Annual Meeting 2026 - Water Quality Report

Members of the Water Quality Team at Leonard Lake: Rose Veitch, Bill Heatlie, Laurence Jay, Sharon Abbott-Fry and Grahame Abbott, Bruce McNeely, Esther Giesbrecht, with assistance from Ken Riley, Rohan Riley, Betty Isbister.

'Eyes on the Lake" has been in place for several years and remains a key water team and LL resident initiative. Please continue to report any suspected algal blooms or unusual sightings in the water, and a water team member will come to your shoreline to investigate and possibly take a water sample for testing. Phone or text Esther at 647-763-8677 or Bill 705-840-6421.

We are indebted to Dr. Norman Yan, Friends of the Muskoka Watershed for his generosity in offering advice, expertise, and guidance.

WHY do we monitor the water in Leonard Lake?

Dr. Andrew Patterson (Queens University), in an on-line seminar in Feb 2026, stated that, "Most lakes with recurring (algae) blooms had the following characteristics: they were less than 15 m deep, they stratified, and they had anoxia." That is, they tended to be shallow, had large temperature differences between the top and bottom layers, and had no oxygen near the sediment. Leonard Lake fits that profile. That makes our lake vulnerable.

To ensure a healthy lake we need: to keep the water phosphorus levels low enough to reduce the overall growth of algae; maintain a delicate balance of algae, zooplankton, oxygen, temperature, and various minerals; and avoid the introduction of invasive species, pollutants, and toxins. In the face of changing weather patterns, we try to encourage good practices, good stewardship, and a shared responsibility to preserve our shared resource.

HOW do we monitor the water quality?

1. Once every 2 weeks we take measurements at 3 deep sites on the lake; these are marked with buoys. We use sensitive instruments like a Sonde (purchased by the LLSA) to measure temperature, dissolved oxygen, and conductivity at various depths between the surface and sediment. We may also obtain water samples at different depths to test for cyanobacteria (blue-green algae) as well as for specific minerals. (When oxygen is depleted near the sediment, some minerals can be released; these can benefit the growth of cyanobacteria and make algal blooms more likely.)

2. Biweekly, we also monitor 4 shoreline sites that have experienced algae blooms in the past. These samples are usually tested for cyanobacteria to check for any bloom activity. Two pigments,

3. Chlorophyll (from all algae), and phycocyanin (from cyanobacteria) are measured using a fluorometer. We can determine when a bloom might be starting, and then track the progress – sometimes it develops further into a visible bloom, and other times it fails to progress.
4. We participate in programs run by other agencies:
    a. Lake Partner Program:

Provincial program that requires sampling in May for total phosphorus, occasionally other parameters as well. In addition, water clarity (Secchi depth) and water temperature are documented and submitted.

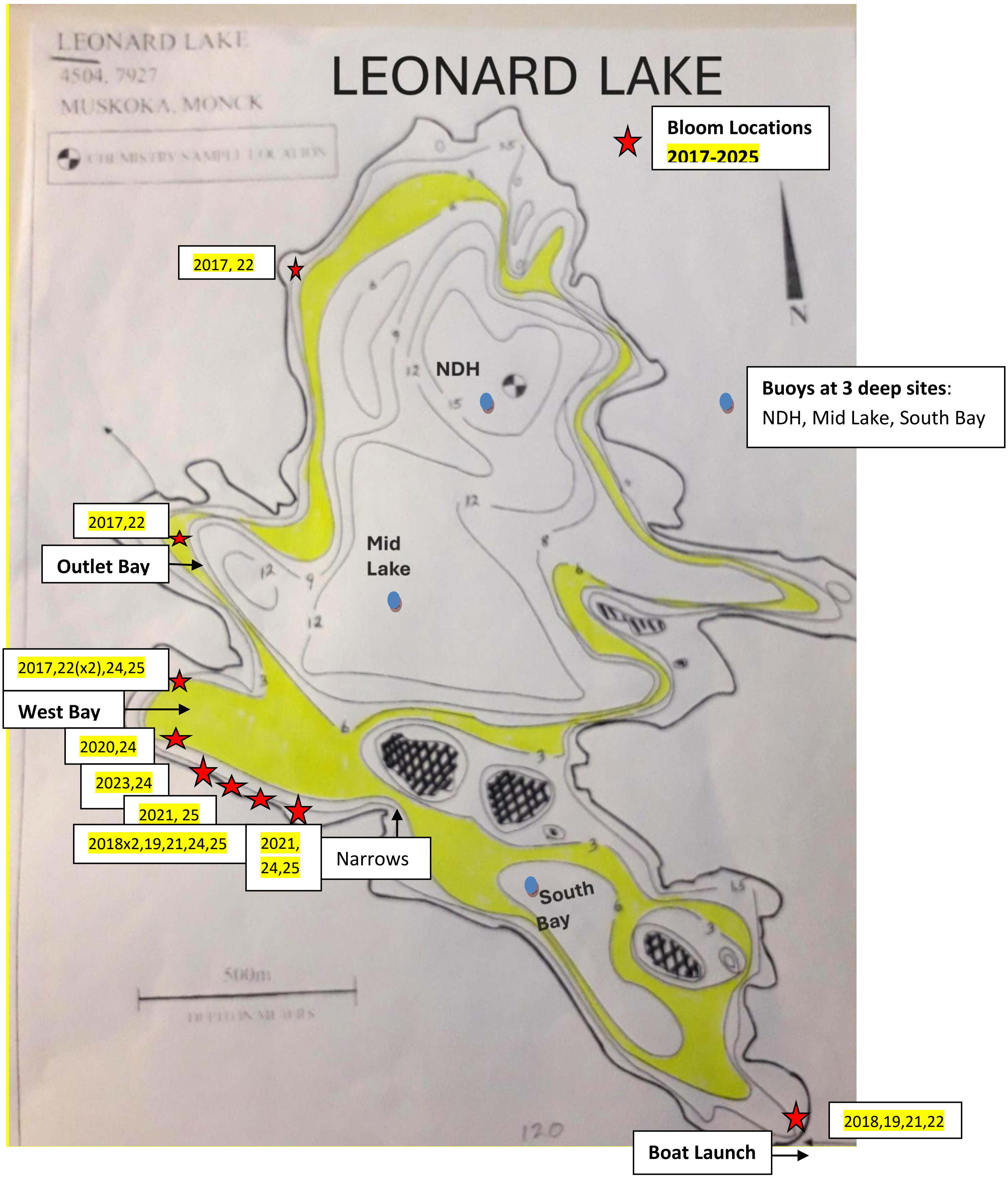
b. Friends of Muskoka Watershed Algae Monitoring Program:
   Four sites are sampled (2 nearshore and 2 farshore) for algae levels. We have participated for 6 years.

5. We take part in projects that will help us:
   a. To understand the changes that occur in the water during the ice-free season;
   b. To understand the dynamics between phytoplankton (plants and algae) and zooplankton (small animals that feed on the algae);
   c. To understand how invasive species, pollutants, toxins, and weather could impact the balance of the lake ecosystem.
   d. To understand the dynamics of algae blooms.

What have we learned ?

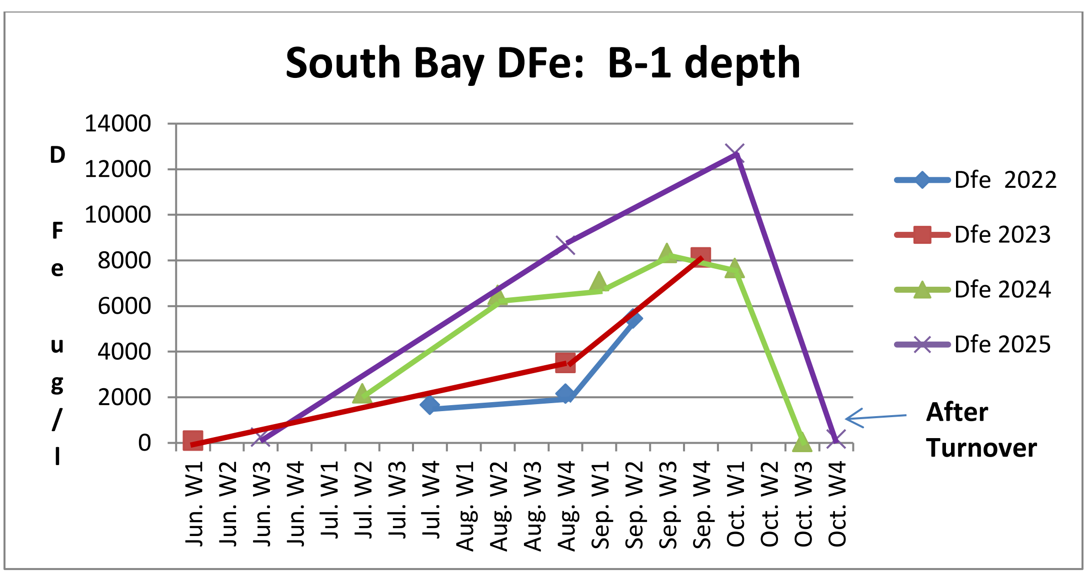
A brief review and some outstanding issues:

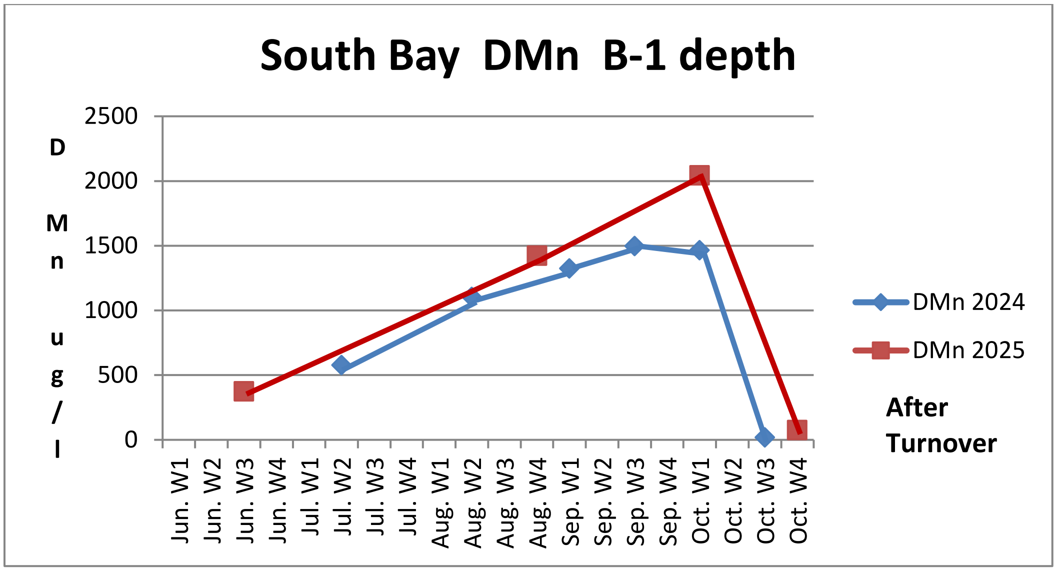
1. **Leonard Lake consists of 2 basins** – the shallower South Bay which includes West Bay, and the deeper Main Basin. See Bathymetric map below.
   The difference in depth between the 2 basins can result in different dynamics in a variety of characteristics.
   a. The numbers on the contour lines specify the depth in meters. Blue dots indicate the locations of buoys at the 3 deep sites: South Bay (maximum 9.5 m), Mid Lake (maximum 14.5 m), NDH (North Deep Hole, maximum 18.3 m).
   b. Cyanobacterial blooms have been documented along the shoreline from the Boat Launch in the south and along the western shore; stars indicate at least 2 blooms between 2017 and 2025. Most blooms have occurred in the Fall, have been transitory, or of short duration, and limited in size. Toxicity tests have been negative for Anatoxin A and negative (or very near the detection limit) for Microcystins.


LEONARD LAKE
4504, 7927
MUSKOKA, MONCK
CHEMISTRY SAMPLE LOCATION
LEONARD LAKE
Bloom Locations
2017-2025
N
2017, 22
NDH
Buoys at 3 deep sites:
NDH, Mid Lake, South Bay
2017,22
Outlet Bay
Mid
Lake
2017,22(x2),24,25
West Bay
2020,24
2023,24
2021, 25
2018x2,19,21,24,25
2021,
24,25
Narrows
South
Bay
500m
2018,19,21,22
Boat Launch
120

2. **Temperature**:
    a. We have a device recording water temperature at a 2m depth from Spring until Fall. Annual temperature profiles are generally similar but can show important variations from year to year.
    b. Thermal stratification occurs at all 3 deep sites – the upper layers of water are warm whereas the deeper layers are much colder.
3. **Water Clarity**:
    a. The clarity of the water is described as the "Secchi Depth"; it varies during the season and between different areas of the lake, but is generally between 3-3.5 m. Twice the Secchi depth defines the "Photic zone" - the depth to which sunlight can penetrate.
4. **Anoxia (lack of oxygen):** occurs at the sediment at all 3 deep sites each year. It is already established in South Bay by mid June, and extends all the way up to the 6m depth by early August. At the Mid Lake site and at the North Deep Hole, anoxia begins in early August and extends upward to 11m by the end of October.

5. **Internal Loading** (release of nutrients such as phosphorus as well as minerals such as iron and manganese from the sediment due to the decline in dissolved oxygen.)
    Anoxia is accompanied by an increase in conductivity due to the release of minerals from the sediment. The increase in concentration of phosphorus and in dissolved minerals is significant. The 2 graphs below illustrate the concentration of dissolved iron (DFe) and dissolved manganese (DMn) at 1m above the sediment (B-1) in the South Bay between June and October during the last years.





The extent of internal loading is greatest in South Bay; at the sediment, the concentration of dissolved iron can reach > 12000 ug/l (surface level <50), and dissolved manganese 2000 ug/l.

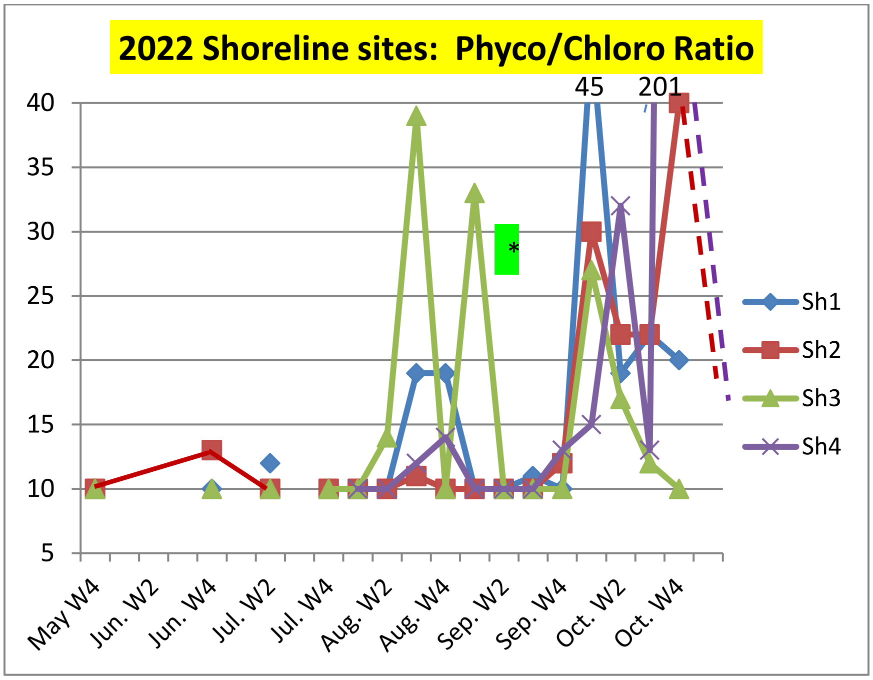
Total phosphorus near the sediment can reach 50ug/l (surface level <10).

6. Algae Pigments and Blooms:

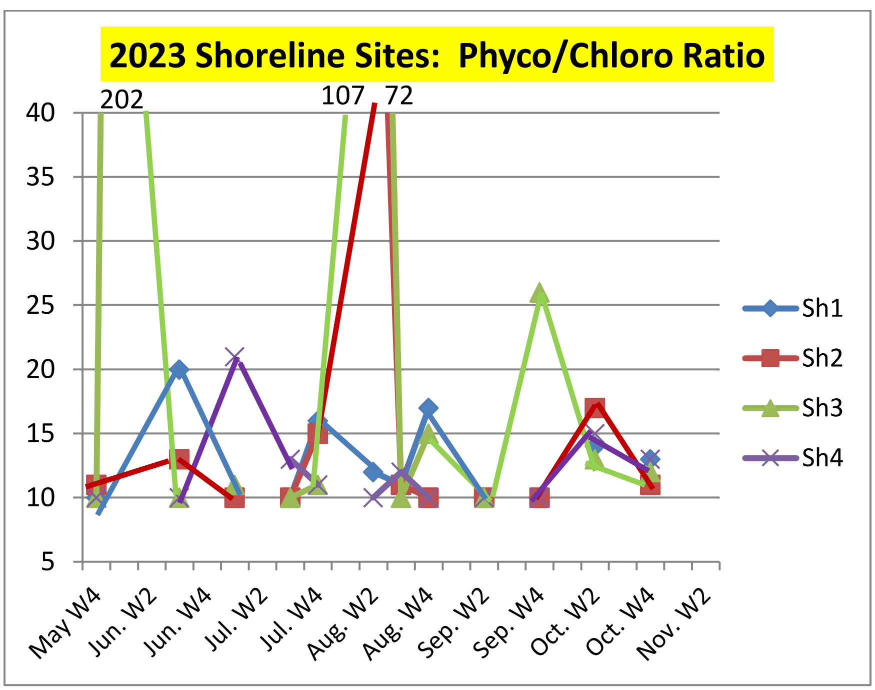
Chlorophyll is the green substance in all plants including algae. Phycocyanin is produced only by Cyanobacteria (Blue-green algae). We can measure both using the fluorometer purchased by the LLSA. The **RATIO** between them (phycocyanin/chlorophyll) is a number that tells us when a cyanobacterial bloom (rather than an algae bloom of another type) is occurring. The ratio is usually less than 10, but can increase dramatically during a bloom. See 4 graphs below.

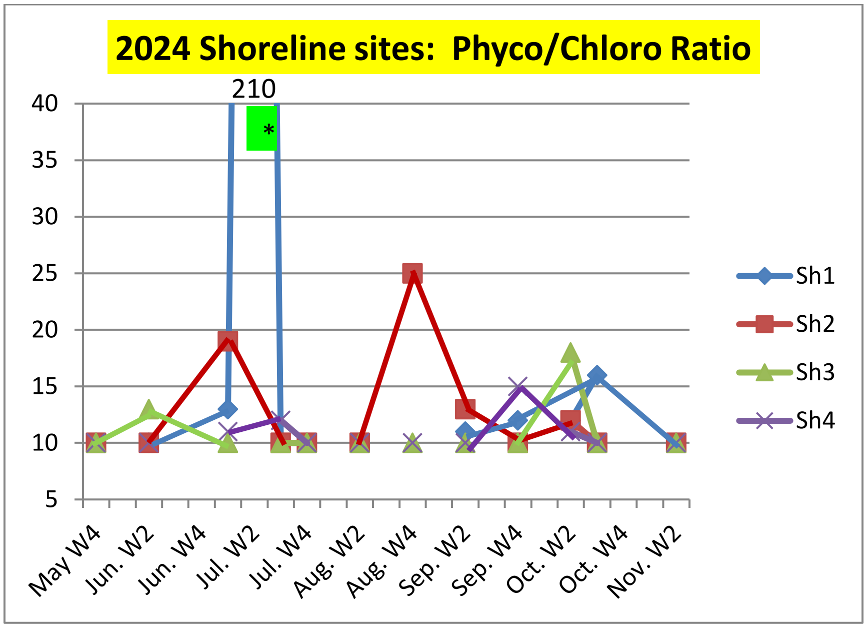
The 4 Shoreline sites where we monitor the water (Shorelines 1-4) are shown from year 2022-2025, one graph for each year; the ratio number is on the left of the graph, and the date is along the bottom.

The graphs show peaks (blooms) of various sizes; some may increase a little before decreasing again (and may not "look" like a bloom), while others show much larger increases (to over 200) and these would appear as visible blooms. Blooms vary in intensity, frequency, and may be more active some years than others, but recurring blooms at these sites seems to continue.

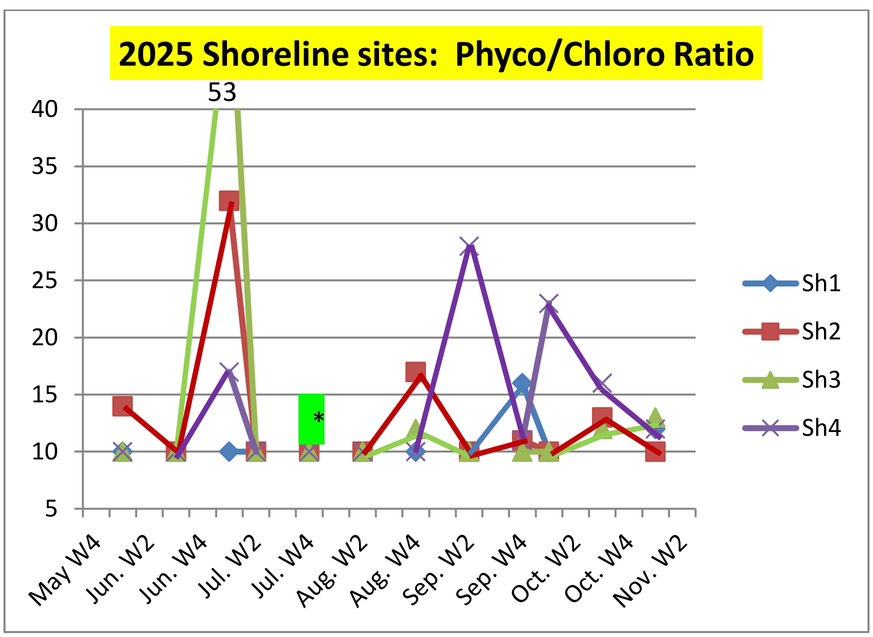


*B-1 sample in South Bay Positive for D. lemmermannii





*B-1 sample in South Bay Positive for D. lemmermannii



*** DCM sample in Mid Lake Positive for D. lemmermannii**

Although some blooms in late Fall can persist for several days and spread over a wider area, we have been fortunate that most remain small and dissipate within 24-48 hours. Our goal is to keep them infrequent, small, and transitory.

7. Daphnia Status:

Historical data of Zooplankton sampling on Leonard Lake dates back to the 1980's; it describes a healthy and diverse component of Daphnia species. Much has changed in the ensuing 40 years – the introduction of the invasive spiny water flea, changes in water chemistry (increased salt levels as measured by chloride concentration as well as lower calcium levels), pollutants such as insecticides, development density with shoreline alterations and erosion, and changes in weather.

With advice from Dr. Norman Yan, we conducted a pilot project to assess current zooplankton status. On Aug 21 and 22, 2025, we collected 5 zooplankton samples - - 3 from the deep sites and 2 composite samples from several nearshore areas; all samples were sent out for analysis. The results are based on a single date and are therefore qualified observations:

a. Zooplankton are in reasonable shape.
b. The sizes of various zooplankton are on the smaller end of their size range.
c. A gelatinous water flea (Holopedium) is at least double the numbers found in the 1980s. It has much lower phosphorus and calcium requirements than Daphnia, and can better tolerate the spiny water flea.
d. Some Daphnia species appear to be gone, and other species are present.

We don't know if the changes observed apply to other lakes in Muskoka. We suggest that it is important to monitor changes in the zooplankton population on a regular, more frequent basis.

8. WHERE do the Blooms "come from"?

Cyanobacteria, in small numbers, are part of the "normal population of algae" in our lakes. They become problematic when they "take over" and become dominant by forming colonies and undergoing a rapid increase to form visual accumulations called Blooms. This occurs more frequently in warm, calm, shallow shoreline areas where nutrients (phosphorus) may be available.

They can, under some conditions, produce toxins. And when they die off they can leave "Seeds" (called akinetes) in the sediment which can reactivate the following years. This is one reason why blooms reoccur at the same sites. It is important to reduce the availability of nutrients at all shorelines, to reduce erosion and run-off, and to encourage naturalization of shorelines.

Blooms can also benefit from Internal Loading (release of phosphorus and iron) from the sediment at deep sites which are anoxic (lacking oxygen). This situation is most apparent in South Bay – the anoxia is established by June, and the release of nutrients from the sediment is continuously increasing during the entire season. The concentration of Iron and Manganese reaches its highest level in the first week in September, coinciding with the anoxia extending up to 6 meters; sunlight can now reach this depth, and the water temperature t6 m also reaches its highest point. This combination is optimal for algal growth and could sustain and fortify cyanobacteria.

It is believed that Dolichospermum (the cyanobacterial species that is found in virtually all the blooms on the lake) can more easily access this favourable habitat in South Bay than the deeper sites in the Main Basin. And while we have some evidence in this regard, the definitive proof is elusive.

We have also borrowed some devices called "Cyanotraps" to try to "follow the trail of Dolichospermum".

9. The Role of Water Currents:

We are still trying to understand the movement of cyanobacteria in the lake. Dr Yan has suggested the use Drogues to enable the studies of water currents.

10. The Impact of Salt:

We have learned that the concentration of chloride has been increasing in Leonard Lake, and that this is coming primarily from road salt used on Highway 118. Run-off from areas close to the Highway near the boat launch, can contain 10 times more salt than what is measured in our lake. More recently we have also learned that some of this salt can remain in wetland areas for longer periods of time, and can continue to be released throughout the summer.

Daphnia, the zooplankton that graze on algae, thereby reducing the possibility of algae blooms, are harmed by road salt. While some zooplankton can tolerate higher levels of salt, others are much more sensitive. In oligotrophic lakes (those with lower algae levels) the most sensitive Daphnia are toxic when the chloride (salt) level reaches 5 mg/l. We are currently between 4-5 mg/l.

We will continue to monitor chloride levels to see if the trend continues. The Friends of the Muskoka Watershed have launched the "Salty Muskoka" project to increase awareness about the negative impacts of road salt, and there have been some suggestions about possible ways to reduce the amount of salt already sequestered in wetland areas.

11. Availability of Data:

Our goal is to make data available on-line so that any interested party can view our findings. Sharing protocols and other relevant information benefits everyone in the community, and helps all of us to promote our common goal of preserving the health of our lakes.