Project Update Bob Lake Benthic Analysis Project #6132

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Summary

The Purpose of this paper is to update to the members of Bob Lake Association on the progress of the benthic assessment project. This year marks year three of five in completing the construction baseline dataset. Once this baseline dataset is complete, future monitoring of benthic invertebrates will be able to be compared to show a change in the benthic invertebrate community. The basic principle behind monitoring benthic invertebrates is that a change in the benthic community is caused by a change in water quality. The interaction between different benthic invertebrate groups and water quality is well studied and inferences can be made on the change in water chemistry.

Monitoring the water quality of Bob Lake is important for several reasons. The first reason is for the Bob Lake community. There are over two-hundred and thirty cottages on Bob Lake. These cottagers come to enjoy time on and in the lake. Bob lake is the reason the come to the cottage, to enjoy its clean waters to swim, boat, and relax. Monitoring Bob Lake will ensure that families will be able to enjoy the lake for years to come.

Another reason that it is in the best interest of the Bob Lake Community is water quality is positively correlated with property value. It is estimated that a 1% increase in water clarity results in a 0.27% increase in property value (Guignet., 2022). Property owners on Bob Lake should care about the water quality of the lake because it increases their property value.

Monitoring the water quality of the lake is also important to ensure that the members of Bob Lake are not polluting downstream communities. Bob lake is a headwater lake to the Trent Severn waterway. The water quality of Bob Lake effects the water quality of downstream

waterbodies. There is a moral obligation to maintain the water quality of Bob Lake so that it does not also become the problem of downstream communities as well.

One more reason monitoring water quality in Bob Lake is because Bob Lake is home to a unique fish, the small, bodied lake trout. These fish provide a unique natural resource and recreational opportunity. Lake trout inhabit only 1% of lakes in Ontario and are disappearing from some lakes as they are sensitive to a change in water quality. The MNRF and MECP are also monitoring lake water quality to help protect Lake Trout. The Lake Trout in Bob Lake have been found to be naturally reproducing (MECP 2018). Monitoring the water quality of Bob Lake will help ensure that this self-sustaining resource and the unique recreational opportunity that comes with it remain healthy.

Done to Date

Field Work

The field work component of the project has been completed. The fieldwork was completed by Frank Figuli and myself with the assistance of a Bob lake community member. In total, eight samples were taken from four sites on the lake. The sample sites can be seen in figure 1. Water

levels on the day of sampling were normal to other years was normal. (Government of Canada., 2023)

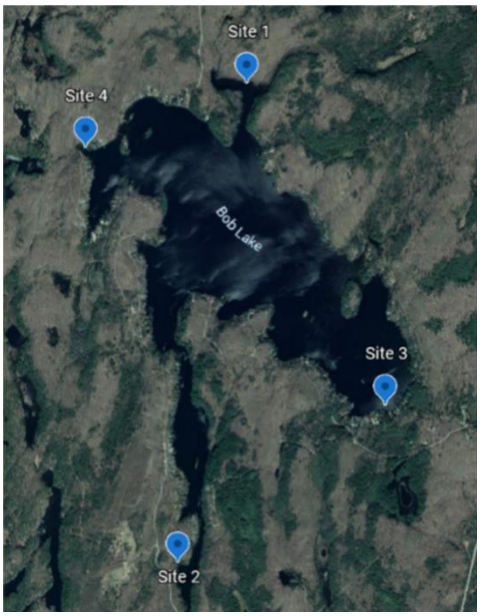

Figure 1: Sites that were sampled to build year three's baseline benthic community. Site 1 is at the north section of the lake near the inflow. Site two is located at the southern section of the lake near the dam or outflow of the lake. Site three is located on the eastern shore of Bob Lake. Site four is located on the western shore of Bob Lake.

Lab Work

Lab work is 50% complete with 5 of ten jars of samples being processed. It is my goal to have all samples processed by December 10th. Lab work is completed to OBBN protocol. The Lab work involves picking the first 100 seen benthic invertebrates from a random scoop from the sample. These benthic invertebrates are then identified to the twenty-seven groups found in the OBBN protocol. In total, 12 of the 27 groups have been observed in the samples already processed. The most abundant group that has been seen so far is scuds (Amphipoda) which is not uncommon in lakes in the Haliburton area ( ). Another species that has been seen is multiple samples which

is interesting are Megaloptera which are predators of other benthic invertebrates (Thorp and Rogers, 2015). Pictures of a scud (Amphipoda) and Megaloptera can be seen in Figure 2 and Figure 3 respectively. Other groups that have been found in samples include midges, caddisfly, mayfly, snails, damselfly, beetles, dragonfly, leeches, bi-valves, and aquatic earth worms.

Figure 2: A scud (amphipoda) found in one of the samples at Bob Lake. These benthic invertebrates play an important role in the ecosystem as a main food source for yellow perch (Jansen & Mackay., 1992)

Figure 3: A Megaloptera found in one of the samples at Bob Lake. Megaloptera is a opportunistic predator and feeds on many smaller benthic invertebrates (Thorp and Rogers, 2015).

Data Analysis and Final Report

All data from samples that have been processed have been digitalized and are ready for data analysis. Data analysis will begin as soon as all samples have been processed. Data Analysis will consist of the qualitative measurements taken in the field, as well as water chemistry data taken on the field day. This includes riparian zone classification, detritus, macrophyte, algae or woody debris presence or absence, as well as the dominant substrate material. Water chemistry Parameters include dissolved oxygen, pH, temperature, and conductivity. Biological indicators will be calculated for species richness, % composition, Simpson's Diversity Index, Shannon Wieners Diversity Index and %EOT.

Literature Review

Beetles (Coleoptera)

Beetles are the most diverse insect in the world. It is estimated that 1 in 4 animals on earth are a beetle. Beetles in the OBBN protocol include beetle larvae and adult aquatic beetles. Because beetles are so diverse, they can be hard to correlate the order with water quality as many of the different families have different tolerances to different pollutants and occupy different levels of the trophic scale. (Thorp and Rogers, 2015) (Wisch et al., 2023)

Chironomidae

Midges (Chironomidae) inhibit a large variety of habitat and are found throughout a lake. They are very adaptable to changing water level and have a high tolerance to low dissolved oxygen Chironomidae are one of the most used bioindicators of poor water quality (Mandaville, 2002) (Wisch et al., 2023).

Mayflies (Ephemeroptera)

Mayflies found under the water are in their larval stage. Their strategy for food consumption is either a scraper or a collector. Scrapers consume their food by scraping periphyton (benthic algae) off rocks and woody debris. Collectors filter water to catch detritus material in the water. They use setae on their mouthparts or use their forelegs to act as filters. Understanding the feeding behavior of some of the benthic groups can be important in understanding their presence or absence in some sites. (Thorp and Rogers, 2015) (Wisch et al., 2023) Mayflies show a low tolerance to acidic waters and start to be affected at a pH of 4.5 and are almost show a complete intolerance at a pH of4.0 (Rowe et al., 1988).

Megaloptera

The order Megaloptera belongs to consists of Alderflies, Fishflies and Dobsonflies. All members of this order have aquatic larvae that are generalist predators of other aquatic invertebrates. (Thorp and Rogers, 2015) (Wisch et al., 2023).

Dragon Flies (Odonata)

Odonata is an order of flying insects consisting of dragonflies and damselflies. They are obligate carnivorous predators that feed on a wide variety of prey (Thorp and Rogers, 2015) (Wisch et al., 2023).

Stoneflies (Plecoptera)

Stoneflies are more often found in cold-water streams than in lakes. They are known to inhibit fast moving riffles and well oxygenated water. They are also one of the most sensitive groups of benthic invertebrates (Thorp and Rogers, 2015) (Wisch et al., 2023).

Caddisflies

Caddisflies are aquatic insects that make a protective casing around themselves. The material they use can vary from sand, woody debris and plant material. The feeding behavior of Caddisflies varies from filter feeders, scrapers and omnivores. Trichopteran larvae play an important role in the lake ecosystems. They are an important food source for a variety of aquatic predators (Mandaville, 2002)

Crayfish (Decapoda)

The diet of a crayfish diet is mostly comprised of plant matter, however, are opportunistic to feed on dead and living animals (Thorp and Rogers, 2015) (Wisch et al., 2023). One of they main factor in the presence of crayfish is available habitat. Crayfish inhabit areas with lots of structure

such as woody debris, roots, and cobble. In these areas they can hide from potential predators. Different types of Crayfish can tolerate a wide range of water quality.

Sow Bugs (Isopoda)

Sow Bugs show a great representation of water as they inhabit the sediment by burrowing for their entire life. This being said, they are very robust and have a high tolerance to many pollutants. This would suggest that the abundance of sow bugs and absence of others may indicate lower water quality (Thorp and Rogers, 2015) (Wisch et al., 2023).

Scuds (Amphipoda)

Scuds are abundant and ecologically important members of soft-bottom benthic communities (Thorp and Rogers, 2015). They are an important food source for many fishes including the Yellow Perch (Jansen & Mackay., 1992).

Understanding the significance of descriptive statistics

The Purpose of these descriptive statistics is to describe the samples and data. This allows for easy comparison of samples to each other. Samples can be compared through time, as well as through comparison of different water bodies. Descriptive statistics are a standardized way to describe data (Mandaville, 2002)

%EOT (Ephemeroptera, Odonata, Trichoptera)

%EOT is calculated by combining the proportions that Ephemeroptera, Odonata, and Trichoptera make up in a sample. The basic principle behind this descriptive statistic is that members of these groups are more sensitive to pollutants than others. Therefore, a higher %EOT value represents a higher water quality (Mandaville, 2002) Typical %EOT ranges from 4.18-37.12% in the

Haliburton region. Samples with atypical values either show that they may be unhealthy compared to other lakes or are extremely healthy compared to other lakes. Further investigation is recommended when atypical values are seen. (U-Links., 2022)

Simpson's Diversity Index

Simpsons Diversity index is a descriptive statistic used to describe the diversity of a community. It is a number that ranges from 0 to 1. Values that are higher indicate a more diverse community than those that are smaller. Simpson's Diversity Index weighs more common species heavier than more rare species meaning that the inclusion of one benthos group that represents 1% of the sample is weighed far less than one that makes up 15% of the sample (Mandaville, 2002).

Shannon Weiner Diversity Index

The Shannon Weiner Diversity is similar to the Simpson's Diversity Index in that it describes the diversity of a sample. Its Basic Principle is that as the number and distribution of taxa (biotic diversity) within the community increases, so does the value.

Current water quality Trends in Haliburton Lakes

Overall water quality health can be taken from what the MECP has found in 2018 the Provincial Water Quality Objective range of pH is between 6.5 and 8.5 as stated by the (MECP., 2018) Conductivities Ranges from 16-218 µs/cm (MECP 2018).

Halls Lake is located in the same watershed as Bob Lake. It is a larger lake and is not a headwater lake. The lake condition has been determined to be "fair" in 2022 and has shown fluctuations in %EOT over the past years of sampling. (Dorothy et al., 2022) Walters., 2022 found that Halls Lake water quality was also "fair", Little Hawk lakes water quality was

decreasing as the lake showed signs of increased acidity. Water quality was determined to be "good" at Big Hawk Lake. Halls Lake may show varying water quality because of more intense shoreline development, or because it is not a headwater lake. Then means that is subject to cumulative effects from the water quality upstream. Bob lake should show healthier water quality as it will have cleaner water inputs into the lake to start as a headwater lake. Head water waterbodies have lower concentrations of nutrients and contaminants as they have not accumulated as much as higher order waterbodies (Alexander et al., 2007)

The previous years Project for Bob Lake assesses the lake health of Bob Lake as Healthy. %EOT ranged from 2.94 - 22% (Guindon., 2022). This range is within normal ranges of Haliburton lakes. (U-Links., 2022). The Previous years study has also found that the Simpson's Diversity Index indicates there is moderate species diversity present. Something important to consider is that benthic communities can show changes in their community without water quality changes. This is why it is important to build a baseline inventory so general trends can be established. (Chaumel., 2019) (Jacks et al., 2021)

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