Water Quality 2009

Water Chemistry

Water quality was measured on 6 occasions in 2009. Deep-water samples, taken at sites B and C on June 18, July 17 and August 30, were analyzed for total phosphorus (TP) concentration through the Lake Partners Program (Ministry of the Environment). Deep and shallow-water samples at 10 different sites were also taken by the Rideau Valley Conservation Authority (RVCA) on June 18, August 19 and October 6. These were analyzed for a number of variables including TP, E. coli, dissolved calcium and total organic nitrogen concentration. The laboratory results are summarized in Tables 1 and 2.

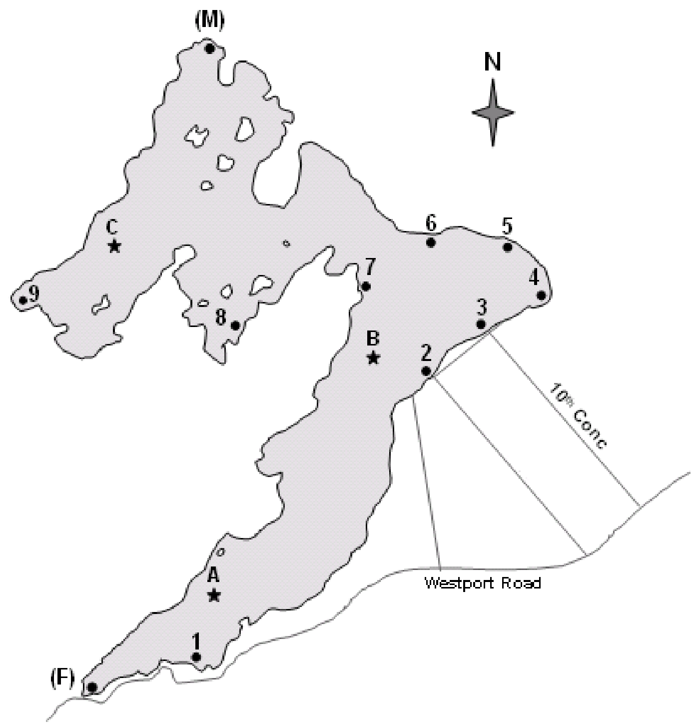


Table 1: TP Concentration, µg/L (Lake Partners Program Data)

	Site	
Date	**B**	**C**
June 15	8.1	8.9
July 17	12.9	10.6
August 30	11.3	12.2

Table 2A: TP Concentration, µg/L (RVCA Data)

Date	Site B	C	1	2	3	4	6	7	8	9	(F)	(M)
June 18	11	-	12	10	10	21	14	10	9	10	17	14
August 19	12	-	11	11	12	14	12	11	11	-	11	-
October 6	12	17	12	12	11	11	14	13	11	16	10	12

Table 2B: E. coli Concentration, cfu/100 ml

Date	Site 1	2	3	4	6	7	8	9	(F)	(M)
June 18	8	2	20	2	2	6	2	2	14	2
August 19	2	2	4	32	2	2	2	-	2	-
October 6	2	2	2	50	2	2	2	2	2	4

Interpretation of Results

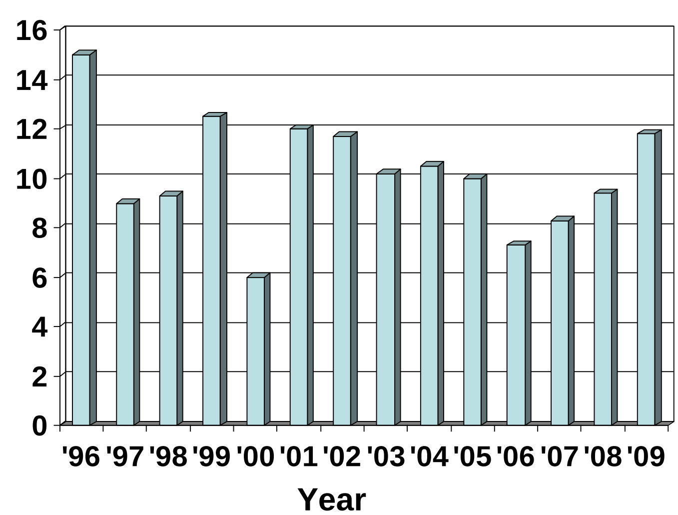
Total Phosphorus. Phosphorus is the main nutrient for algal growth in lakes in our region. In general, the higher the phosphorus concentration, the greater the growth of aquatic vegetation, the lower the water clarity and the greater the tendency for the water to have a "weedy" odour. Phosphorus enters a lake naturally from upstream soil and vegetation, being transported by those streams and creeks that flow into it. A second major source of natural phosphorus is rainwater runoff from the immediate lakeshore and, finally, a significant amount is added directly from the atmosphere through the phosphorus dissolved in rain. Once phosphorus enters a lake, it becomes involved in a cycle whereby it is taken up as a nutrient by aquatic weeds and algae as they grow in the spring and summer, but then released again as they die back and decay in the fall. Thus, in any given year, the phosphorus concentrations in our lake are affected by the average rainfall, temperature and sunlight.

In addition to natural sources, phosphorus also enters a lake as a result of human development. It is difficult to determine how much of the total in Wolfe Lake can be attributed to human sources but, in highly developed lakes, estimates often exceed 25%. In such instances, the major sources are usually detergents leaking from septic and wastewater systems or fertilizer runoff from lawns, farms or golf courses. The addition of appliances such as dishwashers, washing machines and showers to older recreational cottage properties without upgraded septic systems exacerbates the problem.

Over the 3 summer months, deep-water samples analyzed through the Lake Partners Program averaged 10.7 µg/L and ranged between 8.1 and 12.2 µg/L. The July value of 11.8 (average for sites B and C) is presented graphically in Figure 1, along with July data dating back to 1996. As can be seen, TP concentrations were higher last summer than in 2008 and higher than they have been since 2002. Near-shore samples (Table 2A) also tended to be slightly higher at most sites than in the past. Whether this indicates the beginning of a trend or is simply the result of the unusually rainy summer that we had last year remains to be seen.

E. coli. Escherichia coli (E. coli) are bacteria that live in the gastrointestinal tracts of warm-blooded animals and birds. While most E. coli pose no health risk to humans, their presence in water is an indication that fecal matter (which **may** contain disease-causing organisms) has entered the water. Near-shore testing for E. coli is thus an effective method of determining whether there may be faulty septic systems in the vicinity, or contamination from upstream livestock. E. coli concentrations are conventionally expressed as the number of organisms (Colony Forming Units, or cfu) per 100 ml of water, but since the standard measurement technique does not differentiate the species of E. coli, it is unknown whether they are from an animal or human source. To put the values in Table 2B into perspective, recall that the "safe limit" in Ontario, above which public beaches are closed, has been set at 100 cfu/100ml. Samples at all sites thus fall within the acceptable range; however, it should also be pointed out that water containing any trace of E. coli should be boiled or treated before drinking.

FIGURE 1
Deep Water Total Phosphorus Concentration (July), μg/L



Zebra Mussels

From observation of the rocks in front of our place, and anecdotal reports from other cottagers, zebra mussel numbers were greater than in 2008. The increase in numbers however, did not seem to be as great as that which occurred between 2007 and 2008.

They may thus be approaching their ecological balance point. This point occurs when they have filtered the water to the point that there is not enough plankton available to support further reproduction. It should be noted at this point that water clarity readings were at an all-time high last summer, with Secchi disc readings being in the 8 to 10 m. range.

Each day an adult mussel filters the plankton from more than 1 liter of water. Some of this is consumed as food and excreted as feces while the remainder is combined with mucus and other matter and deposited on the lake floor as what is known as pseudofeces. This biomass increases as the number of mussels increases and is the source of the strong odour that we now detect after swimming in the lake or handling submerged objects such as water pipes, anchor chains or minnow buckets. It may also be a contributing factor for the growth of certain algae species (see below).

Algae Blooms

Many of you will recall the bright green algal blooms that began appearing last June and increased as the summer went on. Unlike the blooms in previous years, where the water took on a "pea soup" appearance but then cleared in a week or so, these blooms seemed to be enclosed in a mucus-like tent that kept growing as the summer went on. This continued until October, when Parks Canada began lowering the water level in our lake and they then suddenly disappeared.

There are hundreds of different species of algae in Ontario lakes and they are a vital part of each lake's ecology. Algae are plant-like microscopic organisms (although blue-green algae have a structure more similar to bacteria) which do not have roots, stems or leaves and normally float around, suspended in the water. While most species are single-celled and free-floating, apparently some types of blue-green algae can join together to form filaments. These types begin growing on the bottom of the lake but then rise toward the surface as they reproduce (bloom) and become more buoyant. The thread-like filaments hold the mass together and give them the slimy, stringy texture that you are familiar with if you have ever handled one of these blooms (some lake association newsletters refer to these species as "elephant snot").

Blue-green algae blooms occur most frequently in lakes where there is little water movement, temperatures are warmer than normal and there is abundant dissolved phosphorus. Since phosphorus levels in Wolfe Lake are still lower than in most lakes, there must be other reasons for the unprecedented algae growth that we saw last summer. My guess is that part of it may have been due to the fact that, for most of the summer, there was little water movement out of the lake, because Parks Canada was controlling water levels in the Rideau Canal. My other guess is that part of it may have been due to the changes that have occurred in our lake due to the zebra mussels. Because of the changes in water clarity, sunlight penetrates deeper than ever before, causing growth of new aquatic species and growth in new locations. In addition, the feces and pseudofeces that are now building up on the bottom of the lake (see above) are apparently also an ideal fertilizer for blue-green algae. In support of this explanation is the fact that most of the algal blooms appeared in parts of the lake that have rocky bottoms (where there had never been weeds before) and this is, of course, where zebra mussels are concentrated.

Benthic Invertebrates

Benthos is the term that biologists use for the bottom of a body of water. Benthic invertebrates are therefore those tiny "bugs" and shellfish that live in the sediment at the bottom of the lake. Technicians from the RVCA have been sampling their numbers and diversity for the past several years as an indirect measure of water quality. Samples are taken at several locations (sites 3, 9 and the north shore of the west branch near Derbyshire's Island) in May and October. At the time of this report, only the May samples had been fully analyzed and therefore the RVCA was unable to comment on the productivity of these species over the course of the summer. Hopefully they will be available by the time of our AGM.

Duncan MacDougall