



2022 KAKSHE AND BASS LAKE STEWARD REPORT – EXECUTIVE SUMMARY

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ABSTRACT

The findings of all environmental water quality and biological monitoring for both Kakshe and Bass Lakes in 2022 have been summarized and compared to acceptable water quality and aquatic health benchmarks for algal friendly nutrients phosphorus and nitrogen as well as over 30 different chemical parameters. Historical trends in water quality over four decades have, with one minor exception, identified no major contamination issues that would explain why Kakshe Lake was impacted by harmful algal blooms (HABs) in both 2020 and 2021. The exception was for phosphorus at one location in Kakshe Lake, where levels have gradually started to rise and are now well above a 'Background' level. This report discusses why this happening and identifies four key actions waterfront property owners can take to reduce the likelihood of future HABs as our climate changes. Based on a KLRA-funded near-shore sampling program in 2021, we need look no farther than our own shorelines to understand why the historical monitoring at mid-lake, deep water sampling locations is not generating a true picture of water quality close to the shore. This report also identifies some insights and linkages between our changing climate and its role in the development of late season HABs in Kakshe Lake.

Executive Summary

2022 Kahshe and Bass Lake Steward Report

A comprehensive review and analysis of all historical environmental monitoring on Kahshe and Bass Lakes has now been completed and presented within annual Lake Steward Reports from 2012 through 2022. These documents as well as Executive Summaries each year have been posted on the KLRA website: <https://kahshelake.ca/Water-Quality>.

This report captures the findings from sampling and analysis of both Kahshe and Bass Lakes in 2022.

In an effort to simplify the reporting of a large amount of measurement and analysis data, the report has been structured to address the following issues/areas of potential concern for both Kahshe and Bass Lakes:

- Nutrients, Water Clarity, Temperature and Algal Growth
- Calcium Depletion
- Lake Acidification
- Metals and Other Chemical Contamination
- Dissolved Oxygen Depletion
- Benthic Health

To better understand the chemical and physical data that have been collected, the 2022 report includes an overview of the climatological factors that have the potential to influence lake conditions.

This comparison demonstrated that air temperatures in 2022 were generally similar to the three previous years and to the 30 year normal for most months, with the exception of much warmer conditions in May and to a lesser extent, August and September. In the case of precipitation, total monthly amounts were noticeably lower in May through July and above normal in August. The lower levels of precipitation in late summer in 2022 may have played a role in the absence of a blue-green algal bloom in 2022 as major late-season precipitation events in 2020 and 2021 appeared to have accelerated the leaching and run-off of algal-friendly nutrients into near-shore waters and the development of harmful algal blooms.

In 2022, the ice-out date was April 16 and the data for Kahshe Lake appear to generally follow the ice-out dates for the larger Muskoka Lakes, with no evidence of a trend towards earlier or later ice-out times on Kahshe Lake over this 135 years period.

A full discussion of the findings of DMM and MECP water quality and biological monitoring programs can be found in Section 4 of this report, and these findings are summarized in Section 5. Based on these investigations, the following conclusions have been reached regarding the six water quality indicators identified above.

Lake Health Parameter	Summary of 2022 Findings
Nutrients, Water Clarity, Temperature and Algal Growth	<p>With one exception, the 2022 water quality monitoring of Kahshe and Bass Lakes by the DMM and the MECP has not identified any major water chemistry issues or trends in terms of algal friendly nutrients – nitrogen and phosphorus. The only exception was an increase in mid-lake total phosphorus levels at one location in Kahshe Lake and this has resulted in the 2022 levels at the DMM’s Main site near Hens and Chickens now reaching the DMM’s Threshold level for Kahshe Lake. This likely due to mixing of higher phosphorus-laden waters via current flow from Bass Lake, as it is now known that the east end of Kahshe Lake has higher levels of total phosphorus due to its proximity to Bass Lake which typically has about twice the levels of total phosphorus.</p> <p>Trends in water temperature and clarity which can be indicators of favourable algal growth conditions also were examined and there was no evidence of a warming trend based on water temperature measurements dating back to the early 1980s. Water clarity also has remained fairly steady over this four decade period.</p> <p>And finally, the good news is that although the Simcoe-Muskoka area experienced HABs in 10 lakes/water bodies in 2022, there were no confirmed HABs on Kahshe or Bass Lakes in 2022.</p>
Calcium Depletion	<p>Decreasing lake water calcium concentration is an emerging concern for lakes on the Precambrian Shield in Ontario due to its impact on the reproduction and survival of zooplankton and other aquatic species that are important components of the aquatic food chain.</p> <p>The 2022 data confirm that there is no detectable trend towards decreasing levels of calcium in either Kahshe or Bass Lakes. However, as levels of calcium are fairly close to the aquatic growth limiting threshold of 1.5 mg/L and as this threshold value would not be protective of all aquatic organisms, continued vigilance is necessary.</p> <p>This is underscored by late season population explosions of <i>Holopedium</i> in Kahshe Lake in both 2021 and 2022. These pea sized, jelly-like orbs are not known to be toxic, but are an uncomfortable nuisance as they can be felt against your skin while swimming.</p>
Lake Acidification	<p>The waters of Kahshe and Bass Lake have acidity (pH) levels that are within a normal range and there is no evidence of an increasing or decreasing trend in acidity over the two decade monitoring period.</p> <p>While the pH findings represent good news, it should also be recognized that the waters of Kahshe and Bass Lakes have low levels of alkalinity, and as such, are more susceptible to acidification, as the ability of the water to buffer the acid input is low.</p>
Metals and Other	<p>The analysis of over 30 additional anions, cations and other chemicals by the DMM in 2022 has identified no aquatic toxicity/health issues. While there were some minor</p>

Lake Health Parameter	Summary of 2022 Findings
Chemical Contamination	<p>exceedances of chronic (long term) health protection benchmarks established by the MECP and other agencies in the early years, most of these exceedances were likely due to sampling or laboratory artifacts, as more recent sampling has shown concentrations that are in the expected range for non-impacted surface water bodies in Ontario.</p> <p>However, it should be noted that in several cases the laboratory detection limits are at or close to aquatic protection values, and as a result, firm conclusions regarding these substances cannot be drawn. This situation was exacerbated by the increase in some Detection Levels in 2021 and 2022</p> <p>In the case of aluminum, the aquatic benchmark has been exceeded in Bass Lake in several years; however, the benchmark consists of a range in values and must be evaluated based on the pH and DOC concentrations in lake water. Based on these findings, the levels of aluminum need to be followed carefully in future monitoring to ensure that the waters of Kahshe and Bass Lakes are safe from an aquatic perspective.</p>
Dissolved Oxygen Depletion	<p>Dissolved oxygen (DO) in lake water is important, as it is essential for the survival of all aquatic organisms. A lack of oxygen in the lower layers of the lake (referred to as being anoxic) also can cause mobilization (release) of phosphorus from sediments.</p> <p>Dissolved oxygen is influenced by seasonal temperature changes that factor into lake stratification, the process whereby lake water is turned over (mixed) in the late fall and again following the winter ice melt and then begins to stratify through the spring, summer and fall as water temperature increases at the surface and DO levels decrease with increasing depth.</p> <p>The DO at increasing water depths in both Kahshe and Bass Lakes for 2022 revealed that:</p> <ul style="list-style-type: none"> ▪ In Kahshe, the DO levels follow the historical trend of falling below the PWQO at a depth of around 5m below the surface. However, unlike the earliest data from the 1980s and 1990s, they begin gradually recovering (increasing) in 2022, following the trend that was observed in the 2000-2009 and 2010-2019 decades. This is good news in terms of aquatic life at lower depths of the lake. ▪ In Bass Lake, by early August, the 2022 DO levels are essentially similar to the historical records of DO levels down to about 2m depth and then decrease gradually through the 3m depth, falling below the PWQO just below the 2m depth. This is a concern from both an aquatic health and phosphorus mobilization from sediment perspective.
Benthic Health	<p>Benthic health assessment is now undertaken annually, as Kahshe Lake is now considered a 'Vulnerable' lake due to the appearance of HABs in 2020 and 2021. The types of benthos indicate the health of both the riparian and littoral zones as these</p>

Lake Health Parameter	Summary of 2022 Findings
	<p>areas can be impacted by snowmelt, runoff, sedimentation and other development activities.</p> <p>Collected benthos are grouped into seven different categories based on their typical response to environmental contamination and are then compared to the Muskoka average. The 2022 findings confirmed that species richness (biodiversity) was good and that species that thrive in good water quality were above the Muskoka average while species that thrive under pollution stress were below the Muskoka average, both of which are favourable findings.</p>

Based on the 2022 water quality and benthic monitoring of Kahshe and Bass Lakes by the DMM and the MECP, with a few exceptions, no major water quality issues or trends were identified. However, given the documented occurrence of HABs in Kahshe Lake in both 2020 and 2021 as well as the late season population explosion of a zooplankton organism (*Holopedium*) known to be associated with decreasing levels of available calcium in Muskoka region lakes, it is clear that the tracking of water quality via the mid-lake, deep water sites of the DMM and MECP is not providing a fully representative assessment of water quality in the near-shore environment where algal blooms have been documented..

In the case of Bass Lake, the DMM has identified it as a ‘Vulnerable’ lake and has undertaken a more comprehensive Causation Study in 2021. Hopefully, the findings from those investigations will shed light on the cause of the elevated total phosphorus which has been recorded in Bass Lake since monitoring by the DMM began back in the early 1980s. A draft of the DMM’s investigation was released in late 2022 and comments were provided by the KLRA. The final report has not yet been released.

So, for Kahshe Lake, where do we go from here?

Kahshe Lake also has been identified by the DMM as a ‘Vulnerable’ lake and a DMM-funded Causation Study will be undertaken when funds and staffing are available following the completion of Causation Studies on the first group of vulnerable lakes (including Bass L). Given the uncertainty regarding the implementation of a DMM-funded Causation Study and the concern of property owners regarding the late season HABs in 2020 and 2021, the KLRA funded a Conservation Committee project in 2021. The purpose of this study was to explore the chemistry of near-shore waters over the spring and summer season in an effort to better understand why Kahshe Lake has been impacted by HABs in spite of reasonably low and unchanged phosphorous levels reported by the DMM and MECP over the past 40 years.

The findings from this Near-Shore Water Sampling Project (NSWSP) have been published in a final report available on the KLRA Water Quality web portal. The NSWSP identified some very useful insights and linkages between our changing climate, its impact on water quality and the development of late season HABs in Kahshe Lake. Briefly, the NSWSP demonstrated that:

- Mid-lake, deep water sampling in the spring of the year is a reasonable way to track long-term, historical changes in water quality but is not providing a very accurate assessment of water quality in the near-shore environment where HABs have been documented.
- The mid-lake, deep water sampling also has failed to capture much higher total phosphorus levels in the east end of the lake, as there are no DMM sampling sites in that area.
- Levels of algal-friendly nutrients (phosphorus and nitrogen) tend to increase and fluctuate as the season progresses, further limiting the relevance of the spring sampling of mid-lake sites in terms of assessing the potential for HAB development.
- The near-shore water chemistry findings for some algal-friendly nutrients appear to be associated with effluents from human & animal waste sources and are known to be linked with HABs.
- Although more study is warranted, the near-shore findings point to accelerated leaching and/or runoff of soil-borne nutrients due to a changing climate which is resulting in more intense late season rainfall events.

Although we have virtually no control over the change that is affecting our climate, there are actions we can and must take to minimize the accelerated leaching of algal friendly nutrients to our shoreline water and thereby reduce the potential for future algal blooms. These actions have been thoroughly explored by the Conservation Committee and are summarized below:

- 1. Divert roof drainage and runoff from paths and other hard surfaces away from your septic system and the shoreline. If necessary, direct rain water into rock-filled drainage pits.**
- 2. Keep most of your shoreline as natural as possible with a zone of trees, shrubs or tall grass between the shore and any lawn area to discourage grazing by Canada geese and to reduce soil & goose poop runoff into the lake.**
- 3. Have a licensed professional pump out and inspect your septic system for failures and deficiencies every 3-5 years and more often for aging systems installed pre-2000. The Town will be inspecting in 2023, but we don't need to wait until then and be subject to system shutdown until failing systems are repaired.**
- 4. Don't use phosphorus or nitrogen fertilizers or cleaning agents anywhere near the shore.**



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Kahshe and Bass Lake Steward - Conservation Committee