Monitoring Cayuga Lake with the Community Science Institute

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Harmful Algal Bloom (HAB) that occurred on the shoreline of Taughannock Boulevard on July 9, 2020. The bloom was reported and sampled by HABs Quadrant Leader, John Abel.
CSI partners with community-based volunteer groups to better understand and protect local streams and lakes by collecting and disseminating scientifically credible, regulatory-quality data that inform long-term, sustainable management strategies.

CSI’s Mission:

- Volunteer Water Monitoring Partnerships
- Chemical Monitoring Partnerships
- Harmful Algal Bloom (HABs) Monitoring
- Biological Monitoring Partnerships
- Outreach and Education Initiatives
- Online Public Database
- NY State and EPA Certified Lab
- Nonprofit 501(c)3
- Community Science Institute

CSI’s 501(c)3 nonprofit status allows it to serve as a certified lab and contribute to public databases.
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 science monitoring programs are guided by a Quality Assurance Project Plan (QAPP).

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 community’s potable water testing needs.
All data that we collect in partnership with our volunteers are archived in CSI’s online public Water Quality 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 80,000 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.
Volunteer Monitoring Partnerships

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

Map Legend
- Blue: Synoptic Monitoring Partnerships
  Certified laboratory analyses
- Red: Red Flag Monitoring Partnerships
  Quality-assured field measurements
- Yellow: Biomonitoring Partnerships
  Benthic macroinvertebrates

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We have three Synoptic Monitoring Partnerships on Cayuga Lake:

- **Open lake monitoring of seven** locations with the Floating Classroom of Discover Cayuga Lake (DCL)
- **Shoreline monitoring of 22** locations on the southwest shore of Cayuga Lake with partners from the West Shore Neighbor Association
- **Shoreline monitoring of eight** locations on the southeast shore near Meyers Park with partners from our Salmon Creek monitoring team.
CSI has monitored **seven** mid-lake locations in partnership with Discover Cayuga Lake (DCL) and Tompkins County 4-H since 2004.

- Four locations at the southern shelf, and three further up the lake near Salt Point. At two of the locations, samples from deep (50m) are collected.
- Field measurements and samples are collected aboard the Floating Classroom of Discover Cayuga Lake during summertime Water Quality Cruises.
- These monitoring cruises serve as events in our 4-H2O Youth Education Program provided in partnership with Tompkins County 4-H. Children and families are invited on the cruise to learn about water science and to contribute to monitoring the lake!
What are We Monitoring For?

The samples collected during these monitoring cruises are analyzed at our state-certified water testing lab for the following parameters of water quality:

- Conductivity
- Chloride
- Turbidity
- Total Suspended Solids
- Soluble Reactive Phosphorus
- Total Phosphorus
- Nitrate + Nitrite Nitrogen
- Dissolved Oxygen
- E.coli

These parameters are important for characterizing Cayuga Lake water quality. Building long-term datasets helps to reveal any long-term water quality trends.

One of the many interactive graphs found on CSI’s public Water Quality Database at www.database.communityscience.org
What are We Monitoring For?

Data in Action: De-listing Southern Cayuga Lake

Until 2014, the southern shelf of Cayuga Lake was listed on the 303(d) list of impaired waterbodies for levels of phosphorus and E.coli bacteria. With data collected during our monitoring cruises, CSI was able to de-list the southern shelf as impaired by pathogenic bacteria (E.coli) – importantly showing that Cayuga Lake is a high-quality resource for drinking water, swimming and recreation.

This graph can be found on CSI’s public Water Quality Database at www.database.communityscience.org
CSI has monitored 22 shoreline locations in partnership with the West Shore Neighbors Association since 2014 – nearly seven years of water quality monitoring!
- Members collect samples near the shoreline of their residence to be tested at CSI’s state-certified water testing lab.
- Samples are collected on the same day once per month during the summer as a “Synoptic Monitoring Event”, providing a comprehensive “snapshot” of water quality.
- Samples are collected along an approximately 10-mile length of shoreline!
- All data collected over the past six years can be found on our public Water Quality Database.

What are we monitoring for?
Here at the lab we analyze the samples for levels of E.coli bacteria. E.coli serves as a “red flag” indicator of failing septic systems and runoff.
What Have We Found?

Of the 300+ samples collected by West Shore Neighborhood Association members analyzed at CSI’s certified testing lab, only 13 or 4% have had E.coli levels that exceed the safe limit of 235 colonies/100 ml used to regulate NY State swimming beaches. This long-term dataset indicates that shoreline septic systems are not a source of contamination at these locations, and that during most instances, levels of E.coli do not present a risk to those swimming on this section of Cayuga’s shoreline.
What Have We Found?

This is further substantiated by the fact that all locations monitored on the western shoreline have seven-year average E.coli concentrations well below the safe limit for recreation. Average E.coli concentrations range from 8.33 to 74.33 colonies/ 100 mL.
What Have We Found?

In 2020, all E. coli concentrations were found to be well below the safe limit – at every location, and during each monitoring event – in June, July, August, and September.

![Graph showing concentrations of E. coli in samples collected during all monitoring events during the summer of 2020. The safe limit for NY State swimming beaches is 235 colonies/100 ml.](image-url)
The Cayuga Lake HABs Monitoring Program

The Cayuga Lake HABs Monitoring Program is led by the Community Science Institute (CSI), in collaboration with 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 you, dedicated volunteers who monitor sections of shoreline around the lake and report their observations.
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.
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.
Multi-Year Patterns: An Increase of “High” Microcystin Blooms

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

- **2018**
  - Ranging from 4.0 ug/L to 2,533 ug/L: 22 (55%)
  - Between 0.3 ug/L and 4.0 ug/L: 2 (5%)
  - Less than 0.3 ug/L: 9 (23%)
  - Not Tested for Microcystin: 7 (17%)

- **2019**
  - Ranging from 4.0 ug/L to 2,533 ug/L: 28 (42%)
  - Between 0.3 ug/L and 4.0 ug/L: 8 (12%)
  - Less than 0.3 ug/L: 24 (36%)
  - Not Tested for Microcystin: 7 (10%)

- **2020**
  - Ranging from 4.0 ug/L to 2,533 ug/L: 55 (71%)
  - Between 0.3 ug/L and 4.0 ug/L: 15 (19%)
  - Less than 0.3 ug/L: 7 (9%)
  - Not Tested for Microcystin: 1 (1%)

Shoreline Coverage:
- 2018: 31%
- 2019: 47%
- 2020: 53%

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Multi-Year Patterns: Spatial Patterns

Map Legend

- **Not tested for microcystin.**
- **Bloom with microcystin levels less than the method detection limit of 0.5 µg/L**.
- **Bloom with microcystin levels greater than 0.5 µg/L and less than recreation limit of 4 µg/L.**
- **Bloom with microcystin levels ranging from 4 µg/L to 5000 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 5400. Zones change year to year as volunteers add or retire from the program.

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

**Multi-Year Patterns: Taxa Associated Microcystin**

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

- **Cyanobacteria Taxa Identified in HAB Samples at CSI lab.**
  - **Dolichospermum** Dominant in HAB sample
  - HAB with a mixed assemblage of *Microcystis* and other cyanobacteria taxa.
  - *Microcystis* Dominant in HAB sample

- **NYS DEC “high-toxin” bloom threshold (20 ug/L)**
- **Safe Guidance Value for microcystin in water used for contact recreation (4.0 ug/L)**
- **Safe Guidance Value for microcystin in drinking water (0.3 ug/L)**

Blooms of roughly the same density

- Multi-Year Patterns: Taxa Associated Microcystin
The 2021 Monitoring Season

Over 90 HABs Harrier volunteers are participating in the program this year! Approximately 28 volunteers on the southwest shore!

With 87 monitoring zones, roughly 60% of lake shoreline is being 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.

Over 13,000 views of our Cayuga Lake HABs Reporting Page so far this summer.
The 2021 Monitoring Season

So far this year, **48 blooms** have occurred on the Cayuga Lake shoreline.

Many of these blooms occurred in mid-July, following intense rainstorms. These blooms were widespread and dense.

**Based on tentative multi-year patterns** revealed by the past three years of data, we can anticipate bloom occurrences to become more frequent again in early September, and then fade away by the first week of October.
Thank You

How You Can Help Protect Water Quality?

Volunteer to monitor water quality with the Community Science Institute! Data initiates and informs action! We always welcome new volunteers! If you’d like to volunteer, please contact us at:

info@communityscience.org
(607) 257-6606
or
www.communityscience.org

Take part in the Lake Friendly Living Program to learn how you can continue to be a water quality responsible landowner. For more information in Lake Friendly Living, please contact the CLWN Program Associate, Jennifer Tufano, at:

programs@cayugalake.org

Learn about current proposals to manage Cayuga Lake such as the recently released DRAFT Cayuga Lake TMDL for phosphorus. Participate in public comment of these proposals and take part in local government proceedings when possible.