Water Quality Report
Sagamore Lake
2024

Report prepared for: ***Sagamore Lake Community Association***

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Monitoring performed: *Late Spring and Mid-Summer*

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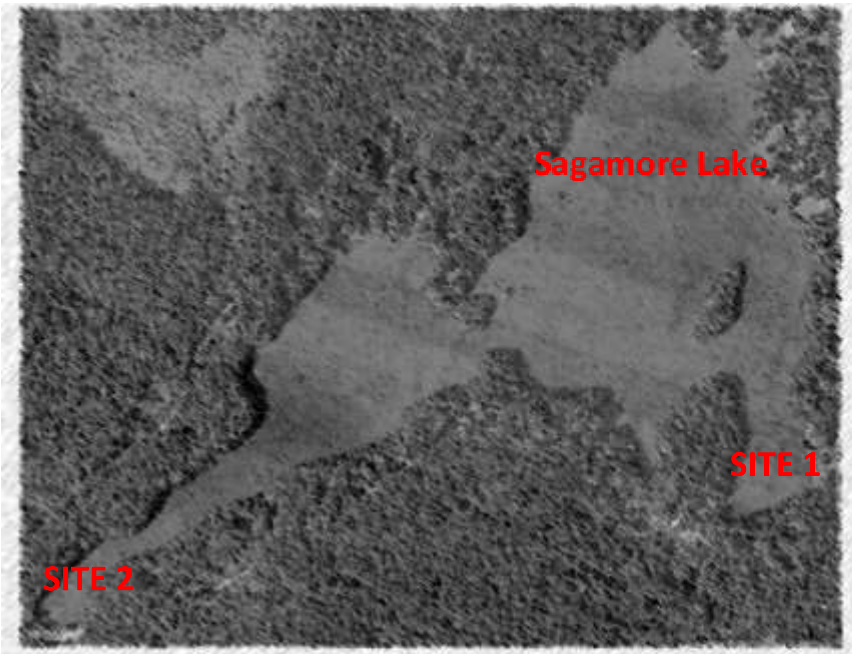
Summary

In 2024, at the request of the Lake Sagamore Community Association (LSCA), AEC continued with the water quality monitoring of Sagamore Lake located in Kent, NY (Figure 1). Based on the findings of the 2023 vegetation survey, AEC recommended that a vegetation survey in 2024 was not necessary.

Figure 1. Sagamore Lake map with sampling locations.



Source: Google Maps

Monitoring was performed to survey water quality conditions at two time points (Late Spring, Mid-Summer) for characterization over the period of recreational use by Sagamore Lake residents. Water quality conditions also provide a baseline for comparison in future monitoring and helps uncover emerging water quality issues which could be of public health concern. In addition, water quality monitoring helps guide management measures to control excess vegetation and harmful algae blooms.

In 2024, monitoring and visual observation suggest that Sagamore Lake continues to have excellent water quality. No adverse water quality conditions requiring supplemental testing or management were observed in 2024. Dissolved oxygen was slightly below optimal levels to sustain fish species during the mid-summer sampling.

Historically, before the addition of sterile triploid carp for vegetation control, Sagamore Lake had high coverage and density of submerged aquatic vegetation in the shallow southern basin, along with moderate coverage in the shallow regions of the northern basin. The high vegetation coverage was impacting recreational use of Sagamore Lake. Similar to 2023, minimal aquatic vegetation coverage (<1%) with emergent/floating-leaved aquatic plants was observed.

Methods

Water Quality Study

We sampled two sites; Site 1 (Dam), Site 2 (Croton River Inlet) during spring (June) and summer (August) at 0.5 meter depths. In addition, we measured water clarity, temperature and oxygen at 0.5-meter depths down to the bottom (4.5 meters) at Site 1 (deep-water near the dam). Sampling included physical, chemical and biological variables with associated methods listed in Table 1 to evaluate water quality in Sagamore Lake.

Table 1. List of variables and associated analytical methods

Variable	***Method***
pH	*YSI multi-meter*
Conductivity	*YSI multi-meter*
Nitrate	*Astoria Pacific - Industrial Method 818-87T*
Phosphate	*Astoria Pacific - Industrial Method 812-86T*
Water Clarity	*Secchi Disc*
Chlorophyll a	*Acetone extraction. Shimadzu Spectrophotometric analysis*
Phytoplankton	*Fixed samples with Lugol's. Identified species with an inverted microscope.*
Temperature and Oxygen	*YSI Multi-Meter*
Phytoplankton Community Identification and Characterization	*Microscopy*

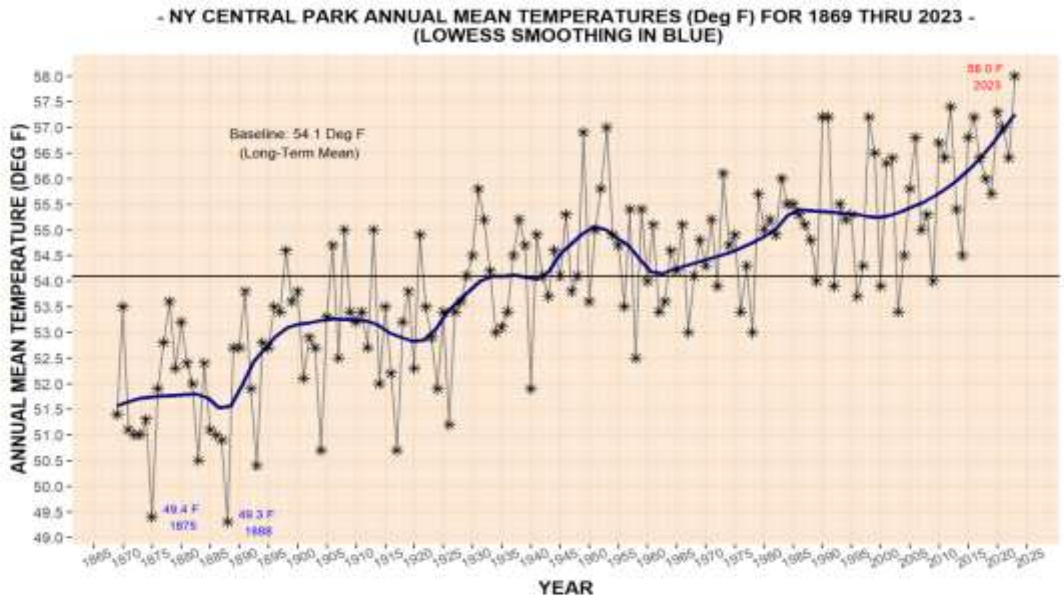
Results

Climatic Conditions

Water quality in waterbodies is highly influenced by climatic conditions. Temperature and precipitation vary from year to year and could be a catalyst to water quality issues. For example, the trend of warmer temperatures (Figure 2) has lengthened the growing season and has, alongside other issues such as human induced excess nutrients, increased the occurrence, frequency, duration, and severity of algae blooms.

In 2024, atmospheric temperatures have been less extreme compared to past recent years with few days above 90^{o}F and fewer precipitation events, leading to less watershed runoff, and hence lower nutrients (nutrients fuel algae blooms). However, earlier than normal warm spring temperatures and extended warmer conditions during autumn extended the growing season.

Figure 2. Historical mean annual air temperatures in New York City from 1869-2023. (Graph: Climatestations.com)



Water quality

Water quality variables are categorized into physical, chemical, and biological parameters. We monitored and measured these variables to characterize water quality and inform on any emerging or current adverse conditions affecting aesthetics, recreation, or public health.

Physical Parameters

For the two sampling dates (Late Spring, Mid-Summer) and two sample sites (Dam, Croton River Inlet) AEC measured water temperature, oxygen, pH, and conductivity.

Table 2. 2024 physical parameters monitored in Sagamore Lake.

Late Spring 2024

Sample Site	Temp (°C)	O2 (mg/L)	O2 Saturation (%)	pH	Conductivity (*u*s/cm)
Dam	23.1	7.6	90	7.69	160
Croton River Inlet	22.6	8.2	97	6.86	156
Mean 2024	**22.9**	**7.9**	**94**	**7.28**	**158**
Mean 2023	**23.3**	**6.0**	**72**	**7.90**	**215**

Mid-Summer 2023 vs. 2024

Sample Site	Temp (°C)	O2 (mg/L)	O2 Saturation (%)	pH	Conductivity (*u*s/cm)
Dam	25.4	4.7	58	7.87	161
Croton River Inlet	25.5	5.4	66	7.57	159
Mean 2024	**25.5**	**5.1**	**62**	**7.72**	**160**
Mean 2023	**25.7**	**7.6**	**95**	**7.59**	**173**

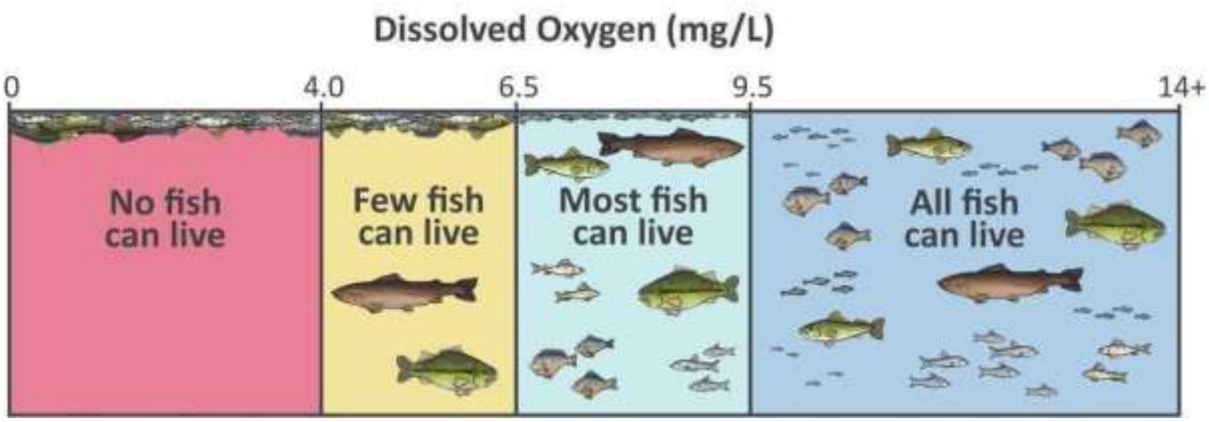
Water Temperature

Water temperature reflects atmospheric temperature. As such, much higher than normal atmospheric temperature results in a longer than average growing season. Also, data from monitoring local surrounding lakes over the last 20 years indicates that water temperatures have been increasing. The consequence of an extended growing season is a contributing factor favoring the occurrence of algae/cyanobacteria blooms.

Oxygen

Dissolved oxygen (DO) is one of the most important indicators of water quality associated with aquatic life. It is essential for the survival of fish and other aquatic organisms. Dissolved oxygen is gaseous, molecular oxygen in the form of O_2 originating from the atmosphere or as a byproduct of photosynthesis. Once dissolved in water, it is available for use by living organisms and can play a significant role in many chemical processes in aquatic environments. Measurements of dissolved oxygen in lakes are an indicator of ecosystem health: repeated low dissolved oxygen measurements are an indicator of impaired water quality. In ecosystems with high photosynthetic production or eutrophic systems, dissolved oxygen fluctuates significantly from day to night as photosynthesis stops at night in the absence of sunlight. Also, acute events such as significant precipitation events with watershed runoff can cause temporarily low dissolved oxygen. The runoff carries nutrients which fuel bacterial growth. In turn, bacterial respiration uses up dissolved oxygen. Healthy oxygen levels in aquatic environments are greater than 6.5 mg/L (Figure 5).

Figure 3. Dissolved oxygen tolerance ranges for fish.



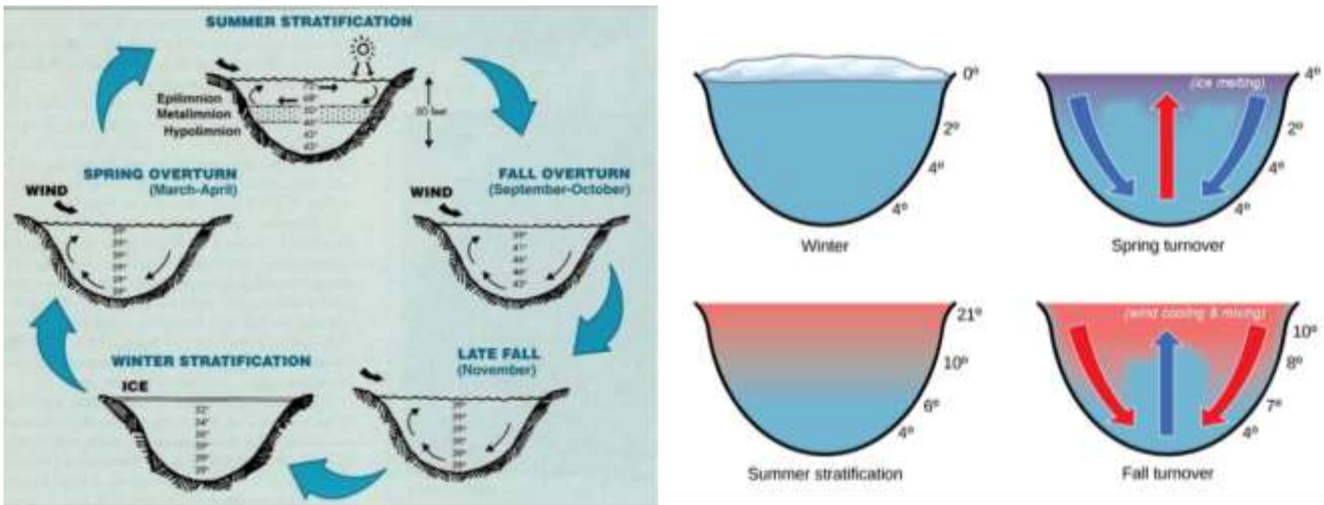
Source: Dissolved Oxygen (DO) (datastream.org)

Based on measured readings (Table 2), dissolved oxygen in Sagamore Lake was below optimal levels in the mid-summer monitoring. As mentioned, acute events such as rainstorms (which did occur just prior to the sampling date, can temporarily lower dissolved oxygen. Consistently low dissolved oxygen indicate impairment and are unfavorable for the survival and reproduction of fish and other aquatic organisms. However, the normal dissolved oxygen measurement during the late-spring sampling suggests the lower measurement in the summer is not a chronic issue requiring further investigation.

Temperature-Oxygen Profile

Temperature and dissolved oxygen were measured at a deep-water location (Site 1) where the maximum depth is about 4.5 meters. For most of the year (much more distinct in mid-summer months) the water column in temperate lakes, such as Sagamore, is stratified (separated into 2 distinct layers with very little mixing) based on water temperature. Winter conditions have colder temperatures at the top and warmer at the bottom and vice versa in other seasons. During the spring when temperatures start to warm and autumn when temperatures cool, there is a brief period where water temperature and oxygen are uniform from surface to bottom. During this time, oxygen poor and nutrient rich water from the bottom mix with oxygen rich lower nutrient surface. These occurrences are called the spring and autumn turnovers. The mixing of nutrients favors the growth of algae and bacteria. During the monitoring period both spring and summer months had warmer surface water layer (epilimnion) than the lower depths (hypolimnion) (Figure 4).

Figure 4. Description of lake summer stratification.



Courtesy: https://images.app.goo.gl/LVULHNnyWYFqcbYi8

In addition to providing a snapshot of lake conditions, the measurement of a vertical temperature and oxygen profile is important for examining year to year patterns. Recent studies have mentioned the warming of lake benthic layers and how these impact nutrient dynamics in a lake and can promote the growth of algae/cyanobacteria.

During the summer months, the upper water layer is warmer, well oxygenated and usually relatively nutrient poor, while the lower layer is cooler, has very low oxygen and is nutrient rich (Figs 7a-b). Northern lakes generally experience a turnover twice annually (during spring when the surface water layer warms up and autumn when it cools down) and is characterized by water temperature and oxygen levels being uniform from the surface to the bottom. The equal temperatures allow a homogeneous mixture of lake water at all depths, which in turn homogenizes oxygen conditions and causes an upwelling of nutrients from the benthic region. Because of the nutrient increase in the upper layers, photosynthetic organisms (algae) thrive, resulting in an algae bloom. The turnover date (spring and autumn) occurs at similar times of the year, though this has been happening earlier in spring and later in summer due to climate warming. The impacts of this are extended growing seasons which are a contributing factor to the occurrence of algae/cyanobacteria blooms, which are a public health concern.

The late spring monitoring indicated that temperature stratification had been established (Fig. 5a), indicating warm spring conditions. The mid-summer monitoring (August) indicates a typical temperature and oxygen stratification (warmer surface temperature with higher oxygen, lower bottom temperature and oxygen) (Fig. 5b).

Figure 5a. Spring Temperature vs Oxygen 2024.

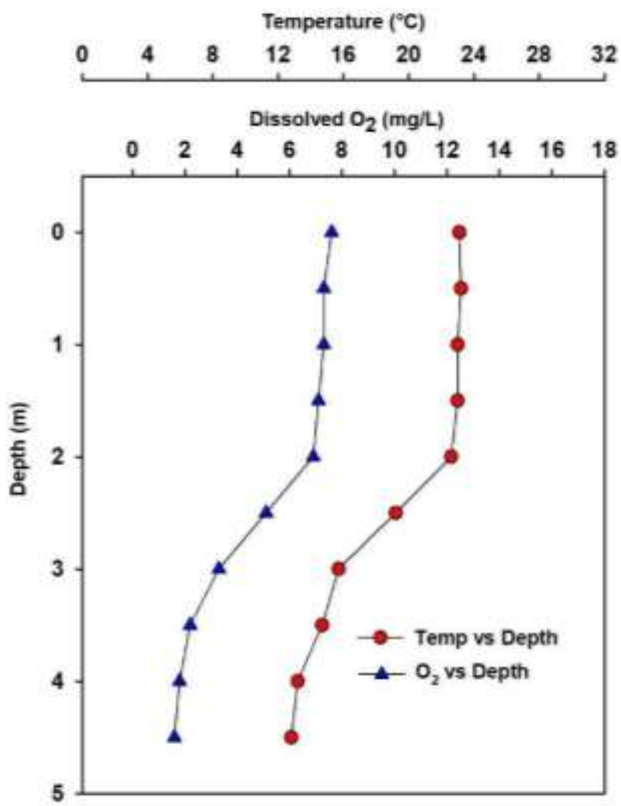
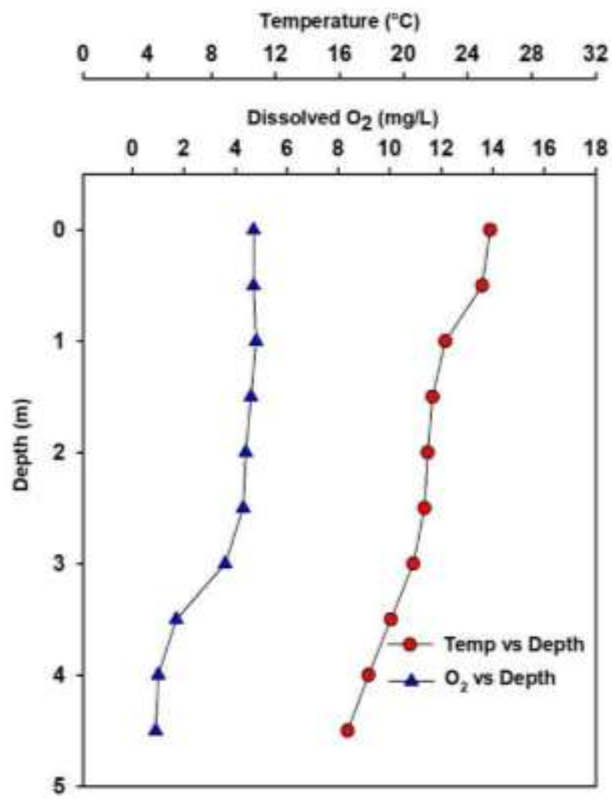


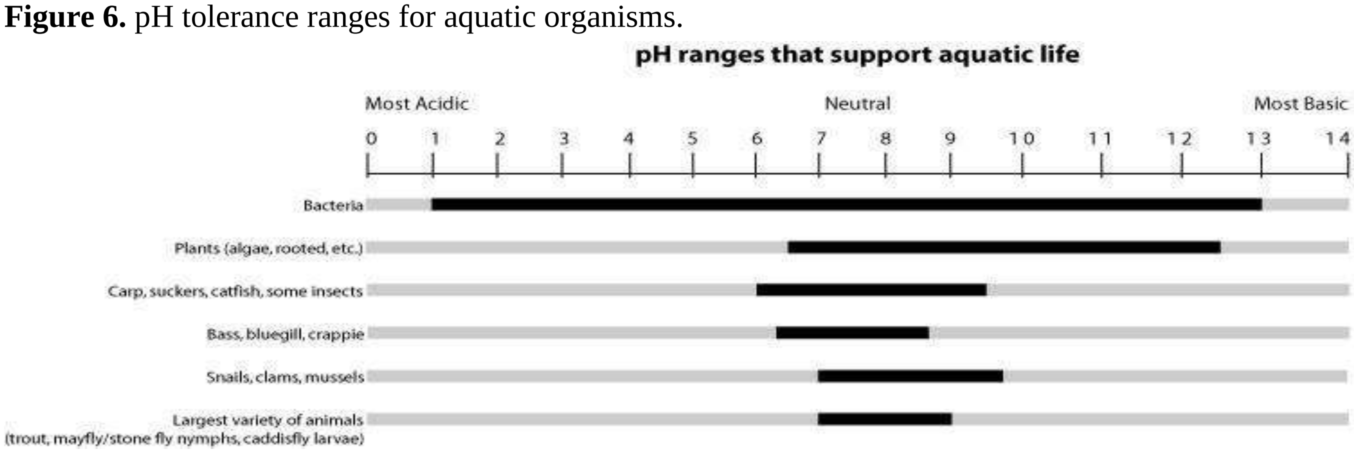
Figure 5b. Summer Temperature vs Oxygen 2024.



pH

The pH level of the water in rivers, lakes, and wetlands is important to plant and animal life. Most animal species cannot survive if the water is too acidic (generally below 5.0), or too basic (above 9.0). Optimal pH for many species is between 7.0 and 9.0 (Figure 6). The measured pH values in Sagamore Lake were all within the optimal pH range and thus supports most aquatic organisms (Table 2).

Figure 6. pH tolerance ranges for aquatic organisms.

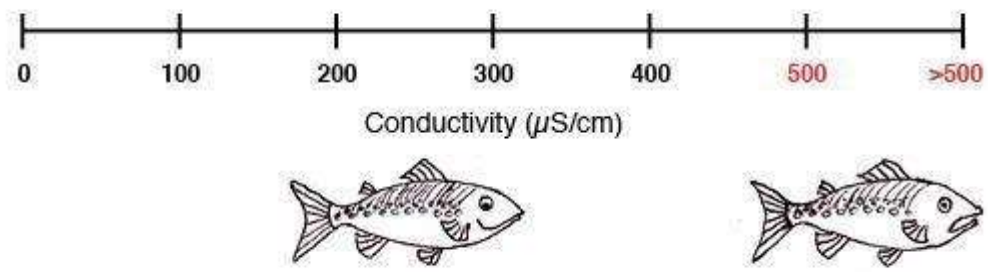


Source: pH | Limno Loan Program

Conductivity

Conductivity is a measure of a material's ability to conduct an electric current. Conductivity in water quality corresponds to a measure of dissolved salts. The concentration of dissolved salts in lakes and ponds has been increasing in the Northeastern United States. This increase is attributed to the use of salt and deicers to maintain safe road conditions in the winter. Unfortunately, the increased dissolved salt is having negative ecological impacts such as delaying spring turnover (the mixing of water and reoxygenation of bottom layers in a lake). Thus, harming less tolerant freshwater organisms, which in turn favors nuisance species, sometimes leading to adverse aquatic conditions. Conductivity measurements taken during the spring and summer (Table 2) were well within the optimal range to support fish populations (Figure 7) in Sagamore Lake.

Figure 7. Conductivity ranges that support fish species.



Source: Water Quality 101 | ACE Project (ace-project.org)

Chemical Parameters

For the two sampling dates and locations, AEC monitored soluble reactive phosphorus (SRP) and nitrate (NO^{3-}) in Sagamore Lake. Nitrogen and phosphorus are the two most important nutrients for plant and algae growth in lake environments. The measure of nitrogen and phosphorus is one of several indices to gauge lake productivity (plants and algae growth – biomass) which range from oligotrophic (low nutrients), mesotrophic (moderate nutrients) and eutrophic (high nutrients) (Figure 8).

Figure 8. Indices of primary productivity in aquatic environments.

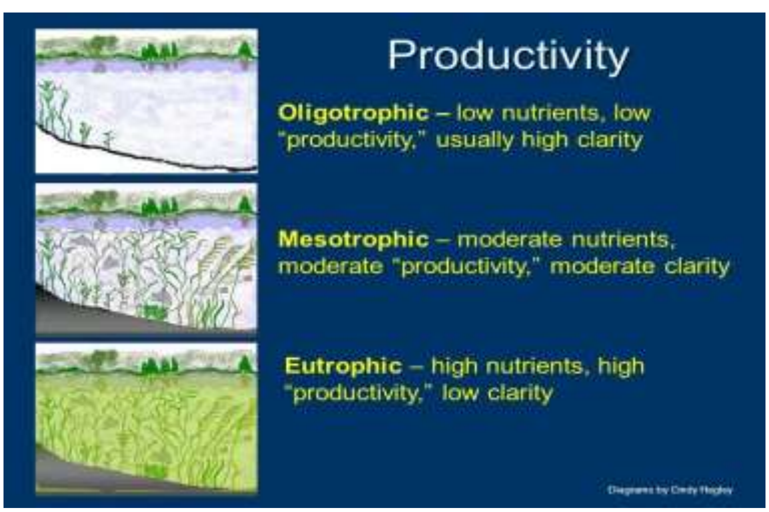


Table 3. Chemical parameters monitored in Sagamore Lake.

Late Spring 2024 vs. 2023

Sample Site	SRP (*ug*/L)	NO^{3-} (*ug*/L)
Dam	7.68	25.11
Croton River Inlet	7.89	19.53
Mean 2024	**7.79**	**22.32**
Mean 2023	**16.8**	**10.62**

Mid-Summer 2024 vs. 2023

Sample Site	SRP (*ug*/L)	NO^{3-} (*ug*/L)
Dam	4.54	10.01
Croton River Inlet	4.59	18.05
Mean 2024	**4.57**	**14.03**
Mean 2023	**15.90**	**15.93**

Soluble Reactive Phosphorus

The measure of Soluble Reactive Phosphorus (SRP) is the form of phosphorus available for use by plant cells for growth and reproduction. Phosphorus is also the nutrient that is most often limiting in most lake ecosystems and the control of it can control nuisance algae and excess aquatic vegetation. Primary sources of SRP include surface runoff (especially in urban environments), and in shallow lakes such as Sagamore Lake, internal loading. The internal load is not a source of new phosphorus, it is the phosphorus that has accumulated over time and that moves between the sediments and water column. The measure of SRP in Sagamore Lake is performed to monitor the amount available for plant growth. According to the SRP measurements (Table 3), Sagamore Lake is a moderately productive lake (mesotrophic), which is characterized as containing moderate amounts of nutrients with healthy populations of aquatic plants, algae, and fish. Occasional algae blooms may occur. Since phosphorus is the primary driver of plant and algae growth in lakes (which has been demonstrated in past experiments), it is important to limit the amount of outside nutrients entering the lake by eliminating phosphorus fertilizers, planting border vegetation, reducing wildlife inputs (geese), and minimizing sediment inputs from road runoff. In 2024, phosphorus measurements were notably lower than 2023 for both spring and summer sampling. This is likely a result of fewer intense storms which caused fewer watershed runoff events carrying phosphorus.

Nitrogen

Nitrogen provides the essential nutrients for all living organisms. Our measure of nitrogen, nitrate, is often associated with flow of human and animal waste, industrial pollutants, and agricultural activity. Elevated concentration of nitrate can increase algae growth and reduce the amount of dissolved oxygen in the water, killing fish and other aquatic life. Like phosphorus, nitrogen is an indicator of the trophic state. As mentioned, these two nutrients are the most important in driving the growth of aquatic vegetation and algae. Over the course of a typical growing season, phosphorus is the primary nutrient limiting phytoplankton growth, which means that all other nutrients are in excess and are present in water. With man-made sources of phosphorus; such as, fertilizers, and road deicers, biologically available or usable nitrogen can become limiting. The seasonal depletion of nitrate, which has been observed annually in many lakes, seems to correspond with the emergence of cyanobacteria in the phytoplankton community. Alongside low turbulence, and warmer temperature, cyanobacteria can capture nitrogen from the atmosphere by floating to the surface (other algae have a much lower buoyancy capacity), which allows them to outcompete normally dominant algal species and possibly causing nuisance or harmful algal blooms. The extension of the growing season with warmer climates favors the earlier depletion of nitrate and increases the frequency of cyanobacteria blooms. According to the nitrate measurements (Table 3), Sagamore Lake is characterized as a moderately productive lake (mesotrophic). In 2024, nitrate measurements were greater in the spring, but slightly lower in the summer monitoring. The phytoplankton assessment section indicates an abundance of atmospheric nitrogen-fixing algal species in the spring, which may reflect this finding.

Biological Parameters

Biological parameters are monitored to evaluate indices of primary productivity and indicator species which can identify current or emerging water quality issues.

Chlorophyll a / Secchi Depth

Chlorophyll *a* is a measure of the amount of algae (phytoplankton biomass) growing in a waterbody. It can be used to classify the trophic condition of a waterbody. According to North American Lake Management Society's trophic state index(https://www.nalms.org/secchidipin/monitoring-methods/trophic-state-equations/), mean chlorophyll *a* measurements in Sagamore Lake are consistent with a mesotrophic or moderately productive lake. Additionally, chlorophyll *a* data indicates slightly higher phytoplankton abundance in 2024, but this was heavily weighted by higher phytoplankton abundance in the spring compared to the summer. This is likely due to the overall low precipitation in the summer and correspondingly lower phosphorus. As a reminder, phosphorus is generally the limiting nutrient for phytoplankton growth.

Secchi depth (a physical parameter) is the measure of water clarity by dipping a Secchi disk to the depth at which it is no longer visible. This measurement is an index of water clarity and is related to turbidity. Turbidity is a measurement of the concentration of suspended particles such as suspended particulate matter or algae. Generally, lower turbidity or higher water clarity is associated with higher water quality and vice versa. Similar to chlorophyll *a*, water clarity can also be used to classify the trophic status of a lake, thus the water clarity of Sagamore Lake is consistent with a meso- to eutrophic condition. In 2024, water clarity was approximately 1.5 meters for both the spring and summer sampling dates, and was slightly greater than in 2023. The higher water clarity in 2024 was likely a result of fewer storms which cause overland runoff of suspended particles into Sagamore Lake.

Figure 9. a) Chlorophyll *a* and Secchi depth measurements in Sagamore Lake in Late Spring and Mid-Summer 2024.

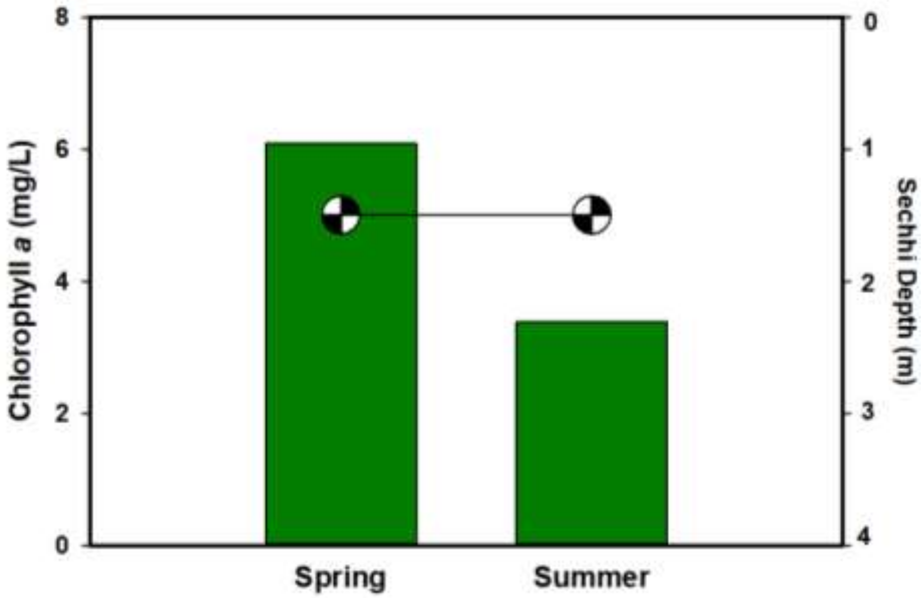
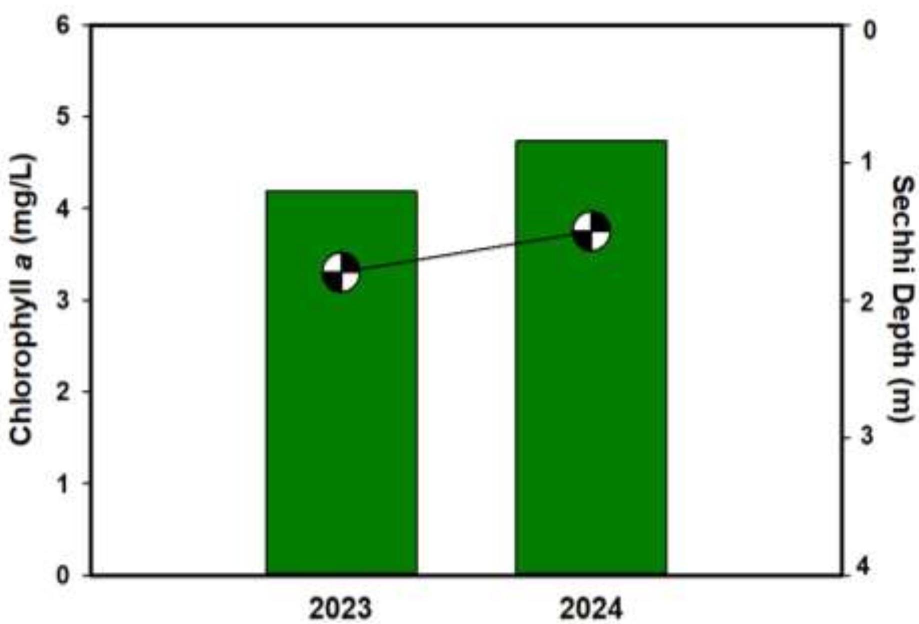
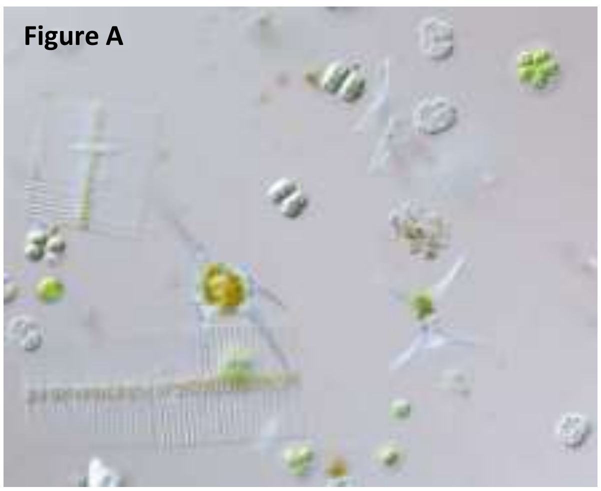


Figure 9b. Chlorophyll *a* measurements in 2023 and 2024: A comparison.



Sagamore Lake - Phytoplankton Assessments 2024

Background. Monitoring programs routinely use information based on the abundance (biomass) and species composition of phytoplankton assemblages (freely-floating algae), because they reflect a longer view of ecological conditions than can be provided by a set of nutrient samples from a single date. A diverse phytoplankton community is generally regarded as an indication of a healthy lake. These algae form the base of lake food webs and generate most of the oxygen in these ecosystems, but occasionally cause nuisance problems. For example, a diversity of species of diatoms, green algae and various flagellates (Figure A) with no single species in abundance, indicate lower nutrient levels and a generally healthy lake. In contrast, a dense phytoplankton assemblage dominated but a few species of cyanobacteria (Figure B) indicate elevated nutrients (human-caused eutrophication) and deteriorated water quality. (Note: the images shown below are samples from two different lakes as examples only, not Sagamore Lake).



Spring – Summer Phytoplankton Community of Sagamore Lake in 2024

This was the second year in which an assessment of phytoplankton from Sagamore Lake in Putnam County, New York was conducted.

Samples and Purpose. Sampling was conducted in June and August of 2024, which was the same time as the monitoring performed in 2023. On each sample date, a surface sample was collected from near the Croton River inlet and near the dam. The goals of these data were (1) to assess the major algal groups in the community, and (2) determine what species serve as indicators of water quality. These data will serve as a basis for comparison with conditions in future years.

How to Read These Data. Table 4 list species of algae observed in samples collected from a 1-m depth by location. The numbers after species names represent the relative abundances (in ranks) of each species by site, to better assess differences in species richness and composition.

The ranks are as follows: 0 = absent or not seen; 1= rare (< 1%); 2 = occasional (1-5%); 3 = common (6-25%); 4 = abundant or dominant (26-50%); 5 = massive or blooms (>50%).

Because some species of cyanobacteria (blue-green algae), when in high ("bloom") densities, can impair water quality, this assessment also includes a percentage assessment of the relative importance of cyanobacteria in each period: the **Cyano Index**, with values from 0 to 100% of total biovolume.

Table 4. List of common phytoplankton (algal) species by taxonomic group, collected from Sagamore Lake in June and August 2024, with relative abundances given as rank scores:

0 = absent or not seen	1 = rare (<1%)	2 = occasional (1-5%)	3 = common (6-25%)	4 = abundant or dominant (26-50%)	5 = massive or blooms (> 50%)

	June 13		August 27	
	Inlet	Dam	Inlet	Dam
Cyanobacteria				
Anabaena echinospora; subspherical; elongate akinete adj. heterocyte	1	0	0	0
Aphanizomenon flos-aquae	0	0	0	0
Aphanocapsa sp. 1	0	0	2	0
Dactylococcopsis cf. smithii	2	2	1	1
Dolichospermum cf. affine; barrel, narrow: 6.0-7.0 um*;* akinete distant	4	4	3	2
Dolichospermum cf. flos-aquae; coiled	2	2	0	0
Dolichospermum planctonicum; spherical 7.3-9.1 um; akinetes pairs	3	4	2	1
Planktolyngbya cf. limnetica (1-15.um; ends rounded)	1	2	3	2
Merismopedia tenuissimia	0	0	1	0
Microcystis cf. aeruginosa	0	0	0	1
Microcystis wesenbergii	1	1	1	2
Oscillatoria sp. 1 (4-5 um)	1	1	0	0
Woronichinia naegeliana	0	0	0	0
Chlorophyta				
Ankistrodesmus falcatus	1	2	2	1
Golenkinia radiata	1	2	1	0
Eudorina elegans	0	1	0	0
Oocystis lacustris	1	0	0	0
Desmidium cf. schwartzii	1	0	0	0
Pandorina cf. morum	1	2	2	1
Planktosphaeria gelatinosa	0	1	0	1
Scenedesmus spp.	0	0	1	1
Sphaerocystis schroeteri	2	2	1	1
Spirogyra sp. 1; single chloroplast; 16-17 um	0	2	0	0
Tetraedon cf. regulare	0	0	1	1
Tetraedon cf. regulare	0	1	0	0
Euglenophyta				
Euglena cf. mutabilis	0	2	1	0
Phacus sp. 1	0	0	0	1
Trachelomonas volvocina	2	1	1	2

Table 4, continued. List of common phytoplankton (algal) species by taxonomic group, collected from Sagamore Lake in June and August 2023, with relative abundances given as ranks:

0 = absent or not seen	1 = rare (<1%)	2 = occasional (1-5%)	3 = common (6-25%)	4 = abundant or dominant (26-50%)	5 = massive or blooms (> 50%)

	June 13		August 27	
	Inlet	Dam	Inlet	Dam
Chrysophyta				
Dinobryon bavaricum	0	0	0	1
Dinobryon cylindricum	0	0	3	2
Dinobryon divergens	3	4	2	2
Mallomonas cf. akrokomos	2	2	0	1
Mallomonas sp. 1	1	1	1	0
Bacillariophyta				
Asterionella formosa	1	2	1	1
Aulacoseira granulata	1	2	0	1
Aulacoseira granulata var angustissima	2	2	1	1
Cocconeis pediculus	1	1	1	0
Cymbella cf. cistula	0	1	1	0
Ellerbeckia arenaria	0	1	0	0
Fragilaria cf. capucina	1	2	2	1
Fragilaria crotonensis	3	3	2	1
Gomphonema sp. 1	1	1	1	0
Gomphonema acumunatum	1	0	0	0
Melosira radians	1	2	1	1
Navicula radiosa	1	2	0	1
Nitzschia sp. 1	0	0	0	1

Table 4, continued. List of common phytoplankton (algal) species by taxonomic group, collected from Sagamore Lake in June and August 2023, with relative abundances given as ranks:

0 = absent or not seen	1 = rare (<1%)	2 = occasional (1-5%)	3 = common (6-25%)	4 = abundant or dominant (26-50%)	5 = massive or blooms (> 50%)

	June 13		August 27	
	Inlet	Dam	Inlet	Dam
Tabellaria fenestrata	4	4	3	2
Ulnaria ulna	0	1	0	0
Pyrrophyta				
Ceratium hirundinella	1	1	1	2
Peridinium sp. A (small: 20-22 um long)	2	2	3	4
Peridinium sp. B (larger, with spine; 45-50 um)	0	0	3	2
Cryptophyta				
Cryptomonas sp. A (24-35 um)	2	2	2	1

Comments and Ecological Indications. The algal community in Sagamore Lake continues to be typical of meso-eutrophic or eutrophic lakes that in this region. A few detailed comments are below.

Major species:

In June, Sagamore Lake experienced a bloom of the filamentous cyanobacteria, mainly Dolichospermum cf. affine / macrosporum and Dolichospermum planctonicum; both are nitrogen fixers. Both species were present in 2023, but in lower densities in June, and only abundant in August. They seem to have peaked earlier in the year in 2024. They co-occurred with chrysophyte Dinobryon divergens, which was also abundant in June 2023. We reiterate that not all algal blooms are health concerns, but heavy growth of Dinobryon another chrysophytes, like Dinobryon species, can cause taste or odor issues (“fishy “smell), especially if water is used for drinking water purposes. Unlike 2023, in late August 2024, cyanobacteria were common but less abundant.

Below is a comparison of the estimated Cyano-Index values (by percentage) for the two years.

	2023				2024			
	June 13		August 27		June 13		August 23	
	Inlet	Dam	Inlet	Dam	Inlet	Dam	Inlet	Dam
% Cyano	**13.3%**	**12.0%**	**53.0%**	**57.4%**	**40.8%**	**36.9%**	**23.5%**	**27.1%**
% Greens	1.5%	0.6%	1.4%	1.7%	3.5%	8.5%	8.0%	6.8%
% Euglenos	0.6%	0.3%	0.9%	3.4%	2.3%	1.9%	1.1%	10.2%
% Chrysos	59.8%	65.1%	30.6%	13.6%	11.9%	16.8%	19.8%	23.7%
% Diatoms	24.1%	21.3%	13.7%	20.4%	38.8%	32.5%	25.1%	18.6%
% Dinos	0.6%	0.6%	0.5%	3.0%	0.4%	1.7%	19.3%	11.9%
% Cryptos	0.0%	0.0%	0.0%	0.4%	2.3%	1.7%	3.2%	1.7%

Most cyanobacteria were filamentous forms, including Aphanizomenon flos-aquae, Dolichospermum cf. affine / macrosporum, Dolichospermum planctonicum, and Planktolyngbya cf. limnetica. None of the most abundant species are known to be toxin producers. Aphanizomenon flos-aquae may at times produce toxins when very abundant, but it was a very minor member of the phytoplankton on both dates.

Members of two other algal groups were also important in 2024: two species of the dinoflagellate Peridinium and two diatoms, especially Tabellaria fenestrata and Fragilaria crotonensis, were also common.

Figure 10. Examples of common phytoplankton species observed in Sagamore Lake in 2024.

Dinobryon divergens *Dolichospermum planctonicum* *Dolichospermum cf. affine*

Conclusions

Physical Parameters

Overall, Sagamore Lake's physical variables indicated unimpaired water quality. However, the summer dissolved oxygen measurement was below optimal levels. As mentioned, acute events such as storms can cause temporarily lower dissolved oxygen. The low measurement seems to be an acute event (storm). Second, a more global issue is increasing water temperature due to climate change which extends the growing season and increases the chances of harmful or nuisance algae blooms. All other physical parameters suggest water quality is suitable to sustain a healthy fish population and ecosystem.

Chemical Parameters

The chemical data (the measure of phosphorus and nitrogen) suggest Sagamore Lake is a moderately productive lake which could lead to excess aquatic vegetation and algae blooms. Intense storm runoff causing pulses of nutrients from the surrounding watershed into the lake are contributors to these conditions. This is generally common in suburban lakes due to removal of vegetation in favor of impervious surfaces (i.e., roads), the application of road salt and abrasives (which contain high phosphorus), the use of fertilizers, failing septic systems, and engineering measures (such as road curbing and culverts) which accelerate and concentrate runoff into lakes; in 2024, lower than average precipitation resulted in fewer runoff events and correspondingly, phosphorus measurements were lower than 2023.

Biological Parameters

Chlorophyll *a* and phytoplankton community characterization also both suggest Sagamore Lake is a moderately productive lake. Although there was a sharp increase ('bloom') of cyanobacteria measured in the spring samples only, a widespread algal bloom was not observed in 2024. Low phosphorus levels throughout the growing season is most likely the reason that a lake wide bloom was not observed.

Overall, Sagamore Lake is safe and generally has excellent quality, but as with other lakes in the region, they are moderately productive and susceptible to nutrient influxes due to climatic driven issues (extreme precipitation events, warmer temperatures extending the growing season), which result in increasingly common harmful and nuisance algae blooms, and elevated fecal coliform bacteria. Below are management methods currently used or should be considered to maintain water quality and correct issues.

Sagamore Lake management methods in use and to be considered:

In use: **Sterile triploid grass carp –** Triploid Grass Carp are a controlled species for aquatic vegetation control and require a permit from the NYS DEC **(http://www.dec.ny.gov/outdoor/7973.html)**.
Since adding too many carp has implications for the occurrence of cyanobacteria blooms, eradicating all vegetation (re-emerging species are sometimes not the same and can be more of a nuisance) is not beneficial to the whole lake system, the carp stocking program could only be resumed once vegetation coverage increases to DEC guided targets. Once this is attained, a small amount of carp re-stocking should occur every 2-3 years to maintain a stable population (since they cannot reproduce, some are lost to mortality). Also, their feeding rates drop significantly after approximately 8 years. This method should continue to be used and evaluated year to year (by conducting a vegetation survey), in order to guide future stocking. Since there is <1% vegetation coverage, a vegetation survey will not be necessary until some vegetation coverage is restored.

Proposed: **Aquatic Herbicide/Algaecide** – if significant algae or aquatic vegetation becomes a nuisance to recreation, the application of aquatic herbicides in a targeted manner is very effective at quickly eradicating any algal or excess aquatic vegetation. However, it needs to be performed annually and cost is relatively high. In addition, the application of chemicals, though a low risk, does have some environmental concerns, with the accumulation in the sediment, resulting in higher costs if dredging is required. Herbicide or algaecide is not preferred in Sagamore Lake but can be considered in the event of a massive, prolonged algae bloom. Typically, to employ this management method, a permit must be filed in spring of each year since it takes 8-10 weeks to obtain a permit and a timely response would not be possible if applying when an algae bloom or excess vegetation condition emerged. For 2025, AEC proposes to apply for an aquatic herbicide application permit. AEC recommends the use of this herbicide only if there is an algal bloom. This is considered a last resort strategy to restore the interruption of recreational use of Sagamore Lake.