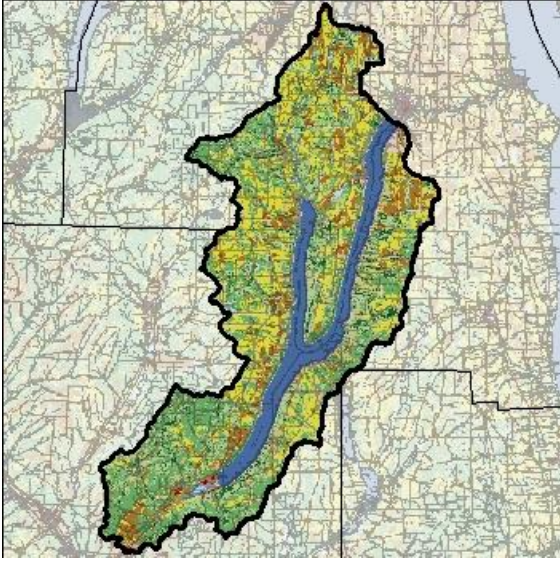
















Keuka Lake	Keuka Lake Association	Town of Milo, Barrington, Wayne, Urbana, Pulteney, Jerusalem	Steuben, Yates County
South – Mid-lake Site (2) 		Lake Characteristics Surface area (ac/ha) 11584 / 4226 Max depth (ft/m) 187 / 57 Mean depth (ft/m) 86 / 26 Retention time (years) 7.08 Lake Classification AATS Dam Classification	
		Watershed Characteristics Watershed area (ac /ha) 112825/45658 Watershed / Lake ratio 11 Lake & wetlands % 12.5% Agricultural % 31.8% Forest, shrub, grasses % 50.5% Residential 5.2% Urban 0.0%	
		CSLAP Participation Years 2017-2018 Volunteers Maria Hudson, Allison Marshall,	
Trophic state	HABs Susceptibility	Invasive Vulnerability	PWL Assessment
Mesoligotrophic	Infrequent blooms, Low susceptibility	Invasives present, High Vulnerability	Threatened

Water quality values for Keuka 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
	6/27	7/25	8/9	8/23	9/5	9/19	10/3				
Clarity (m)	7.9	6.8	7.2	7.3	5.5	7.4	7.5		7.4	no	no
Surface TP (mg/l)		0.006	0.004	0.005	0.005	0.004	0.010		0.007	no	no
Surface TDP (mg/l)		0.004	0.001	0.002	0.002	0.001	0.001		0.003	no	
Deep TP (mg/l)	0.007	0.016	0.005	0.004	0.004	0.003	0.006		0.009	no	
Deep/Surface TP		3	1	1	1	1	1		1		
TN (mg/l)		0.315	0.210	0.357	0.366	0.318	0.269		0.279	no	no
TDN (mg/l)		0.269	0.207	0.384	0.377	0.238	0.363				
N:P Ratio		54	51	69	76	91	26		46		
Deep/Surface NH4											
Chl.a (ug/l)		2.4	1.7	2.1	2.2	1.5	2.2		2.5	no	no
pH		7.8	7.4	8.5	8.0	8.2	7.4		7.9	no	no
Cond (umho/cm)		317	256	352	364	344	230		274	no	no
Upper Temp (degC)	20	24	25	24	24	24	21		23	no	no
Deep Temp (degC)	14	12	18	15	13	13	11		14	no	no
FP BG Chl.a (ug/l)			0	1	1	1			0	no	no
HABs reported?	no	no	no	no	shore	no	no				

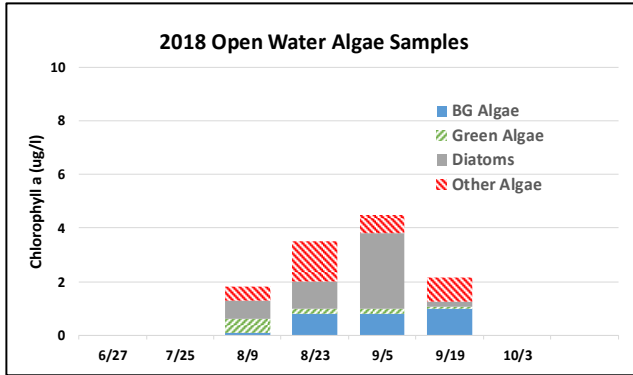
Shoreline bloom and HABs notifications

Date of first listing	Date of last listing	# weeks on the DEC notification list	# Weeks with updates
8/17/2018	9/21/2018	6	4

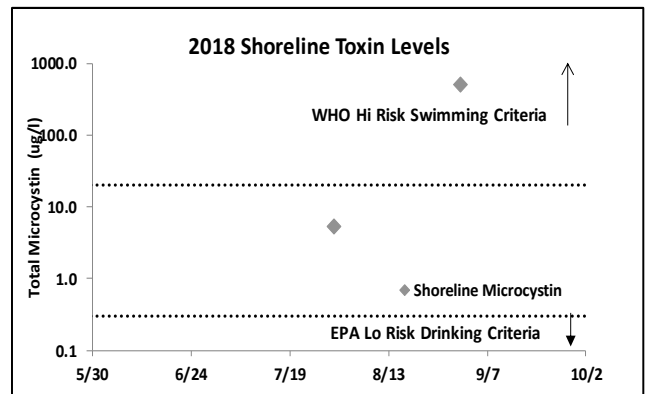
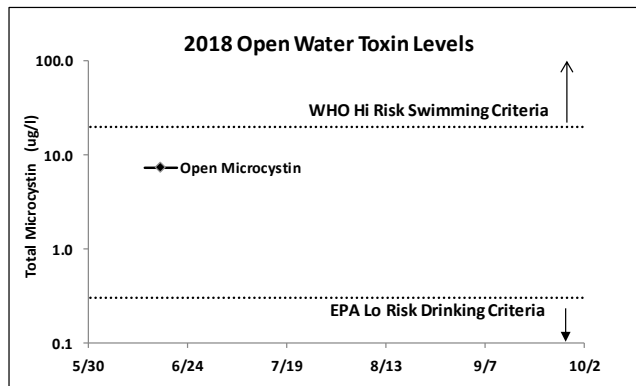
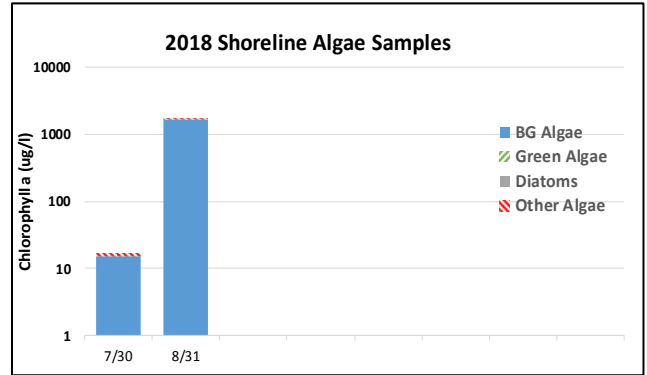
Shoreline HAB Sample Dates 2018

HAB Indicators	HAB criteria	7/30/2018	8/31/2018
BGA	25 - 30 ug/L	15.1	1654.6
microcystin	20 ug/L	5.4	500.0
anatoxin - a	4 ug/L		

HABs Status Open water Algae

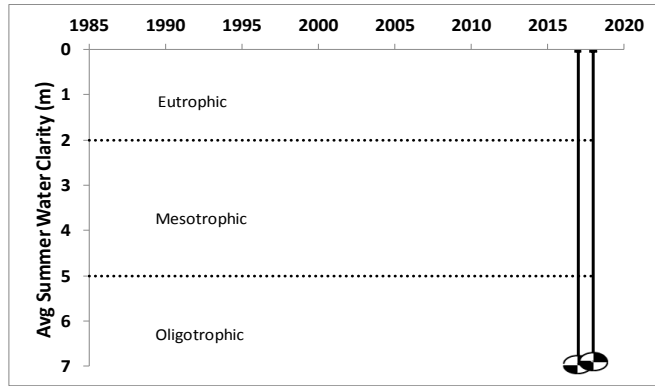


Shoreline Algae

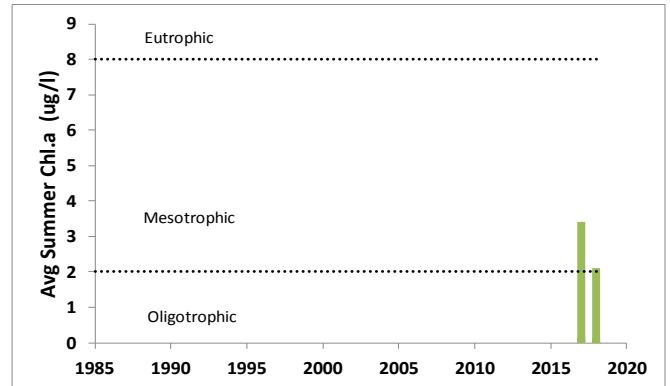


Keuka Lake (S2) Long Term Trend Analysis

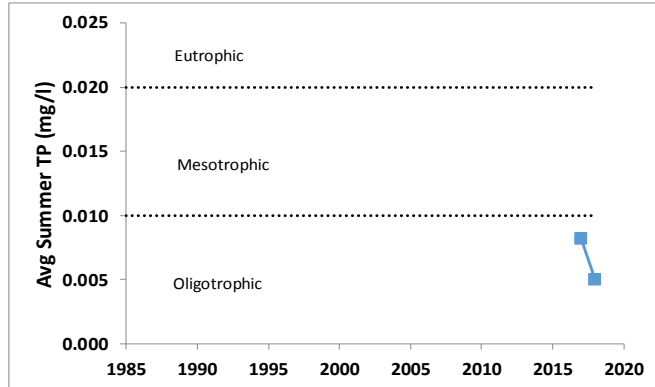
Clarity



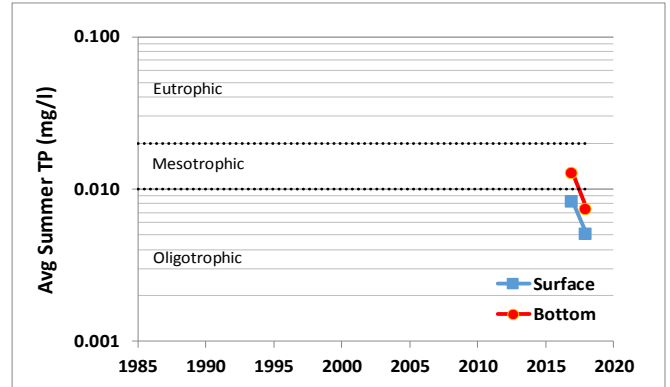
Chlorophyll a



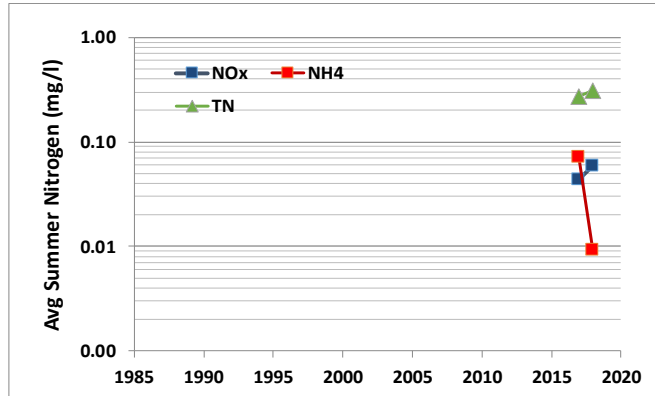
Surface Phosphorus



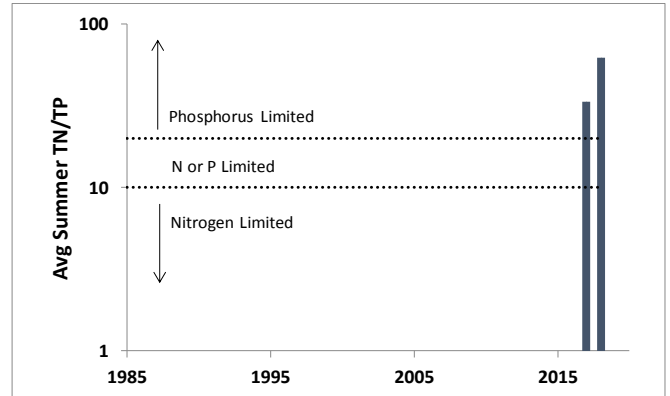
Surface and Deep Phosphorus



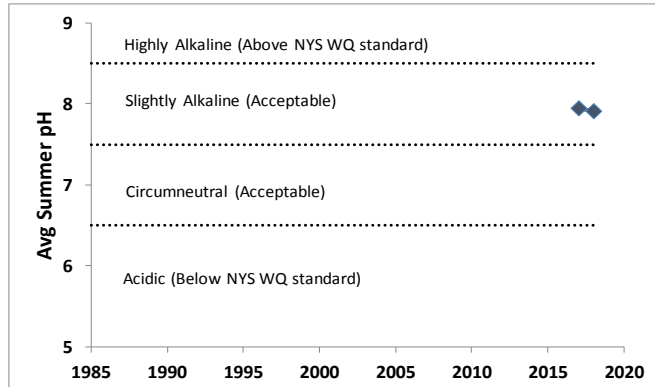
Nitrogen



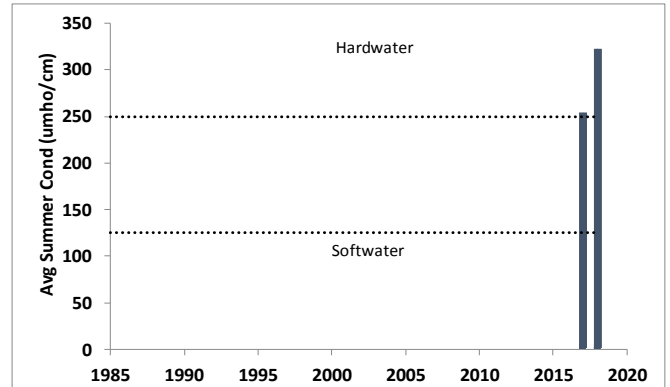
TN : TP



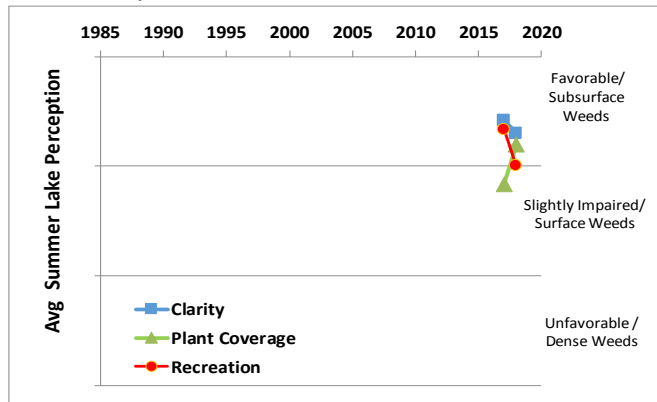
pH



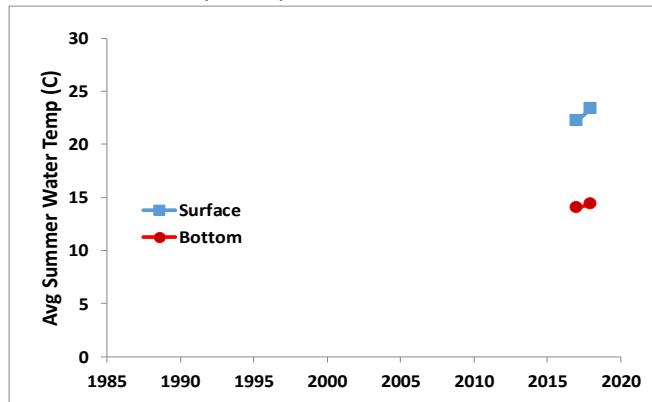
Specific Conductance



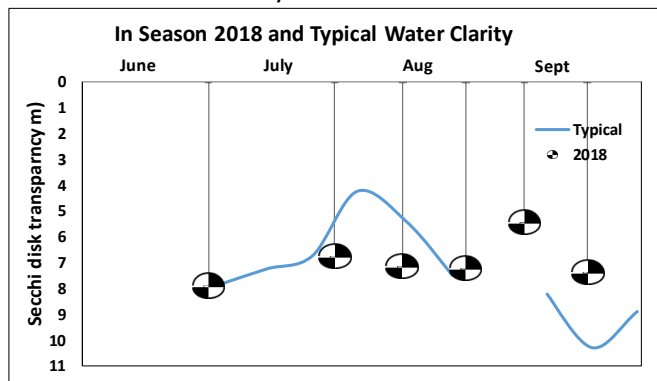
Lake Perception



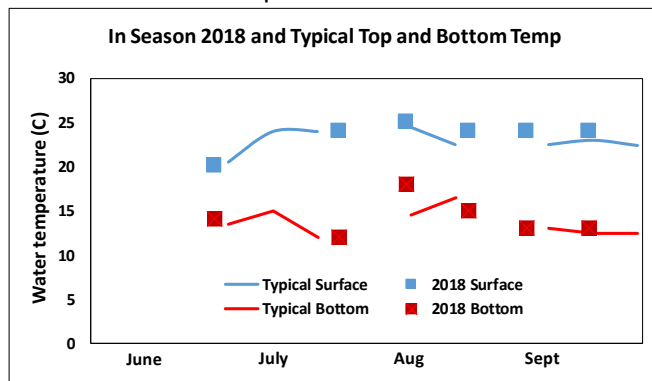
Surface and Deep Temperature



In Season Water Clarity



In Season Water Temperature



Scorecard

Lake Use				
	PWL	Average Year	2018	Primary issue
Potable Water	▲	▲	▲	Algae levels
Swimming	●	▲	▲	Algae blooms
Recreation	●	▲	▲	Algae blooms
Aquatic Life	●	▲	●	Invasive animals
Aesthetics	●	▲	▲	Recreational perception
Habitat	●	▲	▲	Invasive plants
Fish Consumption	●	□	□	Not applicable

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

CSLAP sampling summary- Keuka Lake (S2), 2018

Q. What is the condition of the lake?

A. Keuka Lake (mid lake, south arm) continues to be mesoligotrophic, or moderately unproductive, based on high water clarity, moderate algae levels (chlorophyll a), and low nutrient (phosphorus) levels. Soluble nutrients were analyzed for the first time in 2018. 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, hard water, low water color, and moderately low nitrogen levels.

Q. How did 2018 compare to previous years?

A. Water clarity and algae levels were slightly lower, and conductivity was slightly higher in 2018 than in 2017, although 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, Keuka Lake (mid lake, S arm site) usually has higher water clarity, and lower chlorophyll a levels and phosphorus readings. Keuka Lake usually has more favorable water quality assessments, similar recreational assessments, and similar aquatic plant coverage.

Productivity was slightly higher in 2018 in the northwest arm (relative to the south and northeast arm), based on slightly lower water clarity and slightly higher nutrient and algae levels. Calcium levels were also slightly higher in the NW arm. However, the deeper samples showed the opposite trend- slightly lower phosphorus, chloride and conductivity readings in the NW arm. This suggests some inconsistent (but only slight) variability among the sampled sites.

Q. Are there any (statistically significant) trends?

A. With only two years of data, long-term trends can't be evaluated.

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

A. Water quality conditions indicate a low susceptibility to blooms, with only infrequent blooms reported along the shoreline or in the open water. The open water algal community in the lake is usually comprised of low to intermediate 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 *Microcystis*

and *Dolichospermum* (previously *Anabaena*). 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 to intermediate cyanobacteria levels. Open water toxin levels were undetectable. Shoreline blooms in 2018 were documented in the lake, comprised primarily of cyanobacteria with high toxin levels. The most common taxa were *Microcystis*, and suspicious blooms (not validated by samples) led to beach closures at Red Jacket Park Beach and Indian Pines Park Beach in early August, and near the Indian Parks Park Beach location in late August and mid September.

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

A. There are invasive plants reported or present at Keuka Lake, and invasives have been reported in nearby waterbodies. Invasive species reported in the lake include Eurasian watermilfoil and starry stonewort. Chinese mystery snail, Asian clam, quagga and zebra mussels, and scud has been reported in Keuka Lake. Keuka Lake has high vulnerability for new invasives, based on calcium levels, the presence of several AIS, and multiple access points.

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

A. Keuka Lake supports potable water, recreation and public bathing use. Public water supply is threatened by shoreline HABs, and impacted by raw water cyanotoxins. Public bathing and recreation are threatened by shoreline cyanotoxins, and impacted by shoreline HABs. Aquatic life is threatened by the presence of invasive animals. Aesthetics are fair due to HABs, and impacted by less than favorable recreational 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 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_x** (nitrite and nitrate) and **NH₄** (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, 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.