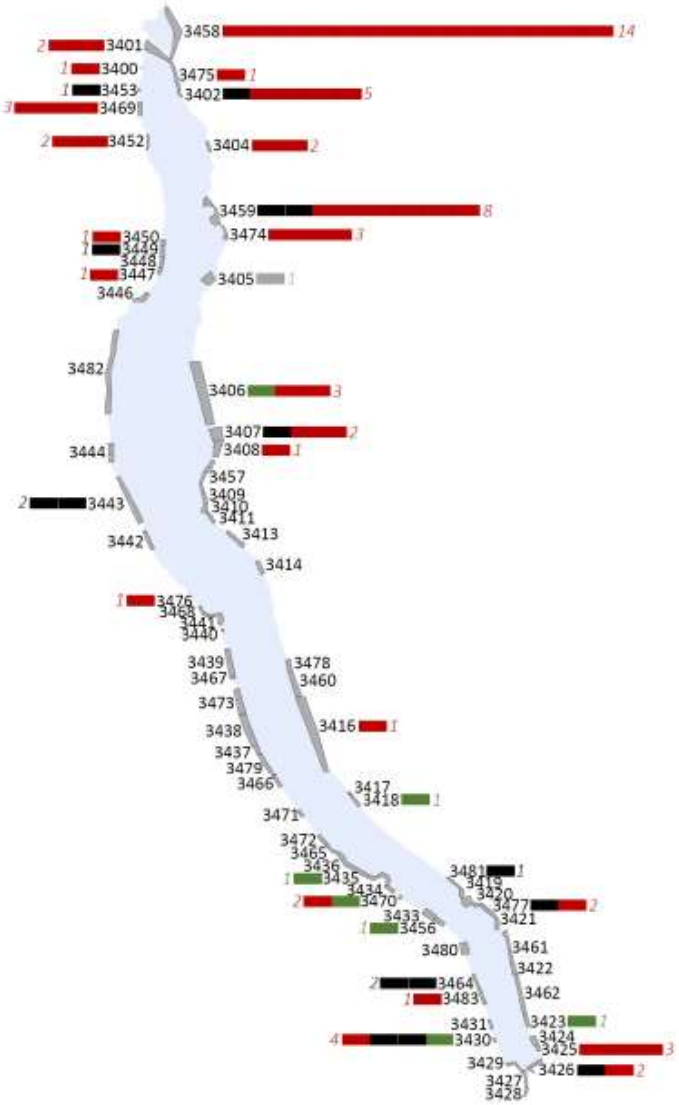
- Not tested for microcystin.
- Blooms with microcystin levels less than the method detection limit of 0.3 µg/L.*
- Blooms with microcystin levels greater than 0.3 µg/L and less than recreation limit of 4 µg/L.
- Blooms with microcystin levels ranging from 4 µg/L to 2,200 µg/L.

Shoreline zones monitored weekly by HABs Harrier volunteers. The four digit number is the lake-specific zone code. Blooms sampled outside of existing zones are labeled with the general lake code 3400. Zones change from year to year as volunteers join or retire from the program.

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

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

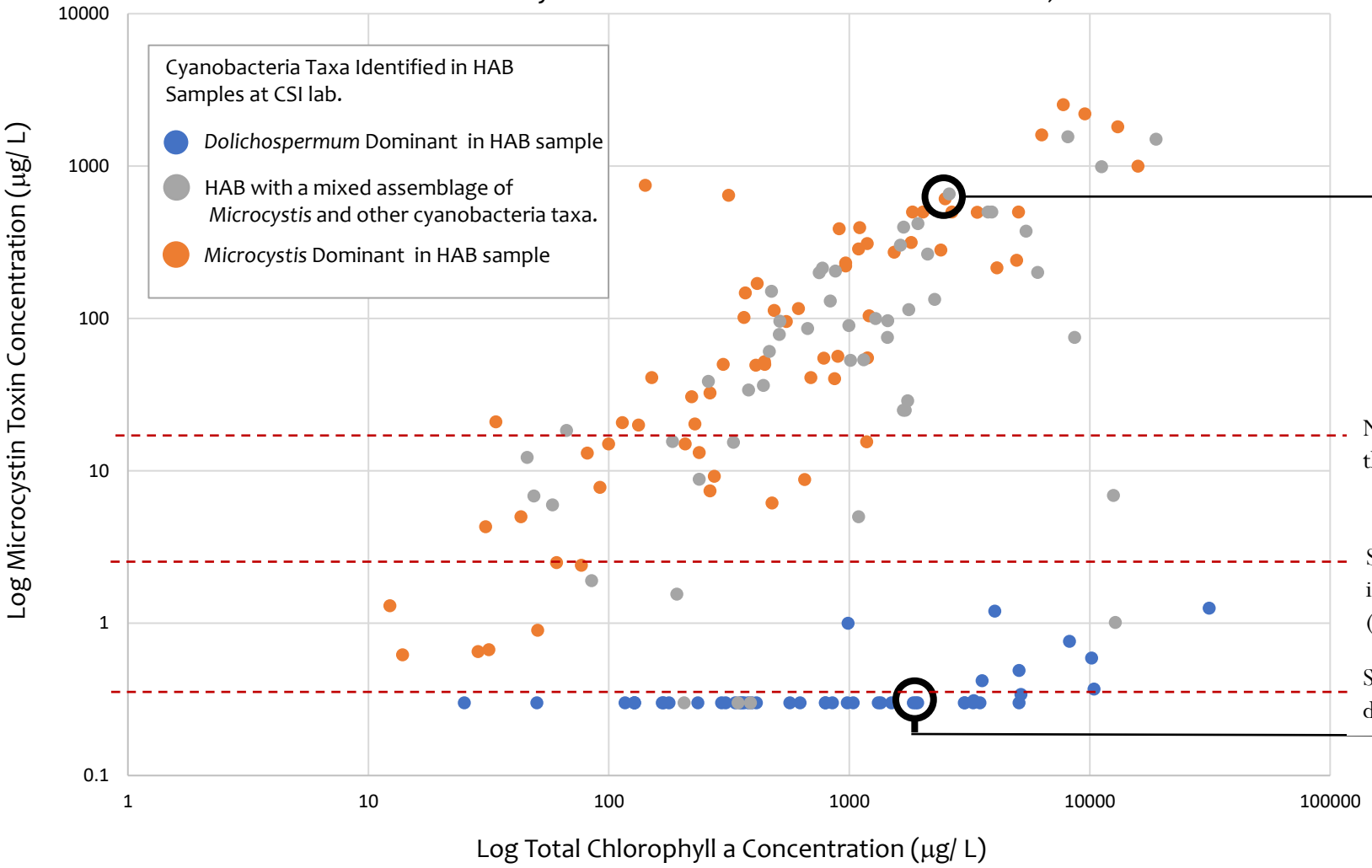
Figure 4b. "High" microcystin blooms were recorded along the southern 75 miles of shoreline in addition to a large cluster in the north.



Multi-Year Patterns: Taxa Associated Microcystin

Three years of bloom data reinforces the idea that the microcystin toxin concentrations of blooms on Cayuga Lake are associated with the 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

Review and The Path Forward

Our mission is to empower community-based volunteers with the tools and knowledge, backed by the expertise of our certified water testing lab, to participate in the scientific enterprise of monitoring their local water resources for sustainable management and protection.

In partnership with the lab, our volunteer-led monitoring programs are uniquely capable of producing scientifically credible, regulatory quality data in order to track chemical and biological water quality parameters, and to identify water quality issues of local concern and their sources.

Through this strategy, CSI is able to facilitate community participation in the Clean Water Act and inform regulatory decision regarding water resource management, and our HABs monitoring program fulfills some of the recommend monitoring actions listed in Section 13.6 of the Cayuga Lake HABs Action Plan.

This structure also makes CSI uniquely position to collaborate and partner with other organizations and agencies to monitor local water resources.

In the years ahead,

- we will continue to monitor local water quality, identify water quality issues and their sources.
- Our data may be used to inform the efficient placement and targeting of watershed restoration efforts.
- Our decadal water quality datasets will help reveal any long-term water quality changes over time, and even the effectiveness of any future restoration projects and plans.
- We will continue to partner with local organizations and agencies to compliment and build-upon each other in order to achieve the effective, multifaceted solutions for sustainably managing water resources.

Thank You

Contact Us

info@communityscience.org

(607) 257-6606

www.communityscience.org

Thanks To Our Partners and Friends!

Cayuga Lake Watershed Network

Seneca Lake Pure Waters Association

Discover Cayuga Lake

clean
cayuga lake environmental action now

Keuka Lake Association
protecting the quality of the lake

West Shore Neighborhood Association