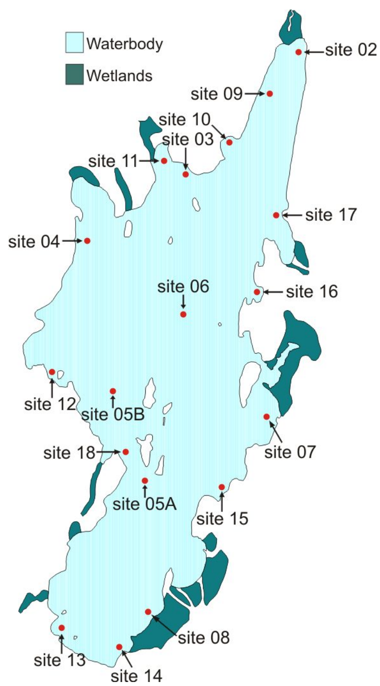
LAKE STEWARD'S REPORT - 2011

Water quality is affected by many things: natural processes of erosion and runoff accelerated by clearing of shorelines, the use of artificial fertilizers and leachate from sewage disposal systems. All result in too many nutrients reaching the lake. Too many nutrients cause profuse weed and algae growth which affect the aquatic animal species makeup by altering habitat and food sources and by reducing oxygen and light penetration.

Water quality testing is an important diagnostic tool to help residents of Otter Lake determine the health of the lake. We need early warnings to predict important changes in the lake's ecological process. By systematic testing and monitoring over time, it is possible to evaluate if water quality is improving or declining. By selective testing at strategic sites, water quality indicators can help determine the source or cause of contamination. The ecological and trophic status of a lake is generally determined by the levels of nutrients it contains.



As in previous years OLLA was once again fortunate to have the assistance of the Rideau Valley Conservation Authority (RVCA) in testing the water quality of Otter Lake. Thanks are due to Sarah MacLeod and her qualified team of technologists. RVCA and OLLA both test at least 3 times per year but at different sites. The combined results give us a good indication of the overall state of health of the lake. The map on the right indicates the location of all the OLLA test sites. These sites have been chosen to be representative of the whole lake. Sites 05A, O5B and 06 represent the 3 deepest water sites (more than 90ft). Sites 04, 07, 08, 11 and 18 are sites 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. OLLA does not test at all of the sites each year, more often we test at select representative sites usually between May and October.

NUTRIENTS & TROPHIC STATUS

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, present in the water. Clarity is measured by a simple visual test using a Secchi Disk, a 20 centimeter black and white disk attached to a measured line that is lowered into the lake until it is no longer visible. Analysis of water samples for chlorophyll a, which provides the green pigment in phytoplankton, gives a more specific measure of the abundance of small creatures in the water. Another perspective is gained through analysis of samples for nutrients, particularly phosphorus but also nitrogen, which tells how much food is available for the algae and aquatic plants. In the late summer when the algae drops to the bottom of the lake, its decomposition uses oxygen, so to find out how much oxygen is available for fish and other aquatic animals, dissolved oxygen and temperature profiles are done. These tests combine to give an indication of the age of a lake and what can be expected. An old or eutrophic lake will have profuse plant growth and relatively few fish species.

The two key indicators of nutrient load in a lake are phosphorus and nitrogen. These are both principal ingredients of fertilizers. When these two are present in excessive quantities in surface water, they stimulate algae and aquatic plant growth, just as they would stimulate the growth of grass or flowers in a garden. Dissolved oxygen levels can also be used to determine the trophic status as they provide a measure of the impact of eutrophication (due to biological growth and decay). Bacterial pathogens (originating from stormwater runoff and leaking septic systems) can also be introduced into a lake, limiting recreational potential and threatening human health. *Escherichia coli* (bacteria found in the intestines of mammals) is commonly used as an indicator of faecal contamination.

Phosphorous 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 limiting factor in the growth of algae, meaning that algae growth will occur in greater amounts as more phosphorus is added to 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 stimulate algae and plant growth. **Mesotrophic** lakes are in between these two extremes and are typical of the lakes found in our region of Ontario.

Nitrogen is also an important nutrient in aquatic ecosystems. In addition to fertilizers, agricultural waste and wastewater contribute nitrogen in to lakes. In large amounts, ammonia and nitrates can be toxic to aquatic organisms. Total Kjeldahl Nitrogen (TKN) is a measure of ammonia + organic nitrogen. While there currently are no guidelines for TKN, according to RVCA, TKN in water bodies not influenced by excessive organic inputs typically range from 100 to 500 µg/L.

Dissolved oxygen (DO) and temperature profiling is important for lakes because both parameters affect all aquatic organisms and the chemistry of the lake environment. As the life cycle of many fish and other aquatic organisms are dictated by temperature, the relationship between DO and temperature is important. Also, since temperature determines the ability of water to hold DO, temperature and DO are usually measured together. Cold water can hold more DO than warm water. The primary source of oxygen in aquatic systems is the atmosphere with wind action constantly recharging the surface waters with oxygen. Lake waters also gain oxygen as a byproduct of photosynthesis by algae and macrophytes. However, as these die, they settle to the bottom of the lake where bacteria convert the organic material into carbon dioxide, consuming oxygen in the process. Because the lake becomes thermally stratified early in the summer, oxygen cannot be replenished in the water in the hypolimnion, the lower part of the lake, so oxygen levels diminish. As a result, as oxygen levels are lowered, phosphorus in the bottom sediments becomes more readily soluble adding to the loading available for plant growth.

All the tests described above give an indication of the age of a lake and what can be expected. An old or **eutrophic** lake will have profuse plant growth and relatively few fish species because of the lack of open water and the competition for oxygen. A middle-aged or **mesotrophic** lake will support the greatest diversity of fish species with a variety of habitats and sufficient oxygen available. Young or **oligotrophic** lakes have very little or no vegetation and are usually well oxygenated but have relatively few fish species.

Bacteria will be present in all lakes, they are naturally present and will be found in the faeces 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 a few strains of coliforms produce serious toxins, most are not harmful. *Escherichia coli* (*E. Coli*) and coliforms 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 aquatic life and 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.

RESULTS FOR 2011

The table below indicates the results of all the water quality testing done in 2011 by OLLA and RVCA. *E. coli* was generally low or not detectable at all sites tested with the only exception being the slightly higher readings at OLLA 07 obtained in July and August. However site is 07 is where Barker's Creek flows into the lake.Total Kjeldahl Nitrogen levels were in the acceptable range of between 200 - 400 µg/L at all sites tested. Phosphorous levels were again quite low this year. The only readings greater than 10 µg/L were at our 2 deep water sites (OLLA 05A and 06) that were tested by RVCA in June and September. Secchi depth readings were all above 6 metres (a reading of 8.5 metres was obtained at OLLA 05A in May) indicating that the lake remains very clear. Increased water clarity means that sunlight can penetrate deeper and may often result in algae blooms over the summer months. While Otter Lake did experience some algae blooms in 2011, they were not as severe as in previous years. The average phosphorous level of 8 µg/L and an average Secchi depth of almost 7 metres indicates that the lake remains on the borderline between oligotrophic and mesotrophic. The almost undetectable *E. coli* at all sites except Barker's Creek indicates that the overall health of the lake is excellent.

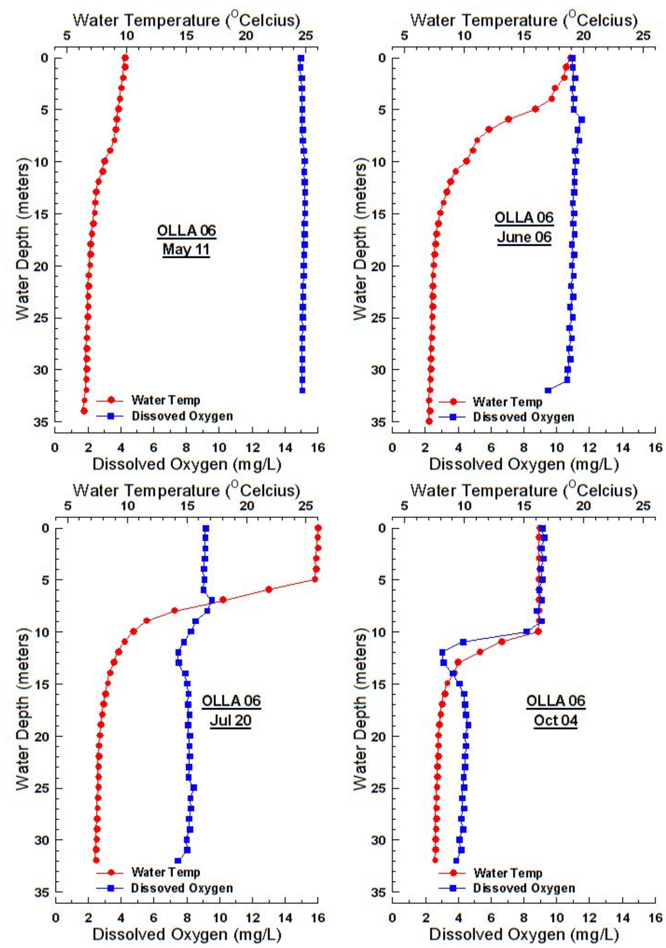
As mentioned earlier sufficient DO in a lake is necessary for all aquatic organisms to

Water Quality Test Results - 2011 (OLLA+RVCA

RVCA ID	OLLA ID	E. Coli (cfu/100 ml)						Total Kjeldahl nitrogen (µg/l)						Total Phosphorous (µg/l)						Sechi Disk (meters)				
		May	Jun	Jul	Aug	Sep	Oct	May	Jun	Jul	Aug	Sep	Oct	May	Jun	Jul	Aug	Sep	Oct	May	Jun	Jul	Aug	Sep
	OLLA 02																							
RVL-26C	OLLA 03		0	<2					340	330					9	6								
RVL-26D	OLLA 04		0		2				370		380				5		7							
RVL-26D P1	OLLA 05A								520	320		290			21	3		14		8.5		6.5		6.25
	OLLA 05B																							
RVL-26D P2	OLLA 06								340	250		430			9	2		18			6.5	6.0		6.50
	OLLA 07			10	12					730	400					<2	4							
	OLLA 08				2						350						5							
RVL-26B	OLLA 09		0	<2					320	310					11	6								
	OLLA10																							
	OLLA 11				2						410						8							
RVL-26E	OLLA 12																							
	OLLA 13				4						400						5							
	OLLA 14			2						550						<2								
	OLLA 15																							
RVL-26A	OLLA 16																							
	OLLA 17			<2						490						10								
RVL-26F	OLLA 18		0	4					340	300					7	4								
Average		3.17						389.05						8.11						6.71				

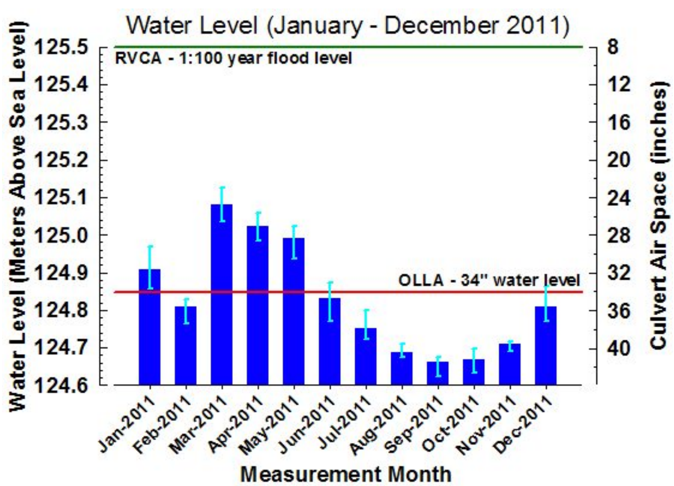
survive. Dissolved oxygen concentrations are linked to water temperature and depth and will therefore fluctuate with the seasons. Over the winter, water temperature decreases and becomes relatively constant (below 10°C). As a result, DO is also relatively constant. As the lake warms up during the months of June through August DO at the surface remains plentiful since it is constantly being recharged from the atmosphere. However, since warm water is less dense than cold water, the DO in the warmer surface water is not able to penetrate the hyperlimnion. As a result, the DO below the hyperlimnion cannot be replenished and DO concentrations at depths greater than 10 - 15 metres will begin to decrease. This stratification of DO usually reaches a peak in early fall. Cold water fish such as lake trout, rainbow trout and splake require a minimum of 5-6 mg/L of DO below the hyperlimnion but will not survive if concentrations fall below 4 mg/L.

Otter Lake was stocked with splake by MNR in 1999, however by 2002 DO levels below the hyperlimnion were almost zero by the end of the summer. Hence Otter Lake would not have been able to support these cold water fish. The reason for this rapid drop in oxygen levels over the summer is unknown. However, beginning in 2007 DO levels began to improve. The graphs on the right show the DO data obtained by RVCA for the months of May to October, 2011. The data shown are for the deep water site OLLA 06 which is about 35 metres (120 ft). As can be seen in early May, before any temperature stratification has occurred DO levels were extremely high at 15 mg/L at all depths. By the beginning of June, at which time a shallow hyperlimnion had formed the level of DO had dropped slightly, but was still high and constant throughout. By late July by which time a significant temperature gradient had formed at between 5 and 10 metres depth, DO levels were beginning to diminish below the hyperlimnion, but still remained at 8 mg/L. Unfortunately, RVCA was not able to measure in August and September, however by early October DO concentrations were still 8 mg/L above the hyperlimnion but had dropped to 4mg/L below it. Depending on how long this level of DO persists it might be stressful for cold water fish since it is below the 5-6 mg/L that these species require. It will be critical to determine if the DO levels recover over the winter as the lake de-stratifies. Therefore the May, 2012 DO levels will be very important to determine if we could once again restock Otter Lake with cold water fish.



WATER LEVELS

The graph below right shows the Otter Lake water level for 2011. The reference line in red shows the empirical “optimal” water level of 34" put forward by OLLA at the AGM in 2007. In 2011, Otter Lake was completely frozen over by January 5, 2011 though the ice thickness would have been extremely variable. Otter Creek remained open and flowed well throughout the winter months and since the ground was frozen, the lake level dropped significantly in January and February. However, our spring thaw occurred in March, hence the high water levels in March and April. According to RVCA water volumes in the entire Rideau watershed peaked around March 19. Unfortunately for Otter Lake and most lakes in the region, this spring "high" occurred while the ice was still on the lakes. As a result some shoreline erosion and damage to any structures that were left in the lake over the winter could have occurred. With the continued rainfall in April (another record breaking month according to Environment Canada) and May, the lake level remained quite high. The summer months of 2011 were hot and dry and as a result the water level dropped significantly and by September reached a level not seen since 2009. In fact RVCA issued a level 1 low water advisory in September, 2011 for the entire Rideau river watershed. With the rain we received in October and November and some moderate snowfall in December, there was a slight increase in water level during the months of November and December. RVCA did not lift the Level 1 low water level advisory until November.



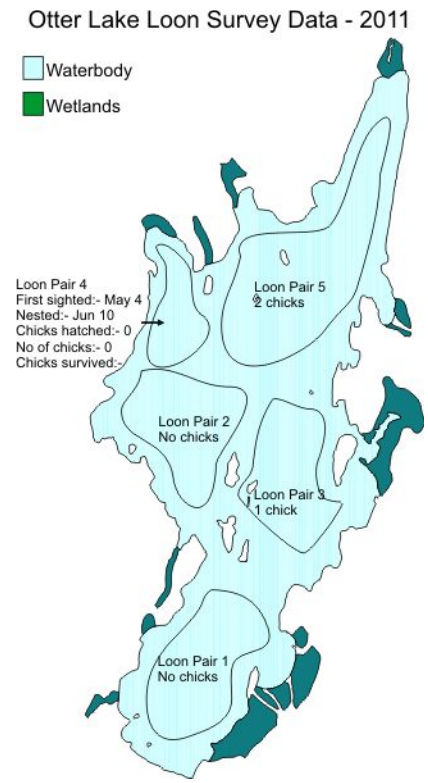
As reported at the OLLA AGM in July, RVCA performed a detailed study of water volume, inflow and outflow rates on Otter Lake in early spring and came up with a new 1:100 year flood level for Otter Lake of 125.5 meters above sea level (masl). This level is shown on the graph above by the upper reference line. This level is quite high and represents a hypothetical high water level that could be reached in Otter Lake under extreme conditions. However, this level has never been reached, at least not during the time OLLA has been recording water levels. The highest level recorded was 125.23 masl in March, 2008 and we did reach 125.12 masl in March, 2011. While RVCA’s 1:100 year flood level does protect Otter Lake’s numerous wetlands, it also means that many low lying properties and several access roads are now considered to lie below the flood plain.

Submitted by:

Doug Franks
Lake Steward
Otter Lake Landowner’s Association
March 2012

OTTER LAKE LOON SURVEY

In 2011 OLLA participated in the Canadian Lakes Loon Survey (CLLS). CLLS was first initiated in Ontario in 1981 to assess the long-term health and productivity of Common Loons, and the lakes they depend on. Loons breed on lakes throughout most of Canada, and as top predators, their survival reflects broader lake health. Each year, hundreds of volunteer participants spend time observing loons on lakes where they breed: at least once in June (for loon pairs), once in July (for newly hatched chicks), and once in August (for young that survive to fledge). This information is used to monitor loon chick survival over time, and is an important indicator of loon and lake health.



Unfortunately, Otter Lake's loons did not do too well in 2011. Of the 5 loon pairs that spent most of the summer months on Otter Lake, only 2 pairs were successful in producing chicks even though all of the loon pairs appeared to nest in early June. The map of Otter Lake on the right shows the approximate location of our 5 loon pairs. Loon pair 3, that seemed to spend most of their time over by the East shore had one chick and pair 5 that were seen at the North end of the lake had 2 chicks. To the best of our knowledge all of these chicks survived and hopefully made the trip South in the fall. Why the remaining 3 loon pairs were not successful in producing chicks is unknown. It may be the result of our fluctuating water levels since if a loon's nest becomes flooded after they have laid their eggs, the eggs will be lost and loons only nest once a year. By contrast, if water levels drop after loons have nested, they will often abandon the nest because it becomes too difficult for the loons to reach it. The latter may be what happened in 2011. In an attempt to make life easier for our loons, OLLA is still planning to construct some loon nesting platforms. Any OLLA member who would like to be involved in this project should contact the Lake Steward or a member of the Board of Directors.

We would also like more information on where the loons are on Otter Lake, so if there is a loon pair living in your part of the lake please let OLLA know when you first saw them, where they are and when you think they may have nested. It is not necessary to know the nest location but if you have a good idea where it is, let us know that too.