2023 Little Hawk Lake Benthic Macroinvertebrate Health Assessment

Purpose

This project is the fourth year Trent University has collaborated with the U-Links Centre for Community Based Research and Halls & Hawks Lakes Property Owner Association (HHLPOA). This collaboration finds Trent University biology students gathering data for a five-year long collaborative benthic macro-invertebrate biomonitoring program. The purpose of the health assessment of Little Hawk Lake is for Trent students to collect data that will be interpreted to provide a statement on the current perceived state of Little Hawk Lake. The data collected will also be used as baseline data for U-Links and HHLPOA projects which will be interpreted in the future by the collaborating groups to evaluate water quality and overall health of the lake through the usage of OBBN benthic macro-invertebrates.

Methods

Trent University Applied Biomonitoring students and U-Link team members followed the U-Links Aquatic Monitoring Protocol Manual. Prior to collecting benthic macroinvertebrates, site features including terrestrial vegetation, aquatic vegetation and substrate were recorded. The U-Links protocol manual used a modified version of the Ontario Benthos biomonitoring (OBBN) kick and sweep method. This protocol was followed at all 4 sites to collect the benthic macroinvertebrates (Fig. 1).

Once the invertebrates were collected, they were brought back to the lab and randomly sampled using the teaspoon method. All the invertebrates identified from Little Hawk Lake used the OBBN 27-taxa grouping (Fig. 2). Following the identification of the invertebrates, different indices were calculated to determine the health of Little Hawk Lake. These included: The modified Hilsenhoff Family Biotic Index (FBI), %EOT, Simpson's Diversity Index and %Amphipods vs. Insects%. It is to be noted that sites that had fewer than 85 specimens identified did not have indices calculated.

Figure 1. Map of Little Hawk Lake outlining the sites surveyed

Figure 2. Little Hawk Lake Sampling Site #2

Results and Trends

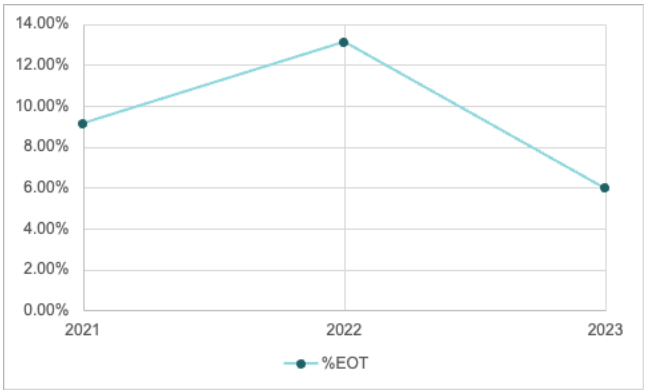

Figure 3. %EOT of Little Hawk Lake 2021-2023

%EOT represents pollution sensitive species like Ephemeroptera, Odonata (Anisoptera + Zygoptera), and Trichoptera.

%EOT in 2023 was lower than in the prior 2 years of sampling, dropping from a high of just over 13% to approximately 6%. This value is the average of all sites- LHWK-02 and 03 both fell well below the average.

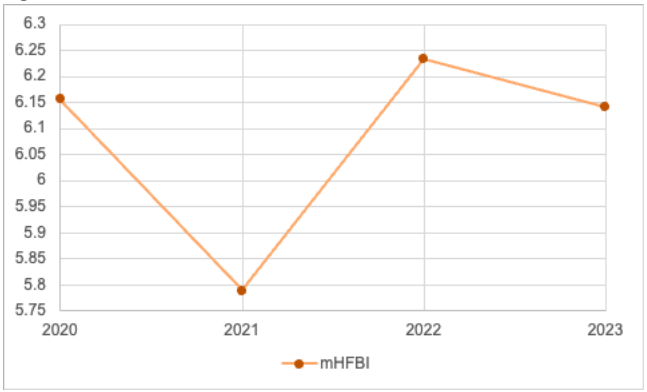

Figure 4. mHFBI of Little Hawk Lake 2020-2023

The Modified Hilsenhoff Biotic Index estimates the pollution tolerance of the benthic community in a given area.

After a drop in 2021, mHBI values appear to have recovered to documented levels in 2020. In 2023, all sites fell into the "fair" range of values.

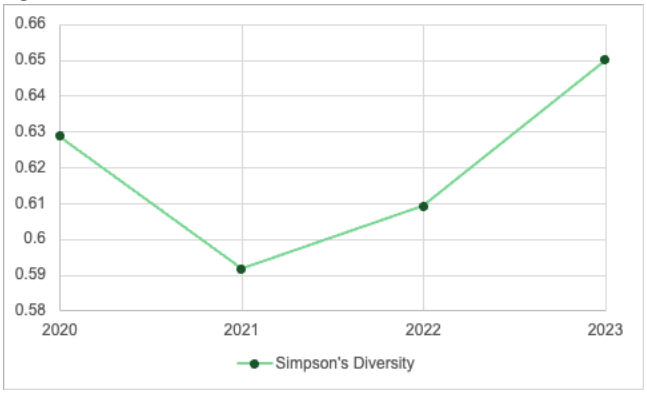

Figure 5. Simpson's Diversity of Little Hawk Lake 2020-2023

The Simpson's Diversity Index represents species diversity by accounting for the number of groups present, as well as the relative abundance of each group. A value of 0 represents no diversity, and a value of 1 represents infinite diversity.

Average values in 2023 were higher than all 3 prior years of sampling, reaching approximately 0.65%. This shows a steady recovery from 2021 values.

In terms of Hills Numbers, some of the sites sampled at Little Hawk Lake exhibited comparable numbers of very common species, with Hills Numbers ranging from 2.19 to 2.83. Regarding the common species, LHWK-02-R1 and R2, as well as LHWK-03-R2, showed slightly higher Hills Numbers at 3.94 and 3.66, respectively. Meanwhile, LHWK-03-R1, LHWK-04-R1, and LHWK-04-R2 had similar numbers ranging from 2.64 to 2.68. It can be reasonably asserted that LHWK-01 and LHWK-02 have the highest diversity among all Little Hawk Lake sites. There are no Hills Numbers available from previous years of study, therefore comparison cannot be done. However, future sampling periods will bring about additional data to examine and compare.

The predominant vegetation identified in the 2023 samples differed depending on the location of each site. In general, most sites exhibited similar types of riparian vegetation, with the notable exception of Site 2, where wetland vegetation was observed. Types of riparian vegetation remain consistent with prior years where benthic data was collected and analyzed, with only some slight deviations where some locations became more abundant in vegetation over the years, thus the riparian type at certain locations changed as well. This consistency in riparian environments is a positive factor in this case because there is little evidence to suggest that major environmental change had drastically reduced plant abundance in the area, therefore it is unlikely that benthic communities were negatively impacted by this.

Water chemistry data was collected to assess the perceived quality of water and the health of the lake ecosystem at Little Hawk Lake. The average water temperature across Little Hawk sites was 20.3°C, showing a slight increase compared to 2021 (19.2°C) and 2020 (17.67°C). Dissolved oxygen conditions at each site fell within a typical range for healthy lakes, as most sites had DO contents of between 7 and 8 mg/L. Conductivity values at sampled sites, were considered typical and indicative of a healthy lake environment in 2023, represented by the values of 13.4 µS/cm for Site 3 and 13.1 µS/cm for Site 4, which shows improvement from the conductivity value measured in 2021. pH values from all sites were between 7-8, a common range for lakes, and fell within acceptable parameters for water quality based on the Provincial Water Quality Objective in Ontario.

Most of the results found in the study complimented previous studies of Little Hawk Lake, in addition to other lake quality biomonitoring assessments in the Haliburton area. The only exceptions were with the lack of algae found at some lakes, the lower DO values reported in comparison to previous years, and the higher than usual Amphipoda and Isopoda populations and temperature reported at Little Hawk Lake in comparison to other lakes. Differences in conductivity measurements for Little Hawk Lake may be attributed to the lack of data collected for some sample sites. Further research within sample sites, between different lakes within the Haliburton region, and even lakes outside of the region will need to be conducted after the baseline data is completed for a more accurate data comparison to be made.

Conclusions

In 2023, Little Hawk Lake had a good variety of benthic macroinvertebrate species present. The dominant species found can survive in moderately to strongly polluted waters. Little Hawk Lake had “typical” to “atypical” amounts of sensitive EOT benthos species. Pollution tolerance for the benthic community was mostly within the “fair” range. The diversity of Little Hawk Lake’s benthic species was rated “good” on average in 2023.

Sample sites 1 and 2 (LHWK 01 & LHWK 02) were found to have the greatest diversity in comparison to the other sample sites. This may be due to macrophyte presence and/or differences in substrate at sample sites, though more research would have to be conducted to reach a definitive conclusion. It would also be beneficial to include Hills Numbers in future assessments to create a historical reference for diversity differences and changes between sample sites. The riparian vegetation and presence/absence of macrophytes did not change in comparison to previous years apart from the first time observed free-floating algae found at sample site 4. This finding is of concern in consideration of possible cultural eutrophication and should be monitored in the future.

Though values differed between sample sites, overall water temperatures, DO, pH, and conductivity were all within range Ontario Provincial Water Quality Objectives parameters and were similar to past results for Little Hawk Lake. Results were also, primarily, similar to the bioassessment data of other lakes in the area with few exceptions (Amphipoda and Isopoda abundance, DO, and lake temperature). This generally suggest a healthy aquatic ecosystem in Little Hawk Lake. Overall, the 2023 benthic macroinvertebrate

data is congruent with past results from Little Hawk Lake and do not suggest a negative shift in health trends, but hard conclusions cannot be drawn until baseline data is fully established.

Recommendations

Continued monitoring to complete the 5 years of required baseline data is recommended. This baseline will give us data to compare against, so that we may track, prevent, and react to any concerning changes in the state of the lake. Preventative measures to maintain the good health of the lake may include lowering the usage of motorized watercrafts, as they can contribute to water pollution, damage aquatic plants, stir up sediment reducing water clarity, and generally disturb aquatic life. Also, regular cleaning and drying of fishing gear, watercrafts, or swimming gear can help prevent the spread of harmful invasive species between water bodies. Leaving natural vegetative barriers between the lake and cottage properties or roadways can act as a buffer to keep pollutants, pesticides, or eroded soils out of the lake. Similarly, restricting the use of pesticides, fertilizers, or road salts to a safe distance from the lake will keep any chemicals that you wouldn't want to swim in out of the lake. In addition to this, monitoring groundwater near septic tanks may help identify any possible leaks that could pollute the lake with excessive nutrients. These steps will help keep Little Hawk Lake healthy so that it can be enjoyed by the community for many generations.

Acknowledgements

As Trent University students, we would like to respectfully acknowledge that we are working on the treaty and traditional territory of the Michi Saagiig Anishinaabeg and extend thanks to these communities. We would also like to thank all parties who contributed to this project and helped make it a success. We would first like to extend our thanks to Halls and Hawk Lakes Property Owners Association and U-Links Centre for Community-Based Research for creating this project. We would also like to thank Dr. Kaitlyn Fleming, our teaching assistants Jade Gorman, Kayla Wilkins, and Cailyn Carscadden, as well as Frank Figuli and Jordan McDonald from U-Links for overseeing this project and sharing their knowledge. This project would not have been possible without your help, and we appreciate your hard work and dedication to our coursework and project.