FRIENDS OF FIRST LAKE SOCIETY

2023 First Lake Water Quality Report

OUR ORGANIZATION

The Friends of First Lake Society (FOFL) is a non-profit, volunteer-run organization deeply committed to preserving First Lake, which is located in Lower Sackville, Nova Scotia. Recognizing the challenges to the lake's ecosystem, diverse aquatic species and the wildlife it sustains, FOFL acts as a steward for the lake's health and strives to keep this beautiful natural area a vibrant resource for Lower Sackville residents for generations. FOFL achieves this mission through various initiatives, including supporting regular water quality monitoring. This monitoring helps identify concerning trends and maintain a record of the lake's health over time. FOFL aims to foster an interest in the lake ecosystem and community stewardship, ensuring that both the environment and the trails around the lake are enjoyed by all.

OUR WATERSHED

First Lake in Lower Sackville, Nova Scotia, stretches across roughly 80.9 hectares with a maximum depth of 23 meters. Nestled approximately 22 meters above sea level, it is part of the Shubenacadie Watershed. It's fed by a freshwater spring at its northwest end and eventually drains into Rocky Lake. While overland flow contributes to the lake's health, stormwater drains and roadside ditches along the shoreline also channel water into the lake.

The 1970s saw rapid development around First Lake. The provincial government's land assembly project aimed to create a satellite community for Halifax and Dartmouth. Unfortunately, this rapid urbanization contributed to a decline in the lake's water quality.

However, there's hope. Over 70 percent of the First Lake shoreline remains in public hands, offering an opportunity for restoration efforts. The Halifax Regional Municipality owns a substantial portion (approximately 3.5 kilometres) of the lake's 6.5-kilometre shoreline, while the province manages another kilometre through its parks program. This significant public ownership presents a strong foundation for restoring and preserving the lake's ecological health.

Beyond its ecological significance, First Lake is a cherished community resource. Residents enjoy swimming, fishing, and exploring the nature trails that weave around the lake's perimeter, making it a vibrant recreational hub for generations to come.

WHAT DO WE MEASURE?

Water Temperature: This physical parameter not only controls the pace of chemical and biological processes in living cells but also triggers the migration, reproduction, and life cycle stages of numerous species. Higher temperatures can reduce oxygen concentration and accelerate chemical processes, posing a significant threat to aquatic ecosystems.

Dissolved Oxygen: This is the oxygen available for aquatic life to respire and for organic oxidation (decay). Levels below 6.5 mg/L are considered unhealthy for aquatic life. Oxygen levels are significantly influenced by temperature, with cold water capable of dissolving much higher levels of oxygen than warm water. Minimum levels are essential for the survival of some species, and levels below 6.5 mg/L will adversely affect most fish.

Conductivity: Electrical conductivity refers to the ability to transmit an electrical current over a certain distance. Conductivity is strongly associated with temperature and salinity and is an indicator of dissolved salts such as chlorides, sulphides, and other electrically charged ions. Elevated conductivity may impact the survival of aquatic species.

Metals: Metals are introduced by the natural weathering or erosion of soils and rocks or at increased rates via soil disruption activities such as construction, forestry, and farming. Some metals are required in trace amounts by aquatic species, while others can be toxic. Metals can move between water and lake sediments or bio-accumulate in tissue. Temperature and pH can influence the mobility of metals.

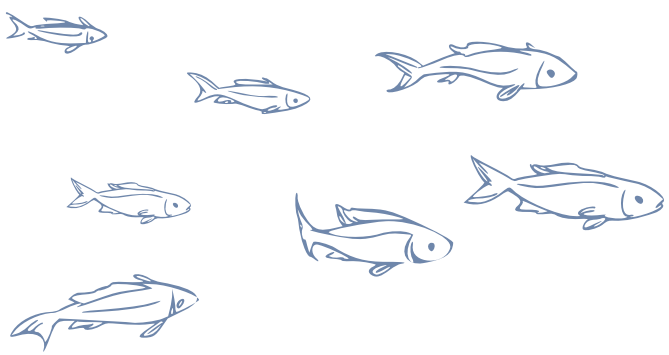
pH: The pH value of water, a measure of Hydrogen ion activity, is a crucial indicator of water quality. It reflects the acidity or alkalinity of the water. The pH range for healthy lakes is above 6.5 and below 9.0 (on a scale from 1-14). The rates of physical-chemical and bio-chemical processes are highly sensitive to pH levels. Slightly alkaline lakes (pH 8.0 or above) have a higher capacity to buffer acidity from natural or human sources (emitted via industrial operations and vehicles).

Total Dissolved Solids: Total Dissolved Solids represent the sum concentration of dissolved substances, primarily inorganic salts. High levels of dissolved solids can reduce the diversity of aquatic life and may indicate contaminated (municipal or industrial) runoff.

Nutrients: Phosphorus and Nitrogen are the essential macronutrients required for plant growth. Aside from natural decay cycles, land run-off and organic sediment, sources of Phosphorus and Nitrogen include chemical fertilizers, municipal sewerage and livestock manure. In equilibrium, Phosphorus is generally the limiting nutrient. It's essential to monitor nutrients because they control the rates of primary production.

Chlorophyll a: This crucial indicator of primary production is found in green plants and algae. It enables photosynthesis and the conversion of sunlight into primary organic compounds. Algae are usually the first organisms to respond by blooming rapidly to the introduction of key nutrients. The chlorophyll threshold to impact fish is generally considered to be 100 ug/L. The cleanest lakes will have chlorophyll-a levels of less than five ug/L.

Coliform Bacteria (E. coli): The bacterium E. coli is an indicator of the potential presence of pathogens from municipal wastewater or other sources. These bacteria live in the digestive tract of warm-blooded animals and are monitored because they are easily cultured in the lab. The Guidelines for Canadian Recreational Water Quality recommend an average concentration of less than 400 coliform-forming units/most probable number (MPN)/100 ml of E. coli as the threshold level of acceptable low risk of gastrointestinal illness.



2023 WATER MONITORING RESULTS

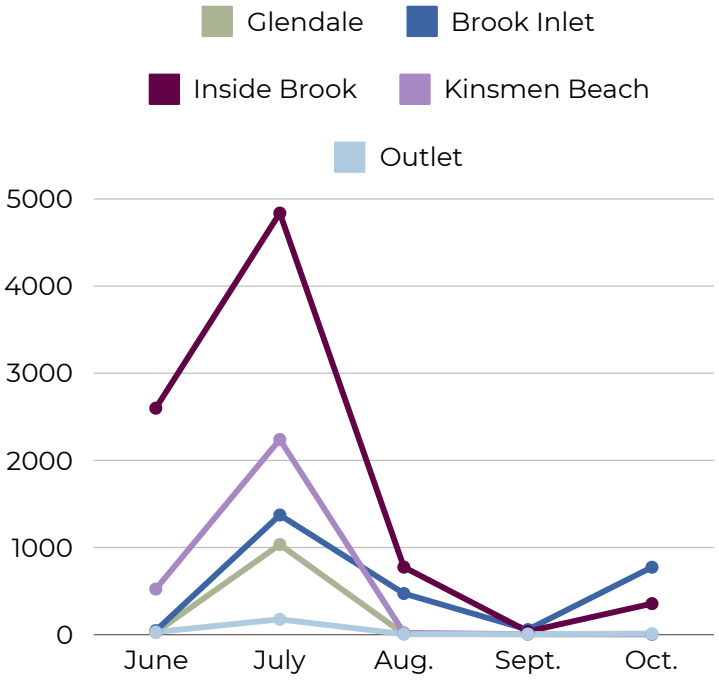
The summer following a dry spring saw significant rainfall, leading to a decrease in overall water conductivity and salinity due to the influx of fresh water. However, this heavy rain also brought in sediment and organic matter (detritus), which reduced dissolved oxygen levels earlier in the season compared to previous years. Water clarity was also affected, as shown by a decrease in Secchi depth. Chloride levels remained near the upper end of the normal range, likely due to road salt runoff. This trend aligns with observations of other lakes located in the Halifax Regional Municipality.

Fortunately, most measured metals remained below detection limits and within safe ecological ranges according to Canadian Council of Ministers of the Environment (CCME) guidelines. The exceptions were manganese and iron, which were elevated at the deepest part of the lake in mid-July and September, mirroring patterns observed in 2022. It's important to note that these metals are naturally occurring in the local bedrock.

For more details on E. coli levels, please refer to the separate document available on our website. Overall, most water quality parameters fell within acceptable ranges based on CCME guidelines.

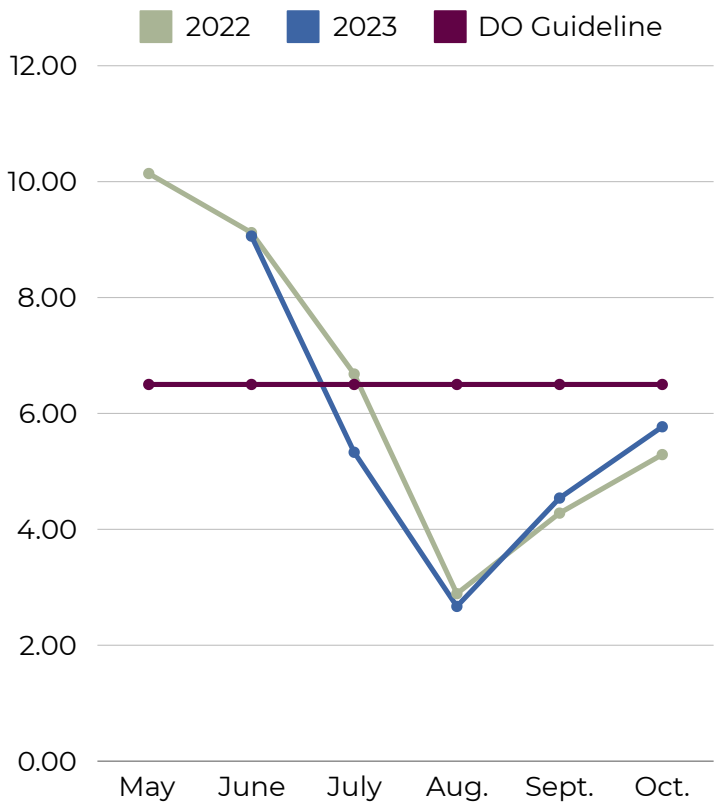
E. Coli (MPN/100 mL)

E. Coli levels above the 400 MPN/100 mL guideline for Canadian Recreational Water Quality were observed at certain stations in early summer. Levels decreased after the flood, perhaps due to the large influx of freshwater. An increase was noted again in October at the Brook Inlet only.



Dissolved Oxygen (mg/L)

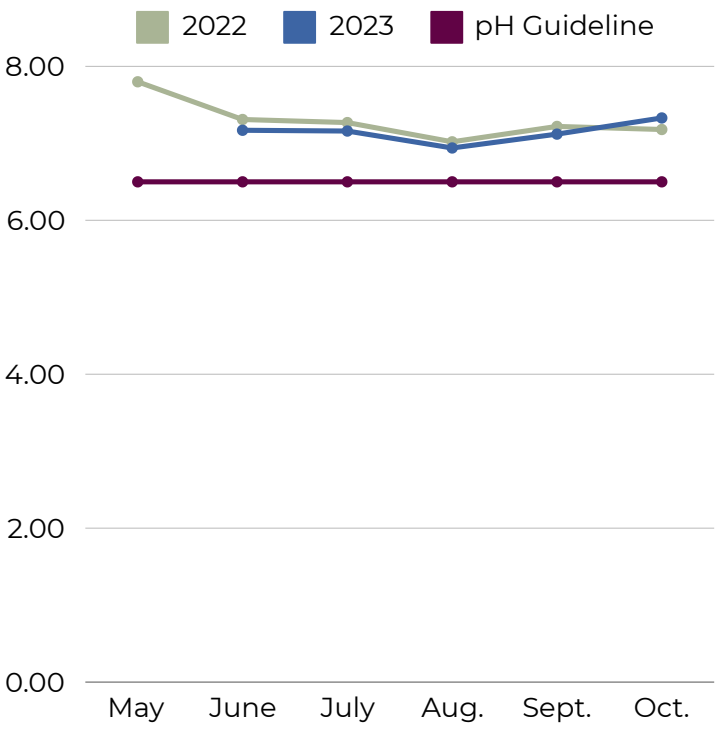
Levels below 6.5 mg/L were noted during the summer at depths of more than 5m, but with lake turnover in the fall, levels increased.



2023 WATER MONITORING RESULTS

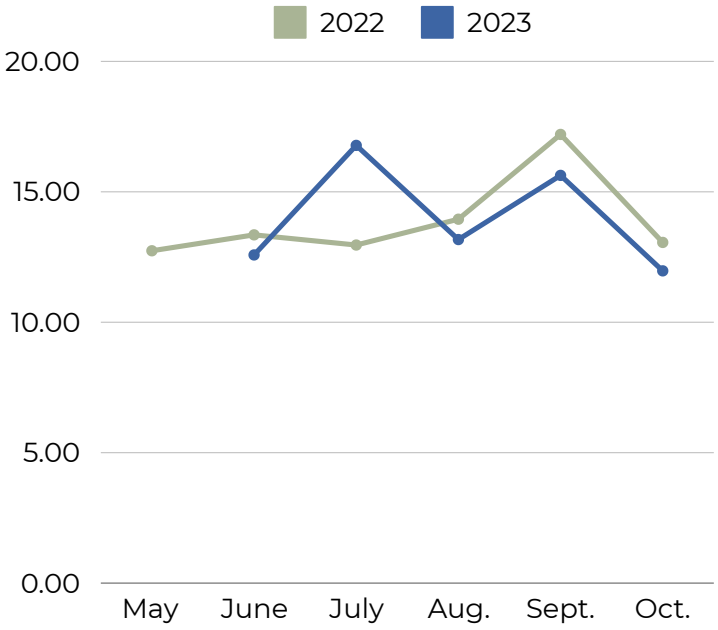
pH

Levels remained within normal limits of 6.5-9 units.



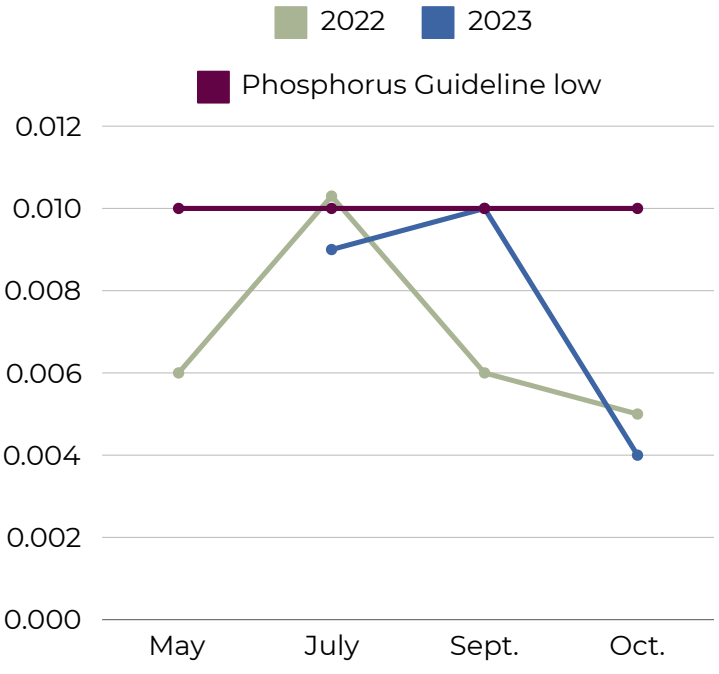
Temperature °C

The average lake temperature was slightly higher compared to 2022, likely due to early summer drought conditions. However, the temperature dropped in late July following the flood event and persistent rainy conditions.



Total phosphorus (mg/L)

Levels were within normal limits.



Total nitrogen (mg/L)

Levels were within normal limits.