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Biodiversity

Using Algae for Diagnose the Health of Watercourses and Lakes

by Isabelle Lavoie and Claude Fortin (INRS) and also Paul B. Hamilton (Canadian Museum of Nature)

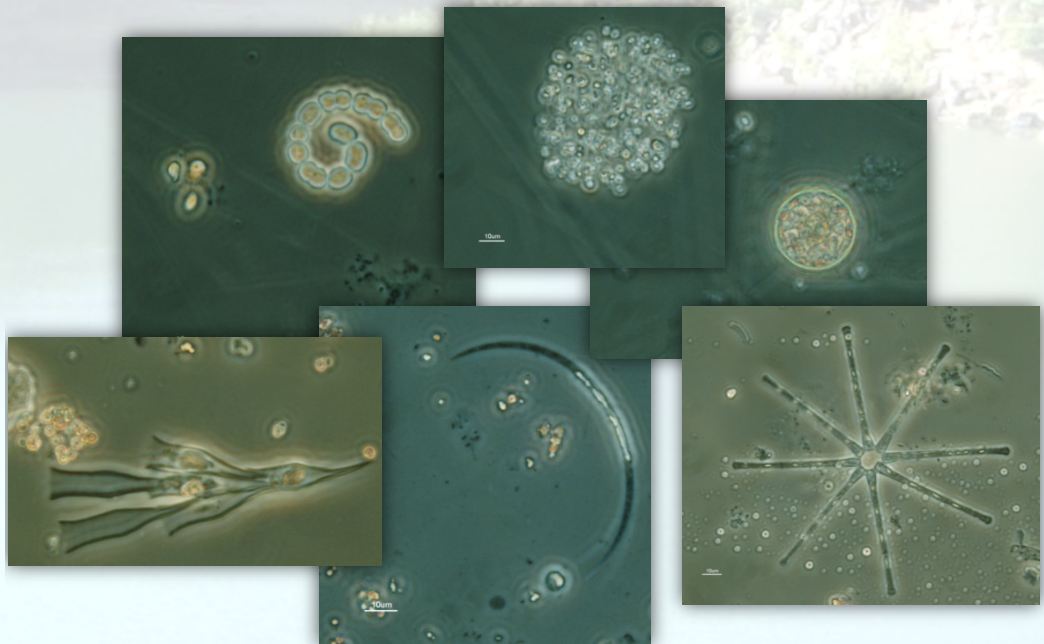
In July 2012, a study was conducted using algae communities to diagnose the health of 16 watercourses and three lakes in Gatineau Park. Taken together, the results of this study constitute a valuable data base that will be most useful for comparison purposes in future years. The study was made possible by a research grant from the NCC. Additional financial assistance was provided by the Friends of Gatineau Park. INRS-ETE, the Canadian Museum of Nature, and Université du Québec à Trois-Rivières also contributed to the study.

In watercourses in the Park, a total of 16 sampling stations (listed below) were selected to provide a range of natural features (watershed size, geological features) and anthropological characteristics (land use, roads, ski areas, camping areas). Taylor Lake, Philippe Lake and Pink Lake were also sampled.

The Eastern Canadian Diatom Index (ECDI)¹ was the biomonitoring tool used to assess the biological integrity of the 16 watercourses. Values

on the ECDI scale indicate water quality, solely on the basis of conditions in communities of microscopic algae called diatoms.

The ECDI is a tool developed exclusively for monitoring the biological integrity of flowing water; as a result, no values on the ECDI scale were calculated for samples taken from lake water. That said, it was possible to assess the eutrophication of the three lakes by briefly describing the algae communities (as oligotrophic,



mesotrophic, or eutrophic), listing the phytoplankton species observed, and estimating the abundance of blue-green algae or cyanobacteria (which can produce toxins). Unlike the samples from flowing water, from which only benthic diatoms are required to use the ECDI, the samples from lake water were classified on the basis of all algae groups, including blue-green algae, and were analyzed quantitatively, that is, by estimating the biomass of algae in a litre of water.

Diatoms

In an increasing number of countries, microscopic algae called diatoms are used to monitor the eutrophication as well as the biological integrity of watercourses. Diatoms are especially sensitive to variations in the concentrations of nutrients (mainly phosphorus and nitrogen) in the water, and to organic and mineral loading from agricultural fertilizers as well as urban and industrial discharges. Some species of diatoms are very sensitive, while others are quite tolerant and able to proliferate in disturbed conditions. Diatoms are also sensitive to increases in water salinity that can be caused by the use of road salt.

For further information on diatoms and their use in biomonitoring, see the 2011 report prepared for the NCC and entitled “**Intégrité biologique des cours d’eau du parc de la Gatineau : Application de l’Indice Diatomées de l’Est du Canada (IDEC)**” [biological integrity of watercourses in Gatineau Park: application of the ECDI].

From the watercourses, the samples at each station were taken by using a toothbrush to scratch the accumulated biofilm or periphyton on rock surfaces. From the lakes, the samples of phytoplankton (algae floating in the column of water) were taken approximately in the middle of Taylor Lake, Philippe Lake and Pink Lake respectively: two-litre bottles were filled at an approximate depth of 0.5 metres.

At most of the stations (10 out of 16) sampled in July 2012, there was **excellent** biological integrity according to the values calculated using the ECDI. These results suggest that, overall, the biological integrity of watercourses in the Park is comparable to that of the least disturbed rivers in eastern Canada. At almost all the remaining sampling stations, there was **average** water quality. One exception was found at a small stream crossing Philippe Lake Road (approximately 650 metres south of Schnob Road), where there was **poor** biological integrity, with a value of 27 on the ECDI. Part of this watershed is located

outside the Park limits; roads and agricultural activity may cause higher water salinity and nutrient concentrations at this sampling station. Another exception was found at the sampling station located on Des Fées Creek at the outflow from Des Fées Lake, with a value of 22, or **very poor** water quality, on the ECDI. This station is located in the narrow part of the Park that is surrounded by residential areas; this low value may be the result of major traffic arteries nearby.

Detailed analyses of phytoplankton communities conducted by the Canadian Museum of Nature suggest that Philippe Lake is mesotrophic, Taylor Lake oligotrophic, and Pink Lake oligo-mesotrophic. This classification is based more on algae biomass than on the structure of the algae communities observed. Significant presence of blue-green algae in Philippe Lake and Pink Lake was noted, although this fact may have to do with the hot, dry conditions in the summer of 2012.

In July 2011, a similar study was conducted at 25 sampling stations on 20 watercourses within the Park. The main purpose of the July 2012 sampling was to assess year-to-year variations in the biological integrity of these watercourses. However, the dry conditions in the summer of 2012 meant that it was possible to re-sample the water at only 11 of the 25 stations sampled in 2011. The comparative ECDI values obtained in 2011 and 2012 suggest that, overall, the biological integrity of these watercourses has remained constant from one year to the next, although the ECDI values can vary considerably (by up to 20%). These variations may have to do with year-to-year changes in environmental conditions, possibly amplified by the dry conditions in the summer of 2012. Details of the 2011 and 2012 studies can be found in the reports prepared for the NCC and entitled “**Intégrité biologique des cours d’eau du parc de la Gatineau : Application de l’Indice Diatomées de l’Est du Canada (IDEC)**” [biological integrity of watercourses in Gatineau Park: application of the ECDI] and “**Biosuivi de l’intégrité écologique des ruisseaux et des lacs du parc de la Gatineau à l’aide des diatomées et des autres groupes d’algues**” [biomonitoring the ecological integrity of streams and lakes in Gatineau Park using communities of diatoms and other algae].

A lake's trophic level

The intensity of a lake's primary production can be described as "oligotrophic", "mesotrophic" or "eutrophic". Primary production is closely linked to the concentration of nutrients in the water, resulting from a natural process: a lake's tributaries bring in significant quantities of matter of various types. However, human activities in a watershed (such as municipal or industrial wastewater discharge, urban or agricultural runoff, or aquaculture operations) can accelerate the buildup of nutrients.

Oligotrophic: low primary production, low nutrient content

Mesotrophic: moderate primary production, moderate nutrient content

Eutrophic: high primary production, high nutrient content, risk of eutrophication

A third study of watercourses in the Park is planned for July 2013. The water at the stations used in 2011 and 2012 will be re-sampled to obtain data over two if not three years for each station. This third study will ensure that year-to-year variations are factored into water quality monitoring. It would be ideal (if not always feasible) if this third study were conducted under more "normal" environmental conditions, without heavy rainfall as in late June 2011 or dry conditions as in the summer of 2012.

Acknowledgements

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2012 Sampling Stations (Watercourses)

- Chelsea Creek, Meech Road
- Chelsea Creek, Sugarbush Trail bridge
- Meech Creek, Cowden Road
- La Pêche River west
- La Pêche River east
- Fortune Creek north
- Fortune Creek south
- McCloskey Creek south
- Meech Creek, north of covered bridge
- Philippe Lake Road
- Pink Lake tributary
- Treatment Plant 1 outflow
- Treatment Plant 2 outflow
- Philippe Lake tributary
- Philippe Lake outfall
- Des Fées Creek

¹ The EDCI is used to assess a watercourse's eutrophication as well as its overall biological integrity. Its scale, from 0 to 100, indicates changes in conditions between a diatom community and its reference community. A high value indicates that the conditions in the diatom community correspond to the reference conditions, with no disturbances and few, if any, changes of human origin. Conversely, a low value indicates that the diatom community has been very much affected by human activities.

Lavoie I, Grenier M, Campeau S, Dillon PJ (2006). "A Diatom-Based Index for Water Quality Assessment in Eastern Canada: An Application of Canonical Analysis". *Canadian Journal of Fisheries and Aquatic Sciences* 63: 1793-1811.



Heritage

Gatineau Park's 75th Anniversary

by Louis-René Sénéchal (NCC)

When the first Europeans set foot in the region early in the 17th century, they met the Anishinabe who have lived here for generations (and are still present to this day). Settlers farm the land, but poor, rocky soil pushes them to also hunt and fish. Forests and mining resources are also being used.

In the late 1800's, the great outdoors are attracting an ever-increasing number of people from the city. In the hills just North of Ottawa, the first

cross-country ski trails make their appearance, some of which are still being used today.

A few wealthy residents of the capital region begin building cottages in the Gatineau hills; one of them is none other than William Lyon Mackenzie-King. First acquiring a small lot on the shores of Kingsmere Lake and building a small cabin, he spent five decades developing his Estate. As Prime Minister, he invited many guests – from all over the country, and from overseas – to enjoy his summer retreat. For the most part, though, time spent on his Estate allowed him to take refuge from the pressures of the political world. Mackenzie-King passed away in 1950; in his will, he bequeathed his Estate to the people of Canada, so that all Canadians could also enjoy the benefits of spending some time in a natural environment.

More summer cabins begin showing up on the shores of lakes in the area: Kingsmere, Meech and Mousseau (Harrington) lakes, to name a few. Their owners trust local families and settlers for various chores and supplies. One of them, the Healey family, took good care of the Edwards and Herridge cottages, and provided them with products from their crops. The extra revenue thus gained helped make farm life a little less harsh. Stanley Healey and his sister Dorothy were the third, and last, generation to live on the family farm; in 1955 they moved to the caretaker's cabin near the prime minister's summer retreat, on Mousseau (Harrington) Lake. There, Stanley will maintain the grounds and buildings for the following twenty years. Despite their modest origins, the Healey family enjoyed personal relationships with many famous people visiting the region; prime ministers, heads of states visiting Canada, and the royal family. Today, the Healey home, and the Herridge cottage, are day-use shelters on trail #50 in Gatineau Park.

Relations between residents and cottagers in the Gatineau hills were not always harmonious. Cottagers wanted to keep the forests and lakes intact for their enjoyment, while residents and small local businesses made a living farming the land and harvesting trees. This last activity gained momentum during the Great Depression in the 1930's. In 1934, concerned citizens formed the

Federal Woodlands Preservation League. Their outspoken objective: stop tree cutting in the Kingsmere and Meech lake sectors. Roderick Percy Sparks, Harry Baldwin and Ottawa Ski Club president Charles Edmond Mortureux, to name a few, are pushing the government into action.

In 1937, Sparks, the League's president, presented Prime Minister Mackenzie-King with an Action Plan which could lead to the creation of a park in the Gatineau hills. King enthusiastically supported the plan and in 1938, the federal government allocated \$100,000 in order to buy land which would be protected; thus began Gatineau Park. No longer intended for natural resources exploitation, these newly protected spaces in the Gatineau hills became prime conservation and recreation areas. Over the course of the following decades, this new park not only provided local residents with a means of taking part in recreational activities, but also offered employment opportunities and had an impact on economic development.

Today, Gatineau Park offers visitors a chance to take part in numerous activities, from short hikes to back-country expeditions. Pressures to which the Park's ecosystems are being subjected, due in part to an ever-increasing number of visitors, made the Park's management choose environment protection as its priority objective. The Park's awe-inspiring landscape, which can be seen in the distance from the heart of the nation's capital, is a reminder of the vast natural expanses of Canada. It is everyone's responsibility to ensure its long-term preservation, so that future generations can too enjoy its benefits. ♪



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