Assessment of Benthic Evaluation in McKellar Township following the completion of the initial three year sampling in McKellar Township and reporting by Georgian Bay Biosphere

(Prepared for the Lake Stewardship and Environmental Committee, March 2023)

Benthic macroinvertebrates are aquatic, bottom-dwelling animals without backbones, that include worms, crustaceans, molluscs and the larval stages of many insects. Sampling can be done in the littoral (from the shoreline to the furthest penetration of light), sub-littoral or profundal (deepest) zones of a lake or river. Both zooplankton and phytoplankton (small animals and plants) can be monitored. In Canada, the research focuses on zooplankton, or macroinvertebrates, small animals without a spine that can be seen by the naked eye.

Macroinvertebrate communities have many advantages as biological indicators:

- They reflect conditions at specific locations and show cumulative impacts
- They are sensitive to a variety of disturbances
- They are present in all freshwater ecosystems
- They are a key part of aquatic food webs
- Their assessment methods are well-developed

Additionally, biological monitoring complements testing water for chemicals (chemical monitoring) because aquatic life can be affected by:

- the effects of chemicals interacting with each other
- contaminant releases are not always detected
- unknown contaminants
- introduction of exotic species
- habitat degradation in the water or surrounding land
- climate change
- changes in water levels, flows, and timing (ice formation and spring thaw)(Science of aquatic biomonitoring - Canada.ca)

Sampling of the benthos to evaluate the health of waterways takes place in all seven continents including Antarctica. Guidelines for assessment exist throughout the

world and are based on the established premise that the effects of human activity on aquatic ecosystems can be reliably monitored by regular evaluation of the benthos. In Europe, the Water Framework Directive has shifted the focus from chemical monitoring for safety of human consumption of water to viewing the water system as a natural heritage. In Canada, The Canadian Aquatic Biomonitoring Network (CABIN) oversees the collection of benthic macroinvertebrates at site locations and uses their counts as an indicator of the health of that water body, maintaining data banks and ongoing analysis. In order to use the Canadian Aquatic Biomonitoring Network and the analysis tools, researchers must complete required training and certification.

The site being sampled is compared to a reference site, undisturbed by human activity, in order to evaluate whether there have been any anthropomorphic changes. "Reference sites represent habitats that are closest to "natural" before any human impact. The data from these sites are used to create reference models. CABIN partners use these models to evaluate their test sites in an approach known as the Reference Condition Approach (RCA)." (CABIN training and certification - Canada.ca)

This is similar to practices elsewhere in the world. The European Institute for Environment and Sustainability has established criteria for high ecological status in lakes:

- the taxonomic composition and abundance correspond totally or nearly totally to the undisturbed conditions
- the ratio of disturbance sensitive taxa shows no signs of alteration from undisturbed levels
- the level of diversity of invertebrate taxa shows no sign of alteration from undisturbed levels

Using the RCA models, CABIN partners match their test sites to groups of reference sites on similar habitats and compare the observed macroinvertebrate communities. The extent of the differences between the test site communities and the reference site communities allows CABIN partners to estimate the severity of the impacts at those locations.

This is similar to practice elsewhere.

In Northern Ontario, the Freshwater Invertebrate Reference Network of Northern Ontario (FIRNNO) sets the pace for benthic monitoring.

- The invertebrate groups have varying degrees of tolerance to human impacts; if a sample contains mainly midges, worms, and snails, the water quality in that sampling area is probably poor. If, on the other hand there are mostly stoneflies, caddisflies and mayflies, you can infer good water quality

  (see Laurentian University | The Freshwater Invertebrate Reference Network of Northern Ontario (FIRNNO))

In a paper Valois et al., description is given of the comparison of two common RBP's (rapid bioassessment protocols) used in Canada, a standard approach (Reynoldson et al., 2003), adopted by the federal CABIN (Canadian Aquatic Biomonitoring Pro gram) and EEM (Environmental Effects Monitoring) programs and a live-sort approach (David et al., 1998) used by watershed and provincial organizations.

The report on the monitoring of benthos done by the Georgian Bay Biosphere for McKellar Township and Manitouwabing Lake Community Association bases its research on the Ontario Benthos Biomonitoring Network (OBBN), operated on the principles of partnership, free data sharing, and standardization. Comparisons are presented of lakes in the area, notably Muskoka. The statement is made in the report that researchers are certified in data collection and analysis. It would be good to know where the data from Lake Manitouwabing are stored on this data base, as only the Muskoka lakes could be seen.

However, based on this assessment, the research and report completed by Georgian Bay Biosphere seems to meet expectations in terms of being scientifically conducted and a part of a valued scientific database. Continuation of this research is recommended as long-term data bases are valued for monitoring the health of the Manitouwabing Lake ecosystem.

Resources and References

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Muskoka Water Web Muskoka Water Web

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