Three Lakes Algal Monitoring
2023 Report

Lake Rippowam, Lake Oscaleta, & Lake Waccabuc

SOLITUDE LAKE MANAGEMENT

310 East Washington Ave Suite C
Washington, NJ 07882
Phone: 908-850-0303
www.solitudelakemanagement.com

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Introduction

The Three Lakes Council maintains an outstanding water quality monitoring program to properly manage its three lakes: Lake Waccabuc, Lake Oscaleta and Lake Rippowam. This includes conducting the CSLAP Water Quality Monitoring Program with assistance from the New York State Department of Environmental Conservation (NYSDEC) and the New York State Federation of Lake Associations (NYSFOLA), as well as further water quality testing beyond these programs. This data is reviewed and used to maintain the lakes as a natural resource for the community for recreation and aesthetic value. SŌLitude Lake Management was pleased to provide services to the Three Lakes Council again in 2023. Phytoplankton and zooplankton samples for each of the three lakes were collected by the client on August 10th, 2023. A separate report will outline and discuss the zooplankton results of 2023. This is the 14th season SŌLitude Lake Management has partnered with the Three Lakes Council.

Algae Monitoring

Methodology

Three Lakes Council (3LC) volunteers collected a single algal sample from each basin on August 10th, 2023, and delivered them to SŌLitude Lake Management (SLM) staff for laboratory analysis. In an effort to compare historical data, sampling dates were selected based on previous sampling events. Subsequently, the same historical sample sites, established by the CSLAP monitoring stations on all three lakes, were re-selected. To remain in compliance with the standards of the EPA and the World Health Organization, SOLitude Lake Management has updated their algae analysis method to cells per milliliter.

Algal samples were collected at a depth of 1.5 meters at each station using clean 250 mL HDPE or Nalgene plastic bottles. To preserve the integrity of the sample, bottles were immediately placed in a dark cooler with ice. The samples were returned to SŌLitude Lake Management's laboratory for analysis preparation. Before examination, 50 mL of each of the algae samples were transferred to clean conical centrifuge test tubes with five drops of Lugol's solution of iodine for preservation. The samples were then placed on a test tube rack and moved into the laboratory refrigerator at 4℃ to begin the sedimentation process. Sedimentation was complete after being undisturbed for at least 24 hours. After sedimentation, a calibrated pipette was used to extract 115 µL from the bottom layer of the sample and transferred to a nanoplankton chamber slide (Palmer Maloney, or equivalent). Using a compound microscope with 100X magnification and appropriate taxonomic keys, all algal genera were identified and counted to the cell. The guidelines below, summarized by the Environmental Protection Agency, are used to determine algal density results, and advise on any potentially harmful algal blooms.

WHO's Guidelines for Safe Practice in Managing Recreational Waters*

Guidance level or situation	How guidance level derived	Health risks	Typical actions
Relatively low probability of adverse health effects 20 000 cyanobacterial cells/ml *or* 10 ug chlorophyll-a/litre with dominance of cyanobacteria	From human bathing epidemiological study	Short-term adverse health outcomes, e.g., skin irritations, gastrointestinal illness	Post on-site risk advisory signs Inform relevant authorities
Moderate probability of adverse health effects 100 000 cyanobacterial cells/ml *or* 50 ug chlorophyll-a/litre with dominance, of cyanobacteria	From provisional drinking-water guideline value for microcystin-LR and data concerning other cyanotoxins	Potential for long-term illness with some cyanobacterial species health outcomes, e.g., skin irritations, gastrointestinal illness	Watch for scums or conditions conducive to scums and further investigate hazard Post on-site risk advisory signs Inform relevant authorities
High probability of adverse health effects Cyanobacterial scum formation in areas where whole-body contact and/or risk of ingestion/aspiration occur.	Inference from oral animal lethal poisoning. Actual human illness case histories	Potential for acute poisoning Potential for long-term illness with cyanobacterial species Short-term adverse activities health outcomes, e.g., skin irritations, gastrointestinal illness	Immediate action to control contact with scums; possible prohibition of swimming and other water contact activities Public health follow-up investigation Inform public and relevant authorities

*Summarized by EPA from World Health Organization. 2003. Guidelines for safe recreational water environments. Volume 1, Coastal and fresh waters.

Figure 1. World Health Organization's Guidelines for Cyanobacteria in Recreational Waters

2023 Algal Results

Cyanobacteria were present in all three lakes and dominated Lake Rippowam. This is a positive change from last year, as cyanobacteria also dominated Lake Waccabuc. The dominance of green algae in both Lake Oscaleta and Lake Waccabuc in 2023 is encouraging, as it implies these benign algae are outcompeting the cyanobacteria.

Because algae are excellent indicators of water quality and system health, it is recommended that stakeholders invest in a robust monitoring plan that extends parameters and sample frequency. The additional data would support improved conclusions and recommendations.

Table 1: 2023 Algal Totals and Percent Distribution						
Functional Group	**Lake Rippowam**		**Lake Oscaleta**		**Lake Waccabuc**	
	Cells/mL	%	Cells/mL	%	Cells/mL	%
Diatoms	560	6.0%	2,944	28.0%	2,104	6.6%
Golden Algae			280	2.7%		
Green Algae	1,402	14.9%	6,310	60.0%	18,930	59.0%
Cyanobacteria (Blue-Green Algae)	5,889	62.7%	561	5.3%	10,376	32.3%
Euglenoids	1,262	13.4%	421	4.0%	701	2.2%
Dinoflagellates	280	3.0%				
Total Cells/mL	**9,393**	**100%**	**10,516**	**100%**	**32,111**	**100%**

Lake Rippowam

In 2023, the algal distribution at Lake Rippowam was the least diverse out of the three lakes (Table 1). There were eight (8) different genera observed at Lake Rippowam including: *Synedra, Oocystis, Peridinium, Euglena, Trachelomonas, Gloeocystis, Stephanodiscus and Aphanizomenon*. The genera were spread out over five functional groups: diatoms, dinoflagellates, euglenoids, green algae, and cyanobacteria. Algal density was considered low at 9,393 cells per milliliter and was the lowest overall abundance of the three lakes. The only functional group that was not represented in this year's assemblages were golden algae. The most abundant functional group of algae observed was nuisance cyanobacteria (62.7%), which was dominated by *Aphanizomenon* at 5,889 cells/mL (Figure 2). Although cyanobacteria were the dominant group represented, green algae accounted for 14.9% (or 1,402 cells/mL) of the total assemblage in 2023. The third most abundant group was euglenoids at 13.4% (or 1,262 cells/mL). Low amounts of diatoms and dinoflagellates rounded out the assemblage at this site in early August. These results are similar to the percent distributions observed in 2022 and continue to be the average for Lake Rippowam.

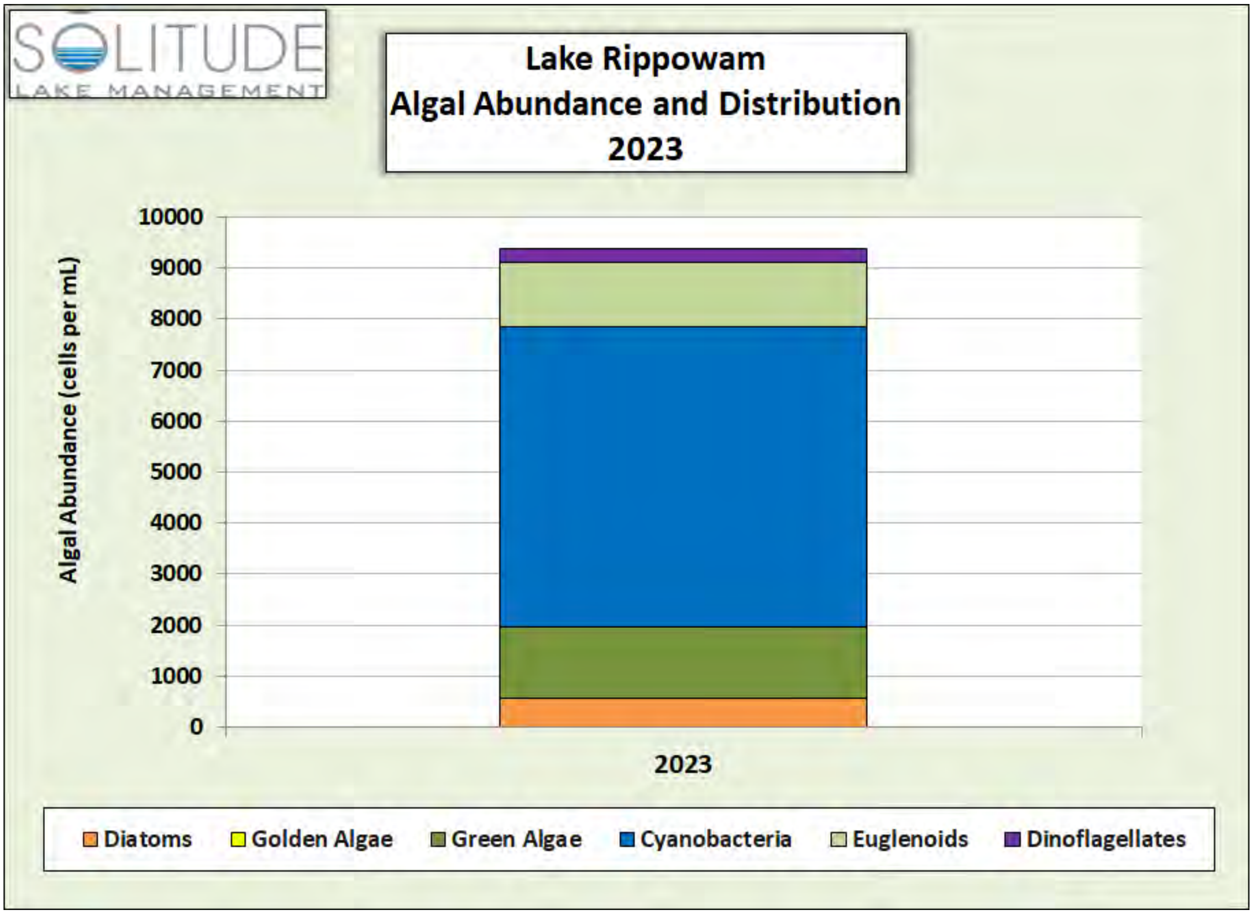


Figure 2. Lake Rippowam Algal Abundance and Distribution (cells/mL), 2023

At Lake Rippowam, algal abundance and distribution has varied greatly over the years but remains high on average (Figure 3). In 2021, overall abundance increased significantly (2020: 880 organisms/mL, 2021: 1,640 organisms/mL) but decreased in 2022. This could be attributed to a variety of factors, including decreased rainfall from the mid-season drought. Less rainwater runoff prevents extra nutrients from being introduced into the system that could cause prolific algal growth. However, less rainfall can cause other stressors to affect the lake ecosystem and surrounding area.

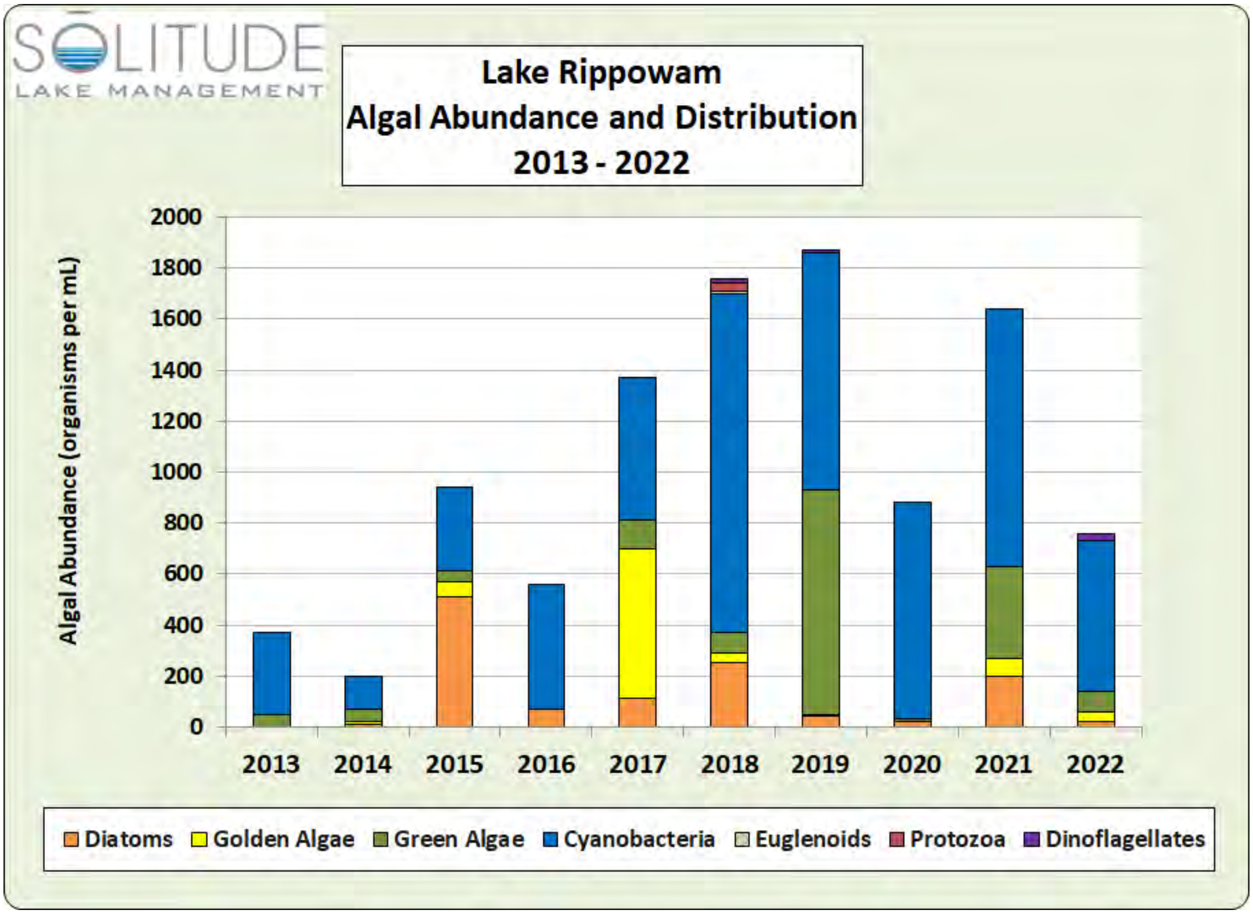


Figure 3. Lake Rippowam Algal Abundance and Distribution (orgs./mL), 2013 - 2022

It is important to note that throughout the years, assemblages have been dominated by cyanobacteria. This is the case for many different aquatic systems throughout this service territory of SŌLitude Lake Management. Cyanobacteria are often associated with malodors, unusable waters, and potential toxin production. Large populations of cyanobacteria that produce toxins are referred to as Harmful Algal Blooms (HABs). Monitoring nutrient loads and algal densities throughout the growing season can assist in the prediction of HABs. Acting before these parameters exceed acceptable limits is key to preventing Harmful Algal Blooms.

The average water clarity measured at Lake Rippowam in 2023 was 1.55 meters which is a slight decrease from secchi readings in 2022. Water clarity at Lake Rippowam was the highest of the three lakes sampled on this date, which correlates with the low algal abundance. At the time of sampling, water clarity at Lake Rippowam was considered to be fair and suitable for early August water quality.

<u>Lake Oscaleta</u>

In 2023, the overall algal abundance at Lake Oscaleta was considered low with a total of 10,516 cells/mL (Figure 4). Algal diversity was moderate as nine (9) different genera were recorded from five different functional groups. The only functional group that was not documented was dinoflagellates. The functional group with the highest abundance was green algae, consisting of 60.0% of the assemblage. Most green algae were represented by *Coelastrum* at 3,926 cells/mL. Diatoms were the second most abundant functional group observed, present at 2,944 cells/mL (or 28.0%). At the time of sampling, cyanobacteria only accounted for 5.3% (or 561 cells/mL) of the assemblage. Euglenoids were recorded at 4.0% of the assemblage (or 421 cells/mL). The lease observed functional group at Lake Oscaleta was golden algae, which was only documented at 280 cells/mL (or 2.7%).

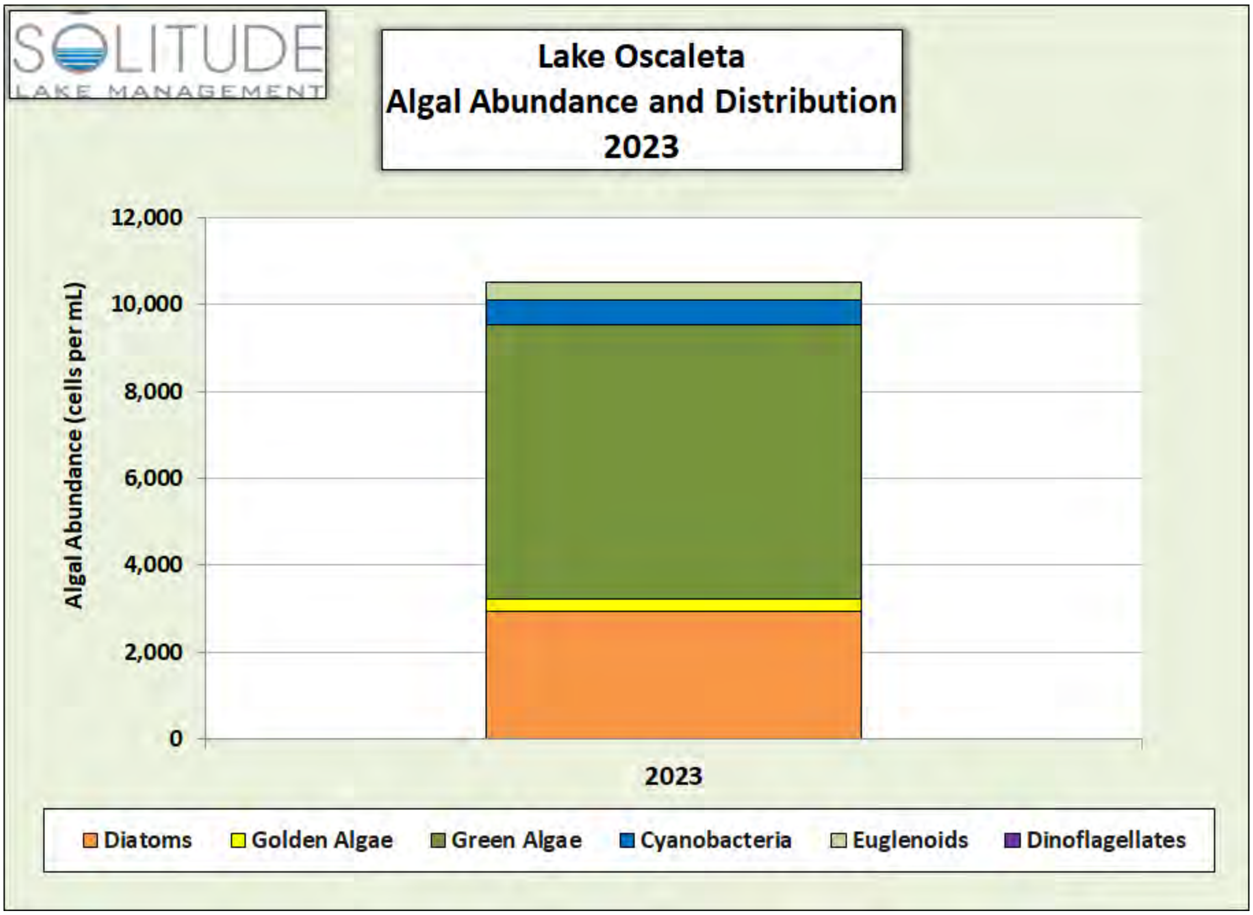


Figure 4. Lake Oscaleta Algal Abundance and Distribution (cells/mL), 2023

Water clarity at Lake Oscaleta was measured at 1.35 meters, which is considered fair for early August. Typically, in mid-summer, algal densities are the highest of the growing season, which can negatively impact water clarity.

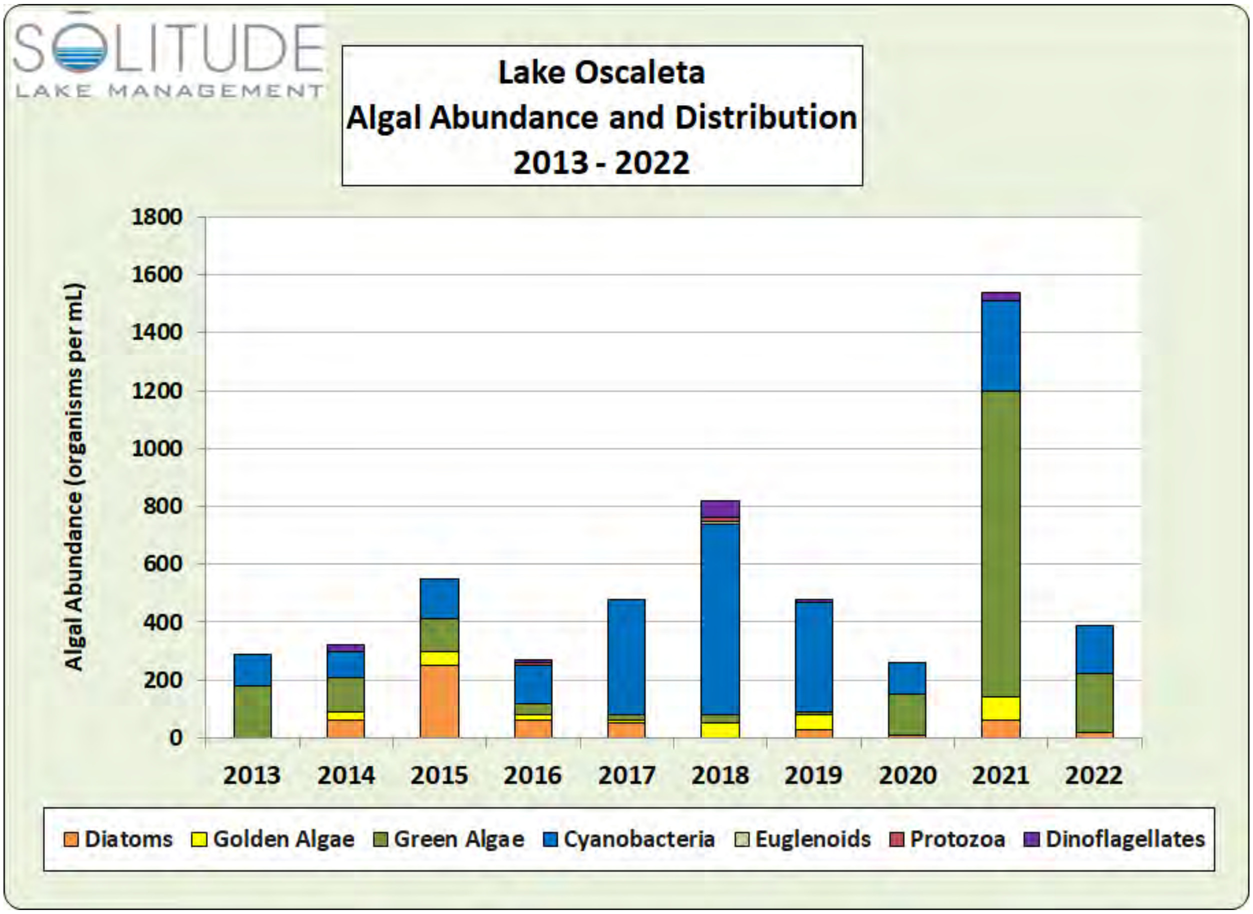


Figure 5. Lake Oscaleta Algal Abundance and Distribution (orgs./mL), 2013-2022

At Lake Oscaleta, overall algal abundance fluctuated from 2013 to 2022 (Figure 5) but remained low on average. However, the 2021 abundance increased dramatically and was dominated by green algae. The results from 2021 are unique to Lake Oscaleta as this is the highest level of algae we have seen in the lake. It is possible that the 2021 season was a naturally high production year at the Three lakes because of the record rainfall. This data is supported at the other two sites.

The trend in cyanobacteria dominance at Lake Oscaleta needs to be closely monitored as it could indicate a shift in the algal community. However, we are examining a very limited dataset. More data is needed to accurately understand the ecosystem at Lake Oscaleta during the growing season. Increasing sampling sites, frequency of sampling events, and additional water quality parameters are all tools that would help to better comprehend the algal community in the lake.

Lake Waccabuc

Out of the three lakes sampled, Lake Waccabuc supported the highest algal density in 2023 at 32,111 cells/mL. Four different functional groups were observed including: diatoms, green algae, cyanobacteria, and euglenoids. Overall, sample diversity was moderate at ten (10) different genera observed. The most abundant functional group was green algae which accounted for 59.0% (or 18,930 cells/mL) of the total assemblage. Lake Waccabuc had the highest abundance of cyanobacteria out of the three basins. However, the nuisance functional group only accounted for 32.3% (or 10,376 cells/mL) of the Lake Waccabuc algal assemblage. Specifically, the genus *Aphanizomenon* accounted for 9,675 cells/mL of the assemblage at Lake Waccabuc. Diatoms accounted for 6.6% (or 2,104 cells/mL) of the assemblage while euglenoids accounted for 2.2% (or 701 cells/mL).

Figure 6. Lake Waccabuc Algal Abundance and Distribution (cells/mL), 2023

Water clarity at Lake Waccabuc was measured at 1.5 meters and is considered fair at the time of sampling. This is likely due to the high algal density that is common at Lake Waccabuc in early August. Late July through August is typically the time of year for peak photosynthetic production.

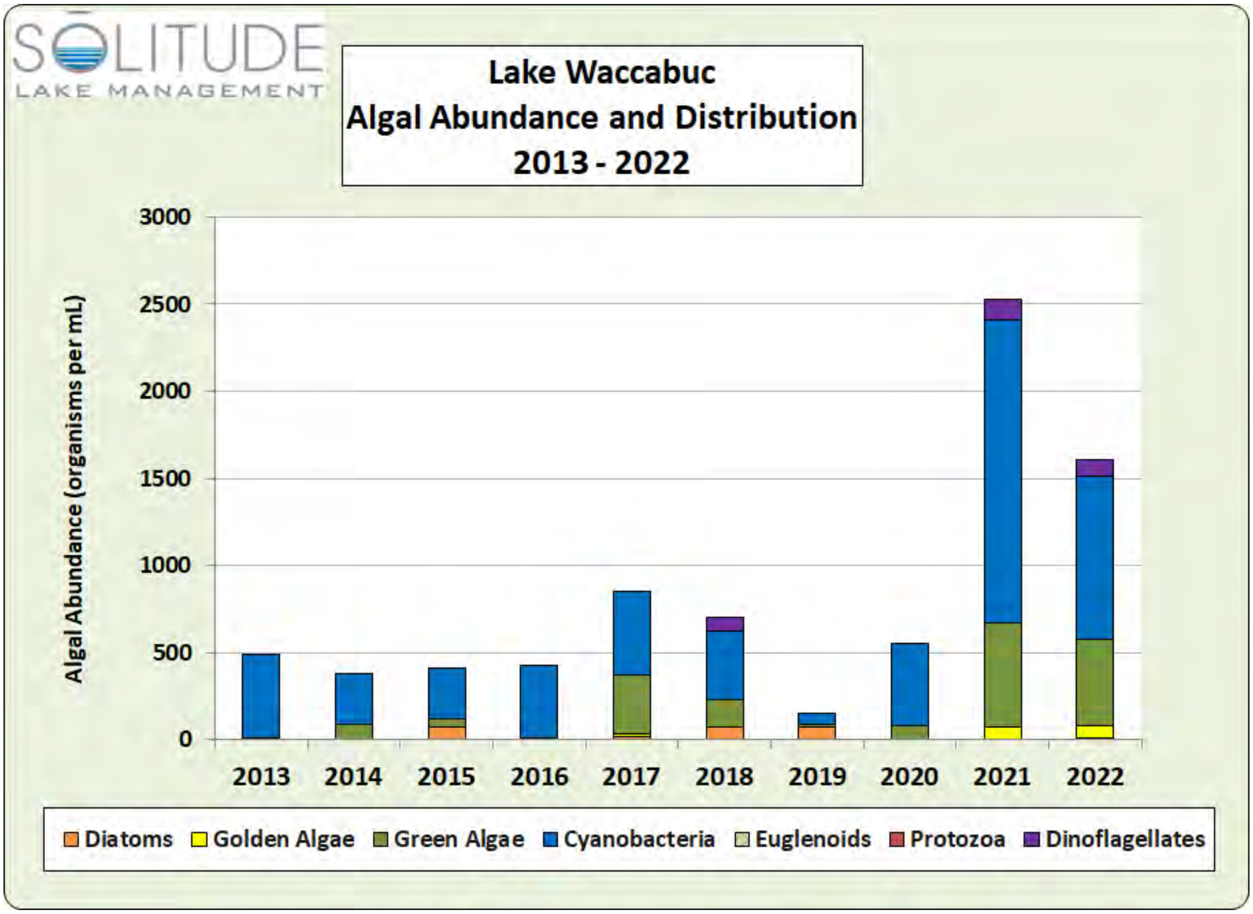


Figure 7. Lake Waccabuc Algal Abundance and Distribution (orgs./mL), 2013-2022

Based on the data (Figure 7), Lake Waccabuc contains the most consistent cyanobacteria population over the past ten years. Over 50% of each assemblage from nine of the previous ten years consisted of various genera of cyanobacteria. In 2022, similar to the other lakes, total abundance decreased significantly. All three lakes show overall increases in algal populations over time. Lake Waccabuc, having the highest amount of cyanobacteria in 2022, has also held the most consistent and stable population compared to the other two basins. Only during the 2017 season did we observe a significant increase in green algae genera, indicating competition over cyanobacteria. This basin contains a moderately diverse algal community, though assemblages over the years are temporal and inconstant. The high abundances of cyanobacteria are currently outcompeting the other algal groups and are most likely a result of seasonal variation.

In 2021, we observed a significant increase in overall algal and cyanobacteria abundance. This was the highest overall algal density among the ten years of algae samples. This year could be the outlier of the dataset.

Lake Profiles

Table 2: 2023 Temperature and Dissolved Oxygen Profiles						
Depth (meters)	**Lake Rippowam**		**Lake Oscaleta**		**Lake Waccabuc**	
	Temp. (°C)	Dissolved Oxygen (mg/L)	Temp. (°C)	Dissolved Oxygen (mg/L)	Temp. (°C)	Dissolved Oxygen (mg/L)
0	24.8	8.28	24.9	8.60	25.1	8.95
1	24.6	8.33	24.5	8.59	24.8	8.93
1.5	24.6	8.29	24.4	8.39	24.7	8.72
2	24.6	8.19	24.4	8.20	24.6	8.61
3	23.3	0.33	23.9	5.38	24.5	7.80
4	20.0	0.18	20.5	2.20	23.3	2.84
5	16.4	0.13	17.0	0.55	17.5	0.20
5.5	15.3	0.13	---	---	---	---
6			13.7	0.18	14.8	0.12
7			11.4	0.12	12.7	0.11
8			10.3	0.11	10.9	0.10
9			9.5	0.10	10.0	0.09
10			9.2	0.10	9.3	0.09
10.5			8.9	0.10	---	---
11					8.5	0.09
12					8.1	0.09
13					8.0	0.09
14					7.9	0.09

In 2023, temperature and dissolved oxygen profiles were measured at each lake station by the client and the data was provided to SLM for a summary. Data was collected at one-meter intervals with some extra measurements at half-meter marks based on the depth measurements of each basin. All three profiles have an extra measurement at the 1.5-meter depth coinciding with the depth of the algal collection. Lake Rippowam has an added measurement at the 5.5-meter depth. Lake Oscaleta has an extra measurement at the 10.5-meter depth.

At Lake Rippowam, dissolved oxygen readings were at a normal range until reaching a depth of three meters. We observed a gradual decrease in the dissolved oxygen in the lower levels of the water column. The highest dissolved oxygen occurred at the one-meter mark (8.33 mg/L). At three meters, and the rest of the water column, the dissolved oxygen was effectively anoxic which is a concern for aquatic biota.

At Lake Oscaleta, dissolved oxygen levels were average from the surface with a slight decrease at the three-meter mark. Dissolved oxygen readings continued to decrease at the four-meter depth (2.20 mg/L) becoming anoxic. The anoxic conditions continued down through the water column to the bottom of the lake. Readings dropped as low as 0.10 mg/L which can cause stress to the aquatic biota within the basin.

At Lake Waccabuc this year, dissolved oxygen was average from the surface through the three-meter mark. By the four-meter depth, a significant decrease in dissolved oxygen was recorded with an anoxic reading of 2.84 mg/L. These anoxic conditions continued down the water column to the lake bottom.

Conclusion

Summary

Algal abundance and composition varied throughout the Three Lakes in 2023. At Lake Waccabuc, we observed the highest overall algal abundance that supported the highest levels of cyanobacteria. However, green algae were the dominant functional group. At Lake Oscaleta, we observed low overall algal abundance that was dominated by green algae. The assemblage showed the most favorable composition across all three lakes in 2023. At Lake Rippowam, we observed the lowest algal abundance out of all three basins in 2023. However, cyanobacteria continued to dominate the lake this year with low abundance in green algae, diatoms, euglenoids, and dinoflagellates.

Recommendations

It is recommended that the Three Lakes Council continues their historical monitoring program. It is strongly recommended that stakeholders invest in a more robust monitoring program including increased sampling frequency and water quality parameters. The data collected can be used to better inform the surrounding community of the conditions of the lakes. Algae are incredibly variable and can shift populations within a day, so single sampling events only inform what was happening at the exact time the sample was obtained. With increased sampling frequency, biologists will be able to analyze seasonal changes and offer more insight into system dynamics. Oftentimes, problems with algae are attributed to nutrients, so obtaining nutrient data (such as total phosphorus and nitrogen) would address root causes of the issue.

The Three Lakes Council has now compiled over a decade of algal data for Lake Rippowam, Lake Oscaleta, and Lake Waccabuc. Monitoring the health of a lake ecosystem requires sampling a diverse array of biological communities such as fish, aquatic plants, algae, and zooplankton. This is essential to providing stewardship to a delicate ecosystem. The comprehensive water quality collected via the CSLAP program is suitable to be combined with available biological data, to assist with completing the picture of the overall ecological status of the three basins.

SŌLitude Lake Management recommends the Three Lakes Council to continue monitoring zooplankton and algae in the 2023 season. Although sampling throughout the growing season (May through September) would be more suitable to observe seasonal variation, continuing the same sampling format and techniques applied in 2013 through 2023 does provide value. Therefore, at least a single sample event should be collected in mid-July of 2024, to coincide with the SAV surveys and historical data.

SŌLitude Lake Management would like to take this opportunity to thank the Three Lakes Council for allowing us to provide lake management consulting services. We look forward to working with you again throughout the 2024 lake management season.

Sincerely,

Vicky Thiel

Vicky Thiel
Aquatic Biologist
SŌLITUDE
LAKE MANAGEMENT
P: 908-850-0303 **M:** 610-297-0421
solitudelakemanagement.com

Appendix

Algae Primer
2023 Algae Examination Data and Pie Charts
2023 Algae Abundance and Distribution Graphs
Three Lakes Temperature and Dissolved Oxygen Profile Data and Graphs

Algal Sampling

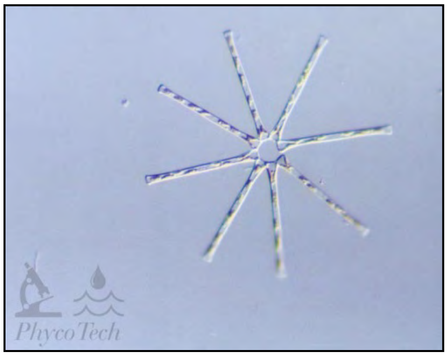
Algae: An Introduction

Lakes typically contain three broad categories of algae. These include unicellular (singular and colonial), filamentous, and macroscopic organisms.

Unicellular algae are typically microscopic and consist of individual cells or colonies of cells suspended in the water column. At high enough densities (HABs), they can impart a green or brown (and sometimes, even red) tint to the water column. Unicellular algae belong to several taxonomic groups. Density and diversity of these groups often vary due to seasonality. When unicellular algae density becomes elevated, it can reduce water clarity (giving the water a "pea soup" appearance) and impart undesirable odors. Usually, cyanobacteria are responsible for these odors, but other groups or extremely elevated densities can impart them as well. In addition to decreased aesthetics, unicellular HABs can cause degradation of water quality, increase the water temperature (turbid water warms faster than clear water), and can possibly produce a variety of toxins, depending on the type of genera present and environmental conditions. Numerous groups of unicellular algae are common in the Northeast, including diatoms, golden algae, green algae, cyanobacteria, euglenoids, and dinoflagellates. Each group shall be discussed in turn.

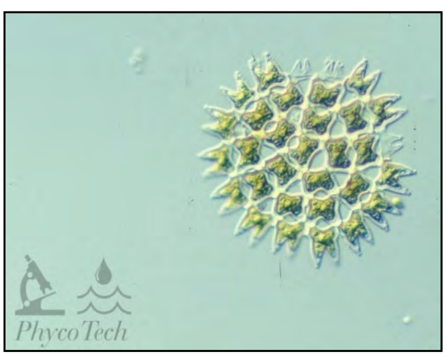
Filamentous algae are typically microscopic but can be visible to the naked eye if enough biomass accumulates. Filaments are generally composed of long chains of cells encompassed in a mucilaginous sheath or matrix that protects against cell desiccation and penetration. Growth is often associated with attachment to a substratum, typically the lake bottom or submersed and emergent vegetation. Filamentous algae of this nature are referred to as benthic filamentous algae (BFA). However, under certain environmental conditions, rampant growth and the production of gas vesicles can cause BFA to float to the surface and form mats. Typically, genera of green algae or cyanobacteria develop into these nuisance, filamentous mats. Abundant nuisance growth of filamentous algae can cause operational and functional impairments to the water. Examples include a decline in aesthetics, recreational use, water quality, and aquatic organism survivability.

Macroscopic algae appear to be submersed plants, especially when viewed in the water column. Physical examination reveals no true roots, stems, or leaves. Although typically only reaching heights of a few inches, under ideal conditions, this type of algae can reach lengths of several feet and create a dense carpet on the bottom of a lake. Therefore, it typically does not reach nuisance levels in a lake, save for high use areas such as beaches and other popular swimming areas. Since these algae occupy a similar ecological niche as submersed plants, it's often included in detailed and visual aquatic plant surveys. It provides numerous benefits to a lake system, including sediment stabilization, acting as a nutrient sink, providing invertebrate and fish shelter and habitat, and is one of the first to re-colonize a disturbed area. In the Northeast, muskgrass (*Chara* sp.) and stonewort (*Nitella* sp.) are two of the most common macroscopic algae.

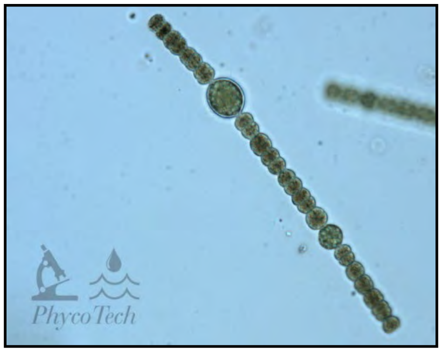


Diatoms are ubiquitous as a functional group and often possess a rigid silica shell with ornate cell wall markings or etchings. Living cells often grow on or in association with benthic substrate, floating debris, or macrophytes. Under ideal conditions, cells can become stratified. When cells die, their silica shells can settle on the water-sediment interface and accumulate to significant depths. Limnologists can then study historical population characteristics of diatoms. Some are round and cylindrical (centric) in shape, while others are long and wing-shaped (pennate). They are usually brown in color and reach maximum abundance in colder or acidic water. Therefore, they tend to dominate in winter and early spring. Common diatoms in the Northeast include *Fragilaria spp., Cyclotella spp., Navicula spp.*, and *Asterionella spp.* (pictured).

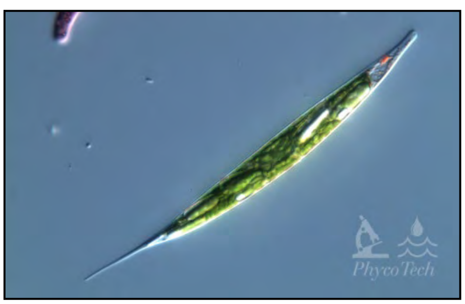
Golden Algae are typically yellow or light brown in color. Cell size is usually small oval shaped with a partially empty area, but several genera can be colonial or even filamentous. Most have two specialized flagella, and some type of scales or a rigid coating that grants it a fuzzy appearance. They typically prefer cooler water, so they dominate in the late fall, winter, or early spring. They also tend to bloom at deeper (cooler) depths. They are common in low nutrient water, and numerous forms produce taste and odor compounds. Common golden algae in the Northeast include *Dinobryon spp.* (pictured), *Mallomonas spp.*, and *Synura spp*.



Green Algae are a very diverse group of unicellular and filamentous algae. There is tremendous variability in this group which varies from family to family and sometimes even genus to genus. There are flagellated single cells, multi-cell colonies, filamentous forms and attached forms, typically with distinct cell shapes light green in color. Some prefer acidic waters, and others highly eutrophic (sewage) conditions. A green algal bloom usually occurs in water with high nitrogen levels. Green algae typically dominate in mid to late summer in the Northeast. Common genera include *Chlorella spp.*, *Scenedesmus spp.*, *Spirogyra spp.,* and *Pediastrum spp.* (pictured).



Cyanobacteria, often referred to as blue-green algae, are ubiquitous, photosynthetic bacteria. They tend to be microscopic, but significant biomass accumulation can result in a Harmful Cyanobacterial Bloom (HCBs) that are visible to the naked eye. Cyanobacteria possess multiple mechanisms conferring a competitive advantage. Structurally, they can have nitrogen-fixing cells that allow them to grow in nutrient-limited conditions and resting cells that allow them to sustain populations. They tend to be encased in a mucilaginous matrix or sheath that protects against cell penetration and desiccation. In addition, they possess antennae-like structures for harvesting incredibly low amounts of incident light, allowing for benthic growth. The production of gas vesicles allows cyanobacteria to regulate their buoyancy to move up and down the water column to obtain nutrients. Cyanobacteria tend to be more abundant in neutral or alkaline, nitrogen-poor waters. Thus, they prefer eutrophic systems with high phosphorus loads. However, cyanobacteria are tolerant of a wide variety of water chemistries and boast many oligotrophic forms as well. Numerous cyanobacteria produce taste and odor compounds, and under certain environmental conditions can produce toxins dangerous to humans, fish, and livestock. Cyanobacteria typically dominate a lake system in late summer to early fall. Common cyanobacteria that occur in the Northeast include *Dolichospermum spp.* (pictured)*, Aphanizomenon spp., Microcystis spp.,* and *Coelosphaerium spp.*



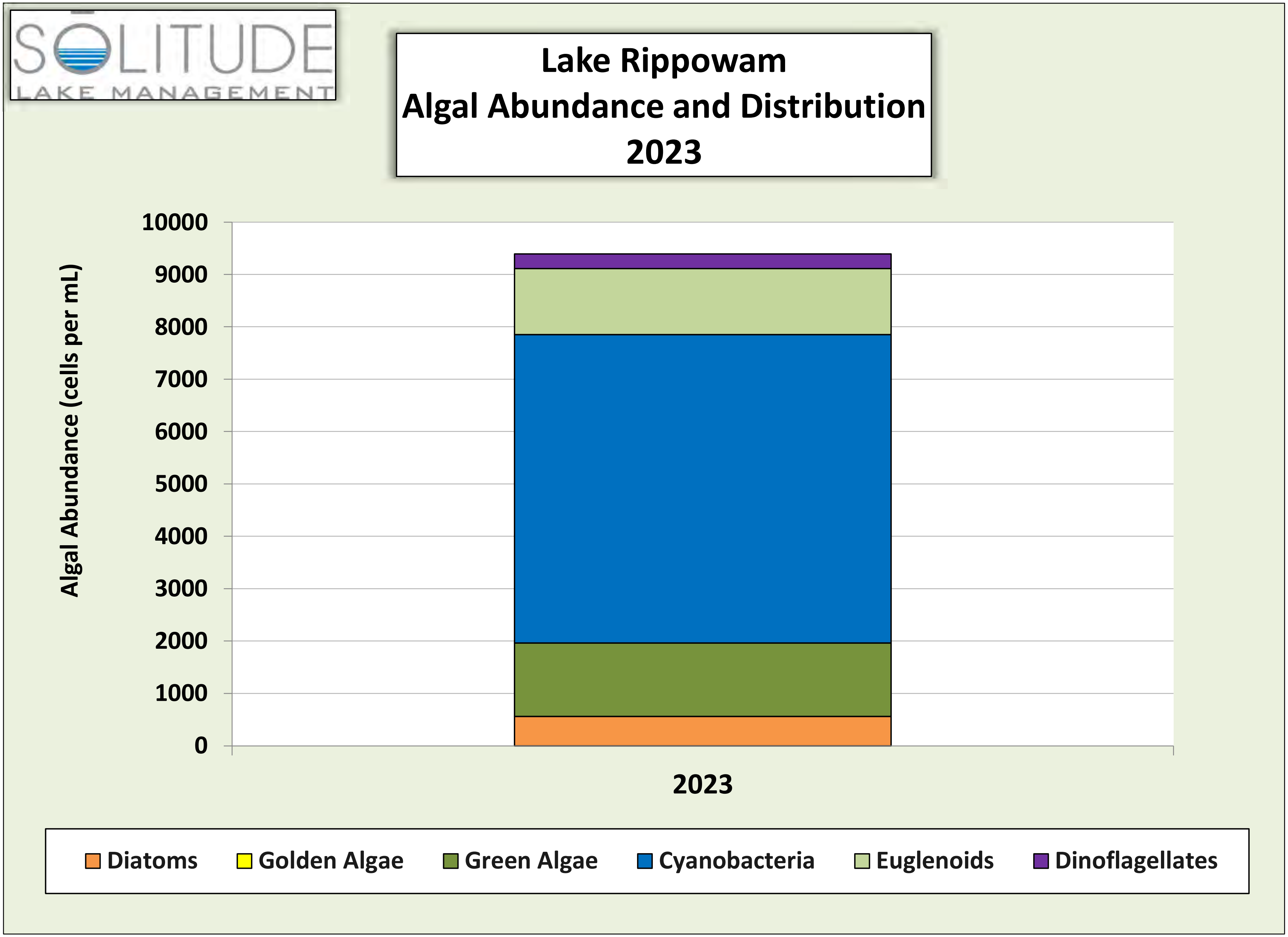
Euglenoids are single-celled eukaryotes typically with a primitive eyespot and flagellum or flagella. They are generally green, but some species are red or colorless. Euglenoids are often associated with quiescent, eutrophic waters containing high concentrations of organic matter. Common euglenoids that occur in the Northeast include *Euglena spp.* (pictured), *Phacus spp.,* and *Trachelomonas spp*.

Dinoflagellates are a monophyletic group strongly associated with marine environments, in which they often cause toxic HABs known as Red Tide. However, toxin production in freshwater genera is very rare. Dinoflagellates are generally larger in size as compared to other phytoplankton. Cells typically present themselves as ovoid or spherical in shape and are encompassed in cellulose plates known as armor. They usually possess two flagella which confers propulsion and rotation through the water column. Dinoflagellates generally prefer organic-rich or acidic waters and can impart a coffee-like brown tint to the water when enough biomass has accumulated. Common dinoflagellates in the Northeast include *Ceratium spp.* (pictured) and *Peridinium spp*.

Site A: Lake Rippowam			Site B: Lake Oscaletta				Site C: Lake Waccabuc				
Diatoms	**A**	**B**	**C**	**Green Algae**	**A**	**B**	**C**	**Cyanobacteria**	**A**	**B**	**C**
Stephanodiscus	280			*Closterium*			140	*Anabaena*		561	701
Synedra	280	140	421	*Coelastrum*		3,926	12,059	*Aphanizomenon*	5,889		9,675
Tabellaria		2,804	1,683	*Gloeocystis*	841		3,646				
				Micractinium		1,683					
				Oocystis	561	561	2,524				
Golden Algae	**A**	**B**	**C**	*Staurastrum*		140	561				
Mallomonas		280						**Results**			
								Site	**A**	**B**	**C**
				Euglenoids	**A**	**B**	**C**	**Total Genera**	8	9	10
Dinoflagellates	**A**	**B**	**C**	*Euglena*	841			**Average Secchi (m)**	1.55	1.35	1.5
Peridinium	280			*Trachelomonas*	421	421	701	**Cells/mL**	9,393	10,516	32,111

Collection Date: 10 August 2023 **Examination Date: 14 August 2023**

This was the first and only sampling event of 2023. Samples were preserved with Lugol's Iodine upon returning to the lab at SŌLitude Lake Management. Algal diversity was moderate at all three lakes with total genera results ranging from eight (8) to ten (10). Algal density was low at Lake Rippowam and Lake Oscaletta while Lake Waccabuc was moderate. At the time of sampling, the assemblage at Lake Rippowam was dominated by cyanobacteria, specifically nuisance *Aphanizomenon.* At Lake Oscaletta, the assemblage was dominated by green algae with *Coelastrum* as the most dominant genera recorded. The assemblage at Lake Waccabuc was dominated by green algae, specifically *Coelastrum*. Water clarity at all three sites was considered fair at the time of sampling.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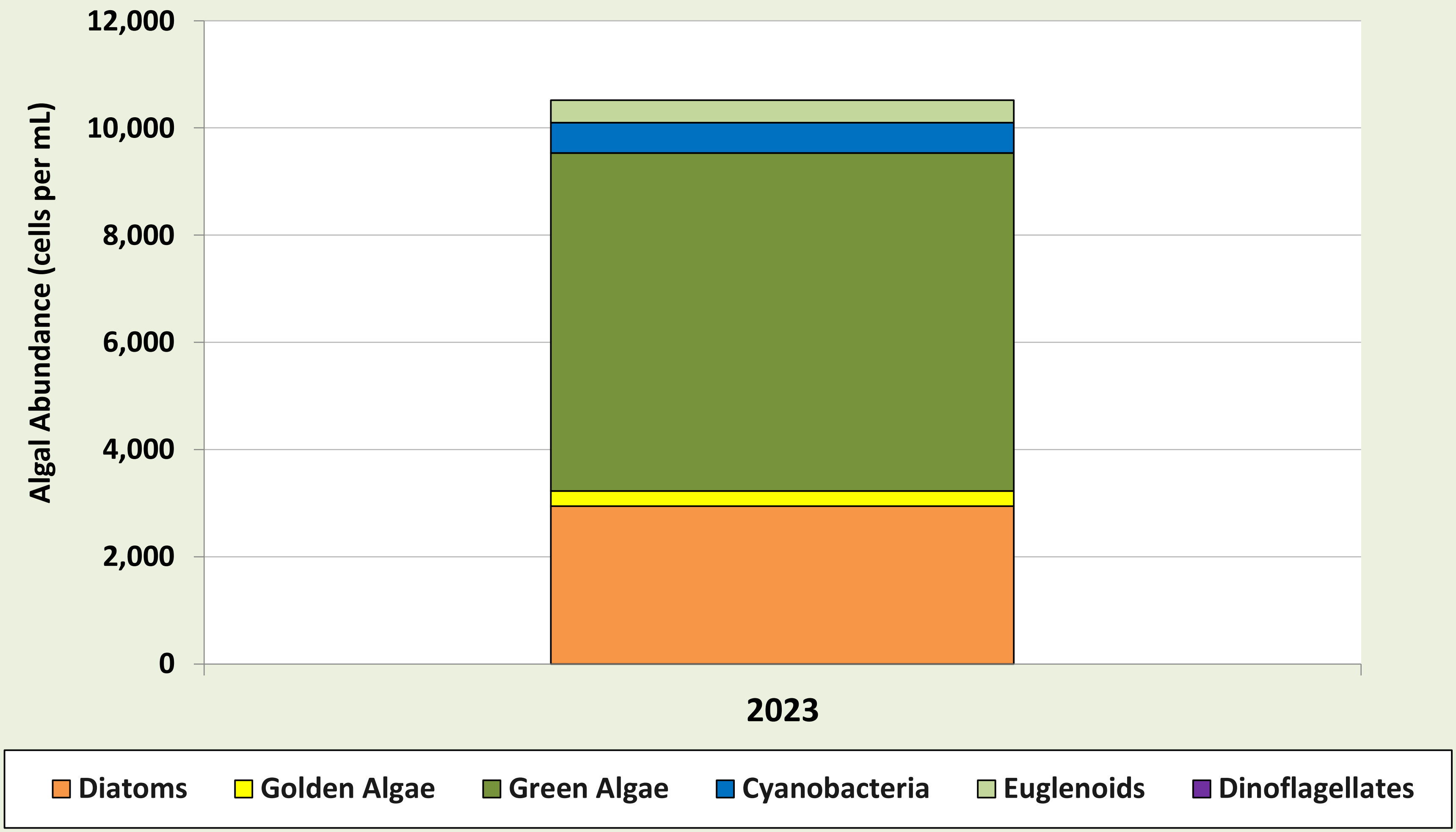
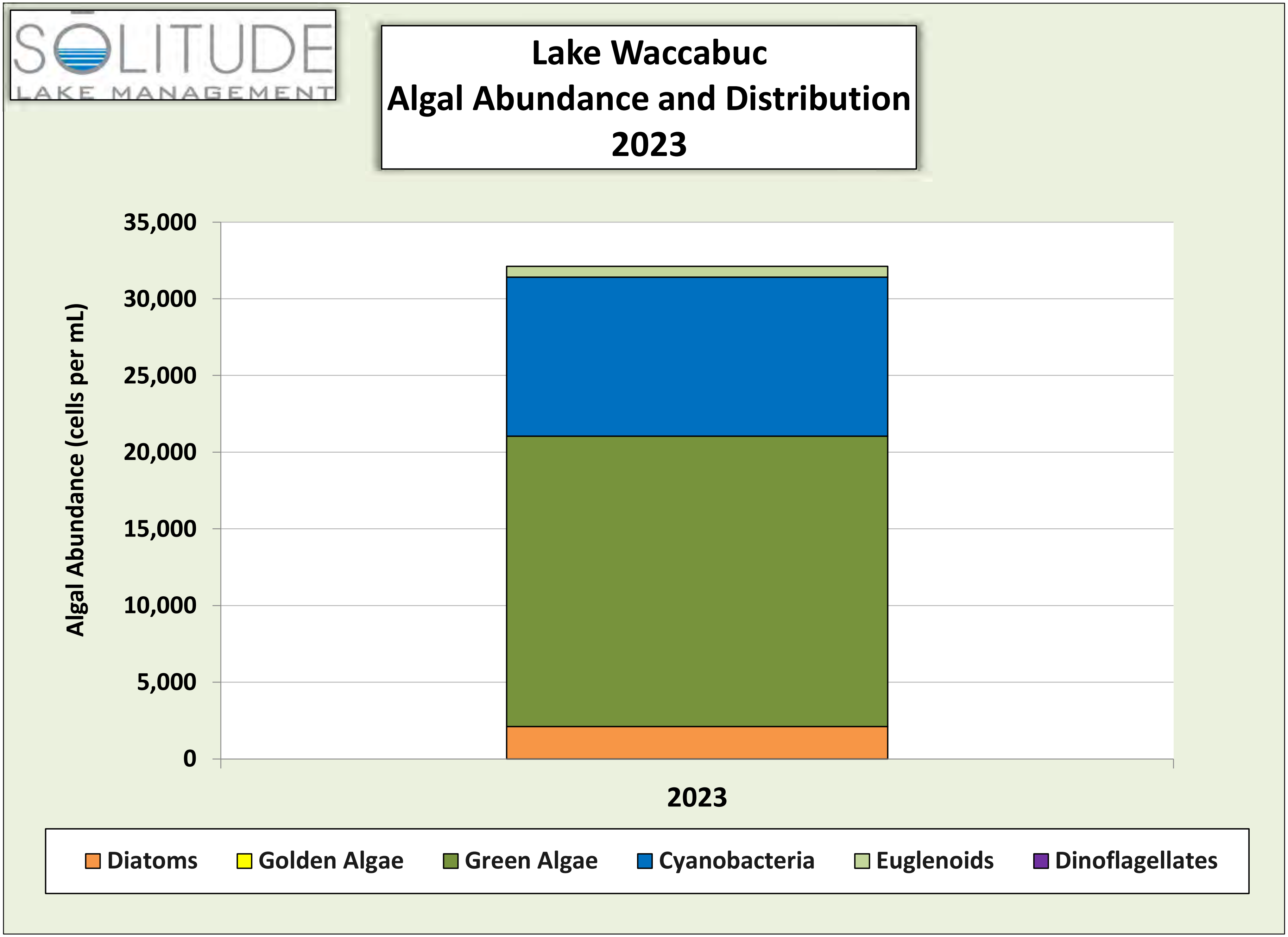
Algal Abundance and Distribution
2023
Algal Abundance (cells per mL)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
2023
Diatoms
Golden Algae
Green Algae
Cyanobacteria
Euglenoids
Dinoflagellates

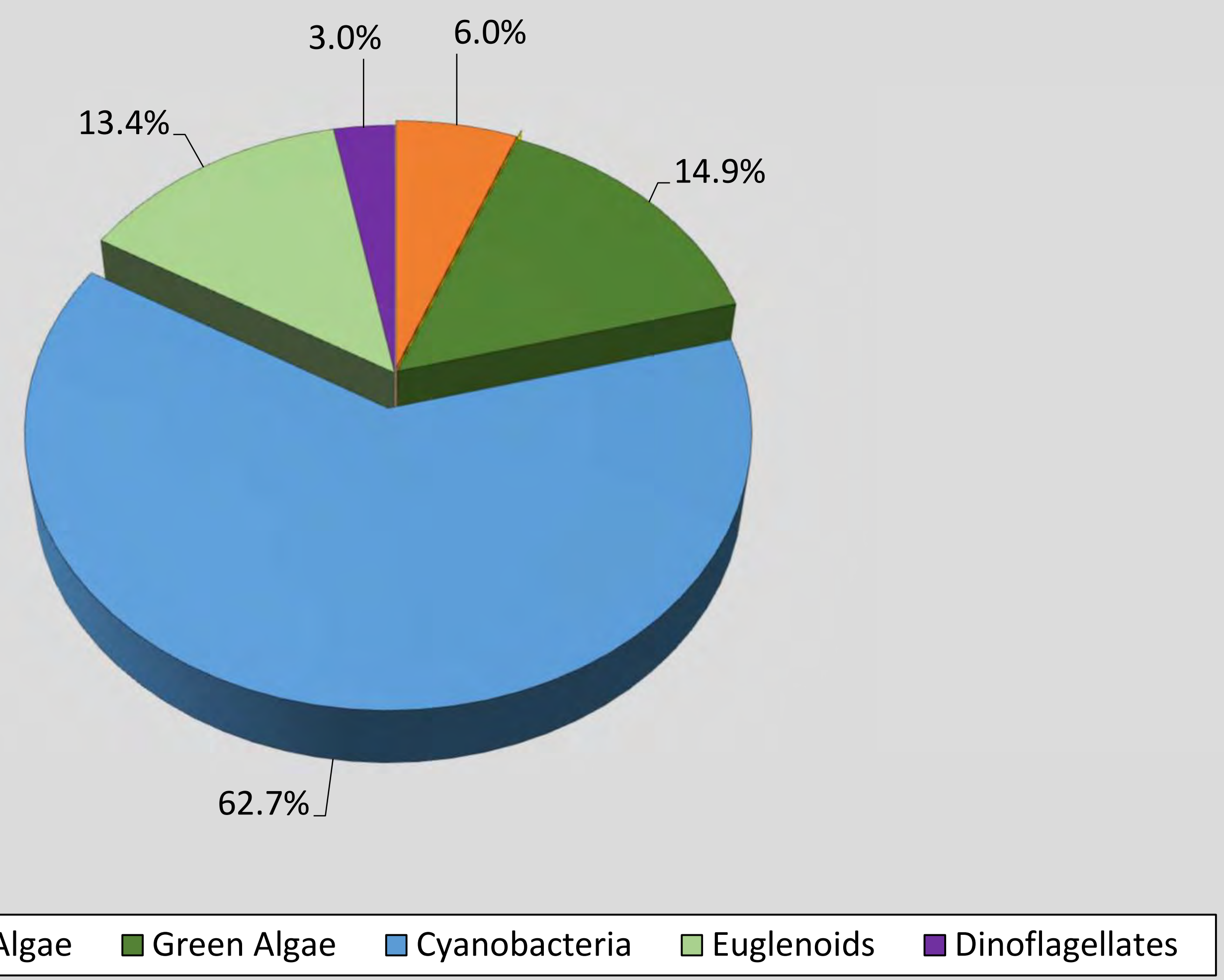
Lake Oscaleta
Algal Abundance and Distribution
2023



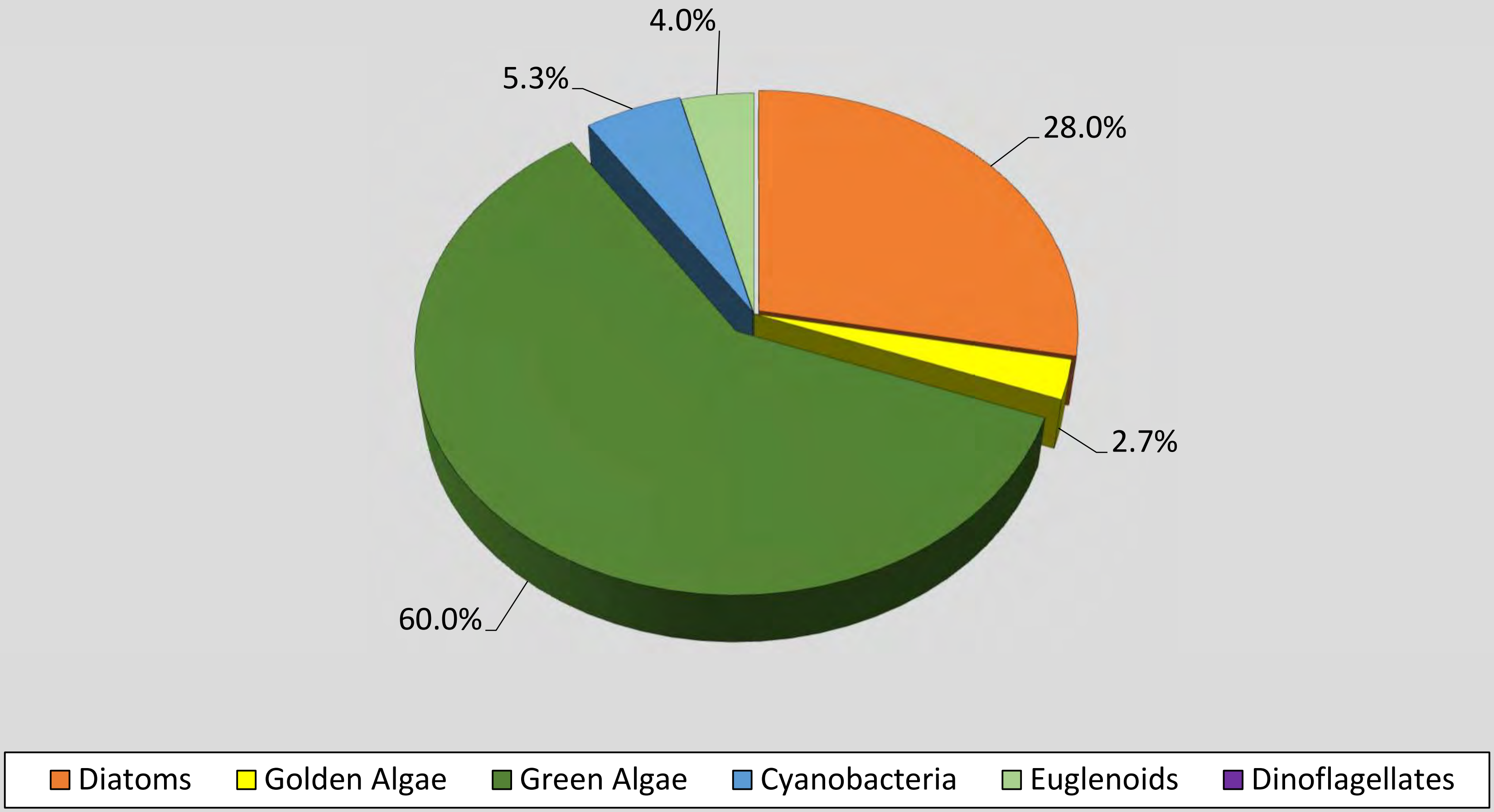


Lake Waccabuc
Algal Abundance and Distribution
2023
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Algal Abundance (cells per mL)
2023
Diatoms
Golden Algae
Green Algae
Cyanobacteria
Euglenoids
Dinoflagellates

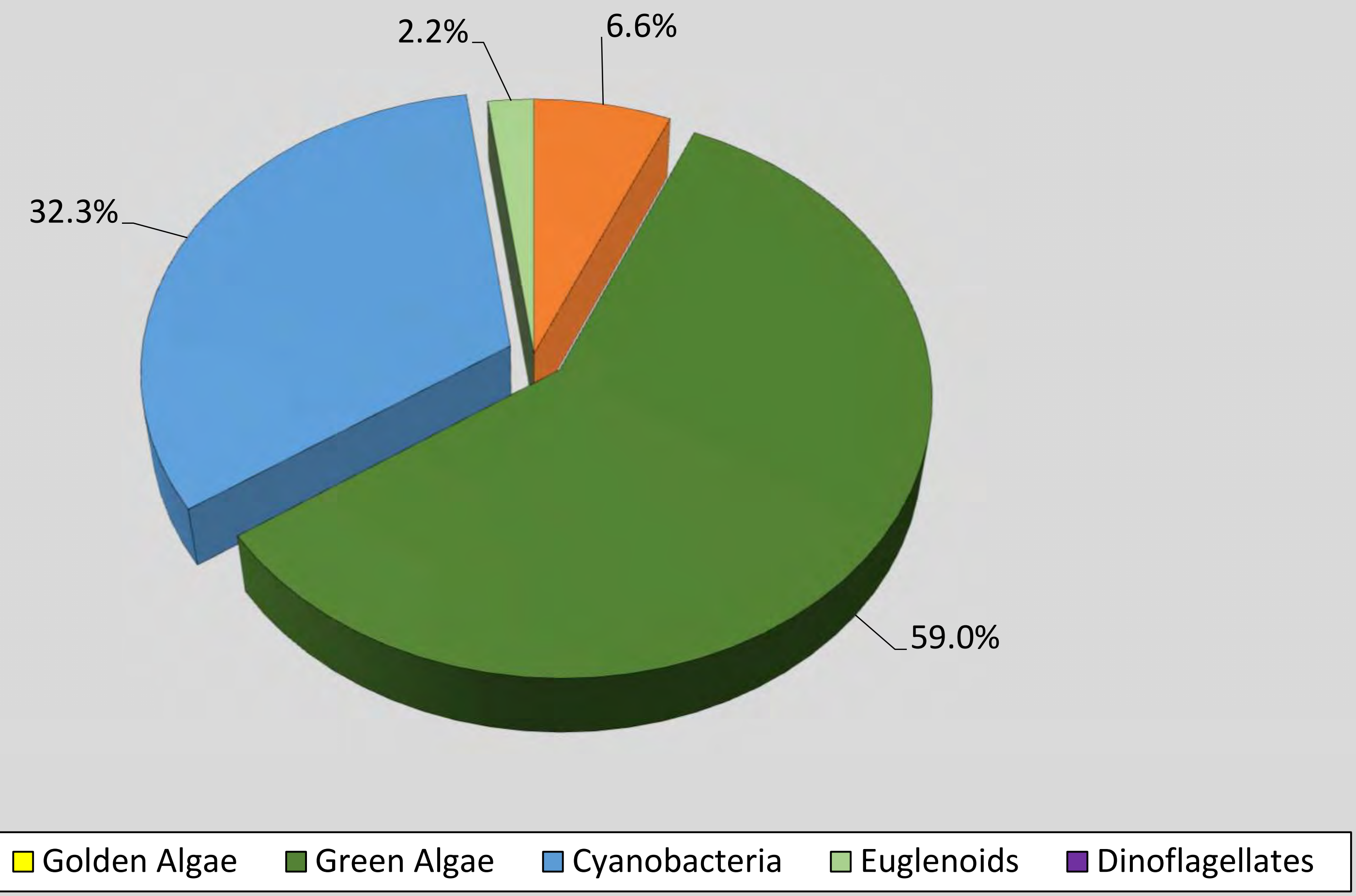
Lake Rippowam Algal Distribution August 10, 2023



Lake Oscaleta
Algal Distribution
August 10, 2023



Lake Waccabuc Algal Distribution July 21, 2022



Three Lakes

Date:	8/10/2023
Sampled By:	Client (JA)

Lake Rippowam

Depth (Meters)	Temp. (ºC)	Dissolved Oxygen (mg/L)
0	24.8	8.28
1	24.6	8.33
1.5	24.6	8.29
2	24.6	8.19
3	23.3	0.33
4	20	0.18
5	16.4	0.13
5.5	15.3	0.13

Total Depth (m):	5.7
Secchi (m):	1.55

Lake Oscaleta

Depth (Meters)	Temp. (ºC)	Dissolved Oxygen (mg/L)
0	24.9	8.6
1	24.5	8.59
1.5	24.4	8.39
2	24.4	8.2
3	23.9	5.38
4	20.5	2.2
5	17	0.55
6	13.7	0.18
7	11.4	0.12
8	10.3	0.11
9	9.5	0.1
10	9.2	0.1
10.5	8.9	0.1

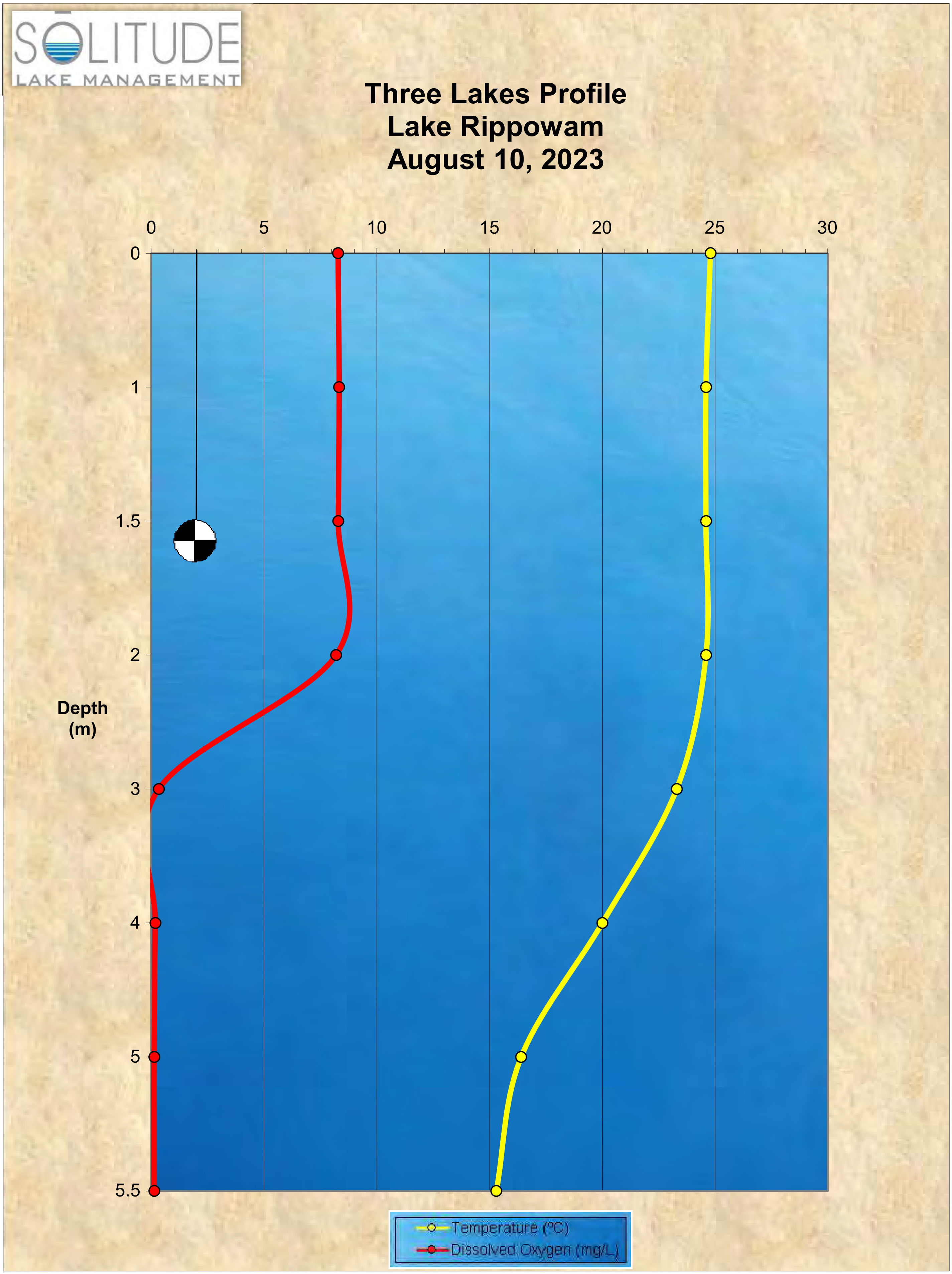
Total Depth (m):	10.8
Secchi (m):	1.35

Lake Waccabuc

Depth (Meters)	Temp. (ºC)	Dissolved Oxygen (mg/L)
0	25.1	8.95
1	24.8	8.93
1.5	24.7	8.72
2	24.6	8.61
3	24.5	7.8
4	23.3	2.84
5	17.5	0.2
6	14.8	0.12
7	12.7	0.11
8	10.9	0.1
9	10	0.09
10	9.3	0.09
11	8.5	0.09
12	8.1	0.09
13	8	0.09
14	7.9	0.09

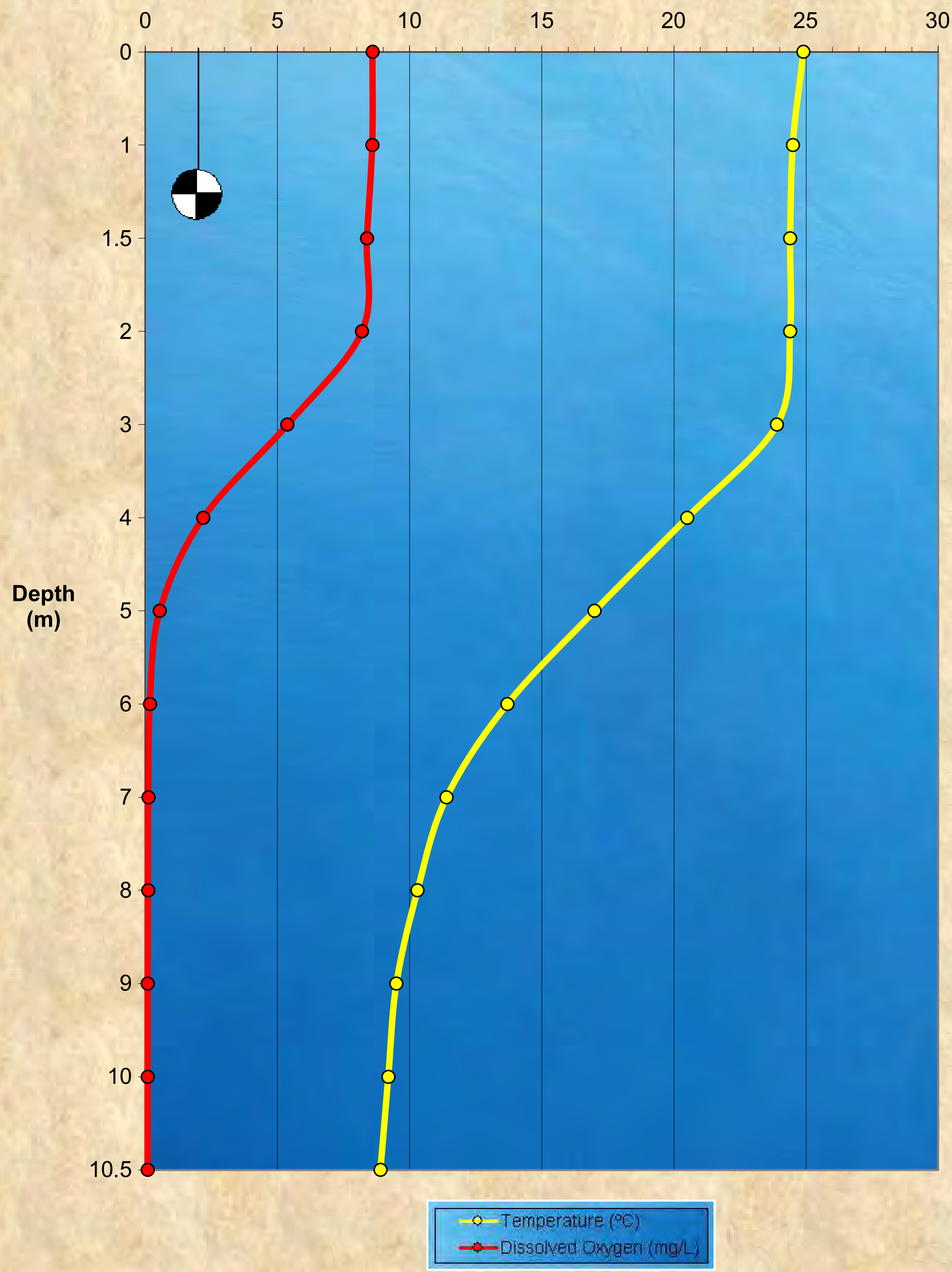
Total Depth (m):	14.1
Secchi (m):	1.50

Notes:



SOLITUDE LAKE MANAGEMENT
Three Lakes Profile
Lake Rippowam
August 10, 2023
0
5
10
15
20
25
30
0
1
1.5
2
3
4
5
5.5
Depth (m)
Temperature (°C)
Dissolved Oxygen (mg/L)

Three Lakes Profile
Lake Oscaleta
August 10, 2023



Three Lakes Profile
Lake Waccabuc
August 10, 2023