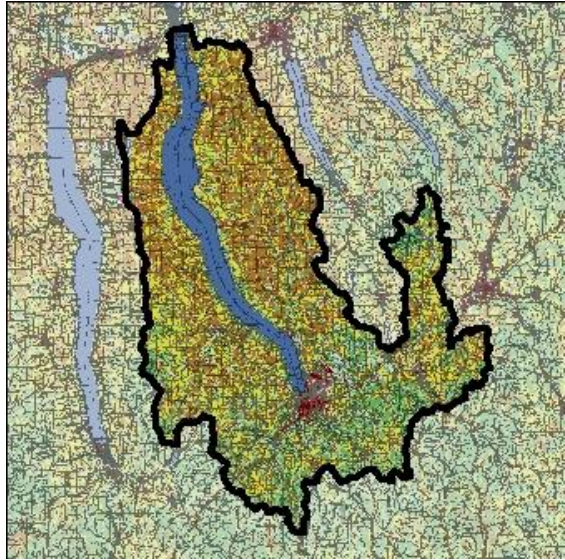

















<b>Cayuga Lake</b>	Cayuga Lake Watershed Network	Town of Montezuma, Aurelius, Springport, Ledyard, Genoa, Lansing, Ithaca, Ulysses, Covert, Ovid, Romulus, Varick, Fayette, Seneca Falls	Cayuga, Tompkins, Seneca County	
<b>Mid-South, Site 2</b> 	<b>Lake Characteristics</b>	Surface area (ac/ha)	42814 / 17326	
		Max depth (ft/m)	435 / 133	
		Mean depth (ft/m)	179 / 55	
		Retention time (years)	9.0	
		Lake Classification	AA(T)	
		Dam Classification	C	
	<b>Watershed Characteristics</b>	Watershed area (ac /ha)	1006158 / 407170	
		Watershed / Lake ratio	24	
		Lake & wetlands %	13.9%	
		Agricultural %	46.3%	
Forest, shrub, grasses %		33.2%		
Residential		6.3%		
<b>CSLAP Participation</b>	Years	2002-2007, 2017-2018		
	Volunteers	Tom Casella, William Ebert, Don Sargent, Shannon Barrett, Corinne Klohmann, Franny Lux, and Ed and Nancy Currier		
<b>Trophic state</b>		<b>HABs Susceptibility</b>	<b>Invasive Vulnerability</b>	<b>PWL Assessment</b>
Mesotrophic		Frequent blooms, Low susceptibility	Invasives present, High Vulnerability	Stressed

Water quality values for Cayuga Lake for the 2018 sampling season. “Seasonal change” shows current year variability. Light red color indicates eutrophic conditions in top table and bloom conditions in bottom table. Summer averages for each of the CSLAP years and long term trend analyses show trends in key water quality indicators over a consistent index period (mid-June thru mid-September).

Open Water Indicators	2018 Sampling Results								Seasonal change	Long Term Avg	Long Term Trend?	18 Diff from Avg
	6/24	7/9	7/21	8/4	9/3	9/24	10/8					
Clarity (m)	5.3	3.8	2.2	3.9	5.2	3.7	4.3		3.5	no	no	
Surface TP (mg/l)	0.007	0.012	0.010	0.009		0.010	0.011		0.012	no	no	
Surface TDP (mg/l)	0.005	0.005	0.005	0.006	0.002	0.004	0.006		0.006	no		
Deep TP (mg/l)	0.006	0.009	0.007	0.006	0.006	0.007	0.009		0.008	no		
Deep/Surface TP	1	1	1	1		1	1		1			
TN (mg/l)	1.560	1.420	0.854	1.240	1.200	1.250	1.270		1.227	no	no	
TDN (mg/l)	1.540	1.340	0.862	1.250	1.240	0.991	1.270					
N:P Ratio	229	121	84	146		123	121		95			
Deep/Surface NH4			1						1			
Chl.a (ug/l)	3.6	4.0	3.6	3.1	2.4	6.0	7.9		3.9	no	no	
pH	7.4	7.4	7.4	7.7	7.1	8.1	7.5		7.8	no	no	
Cond (umho/cm)	475	456	466	470	454	440	406		371	no	↑	
Upper Temp (degC)	15	20	19	22	22	18	19		20	no	no	
Deep Temp (degC)	11	11	16	13	17	16	16		13	no	no	
FP BG Chl.a (ug/l)	0	0	0	0	0	1	0		0	no	no	
HABs reported?	no	no	no	no	no	no	no					

### Shoreline bloom and HABs notifications

Date of first listing	Date of last listing	# weeks on the DEC notification list	# Weeks with updates
7/6/2018	10/5/2018	12	10

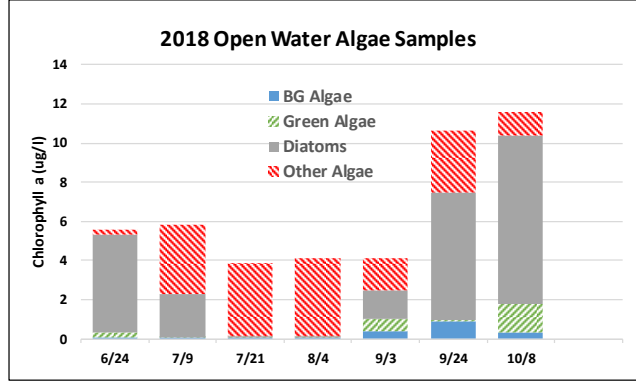
### Shoreline HAB Sample Dates 2018

HAB Indicators	HAB criteria	7/3	7/3	7/4	7/7	7/12	7/16	7/17	7/17	7/26	8/16	8/23	9/4	9/4	9/4	9/4	9/4
BGA	25 - 30 ug/L	417.2	1496.5	579.8	391.0	1089.0	161.4	853.0	275.9	31.6	301.1	0.5	199.2	853.0	1554.7	13231.6	12028.0
microcystin	20 ug/L	0.5	ND	ND	ND	ND	52.0	ND	ND	21.0	4.5	ND	59.0	450.0	210.0	2500.0	410.0
anatoxin - a	4 ug/L																

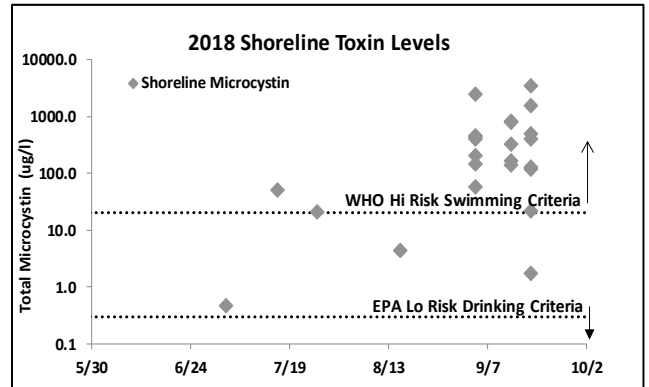
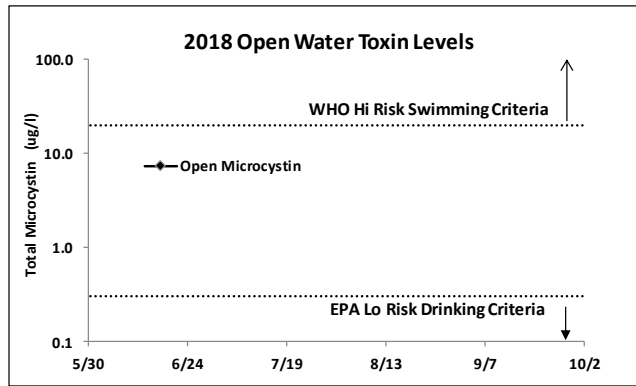
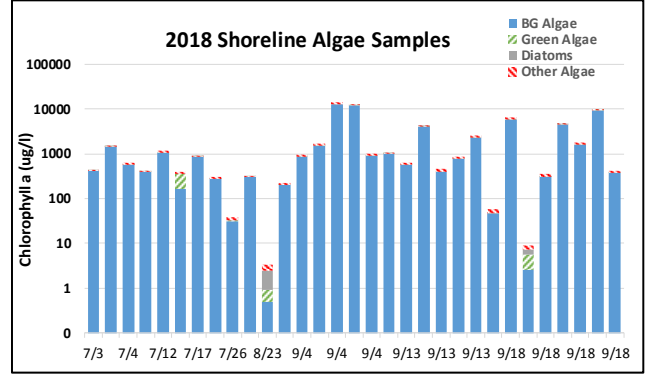
  

HAB Indicators	HAB criteria	9/4	9/4	9/13	9/13	9/13	9/13	9/13	9/18	9/18	9/18	9/18	9/18	9/18	9/18	9/18	9/18
BGA	25 - 30 ug/L	908.7	999.3	560.3	4040.5	406.0	802.1	2323.9	46.7	6058.6	2.6	314.4	4460.4	1658.3	9501.1	369.6	
microcystin	20 ug/L	470.0	150.0	170.0	800.0	140.0	330.0	850.0	22.0	500.0	1.8	130.0	1600.0	400.0	3500.0	120.0	
anatoxin - a	4 ug/L																

### HABs Status Open water Algae

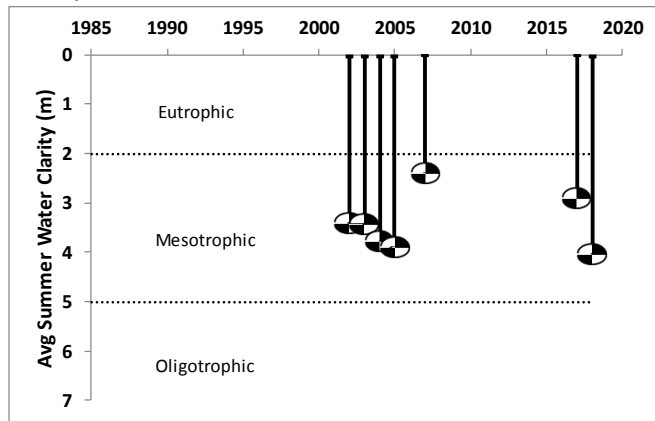


### Shoreline Algae

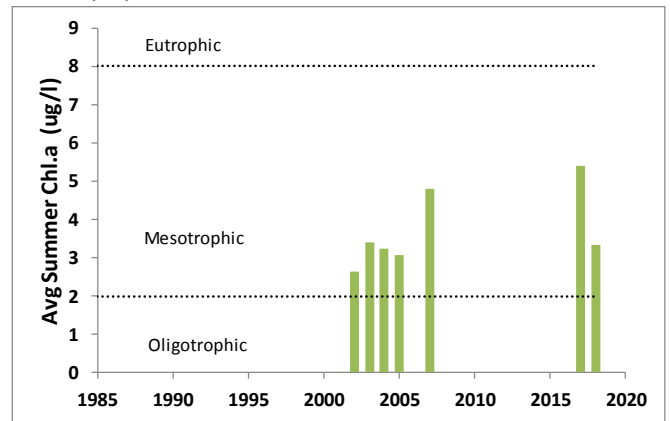


# Cayuga Lake (S2) Long Term Trend Analysis

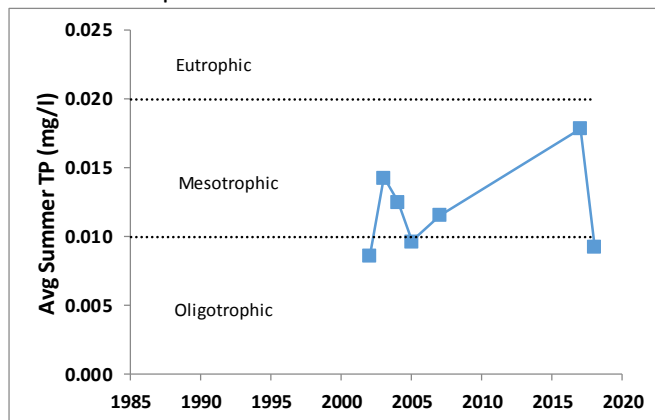
Clarity



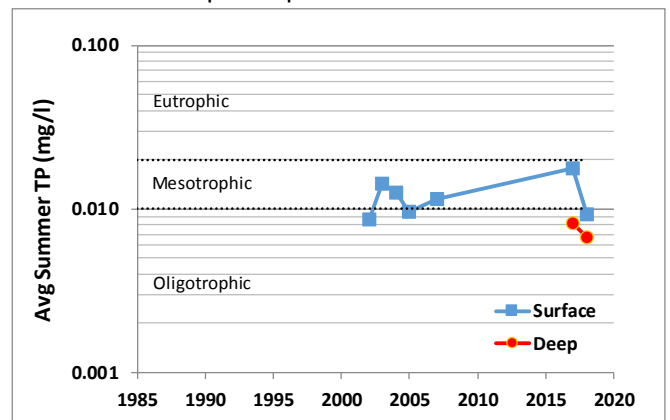
Chlorophyll *a*



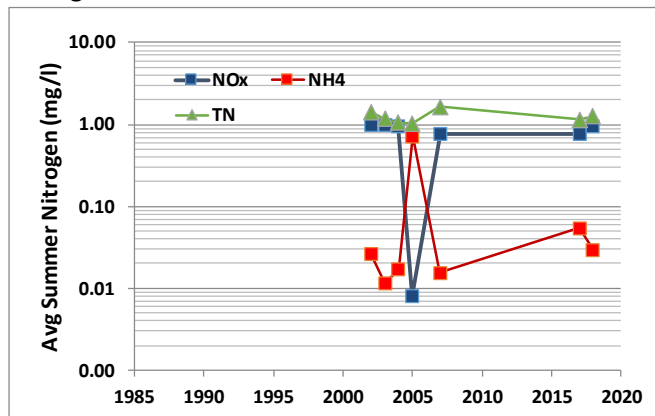
Surface Phosphorus



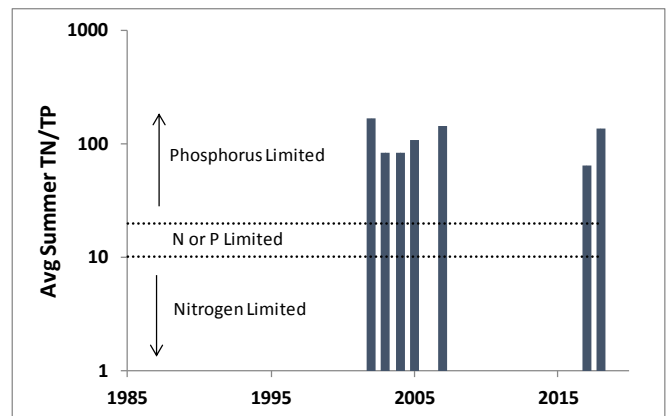
Surface and Deep Phosphorus



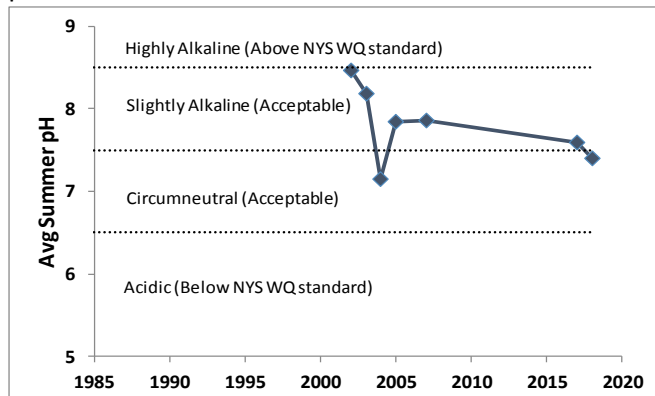
Nitrogen



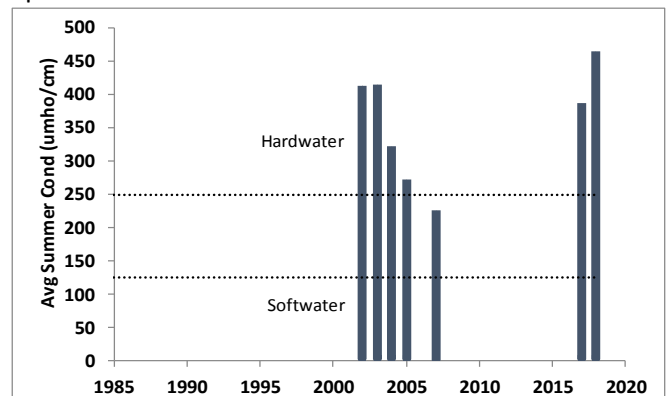
TN : TP



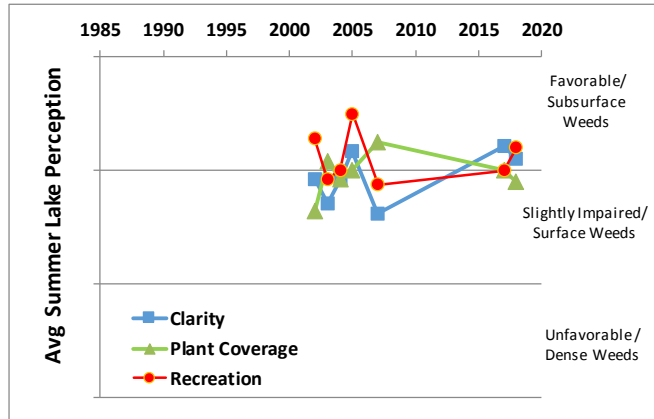
pH



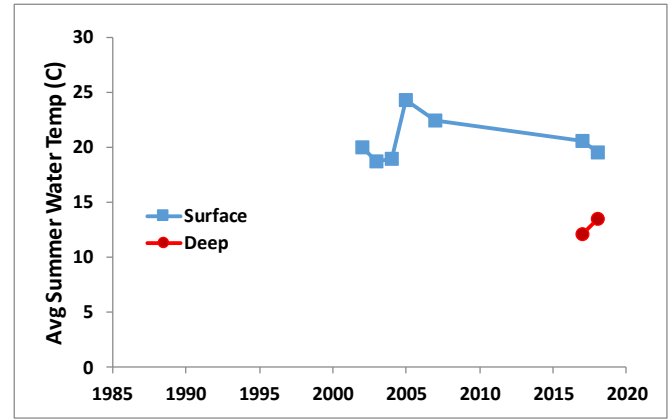
Specific Conductance



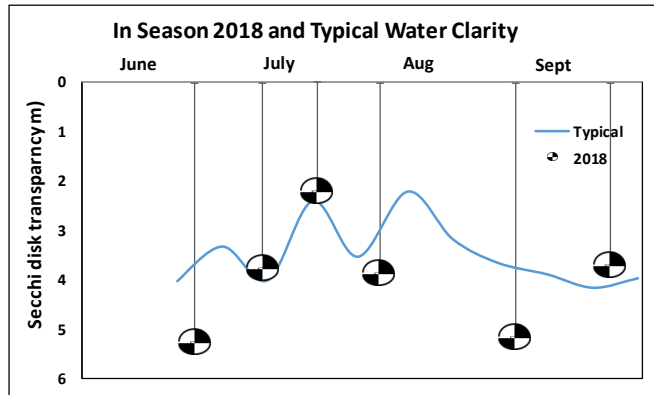
### Lake Perception



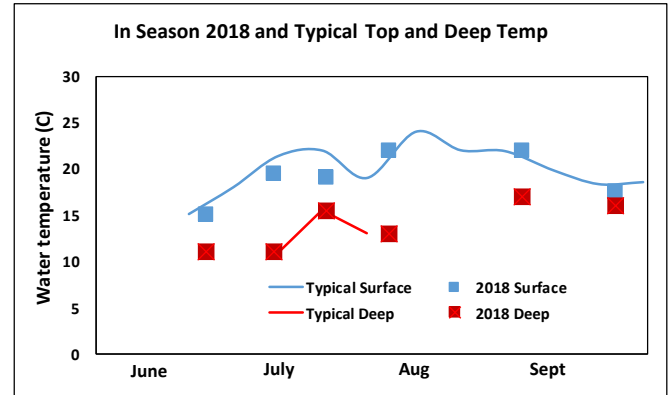
### Surface and Deep Temperature



### In Season Water Clarity



### In Season Water Temperature



## Scorecard

Lake Use				
	PWL	Average Year	2018	Primary issue
Potable Water	Threatened / Fair	Stressed / Poor	Stressed / Poor	Algae levels
Swimming	Stressed / Poor	Stressed / Poor	Stressed / Poor	Algae blooms
Recreation	Stressed / Poor	Stressed / Poor	Stressed / Poor	Algae blooms
Aquatic Life	Supported / Good	Threatened / Fair	Supported / Good	Invasive animals
Aesthetics	Stressed / Poor	Stressed / Poor	Stressed / Poor	Algae blooms
Habitat	Threatened / Fair	Threatened / Fair	Threatened / Fair	Invasive plants
Fish Consumption	Not Known	Not Known	Not Known	Not applicable

● Supported / Good  
▲ Threatened / Fair  
◆ Stressed / Poor  
■ Impaired  
 Not Known

## CSLAP sampling summary- Cayuga Lake (S2), 2018

### **Q. What is the condition of the lake?**

**A.** Cayuga Lake continues to be mesotrophic, or moderately productive, based on moderate water clarity, moderate algae levels (chlorophyll *a*), and moderate nutrient (phosphorus) levels. Soluble nutrients were analyzed for the first time in 2017. Some of the phosphorus in the lake is soluble, indicating some potential for more algae growth. Most of the nitrogen in the lake is soluble. The lake has slightly alkaline, extremely hard water, low water color, and high nitrogen levels.

### **Q. How did 2018 compare to previous years?**

**A.** Water clarity was higher in 2018 than in 2017, consistent with slightly lower phosphorus readings, despite slightly algae (chlorophyll *a*) and total nitrogen levels, and despite much higher conductivity. The other water quality indicators were similar in both years. However, annual changes are difficult to detect with only two years of data.

### **Q. How does this lake compare to other nearby lakes?**

**A.** Compared to other nearby lakes, the mid-south site of Cayuga Lake usually has higher conductivity, calcium, and chloride levels, and lower chlorophyll *a* levels and phosphorus readings. Cayuga Lake at this site usually has similar water quality and recreational assessments, and similar aquatic plant coverage.

Lake productivity appears to be lowest in the mid lake sites (Sites 2 and 4, called mid-south and mid-lake), based on higher water clarity and lower phosphorus and chlorophyll *a* readings. Conductivity was lowest in these sites, although total nitrogen levels were higher. The south shelf had slightly lower productivity than in the very shallow north site. Additional data will help to determine if these characterizations are representative of normal conditions in the lake.

### **Q. Are there any (statistically significant) trends?**

**A.** Since 2002, when CSLAP sampling of the “mid south” site was sampled, none of the water quality indicators has exhibited any clear long-term trends.

### **Q. Has the lake experienced harmful algal blooms (HABs)?**

**A.** Water quality conditions indicate a low susceptibility to blooms, although frequent blooms are reported along the shoreline or periodically in the open water. The open water algal community in the lake is usually comprised of low cyanobacteria levels. Overall open water algae levels are low to intermediate. Open water toxin levels are consistently below recreational levels of concern. Shoreline blooms have been

documented in the lake, comprised primarily of cyanobacteria comprised of *Dolichospermum* and *Microcystis*. The shoreline algal community exhibits periodically high toxin levels.

In 2018, overall algae levels were low to intermediate, with diatoms the most common taxa in open water samples, and with low cyanobacteria levels. Open water toxin levels were undetectable. Shoreline blooms in 2018 were documented in the lake, comprised primarily of cyanobacteria with periodically high toxin levels. The most common taxa in 2018 were the same as reported in previous years.

**Q. Have any aquatic invasive species (AIS) been reported?**

**A.** There are invasive plants reported or present at Cayuga Lake, and invasives have been reported in nearby waterbodies. Invasive species reported in the lake include Eurasian watermilfoil, curly-leafed pondweed, variable leaf watermilfoil, and more recently hydrilla and starry stonewort. Quagga and zebra mussels, common carp, scud, and European stream valvata have been reported in Cayuga Lake. Cayuga Lake has high vulnerability for new invasives, based on calcium levels, the presence of multiple AIS, and multiple public access points.

**Q. Are any lake uses likely to be affected by these conditions?**

**A.** Cayuga Lake supports potable water, recreation and public bathing use. Public water supply is stressed by a high frequency of algae levels above criteria protecting potable water use, and impacted by shoreline HABs and raw water cyanotoxins. Public bathing and recreation are stressed by shoreline cyanotoxins, and impacted by shoreline HABs and periodic open water HABs, and by excessive phosphorus levels. Aquatic life is threatened by the presence of invasive animals. Aesthetics are poor due to HABs, and impacted by less than favorable recreational and water quality perception, and the presence of invasive aquatic plants. Habitat is fair due to the presence of invasive aquatic plants. Fish Consumption use is considered to be unassessed. There are no health advisories limiting the consumption of fish from this waterbody (beyond the general advice for all waters). However, due to the lack of actual fish sampling data, fish consumption use is noted as unassessed, rather than fully supported but unconfirmed.

## How to Read the Report

This guide provides a description of the CSLAP report by section and a glossary. The sampling site is indicated in the header for lakes with more than one routine sampling site.

### **Physical Characteristics influence lake quality:**

- Surface area is the lake's surface in acres and hectares.
- Max depth is the water depth measured at the deepest part of the lake in feet and meters.
- Mean depth is either known from lake bathymetry or is 0.46 of the maximum depth.
- Retention time is the time it takes for water to pass through a lake in years. This indicates the influence of the watershed on lake conditions.
- Lake classification describes the "best uses" for this lake. Class AA, AAspec, and A lakes may be used as sources of potable water. Class B lakes are suitable for contact recreational activities, like swimming. Class C lakes are suitable for non-contact recreational activities, including fishing, although they may still support swimming. The addition of a T or TS to any of these classes indicates the ability of a lake to support trout populations and/or trout spawning.
- Dam classification defines the hazard class of a dam. Class A, B, C, and D dams are defined as low, intermediate, high, or negligible/no hazard dams in that order. "0" indicates that no class has been assigned to a particular dam, or that no dam exists.

### **Watershed characteristics influence lake water quality:**

- Watershed area in acres and hectares
- Land use data come from the most recent (2011) US Geological Survey National Land Use Cover dataset

**CSLAP Participation** lists the sampling years and the current year volunteers.

### **Key lake status indicators summarize lake conditions:**

- Trophic state of a lake refers to its nutrient loading and productivity, measured by phosphorus, algae, and clarity. An oligotrophic lake has low nutrient and algae levels (low productivity) and high clarity while a eutrophic lake has high nutrient and algae levels (high productivity) and low clarity. Mesotrophic lakes fall in the middle.
- Harmful algal bloom susceptibility summarizes the available historical HAB data and indicates the potential for future HAB events.
- Invasive vulnerability indicates whether aquatic invasive species are found in this lake or in nearby lakes, indicating the potential for further introductions.
- Priority waterbody list (PWL) assessment is based on the assessment of use categories and summarized as fully supported, threatened, stressed, impaired, or precluded. Aesthetics and habitat are evaluated as good, fair, or poor. The cited PWL assessment reflects the "worst" assessment for the lake. The full PWL assessment can be found at <http://www.dec.ny.gov/chemical/36730.html#WIPWL>.

### **Current year sampling results**

- Results for each of the sampling sessions in the year are in tabular form. The seasonal change graphically shows the current year results. Red shading indicates eutrophic readings.
- HAB notification periods on the DEC website, updated weekly <http://www.dec.ny.gov/chemical/83310.html>
- Shoreline HAB sample dates and results. Samples are collected from the area that appears to have the worst bloom. Red shading indicates a confirmed HAB.
- HAB sample algae analysis. Algae types typically change during the season. These charts show the amount of the different types of algae found in each mid-lake or shoreline sample. Samples with high levels of BGA are HABs. The second set of charts show the level of toxins found in open water and shoreline samples compared to the World Health Organization (WHO) guidelines.
- If there are more than ten shoreline bloom samples collected in a year, bloom sample information is instead summarized by month (May-Oct.) as minimum, average, and maximum values for blue-green algae and microcystin.

**Long Term Trend Analysis** puts the current year findings in context. Summer averages (mid-June thru mid-September) for each of the CSLAP years show trends in key water quality indicators. The graphs include relevant criteria (trophic categories, water quality standards, etc.) and boundaries separating these criteria.

**In-Season Analysis** shows water temperature and water clarity during the sampling season. These indicate seasonal changes and show the sample year results compared to the typical historical readings for those dates.

**The Lake Use Scorecard** presents the results of the existing Priority Waterbody List assessment for this lake in a graphical form and compares it to information from the current year and average values from CSLAP data and other lake information. Primary issues that could impact specific use categories are identified, although more issues could also affect each designated use.

**The Lake Summary** reviews and encapsulates the data in the lake report, including comparisons to historical data from this lake, and results from nearby lakes.



## Glossary of water quality and HAB indicators

**Clarity (m):** The depth to which a Secchi disk lowered into the water is visible, measured in meters. Water clarity is one of the trophic indicators for each lake.

**TP (mg/L):** Total phosphorus, measured in milligrams per liter at the lake surface (1.5 meters below the surface). TP includes all dissolved and particulate forms of phosphorus. TSP, or total soluble phosphorus, was collected in 2018 and discussed in the lake narrative section.

**Deep TP:** Total phosphorus measured in milligrams per liter at depth (1-2 meters above the lake bottom or at a designated deep site depth at the deepest part of the lake)

**TN:** Total nitrogen, measured in milligrams per liter at the lake surface. TN includes all forms of nitrogen, including **NO<sub>x</sub>** (nitrite and nitrate) and **NH<sub>4</sub>** (ammonia).

**N:P Ratio:** The ratio of total nitrogen to total phosphorus, unitless (mass ratio). This ratio helps determine if a lake is phosphorous or nitrogen limited.

**Chl.a (µg/L):** Chlorophyll a, measured in micrograms per liter. Indicates the amount of algae in the water column. This is an extracted chlorophyll measurement.

**pH:** A range from 0 to 14, with 0 being the most acidic and 14 being the most basic or alkaline. A healthy lake generally ranges between 6.5 and 8.5.

**Cond (µmho/cm):** Specific conductance is a measure of the conductivity of water. A higher value indicates the presence of more dissolved ions. High ion concentrations (> 250) usually indicate hardwater, and low readings (< 125) usually show softwater.

**Upper Temp (°C):** Surface temperature, measured in degrees Celsius

**Deep Temp (°C):** Bottom temperature or temperature at a designated deep site depth, measured in degrees Celsius

**BG Chl.a (µg/L):** Chlorophyll a from blue-green algae, measured in micrograms per liter. This is an “unextracted” estimate using a fluoroprobe. This result is not as accurate as the extracted chlorophyll measurement described above.

**HABs: Harmful Algal Blooms.** Algal blooms that have the appearance of cyanobacteria (BGA)

**BGA:** Blue-green algae, also known as cyanobacteria

**Microcystin (µg/L):** The most common HAB liver toxin; total microcystin above 20 micrograms per liter indicates a “high toxin” bloom. However, ALL BGA blooms should be avoided, even if toxin levels are low.

**Anatoxin-a (µg/L):** A toxin that may be produced in a HAB which targets the central nervous system. Neither EPA nor NYS has developed a risk threshold for anatoxin-a, although readings above 4 micrograms per liter are believed to represent an elevated risk.