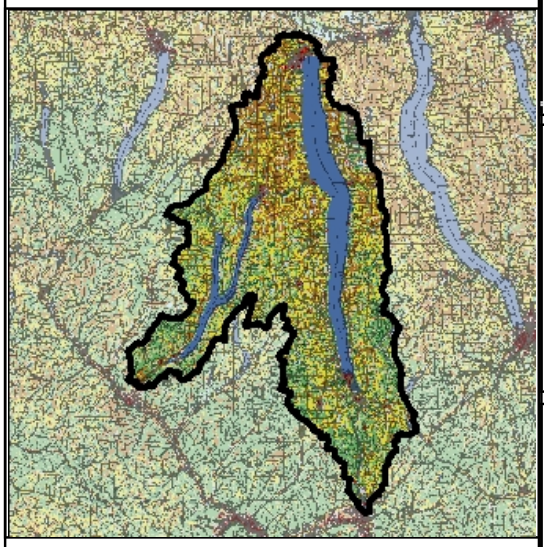
Seneca Lake, Ontario, Schuyler, Seneca, Yates Co., Seneca Lake Pure Waters

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation



Lake Characteristics	Surface Area (ac/ha)	42648	17259
	Max Depth (ft/m)	191	58
	Mean Depth (ft/m)	291	89
	Retention Time (years)	16.70	
	Water Class	AATS	
	Dam Class	C	
Watershed Characteristics	Watershed Area(ac/ha)	455772	184441
	Watershed/Lake Ratio	11	
	Lake and Wetlands	15.4%	
	Agricultural	40.1%	
	Forests, shrubs, grasses	38.0%	
	Residential	6.3%	
	Urban	0.1%	
CSLAP Participation	Years	2017	
	Volunteers	Addison Mason	

Trophic State	HABs Susceptibility	Invasive Vulnerability	PWL Assessment
Mesotrophic	Low	High	Threatened

Open Water Indicators	2017 Sampling Results								Seasonal Change	Long Term Avg.
	6/28	7/10	7/30	8/14	8/27	9/11	9/24	10/1		
Chl.a (µg/L)	3.4	3.1	6	2.5	6.9	4.7	10.2	4.5		5.2
BG Chl.a (µg/L)	0	.9	1.9	0	0	0	0	0		0.5
Clarity (m)	4.4	3.3	2.5	3.9	2.1	4	2.4	4.4		3.4
pH	7.1	7.7	7.6	7.5	7.6	8	8.1	7.6		7.6
Cond (µmho/cm)	627.4	456.4	601.1	603.1	638.4	636.1	608.9	647.6		602
Surf Temp (°C)	22	23	21	20	21	19	20	19		21
Bott Temp (°C)	11	16	11	16	14	15	18	17		15
TN (mg/L)	.604	.684	.58	.428	.317	.449	.528	.475		0.508
TP (mg/L)	.006	.012	.023	.015	.016	.013	.019	.014		0.015
Deep TP (mg/L)	.009	.008	.007	.011	.008	.013	.009	.013		0.010
Surface N:P Ratio	101	57	25	29	20	35	28	34		

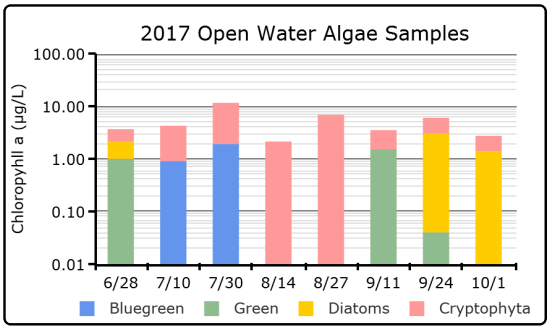
Shoreline HAB Sample Summary 2017

HAB Indicators	HAB Criteria		May	June	July	August	September	October
BGA	25 µg/L	Min					5.25	
		Max					118356.25	
Microcystin	20 µg/L	Min					.41	
		Max					368.7	
Anatoxin-A		Min					.01	
		Max					3.68	
		Count					53	

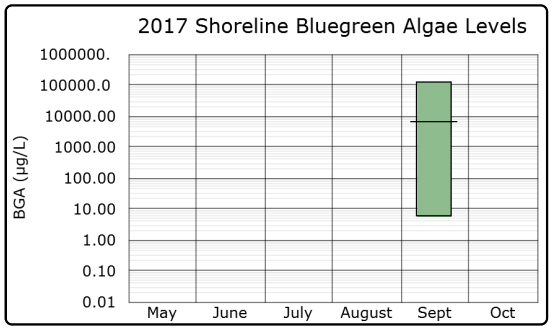
Shoreline bloom and HABs notifications

Date of first listing	Date of last listing	# of weeks on DEC notification list	# of weeks with updates
9/22/2017	10/20/2017	4	3

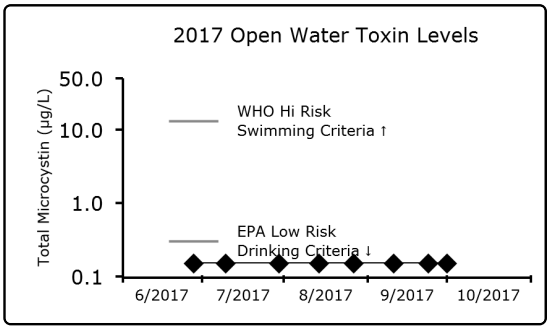
2017 Open Water Algae Samples



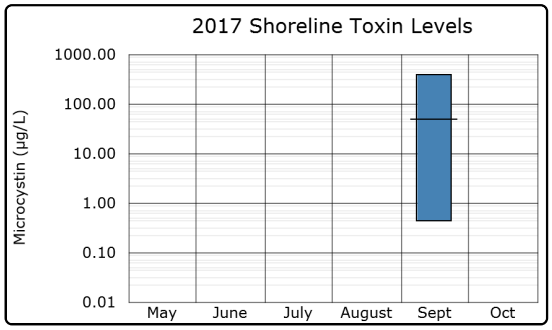
2017 Shoreline Algae Samples



2017 Open Water Toxin Levels

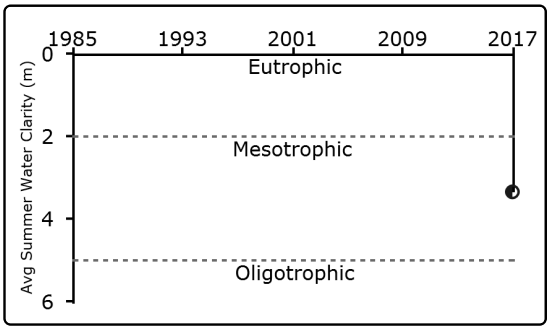


2017 Shoreline Toxin Levels

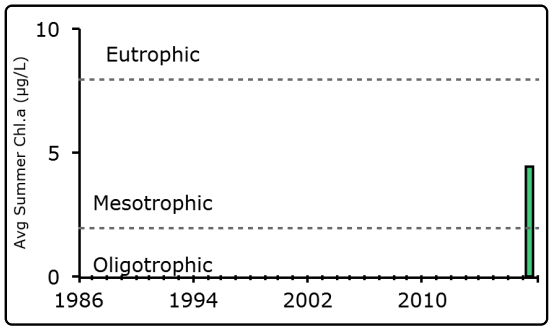


Seneca Lake Long Term Trend Analysis

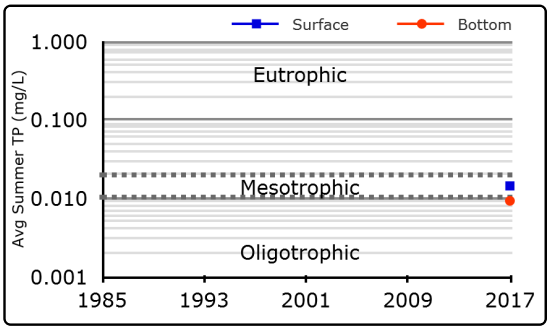
Clarity



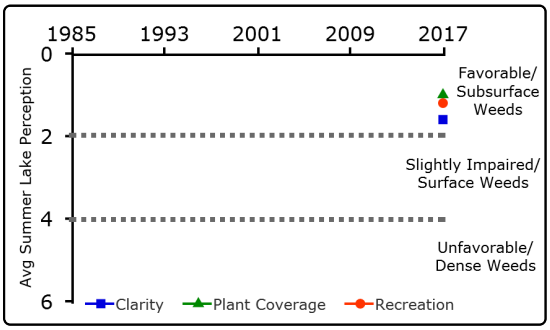
Chlorophyll a



Surface and Deep Phosphorus

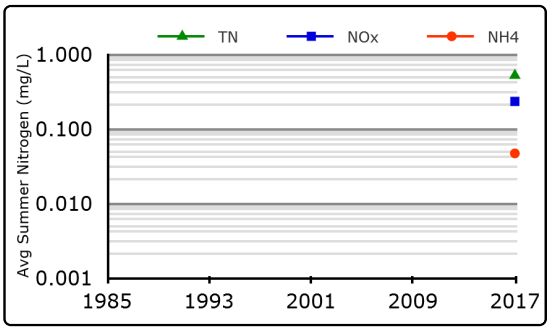


Lake Perception

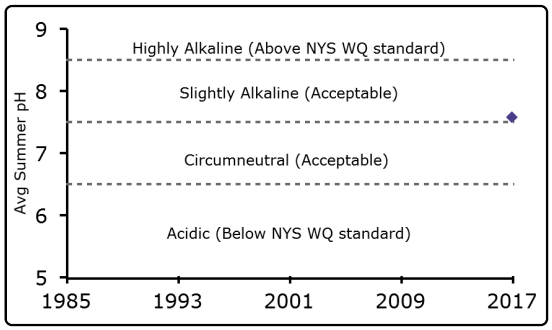


Seneca Lake Long Term Trend Analysis

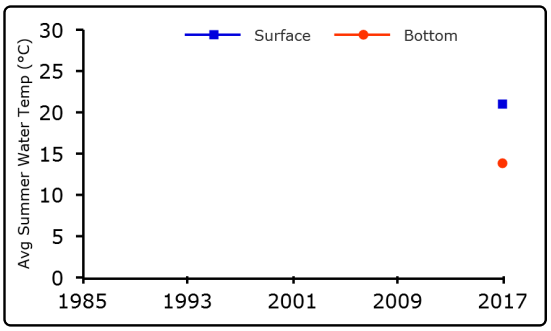
Nitrogen



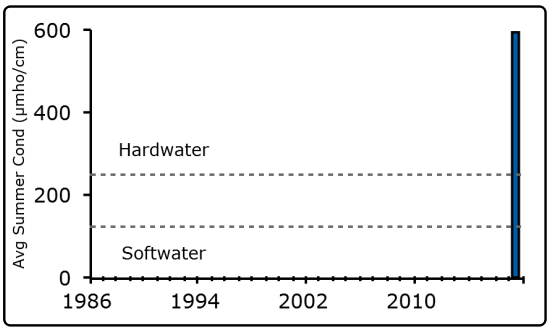
pH



Temperature

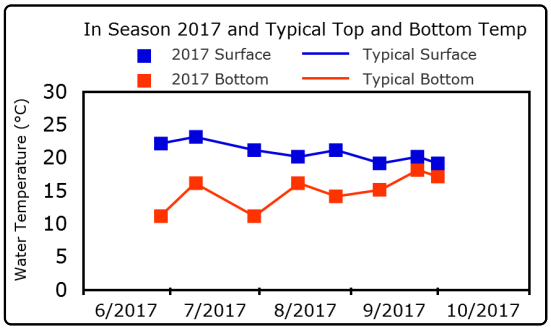


Specific Conductance

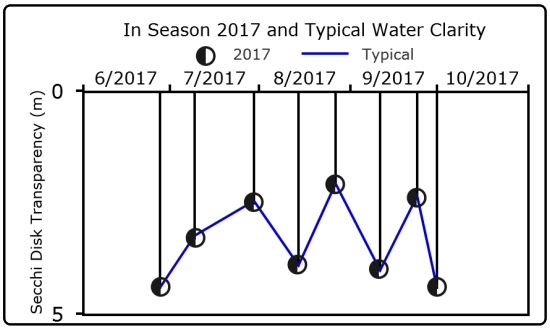


Seneca Lake In-Season Analysis

In Season Temperature



In Season Water Clarity



Scorecard

Lake Use

	PWL	Average Year	2017	Primary Issue
Potable Water	▲	□	□	**No impacts**
Swimming	▲	◆	■	**Algae blooms**
Recreation	●	◆	■	**Algae blooms**
Aquatic Life	□	▲	▲	**Invasive animals**
Aesthetics	□	◆	◆	**Algae blooms**
Habitat	□	◆	◆	**Invasive plants**
Fish Consumption	□	□	□	**Not applicable**

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

Summary

This narrative is a concise summary of 2017 results from the North Site of Seneca Lake. A more detailed evaluation of Seneca Lake and the 2017 Finger Lakes CSLAP program, including available historical NYSDEC data will be presented in a larger NYSDEC Finger Lakes CSLAP report to be released in April 2018. This report will include an enhanced discussion of: (1) spatial differences in Seneca Lake water quality, (2) seasonal patterns in key indicators, (3) differences in vertical water quality, (4) comparisons between Seneca Lake, the other Finger Lakes, and all 2017 CSLAP lakes, and (5) water quality trends over time.

2017 compared to prior years: Seneca Lake was previously sampled through CSLAP from 1991 through 1996, although neither of the 2017 CSLAP sites were sampled in the 1991 to 1996 program. The 2017 data suggests that the north site of Seneca Lake is typical of *mesotrophic* (moderately productive) lakes, based on intermediate water clarity (Secchi disk depth between 2 and 5 m), nutrient (TP levels between 0.010 and 0.020 mg/l) and algae levels (chl.a between 2 and 8 µg/l). Although measured water temperatures decreased during the summer, it is not likely that these are representative of lakewide conditions (and this was not observed in the south lake site). No other strong seasonal changes were measured.

The lake also has alkaline pH (above 7) consistent with very hard water, relatively low color and calcium levels more than high enough to support dreissenid mussels. This site most likely exhibits strong thermal stratification (not apparent from the relatively shallow depth of the deeper samples, corresponding to near water intake depths), although deepwater oxygen levels are probably high. Aquatic plants do not grow to the lake surface in nearby locations, and recreational assessments are highly favorable despite moderate water clarity and consistent with the lack of nearby surface weed growth.

The 2017 data from the north site indicated slightly higher productivity- lower water clarity in response to higher nutrient and algae levels- than in the DEC dataset for Seneca Lake in the late 1990s (the DEC site was near the present CSLAP south site on Seneca Lake). It is not known if the shoreline, and sometimes widespread, cyanobacteria (HAB) blooms on the lake in the last few years represent an ephemeral event or a significant ecological change in development.

Compared to nearby lakes: Seneca Lake has slightly higher water clarity, due to lower nutrient and algae levels, than many other lakes in Seneca-Oneida-Oswego River basin. Chloride levels are above the 50th percentile of New York lakes, but these levels are far below drinking water standards.

Compared to other sites on the lake: Water quality conditions were comparable in the two Seneca Lake CSLAP sites, although algae levels may have been slightly lower in the southern site.

Trends: Water quality trends cannot be evaluated with such limited water quality data, and it is not yet known if the differences between the 2017 CSLAP dataset and the DEC data from the 1990s (collecting using the same sampling protocols and laboratory) represent a long-term trend.

Algal blooms and HABS: Water quality conditions suggest a moderate susceptibility to blooms, based on nutrient and algae levels, and blooms have been reported in several locations in recent years. This may be due to more detailed surveillance and evaluation of blooms in recent years. It is not yet known if these water quality conditions, and the unexpected susceptibility to blooms, are representative of

normal bloom conditions in the lake, and if these conditions are stable. The cause of these blooms, in Seneca Lake and in other New York state lakes, continues to be actively investigated.

Aquatic invasive species: AIS plants reported in the lake include Eurasian watermilfoil and curly leafed pondweed. In addition, quagga mussels; zebra mussels, mud bithynia, scud, bloody-red shrimp, and rudd have also been documented in the lake. The large number of access points and proximity to other infested lakes includes a high vulnerability to new AIS introductions. The hydrilla findings in several locations in Cayuga Lake threaten Seneca Lake and other Finger Lakes.

Indicated Actions: The Seneca Lake Pure Waters Association, The Finger Lakes Institute, Hobart William Smith College, and many other local partners have initiated many actions to reduce nutrient and sediment loading, AIS introductions, and other lake and watershed management actions. In addition to these actions, continued water quality and invasive species monitoring is warranted. Continued algae bloom education and monitoring for HABs is recommended, particularly since blooms have been well documented and reported in recent years. The extensive shoreline surveillance and monitoring network should continue, given the importance of this work for lakefront residents and those using the lake for drinking water and other purposes. The potential impact of blooms and other pollutants to drinking water should be closely monitored.

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, and provides suggested actions for lake management.

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.

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 **NOx** (nitrite and nitrate) and **NH_4** (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.

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 indicate hardwater, and low 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

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.