

Lakes Environmental Association  
2018 Water Testing Report

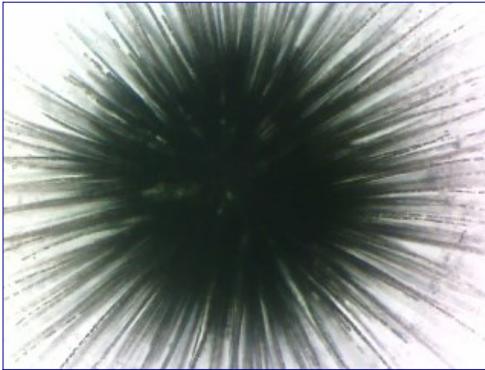


Chapter 3—*Gloeotrichia echinulata* Monitoring



## *Gloeotrichia echinulata* Monitoring

*Gloeotrichia echinulata* (also known as “Gloeotrichia” or simply “Gloeo”) is a colonial cyanobacteria species. Each colony is made up of numerous hair-like filaments that radiate outward, creating the characteristic “fuzzy ball” appearance of this species. The colonies are approximately 1-3 mm in diameter and tend to be free-floating in the water column, only forming surface scums at extremely high concentrations.



A Gloeo colony under the microscope

Cyanobacteria (also known as blue-green algae) such as Gloeo are not actually algae, but photosynthetic bacteria. There are several cyanobacterial species that are notorious for causing toxic blooms in high-nutrient lakes. Gloeo do not form sludgy, green “pea soup” blooms like other cyanobacteria, but they can produce toxins under certain conditions. Rather than pea soup, Gloeo tend to look like small yellow spheres floating throughout the water column, and their relatively large size makes them very noticeable even at low concentrations.

While algae blooms are typically associated with high nutrient lakes, Gloeo is known for its proliferation in low nutrient lakes, such as those in the Lakes Region. One concern with Gloeo is that it may be increasing nutrient levels on these lakes by moving phosphorus from the sediments into the water column, where it can be used by other algae.

*Gloeotrichia* is a fairly common sight in late summer throughout New England, and can be found in high concentrations in several lakes in Maine each summer. They are not an invasive species or particularly new to our waters. Evidence of Gloeo is present in sediment cores, and a report on Waterford Lakes from 1973 shows that Gloeo was common in McWain Pond and Keoka Lake 45 years ago.

While Gloeo can be seen in the water column from June through September, the highest levels of Gloeo are typically seen within a two week span in late July and early August. The amount of Gloeo present in a lake depends on light, temperature, and nutrient levels, as well as several smaller contributing factors. Temperature in particular can be used to explain the timing of peak Gloeo concentrations.



High density of Gloeo colonies seen near the shore of Moose Pond, August 2017.

## *Gloeotrichia* in the Lakes Region

LEA began sampling for Gloeo in 2013. Samples are collected in shallow areas of lakes and ponds using a plankton tow net made of fine mesh, which strains the algae from the water. Sites of sample collection have remained consistent since sampling began, but not all sites were visited in all years. Abundance is measured in a unit called “colonies per liter” (abbreviated col/L), which is the number of Gloeo that would be seen in an average liter of lake water (it helps to imagine the size of a 1 liter soda bottle).

Lakes that were sampled for Gloeo in 2018 are listed to the right. Of the 28 sites tested, nine have had elevated levels of Gloeo (>5 col/L) over the 6 years of testing. These are Keoka Lake, Long Lake (which has 4 sample sites), McWain Pond, Moose Pond’s Main Basin, Crystal Lake, and Peabody Pond. The first seven of these sites were sampled 3 times over the course of 6 weeks in 2018; the remaining sites were sampled once. Four sites have had low levels of Gloeo present in late summer each year (below 5 col/L). That leaves 15 sites, or about 53% of the total sites sampled, which have had virtually no Gloeo in any samples.

The lakes with and without significant levels of Gloeo have stayed consistent since LEA began sampling. It is likely that some lakes don’t have the ability to support higher concentrations of this species. However, the lake characteristics and conditions needed for Gloeo blooms to occur are not well understood.

*The lakes with and without significant levels of Gloeo have stayed consistent since LEA began sampling.*

The following pages present data from the four lakes that were sampled three times in 2018. Each lake’s results are graphed on plots with the same scale on the x-axis and y-axis to facilitate comparison.

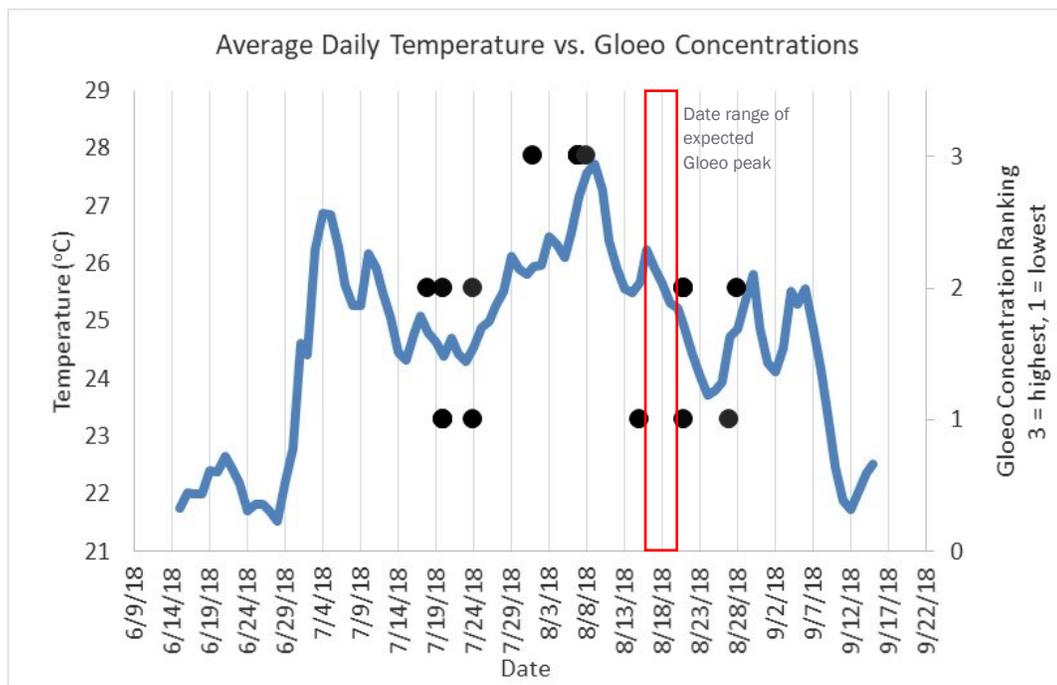
Lakes Sampled for <i>Gloeotrichia</i> in 2018	
ADAMS POND	●
BACK POND	●
BEAR POND	●
BRANDY POND	●
CRYSTAL LAKE	●
FOSTER POND	●
GRANGER POND	●
HANCOCK POND	●
HIGHLAND LAKE (2 sites)	●
ISLAND POND	●
KEOKA LAKE	●
KEYES POND	●
LITTLE MOOSE POND	●
LONG LAKE (4 sites)	●
McWAIN POND	●
MIDDLE POND	●
MOOSE POND (Main Basin)	●
MOOSE POND (North Basin)	●
MOOSE POND (South Basin)	●
PEABODY POND	●
SAND POND	●
STEARNS POND	●
TRICKEY POND	●
WOODS POND	●
● NONE	
● LOW (<5 col/L)	
● HIGH (>5 col/L)	

Concentrations of Gloeo discussed in the summaries should be interpreted with the knowledge that LEA sampling provides a “snapshot” of the Gloeo present at a particular spot at a particular point in time, which may not always be representative for the lake as a whole. Gloeo populations can vary across a single lake due to factors like prevailing winds and substrate quality. Long Lake data is a good example of this: sampling from four sites shows the northern part of the lake consistently has the highest Gloeo concentrations. On most other lakes, only one site is sampled, meaning we potentially miss “hot spots” of elevated Gloeo. That being said, after sampling for 6 years and visiting each lake twice per month every summer for routine water quality monitoring, we can be reasonably sure in our assessment of the relative Gloeo concentrations on these lakes.

## Relationship between Temperature and Gloeo Timing

Gloeo sampling is timed to coincide with the peak in Gloeo populations, which typically occurs in late July or early August. A correlation between Gloeo population and temperature has been demonstrated on our lakes and others, which shows that Gloeo numbers often peak a week to a week and a half after the temperature maximum, which in many years occurs near the end of July. In 2018, the highest lake water temperatures were seen on July 5th and between August 7th and 9th. Because these maximums were both earlier and later than anticipated, Gloeo sampling dates were, for the most part, outside of the critical 7-11 days after peak temperature in July and August.

Gloeo concentrations in 2018 samples were low to average compared to previous years. It is possible that concentrations were actually higher than reflected in the samples taken because the timing of peak temperature did not line up with the timing of sample collection. The fact that there were two high temperature events in 2018 may have also spread out the release of Gloeo colonies, thus causing the concentrations to be lower overall but allowing the Gloeo population to persist longer throughout the summer. Indeed, there were some anecdotal reports of accumulations of Gloeo being seen well into September, but no reports of severe blooms at any point during the summer.



The above graph shows the relationship between daily average water temperature (blue line; taken from Keoka Lake, but representative of the region) and Gloeo concentration. The peak in temperature (based on daily averages) for the season occurred around August 9th, although on some lakes the maximum temperature was reached on July 5th. The black circles show when Gloeo samples were collected, as well as the relative concentration of Gloeo present (3 being the sample with the most Gloeo and 1 being the least). All lakes saw their highest sampled concentrations occur in early August. Additionally, the red box shows the dates of the expected peak in Gloeo concentration based on the date of the peak in temperature.

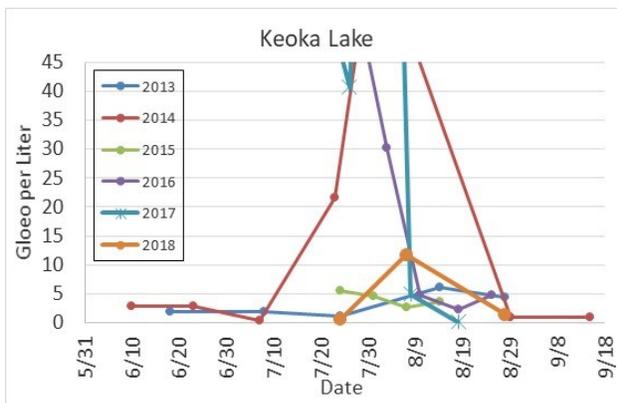
## Keoka Lake

Elevated levels of Gloeo in Keoka Lake have been documented as far back as the 1970s, although they have likely been present in the lake much longer than that. LEA has collected Gloeo samples from Keoka Lake since 2013 at a site adjacent to the public boat launch. Keoka Lake was sampled three times between July 24th and August 28th, 2018, roughly once every 2 weeks.

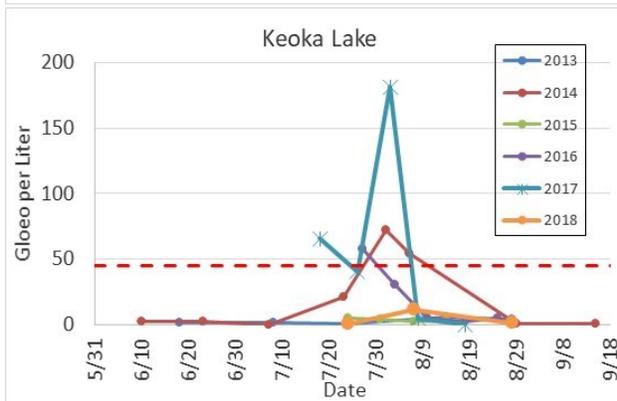
The Gloeo concentration peaked at 11.7 col/L on August 7th. This result is low compared to the peak concentration in 2017, which was over 10 times higher.

Concentrations of Gloeo in Keoka Lake appear to vary greatly from year to year. In 2014, 2016, and 2017, Keoka Lake had the highest Gloeo levels of all the lakes and ponds tested (maximums over 50 col/L in each year), while the highest concentrations found in 2013 and 2015 were 5.5 and 6.1 col/L, only just above the 5 col/L threshold. However, it is possible that prevailing winds and currents had moved much of the Gloeo biomass to other areas of the lake around the time when samples were collected, or that a higher peak in Gloeo concentration occurred in between or after samples were collected in those years.

Results from all Keoka Lake samples are graphed below. The top graph has the same vertical and horizontal axis scale as the rest of the lakes in this report, so that all the graphs are easily comparable. However, because some Keoka Lake data exceeds the upper vertical axis limit, a second graph has been made to show all the data.



Left (top): Graph of Gloeo data from 6 years of testing. Note that the vertical axis on the graph is cut off at 45 col/L to match with other graphs in this report and to provide more detail of individual results.

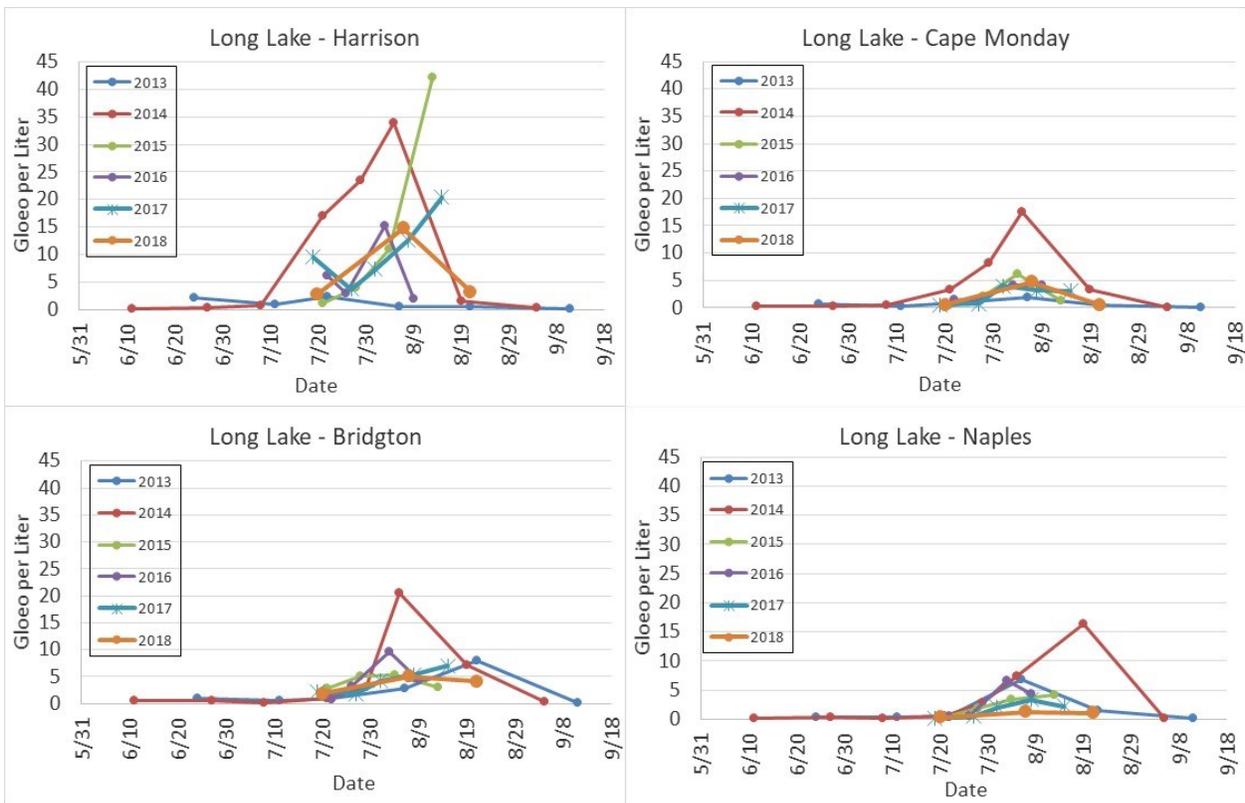


Left (bottom): Graph showing full data, with the vertical axis range being 0-200 col/L. The red dashed line shows where the upper limit from the top graph is (45 col/L).

## Long Lake

There are four Gloeo sampling sites on Long Lake. These sites are at the northwest corner of the lake in Harrison, Cape Monday cove on the eastern side of the lake, in the central part of the lake on the western shore in Bridgton, and on the Naples Causeway on the south shore.

Each of these four sites was sampled roughly once every two weeks between July 20th and August 21st, 2018. Gloeo concentrations at all four sites were highest on August 7th. Overall, the Harrison site had the highest Gloeo levels. The maximum concentration at that site in 2018 was 14.8 col/L, less than the 2017 maximum of 20.4 col/L. Concentrations at the other three sites were relatively low, with the highest value being 5 col/L at the Bridgton site. However, concentrations at these sites have been higher in previous years, especially in 2014.



Sampling results from 2013-2018 for each site monitored on Long Lake. Each graph has the same vertical and horizontal axis values to allow for easy comparison between graphs.

Top Left: Sampling results from the Gloeo monitoring site on the northern shore of Long Lake in Harrison.

Top Right: Cape Monday cove Gloeo sampling results.

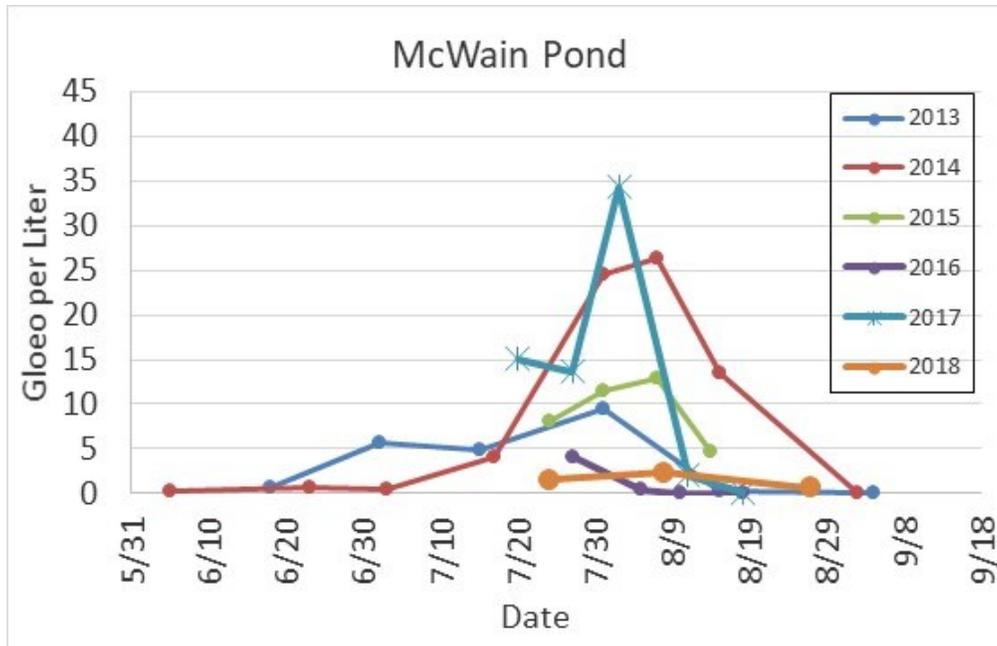
Bottom Left: Gloeo results from the monitoring site on the western shore of Long Lake's middle basin in Bridgton.

Bottom Right: Graph of Gloeo monitoring results from the causeway on the south shore of Long Lake in Naples.

## McWain Pond

Elevated levels of Gloeo in McWain Pond have been documented as far back as the 1970s, although they have likely been present in the pond much longer than that. LEA has been sampling for Gloeo on McWain Pond since 2013, at a site near the middle of the western shore. In 2018, three samples were collected between July 24th and August 27th.

The highest level of Gloeo found in 2018 was only 2.3 col/L on August 8th. This is in contrast to the 2017 peak of 34.3 col/L, but is similar to 2016 results. Because samples are collected only every two weeks, it is possible, and even likely, that higher concentrations were present in between sample collection dates. In addition, the concentration of Gloeo varies throughout the lake and may have been higher at a location other than where the samples were taken. The concentration in a given area varies with wind speed and direction, time of day, and sediment/substrate characteristics.



The above graph shows concentrations of Gloeo at one site on McWain Pond over the past 6 years.

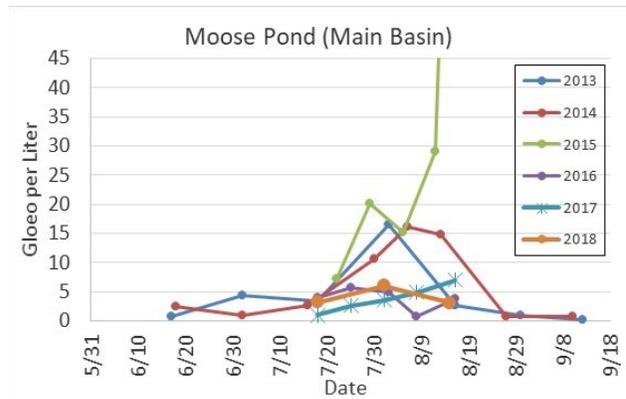
## Moose Pond

The north, south, and main basins of Moose Pond were all sampled for Gloeo in 2018. The north and south basins have consistently had less than 5 col/L of Gloeo since they were first sampled. One sample each from the north and the south basin were taken in 2018. The north basin had a concentration of 1.25 col/L on July 30th and the south basin had a concentration of 0.8 col/L on August 9th. While the main basin did have relatively low Gloeo levels in 2018, back in 2015 this site had the highest Gloeo level recorded anywhere by LEA at 192 col/L. Additionally, higher concentrations of Gloeo are known to accumulate near shorelines, and these populations are not always captured by our testing method.

A total of 3 samples were collected from the main basin at a site on the northwestern shore of the pond between July 18th and August 15th, 2018. The highest level of Gloeo found in 2018 was 6 col/L on August 1st.

Results from the last three years show low Gloeo concentrations on Moose Pond. However, it is important to note that even if the site where samples were taken happened to have low levels of Gloeo at the time of sampling, concentrations elsewhere in the lake may still have been high. Gloeo concentrations are often different across a lake, especially a relatively large one like Moose Pond. The amount of Gloeo present at a site at any one time depends on a variety of factors, including time of day, wind speed and direction, and temperature.

Right (top): Graph of Gloeo data from 6 years of testing. Note that the vertical axis on the graph is cut off at 45 col/L to match with other graphs in this report and to provide more detail of individual results.



Right (bottom): Graph showing full data, with the vertical axis range being 0-200 col/L. The red dashed line shows where the upper limit from the top graph is (45 col/L).

