

Lakes Environmental Association
2017 Water Testing Report

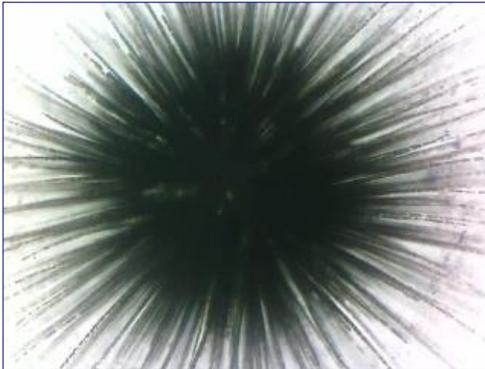


Chapter 3—*Gloeotrichia echinulata* Monitoring



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 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 enriching these lakes by moving phosphorus from the sediments into the water column.

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 from various lakes, 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 primarily 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 2017 are listed to the right. Several lake associations provided funding for the collection of samples on their lakes. Of the 28 sites tested, only seven have had elevated levels of *Gloeo* (>5 col/L) over the 5 years of testing. These are Keoka Lake, Long Lake (which has 4 sample sites), McWain Pond, and Moose Pond’s Main Basin. These sites were sampled five times over the course of 5 weeks in 2017. Several sites have had low levels of *Gloeo* present in late summer each year (below 5 col/L). The remaining sites, about 75% of the total sites sampled, 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 following pages present data from the four lakes with elevated late-summer *Gloeo* concentrations. Each lake’s results are graphed on plots with the same scale on the x-axis and y-axis to facilitate comparison.

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 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. However, on most other lakes, only one site is sampled. This means we potentially miss “hot spots” of elevated *Gloeo* on some lakes. That being said, after sampling for 5 years and visiting each lake on the above list 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.

Lakes Sampled for <i>Gloeotrichia</i> in 2017:	
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)	

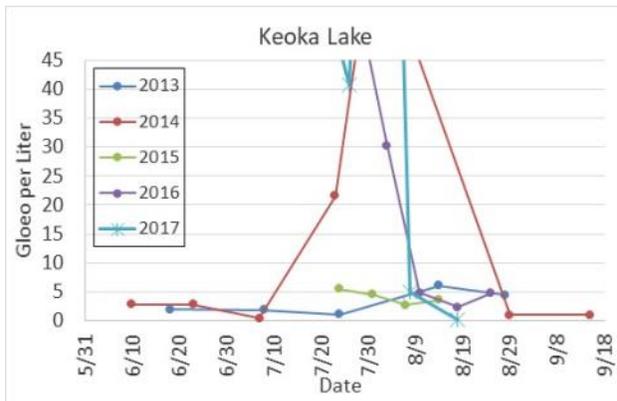
Keoka Lake

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 five times between July 18th and August 18th, 2017, roughly once per week.

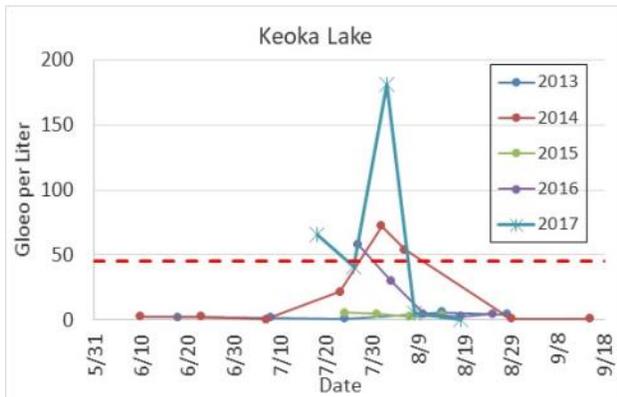
The Gloeo concentration peaked at 181 col/L on August 2nd. This is the highest level recorded by LEA from Keoka Lake and the highest level on any lake in 2017. It is not the record high for all lakes since sampling began, but it is close to it.

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, 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 5 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

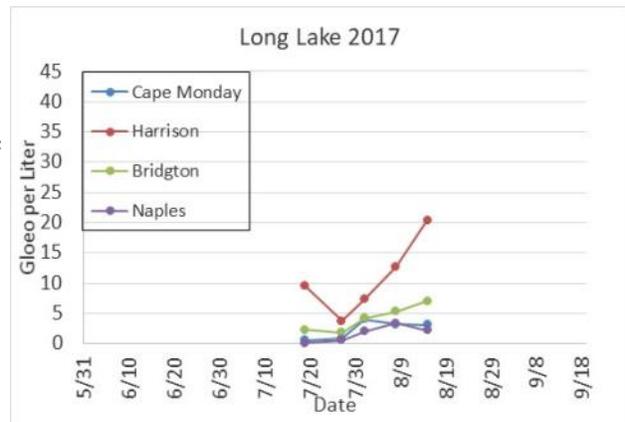
There are four Gloeo sampling sites on Long Lake. These sites are at the northwest corner of the lake in Harrison, Cape Monday cove on the eastern side of the lake, in the central part of the lake on the western shore in Bridgton, and on the Naples Causeway on the south shore. Results from sampling at these sites in 2017 can be seen to the right. This graph, as well as the site-specific graphs on the next page, all have the same vertical and horizontal axes to make it easy to compare values between them.

Each of these four sites was sampled roughly once per week for five weeks between July 19th and August 15th, 2017. The Harrison site consistently had the highest Gloeo levels each time the lake was sampled. The maximum concentration at that site in 2017 was 20.4 col/L. Concentrations at the other three sites were relatively low, with only the Bridgton site reaching a maximum level above 5 col/L. However, concentrations at these sites have been higher in previous years, especially in 2014 (see graphs on the next page).

Sampling is timed to coincide with the peak in Gloeo populations, which typically occurs in late July or early August. The graph above suggests that Gloeo populations, at least at the Harrison and Bridgton sites, were still rising when the last sample was taken in mid-August. The same cut-off upward trend is seen in the 2015 data from the Harrison site (see graph on the next page).

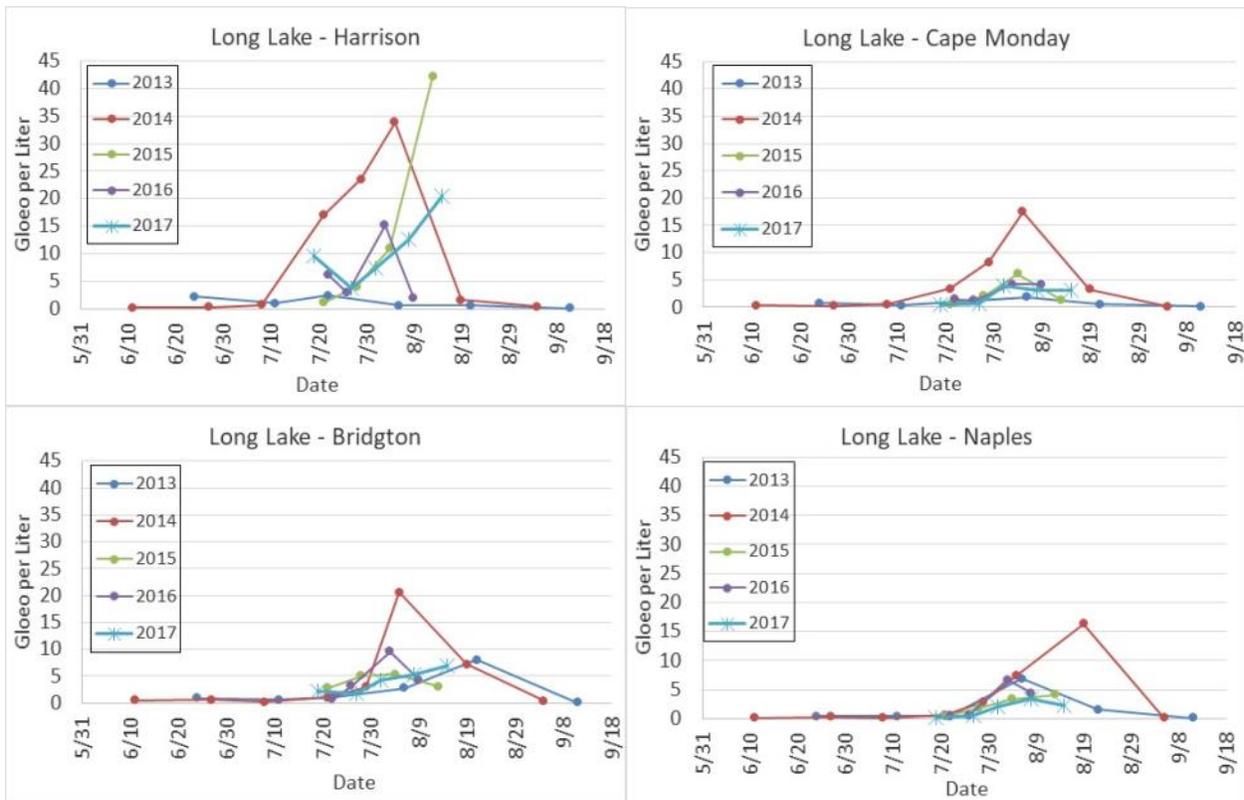
The timing of peak Gloeo populations at a given site depends on several factors, including temperature, time of day, and wind speed and direction. The peak in water temperature on most lakes and ponds in the area occurred around July 20-23. A correlation between Gloeo population and temperature has been 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. This would put the Gloeo peak timing somewhere between July 27th and August 3rd.

Both Keoka Lake and McWain Pond had their highest Gloeo levels for the season on August 2nd, after which Gloeo concentrations dropped off dramatically. However, the two sites on Long Lake (as well as Moose Pond's main basin) appear to have peaked later in August. We don't know exactly why this peak was later, but it could be because these sites have subtly different triggers controlling their release of Gloeo colonies, or it could have to do with wind speed and direction around the time of sampling, which could have caused a build up of Gloeo at these particular sampling sites.



This graph shows only 2017 Gloeo data from each of the four sites on Long Lake. Graphs of year-on-year data from each site are on the next page.

Long Lake



Sampling results from 2013-2017 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. This site has consistently had the highest Gloeo levels of all the sites on the lake.

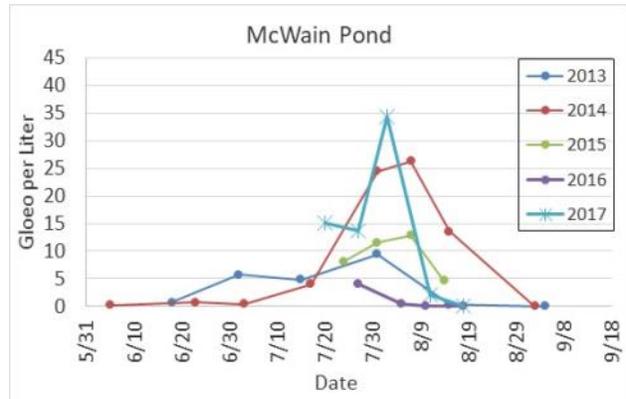
Top Right: Cape Monday cove Gloeo sampling results. This site generally has some of the lowest Gloeo levels each year.

Bottom Left: Gloeo results from the monitoring site on the western shore of Long Lake's middle basin in Bridgton. This site usually has the second highest Gloeo levels.

Bottom Right: Graph of Gloeo monitoring results from the causeway on the south shore of Long Lake in Naples. Like Cape Monday cove, Gloeo levels are usually fairly low here compared to the Bridgton and Harrison sites.

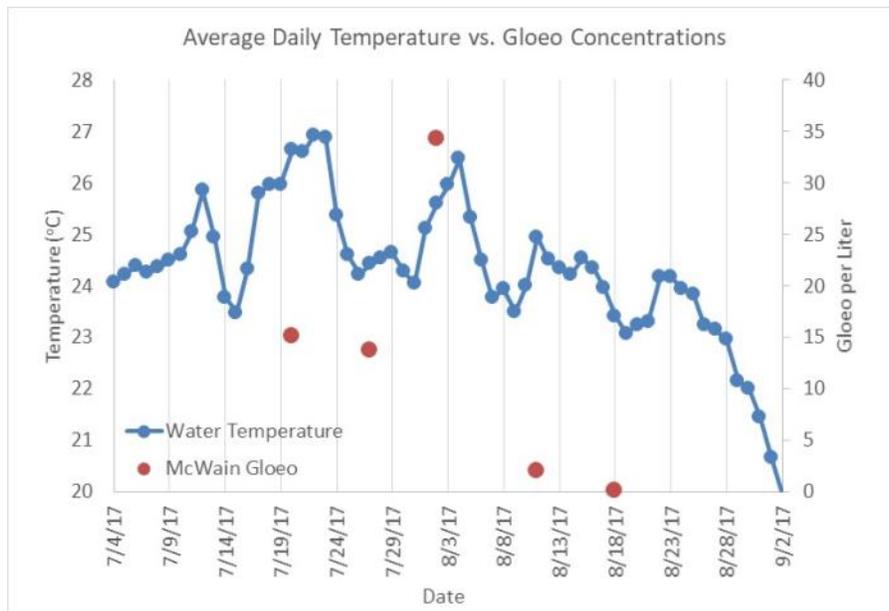
McWain Pond

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 2017, samples were collected approximately once per week between July 20th and August 18th.



The above graph shows concentrations of Gloeo at one site on McWain Pond over the past 5 years.

The peak in Gloeo concentration occurred on August 2nd, and at 34.3 col/L, it was the highest level recorded on the pond in five years of testing. This is in contrast to 2016 results that showed Gloeo concentrations were consistently low (below 5 col/L) each time the pond was sampled. The graph below shows Gloeo levels recorded on McWain Pond in relation to average daily shallow-water temperatures in 2017. It shows that the peak in Gloeo concentration occurred about 11 days after the temperature peak, which matches well with previous demonstrations of the correlation between temperature and Gloeo peaks.



The above graph shows daily average water temperature (taken from Keoka Lake, but representative of the region), with the peak in temperature for the season being between July 20-23. Concentrations of Gloeo from McWain Pond are shown as red dots. The peak in Gloeo concentration occurred about 11 days after the peak in temperature.

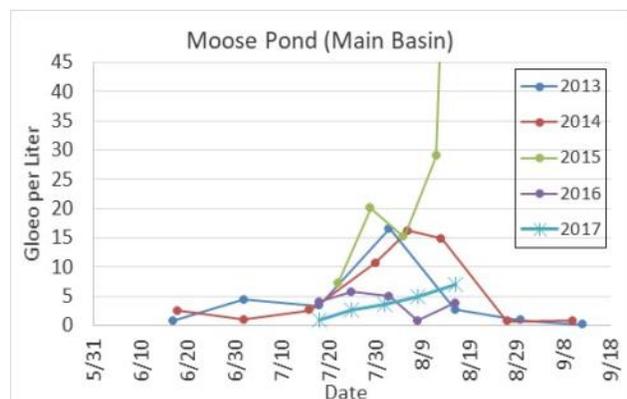
Moose Pond (Main Basin)

The north, south, and main basins of Moose Pond were all sampled for Gloeo in 2017. The north and south basins have consistently had less than 5 col/L of Gloeo since they were first sampled. While the main basin did have relatively low levels in 2017, back in 2015 this site had the highest Gloeo level recorded anywhere by LEA at 192 col/L. Additionally, large concentrations of Gloeo are known to accumulate near shorelines, and these populations are not always captured by our testing method.

One sample was collected each week for five weeks from a site on the northwestern shore of the main basin between July 18th and August 16th, 2017. The highest level of Gloeo found in 2017 was 7 col/L on August 16th, however higher concentrations have been documented (see below).

The last two years' data show low Gloeo concentrations on Moose Pond. 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. For instance, the picture on page two of this chapter shows an accumulation of Gloeo on the shore of Moose Pond seen during routine water testing (at a different location from the Gloeo sample site) on August 10th, two days after the pond was sampled for Gloeo. That sample had a concentration of only 4.9 col/L, much less than what was at the site in the picture. Gloeo concentrations across the pond fluctuate frequently, and the amount 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 5 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).

