Algal Blooms – 2023

During 2023 four algal blooms were recorded. The first type of algal bloom which occurred was from filamentous green algae. This bloom lasted, as in previous years, from mid-June until mid-September.

The second type of bloom was from blue-green algae which this year covered the deeper parts of the lake including Three Mile and Pickerel Bays and extending into the main water body (See Appendix 1). *Note that the Ministry of the Environment policy towards blue-green algal blooms is: "MOE regards any cyanobacterial (blue-green algae) bloom as potentially toxic, whether or not toxins are detected in the water upon testing"*[1],[2].

The authors emphasize that the algal blooms observed by our team are the minimum number for White Lake, and there may very well have been others on the lake which went undetected or unreported. No Provincial or local authority monitors water bodies for algal blooms. The Ministry of the Environment and local health units respond only to reports from the public at large. Currently only two volunteers are monitoring the 22 Km² of White Lake, which has a shoreline stretching nearly 100 km!

3.1 Green Algal Blooms

The first algal bloom of the year started in mid-June and continued until the end of summer. This bloom was of a filamentous green alga, which grew in patches along the shoreline, especially were zebra mussels reside.

In 2023, the filamentous green algal bloom was less extensive than in previous years with fewer occurrences. However, there was an increase in this alga which accompanied one of the Blue-Green algal blooms (September 5 to 10, 2023).

[1] Algal Blooms in Ontario, Canada: Increase in reports since 1994; J.G. Winter, A.M. DeSellas, R. Fletcher, L. Heintsch, A. Morley, L. Nakamoto, and K. Utsumi (all Ontario Ministry of the Environment scientists); *Lake and Reservoir Management*, 27:107-114, 2011.
[2] Cyanobacterial blooms in Ontario, Canada: continued increase in reports through the 21st century; Elizabeth J. Favot, Claire Holeton, Anna M., DeSellas & Andrew M. Paterson; Lake and Reservoir Management, 39:1, 1-20, DOL: 10.1080/10402381.2022.2157781.

Algae bloom when conditions are right for its rapid and uncontrolled growth. These conditions include the presence of excess nutrients (phosphorus), favourable water temperature and clarity, sunlight, and the action of wind and waves. For White Lake, the presence of zebra mussels is an additional factor promoting the growth of filamentous green algae. These mussels tend to concentrate nutrients from open waters to the shoreline area where filamentous algal blooms occur. The severity of the algal bloom resulting from the sum of the above factors can be intensified by the runoff of nutrients from areas of shoreline which have been de-treed or altered in such a way that nutrients can enter the lake unmoderated by the presence of trees and other natural shoreline vegetation which prevents or slows entry nutrients into the lake.

Viewed from underwater, the algae mass forms very large volumes extending from just below the surface of the lake all the way down to the lake floor. Other aquatic plants become enveloped within the growing mass. Over time, the algae die, collapses into itself and sinks to the bottom of the lake.

General Appearance of Filamentous Green Algal Bloom

This alga does not produce toxins in the water and so the bloom is considered a nuisance bloom. However, when large mats of algae die and decompose, the water column can become anoxic (no oxygen) causing the release of phosphorus trapped in sediments. Sediments contain about 200,000 times the concentration of phosphorus found in lake water. The released phosphorus can trigger a secondary bloom which could be larger and last longer than the original event.

3.2 Blue-Green Algal Blooms

Blue-green algal blooms are not benign and so warrant special attention. When these blooms occur, they can create a public health hazard and anyone using the lake should be apprised of the seriousness of this issue. Three such algal blooms were recorded in 2023 starting on September 5.

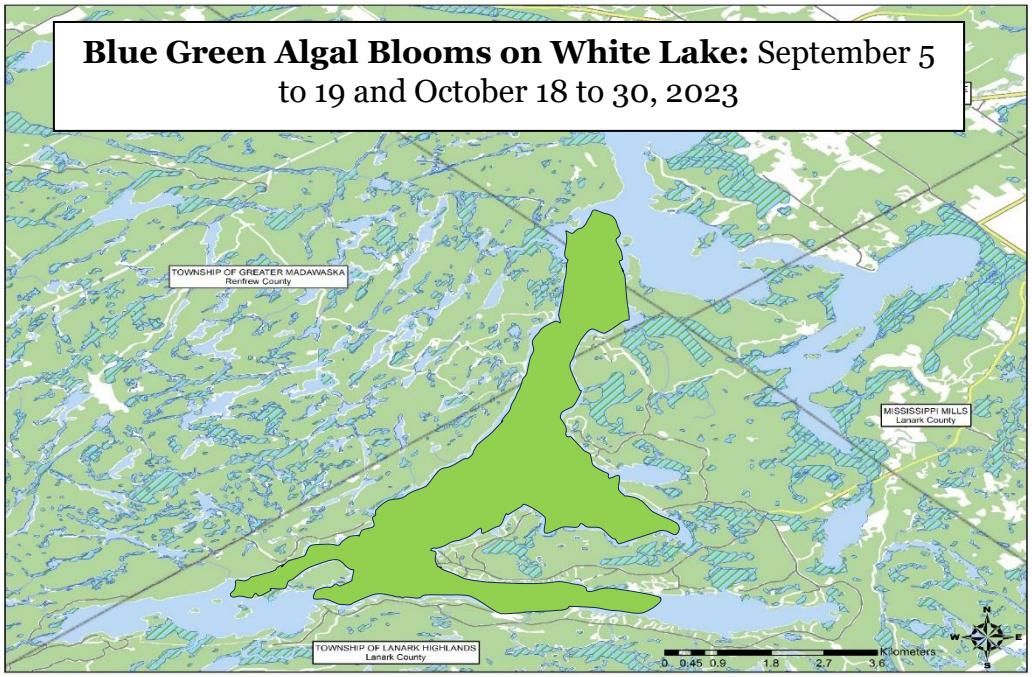
September 5 to 19, 2023 and October 18 to 30, 2023

In 2023, White Lake hosted three blue-green algal blooms. The first occurred on September 5 to 19; the second from September 30 to October 10; and the third from October 18 to 30.

The bloom affected areas from the southern end of Hardwood Island all the way up to the narrows including Three Mike and Pickerel Bays. Some surface scum derived from this bloom was visible in some of these areas. In all of these areas, significant concentrations

of the anabaena blue-green algae were seen in the water column and later confirmed using a microscope.

The September 15 and October 18 blue-green algal blooms are discussed together because they had the same range of occurrence on White Lake. This is illustrated on the map below. The only difference between the two algal blooms is that the September bloom consisted mainly of anabaena blue-green algae whereas the October 18 bloom included significant concentrations of microcystis alga.



The photo below shows the appearance of the blue-green algal bloom along part of the shoreline of White Lake.

The Ministry of the Environment Conservation and Parks was notified and a staff scientist took a number of water samples for analysis for toxins. The results, shown below, indicate that the level of toxins was at or below the level of detection for the analytical method used. This result indicates that dangerous toxins had not developed in this algal bloom at time of sampling. However, one must keep in mind that there is a possibility that toxins were produced at a later date or even at another location on the same date.

Analytical Results

Lab ID: 12257001 **Date Collected:** 9/5/2023 3:59:00 PM
Field ID: 1-3T6PF4 **Matrix:** Water

Parameter	Result	Units	RDL	Rmk	Analyzed
E3469					
Total Microcystins	<0.10	µg/L	0.10		09/08/2023
E3568					
Anatoxin-A	<0 20	µg/L	0 20		09/08/2023
ORGANIC CHEMISTRY					
E3450					
3-Desmethyl-microcystin-LR	<0 050	µg/L	0 050		09/07/2023
3-Desmethyl-microcystin-RR	<0 050	µg/L	0 050		09/07/2023
Anatoxin-a	<0 050	µg/L	0 050		09/07/2023
Microcys in-HilR	<0 050	µg/L	0 050		09/07/2023
Microcys in-HtYR	<0 050	µg/L	0 050		09/07/2023
Microcys in-LA	<0 050	µg/L	0 050		09/07/2023
Microcys in-LF	<0 050	µg/L	0 050		09/07/2023
Microcys in-LR	<0 050	µg/L	0 050		09/07/2023
Microcys in-LW	<0 050	µg/L	0 050		09/07/2023
Microcys in-LY	<0 050	µg/L	0 050		09/07/2023
Microcys in-RR	<0 050	µg/L	0 050		09/07/2023
Microcys in-WR	<0 050	µg/L	0 050		09/07/2023
Microcys in-YR	<0 050	µg/L	0 050		09/07/2023

The occurrence of algal blooms is complicated and dependent on a number of factors including wind, temperature, sunlight, water depth, the presence of different phosphorus

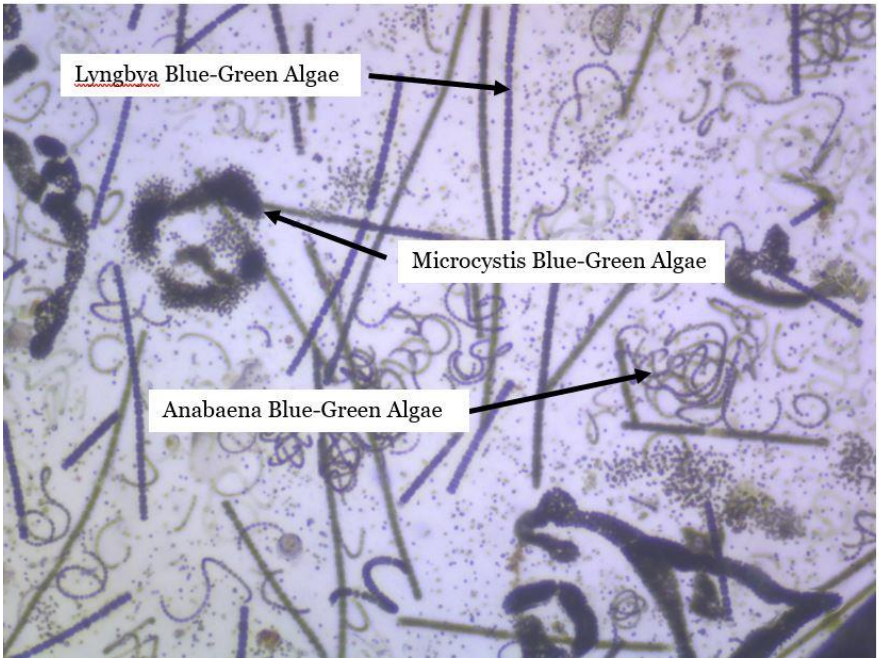
and sulphur containing compounds, as well as nitrate and nitrite concentrations, to name just a few.

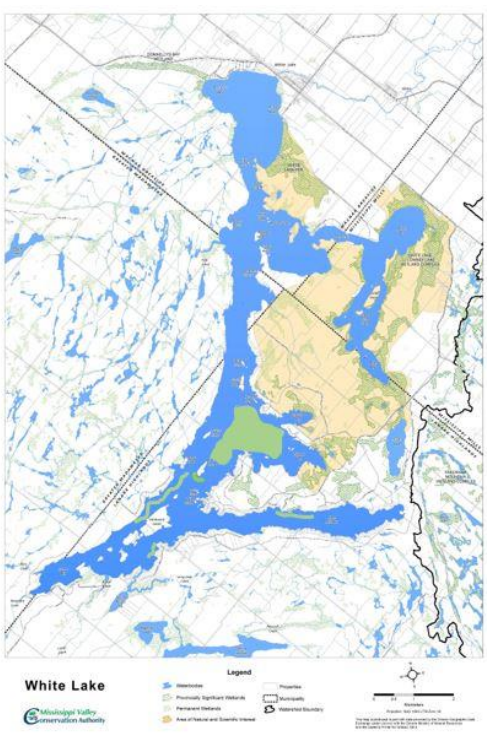
Below is a photo of the appearance of the October 18 to 30 blue-green algal bloom taken along the shoreline at different locations and contributed to us from cottagers.

October 18 to 30, 2023

<u>September 30 to October 10, 2023</u>

Between the two algal blooms discussed above came an additional bloom with different characteristics than the other two: First; the range of distribution was smaller than the other two and the bloom contained comparatively equal concentrations of three different (taxa) blue-green algae. The map below and the photomicrograph illustrate our observations.





For all of the algal blooms discussed above, it should be noted that these blooms occurred in the deeper parts of White Lake. Shallow areas were not affected. This may be because during the fall months and in periods of low or no wind, that the lake becomes thermally stratified. This means that upper warmer waters are not mixing with deeper cooler water. At the same time, the level of oxygen close to the bottom of the lake is greatly reduced by consumption arising from decaying organic matter and microbial action.

Under these conditions, phosphorus stored in sediments, which is 200,000 times more concentrated than in the water column above, can be released and result in algal blooms.

During the late summer and fall of 2023 we experienced long periods of calm weather with low or no winds. These conditions would favour the release of phosphorus from sediments (also known as internal loading) as discussed above.

This phenomenon is one of the collateral effects of global warming and climate change.

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