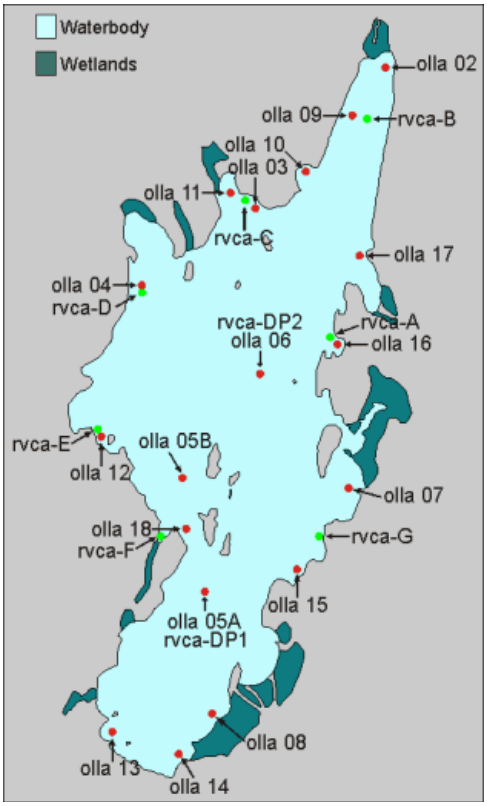
Lake Steward's Report - 2020

Water quality testing is an important diagnostic tool to help residents of Otter Lake monitor the health of the lake. The ecological and trophic status of a lake is generally determined by the levels of nutrients it contains and these are what we (OLLA) and RVCA measure at different sites around the lake at least three or four times a year. OLLA and RVCA's test sites are shown on the map on the right. The sites have been chosen to be representative of the whole lake. Sites 05A, O5B and 06 represent the three deepest water sites (more than 90ft). Sites 04, 07, 08, 11 and 18 are in areas where there are known inflows from streams and wetlands into the lake. Other sites are in shallow bays where there is an increased tendency for weed and algae growth.



<u>An overview of Factors that Influencing Water Quality</u>

Recreational water quality can be expressed in terms of how clear the water appears. Water clarity is influenced by the amount of soil sediment and phytoplankton, or microscopic algae that are present in the water. Clarity is measured by a simple visual test using a Secchi Disk, 20-centimeter black and white disk attached to a measured line. The disk is then lowered into the lake until it is no longer visible and the depth recorded.

<u>Nutrients & Bacteria</u>

Information on water quality is gained through analysis of samples for nutrients, specifically phosphorus and nitrogen, which gives an indication of how much nutrient and energy is available for the growth of algae and aquatic plants.

<u>Nitrogen</u> is an important and essential nutrient in aquatic ecosystems. In addition to fertilizers, agricultural waste and wastewater contribute nitrogen into lakes. In large amounts, ammonia and nitrates can be toxic to aquatic organisms. Total Kjeldahl Nitrogen (TKN) which is what we measure, determines the concentration of all forms of nitrogen in the lake. While there currently are no guidelines for acceptable levels of TKN, according to RVCA, TKN in water bodies not influenced by excessive organic inputs typically range from 100 to 500 µg/L.

<u>Phosphorous</u> is generally recognized as the limiting nutrient in freshwater ecosystems and the major nutrient contributing to eutrophication in lakes. Since phosphorous is the principal source of energy for all living organisms the amount of phosphorous in the environment will determine how fast an organism grows

and proliferates. Phosphorus is therefore the principal limiting factor in the growth of algae, meaning that algae growth will occur in greater amounts as more phosphorus is added to a lake. It should be born in mind that a conventional septic system cannot do much with phosphorous. Any phosphorous that enters a septic system from phosphorous containing detergents will emerge intact, enter the water table and eventually the lake. Phosphorus levels below 5 µg/L are typical of **oligotrophic** lakes that generally are clear and deep with few nutrients. Such lakes are typically found in the northern regions of Ontario. Phosphorous levels above 20 µg/L are typical of **eutrophic** lakes that are laden with nutrients which lead to excessive algae and plant growth. **Mesotrophic** lakes are in between these two extremes and are typical of the lakes found in our region of Ontario.

Bacteria are present in all lakes, they will be found in the feces of the wildlife (fish, waterfowl, beavers, etc.) that inhabit the lake. Coliforms are bacteria found in the large intestine of humans and other mammals and are usually present in soil. While some strains of coliforms do produce toxins, most are not harmful to humans. Some such as *Escherichia coli* (*E. Coli*) do produce pathogenic toxins. Therefore, levels of *E. Coli* are often used as indicators of possible contamination by fecal matter. Thus, high *E. Coli* levels in lakes or rivers can be an indication of septic pollution. The recommended safety level of *E. Coli* in a lake for recreational safety is not more than 100 colony-forming units (cfu) per 100ml of water. *E.coli* at any level is unacceptable for drinking water. Therefore, some form of treatment and purification is necessary for anyone who draws water from the lake for drinking purposes.

Dissolved oxygen (DO) is a measure of how much oxygen is dissolved in the water and the amount of oxygen available to living aquatic organisms. Without DO a lake would be totally without any aquatic life. The amount of dissolved oxygen in a lake can tell us a lot about its water quality. Although water molecules contain an oxygen atom, this oxygen is not available to aquatic organisms living in natural waters. A small amount of oxygen, up to about 14mg/L, is dissolved in water. Oxygen enters a lake from the atmosphere by wave action and from inflow streams. This dissolved oxygen is breathed by fish and zooplankton and is needed by them to survive. However, the concentration of dissolved oxygen in lakes is affected by temperature and has a well defined seasonal cycles.

Testing in 2020 was a challenge for both OLLA and RVCA because of the COVID pandemic. Safe distancing in a small boat was virtually impossible to achieve and restrictions were implemented by Caduceon Labs that performs testing of surface water samples. Hence, OLLA believed water sampling could not be safely performed and did not sample in 2020. RVCA was able to achieve reduced sampling and testing of surface water in some lakes in the Rideau Valley watershed including Otter Lake. The results of water testing in 2020 are

shown in the table below.

Water Qualiy Data - 2020																		
RVCA ID	OLLA ID	Total Coliform (cfu/100 ml)			E. Coli (cfu/100 ml)			Total Kjeldahl nitrogen (µg/l)				Total Phosphorous (µg/l)				Sechi Disk (meters)		
		Jun	Jul	Aug	Jun	Jul	Aug	Jun	Jul	Aug	Oct	Jun	Jul	Aug	Oct	Jun	Aug	Oct
RVL-26C	OLLA 03				5		0	400		400		7		4				
RVL-26DP1	OLLA 05A							400		700	300	8		9	2	5.50		6.00
RVL-26DP3	OLLA 06							400		400	400	6		6	0	5.00		5.50
RVL-26B	OLLA 09				0		3	400				8		5				
RVL-26E	OLLA 12																	
RVL-26F	OLLA 18				1		2	400		400		5		9				
Average					1.83			433.33				6.70				5.25		
Std. Error					1.77			100.00				1.77				0.35		
Oligotrophic								310 - 1160				3 - 18				5.4 - 28		
Mesotrophic								360 - 1400				11 - 96				1.5 - 8.1		
Eutrophic								390 - 6100				16 - 390				0 .8 - 7.0		

The results indicate that the trend that has been seen for the past five years remains the same. Low levels of E. coli were detected at some sites tested. These low values do NOT present a health hazard for swimming since in Ontario' public beaches are closed only when E. coli levels exceed 100 cfu/100ml.

Total Kjeldahl Nitrogen levels were in the acceptable range of between 200 - 500 µg/L, very similar to previous years. As for phosphorous, none of the sites tested had values greater than 10 µg/L and the average for the year was less than 7 µg/L, the lowest ever recorded for Otter Lake. Secchi depth readings were again between 5 and 6 meters indicating that the lake remains very clear and there were few algae blooms last Summer despite the hot weather.

Therefore, Otter Lake is now one of very few lakes in the area that is classified as oligotrophic which is quite unusual for lakes for this area. The only other lake classified as oligotrophic is Wolfe Lake. Most oligotrophic lakes are usually found much further North.

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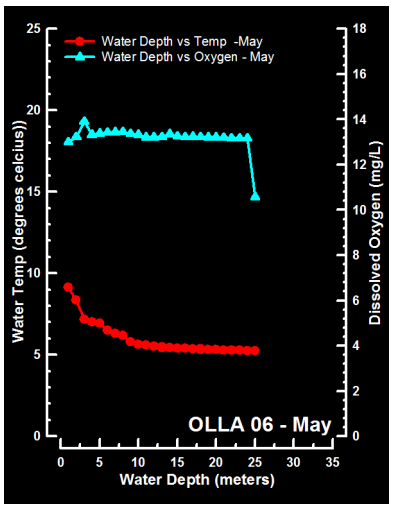
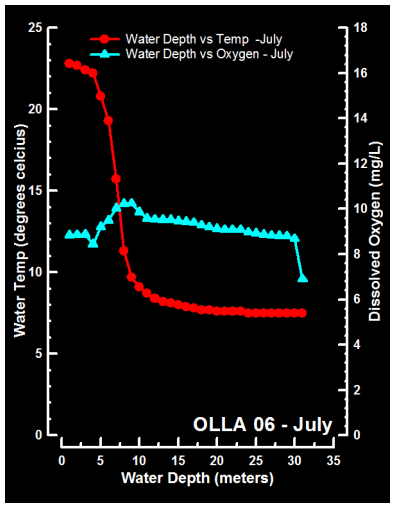
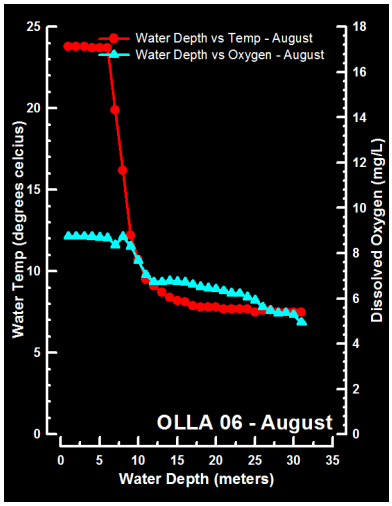
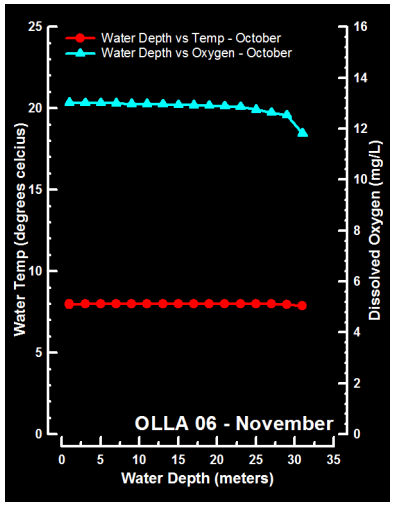
OLLA does not have the sophisticated (and expensive) equipment required to measure DO. However RVCA does perform measurements of water temperature and DO usually 4 times per year in May, July, August and October or November at two of our deep water sites OLLA 5A and OLLA O6. Typical results obtained by





RVCA in recent years are shown in the graphs on the right.





During the winter months when the lake is frozen over the water below the ice equilibrates to a temperature fo 4 degrees celcius (at which temperature water is at it's maximum density). Since cold water can hold more dissolved oxygen than warm water. In winter and early spring, when the water temperature is still low the DO concentration is high since no thermal gradient is established. In July the water has becomes stratified with a layer of warm water at the surface and colder water below the thermocline. As a result the DO concentration drops significantly. By August there is very steep drop in water temperature and a well established thermocline at 10 meters depth. Hence the DO concentration drops significantly below the thermocline since the DO at this depth can no longer be replenished. However, by November the water temperature has dropped to below 10 degrees, there is no more thermocline and DO concentrations return to the levels seen in the early Spring. Cold water fish such as all species of trout live in the cold water below the hyperlimnion and will not survive if DO levels fall below 4mg/L. While Otter Lake is not currently characterized as a "trout" lake the DO levels we experience at present would indicate that the lake would support species of trout if they were introduced.

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