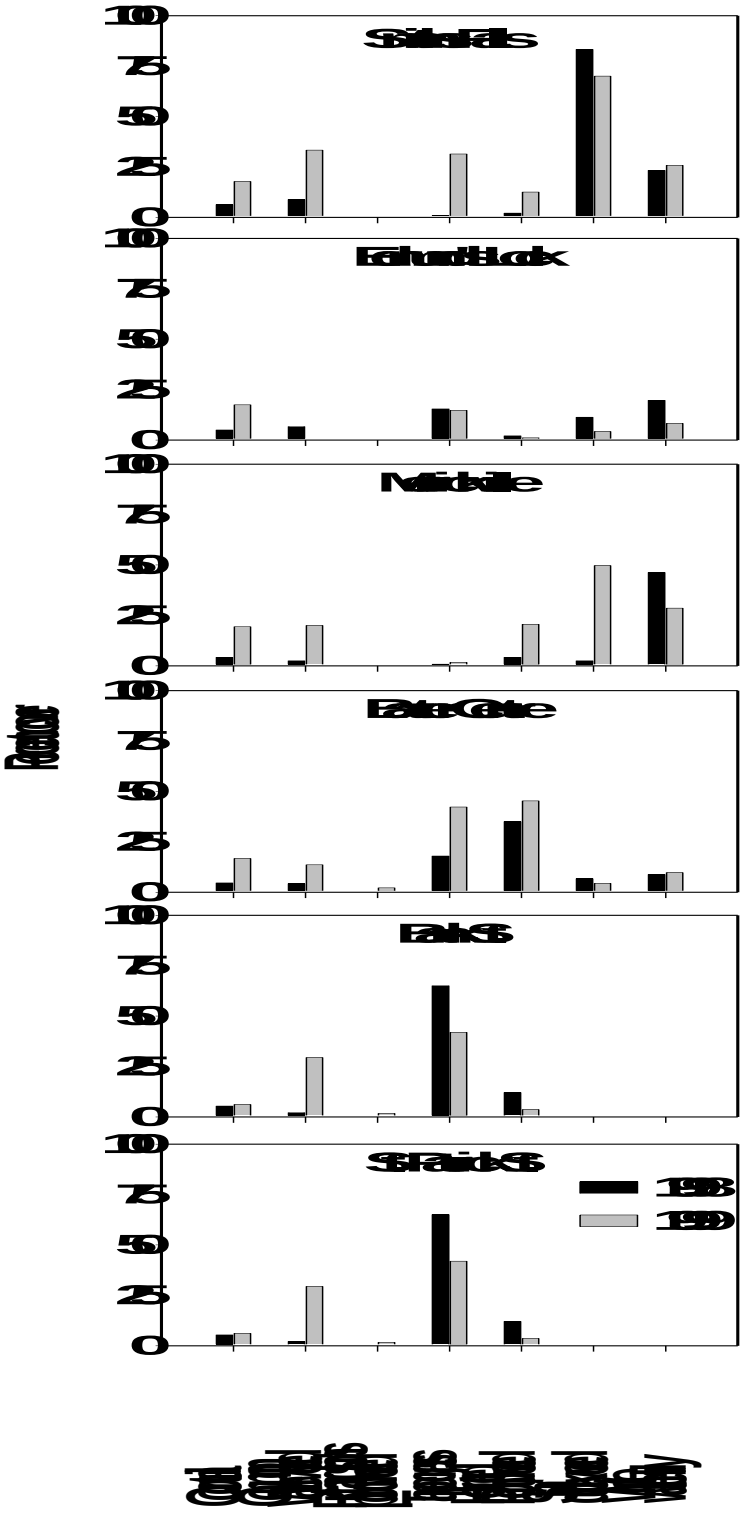

Figure 13 Percent cover of dominant aquatic plants, 1998-1999.
Source: Canadian Museum of Nature

3.6 Biological Indicator: Aquatic Plant Harvesting

Background

Eurasian water milfoil (*Myriophyllum spicatum*) is an invasive introduced species, native to Europe, Asia and North Africa. It was first recorded in Canada in Lake Erie in 1961 and was present in the Rideau Canal by the late 1960s. This species of milfoil can grow in deeper water than most other species of aquatic plants. It is a perennial plant, which spreads readily, and can become established from branch fragments. Mechanical harvesting and boat traffic may encourage its spread, by creating fragments that can colonize new areas. Eurasian water milfoil produces thick growth at the water surface, forming dense floating mats that shade out native plant species, and interfere with navigation and recreation.

Curly pondweed (*Potamogeton crispus*) is another introduced plant species, native to Eurasia, Africa and Australia. It is commonly found in waters that are alkaline and high in nutrients, and spreads by producing burr-like winter buds that are distributed by water currents. Curly pondweed, like Eurasian water milfoil, produces dense growth that interferes with navigation and recreation. When curly pondweed dies off in mid-summer, decaying plants may sometimes result in drastic decreases in dissolved oxygen, and large releases of nutrients. Although this invasive submergent plant is widespread in the Rideau River, the densest growth occurs in the southern end of the Cataraqui portion of the Rideau Canal (above Kingston Mills).

The amount of plant material harvested annually from the Rideau River may be used as an indicator of the extent of Eurasian water milfoil and curly pondweed problems in the Rideau. These invasive species are considered major "nuisance" aquatic plants along the Rideau Canal. Dense aquatic plant growth has been removed from a few select areas of the navigation channel of the Rideau River for decades. In the past, (until 1991) the herbicides Reglone 'A' (diquat dibromide) and Aqua Kleen (2,4-D) were used to control plant growth in some locations. Parks Canada contracted out the annual cutting and removal of aquatic plants to the RVCA (from 1971 to 1985) and has used private contractors since 1986. In addition, landowners and municipalities may obtain permits from Parks Canada and hire contractors for plant removal, and unofficial harvesting (and probably a limited amount of illegal herbicide use) occurs around private waterfront.

Results

Currently, submergent aquatic plants are cut and removed once or twice each summer, in 4 navigation channel locations along the Rideau River (totalling 8 hectares) primarily between Smiths Falls and Burritts Rapids (the "central sector"). Another six sites (about 45 hectares) are located in the "Ottawa reach", the man-made canal cut in downtown Ottawa between Hartwell locks and the Laurier St. bridge (including Dow's Lake).

European water milfoil and curly pondweed dominate the plant material removed from the "central sector" of the Rideau River (Figure 14). In this region, the amount of plant matter harvested annually ranged

from 13 to 28 tons (or between 1.6 and 3.5 tons/hectare) between 1996 and 2000 (Figure 15). By contrast, no harvesting of aquatic plants was necessary in the "Ottawa reach" until 1999. Dense growth of Eurasian water milfoil was first noted there in 1998 and plant harvesting began in 1999. The amount of plant material removed from the Ottawa reach is considerably higher; 349 tons of plant matter were harvested in 1999 and 173 tons were harvested in 2000 (7.8 and 3.9 tons/hectare respectively). Areas of dense plant growth in the Ottawa reach were almost entirely dominated by Eurasian water milfoil, although more than 10% of the total plant harvest was actually composed of algae. The harvest of aquatic plants in the Ottawa reach was lower in 2001; although figures are not yet available, it is estimated that the amount of plant material harvested dropped by about 40% from 2000, possibly due to the effects on plants of the harvesting in the previous two years.

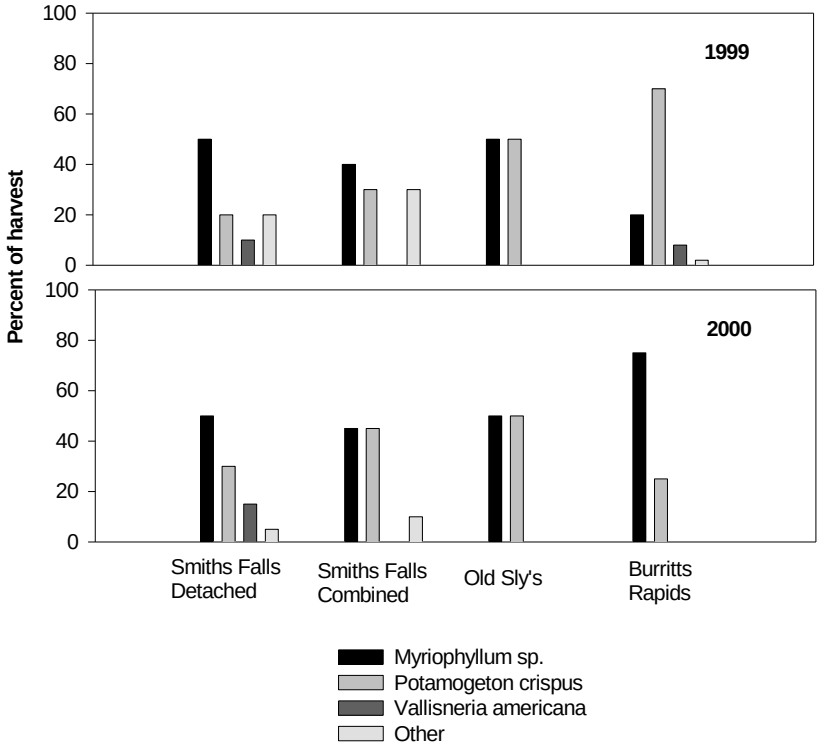

Figure 14 Dominant aquatic plants harvested from the navigation channel, 1999-2000. Source: Parks Canada, Eastern Ontario Field Unit

Prior to 1999, when plant harvesting started in the Ottawa reach, Parks Canada's annual budget for aquatic plant removal on the entire waterway was less than $20,000. In 1999, more than $65,000 was spent for harvesting in the Ottawa reach alone. Currently, the projected minimum annual budget for aquatic plant removal is $100,000, of which $50,000 to $75,000 is for the Ottawa reach.

The sudden increase of aquatic plant growth (particularly milfoil) in the downtown canal cut (Ottawa reach) may be linked to zebra mussel colonization, which has led to increased water clarity in the lower Rideau. Warmer weather in the early spring and summer may also play a role in this increased aquatic plant growth. The

dominance of milfoil in this section may also be partially attributed to winter draw down of the Rideau, which is thought to discourage other plant species. This is somewhat speculative, however, as draw down is also considered to be a possible method of controlling milfoil growth.

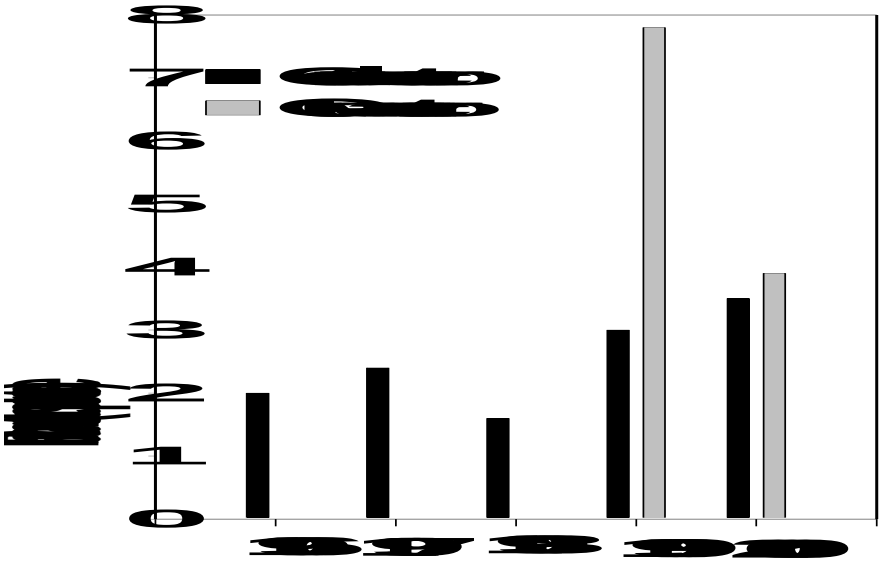

Figure 15 Annual aquatic plant harvest, 1996-2000.
Source: Parks Canada, Eastern Ontario Field Unit

Limitations

This indicator may show general trends in the distribution or abundance of these invasive species, but there is considerable yearly variation in aquatic plant growth due to differences in weather conditions. The amount harvested might reflect changing management practices, such as the timing of harvesting, rather than real differences in plant abundance. In addition, only one of the two contractors harvesting plants in the Rideau River reports the composition of the harvest in any detail, making comparison of the two sections difficult.

3.7 Biological Indicator: Non-native Species: Zebra Mussels

Background

The zebra mussel (*Dreissena polymorpha)*, is native to the Caspian Sea. It was likely transported to North America in a ship's ballast water, and was first identified in 1988 in Lake St. Clair, southern Ontario. Zebra mussels are sedentary, and feed by filtering bacteria, algae, zooplankton and other organic particles from the water. The zebra mussel multiplies rapidly, colonizes many different habitats, is tolerant of extremes of temperature and dessication, and has few natural predators

except a few species of shellfish-eating fish and diving ducks. Zebra mussels also have effective dispersal methods. They are transported easily by natural water currents, or by attaching to boats. This combination of traits has enabled the zebra mussel to spread rapidly, producing dense colonies in freshwaters throughout much of eastern North America.

While some have suggested zebra mussels have a positive effect on lakes and rivers, because they increase water clarity, these exotic mussels have numerous negative impacts. Apart from obstructing water intake pipes and engines on motor boats, zebra mussels may have adverse effects on aquatic ecosystems. Zebra mussels have been found to replace native mussels, to biomagnify toxic organic contaminants, and to cause substantial oxygen depletion in some systems. Intense and selective filter feeding on natural phytoplankton communities can result in an increase of other, possibly toxic algal species, and shifts in food webs which are detrimental to fish populations.

Results

In 1990, the first occurrence of zebra mussel was reported in the Rideau River at Mooney's Bay. Since 1993, zebra mussel distribution and density has been monitored by staff at the Canadian Museum of Nature, at 10 lockstations and 3 additional sites in the Rideau River (Figure 16). Between 1993 and 1995, the abundance of zebra mussels on hard surfaces in the lower section of the Rideau between Kars and Ottawa increased by up to a million-fold. Zebra mussel density has remained high in these areas since then, and the distribution and abundance of zebra mussels may be increasing upstream of Kars.

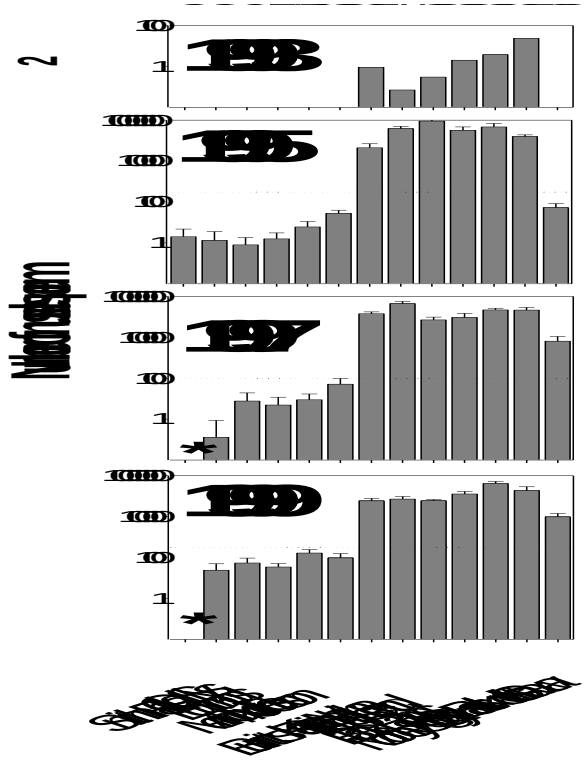

Figure 16 Zebra mussel distribution and density along the Rideau River, 1993-1999.
*** no data available. Source: Martel *et. al*, 2001 (in press)**

Since zebra mussels appeared in the Rideau, there has been a dramatic decline in populations of native freshwater mussels. Zebra mussels colonize any available hard surface, including other mussel species (which cannot survive heavy buildups of zebra mussels). Three native mussel species, which were commonly found in the Rideau River have been virtually eliminated in a 30 km section that has been studied since 1993 (Martel *et al*., 2001, in press). There is also evidence that zebra mussels are responsible for the decline in chlorophyll *a* (suspended algae) which has been observed in the lower Rideau, downstream of Kars, in recent years.

3.8 Biological Indicators - Summary

While total species diversity is fairly high in the Rideau River (comparable to other rivers such as the Trent), aquatic communities are typically dominated by a relatively small subset of species at any given location. There are a number of rare species in the Rideau, but we know little about the size and condition of their populations. Several introduced invasive species are of particular concern. Zebra mussel colonization has caused a dramatic decline in native clam populations in the lower Rideau, and contributed to a decline in the amount of suspended algae and a sudden increase in the density of Eurasian water milfoil in the last few years (by increasing water clarity in the deeper main channel).

- **Species diversity**

The Rideau River supports a diversity of wildlife. The recent 3-year Rideau River Biodiversity Study identified 314 species of phytoplankton, 59 species of aquatic plants, 8 species of native clams, 28 species of amphibians and reptiles, 34 species of fish and 23 species of aquatic birds.

- **Species at risk**

Two species found along the Rideau River are considered “at risk’: the black tern and least bittern (rare, and vulnerable in Ontario). Ten other species on the Rideau are considered rare in Ontario, although not at risk.

- **Fish diversity and abundance**

Fisheries assessments indicate that the Rideau River is dominated by relatively few species of fish. Between 1997 and 2000, index netting in the six reaches along the River captured a total of 21 species of fish, but only 13 or 14 species within any reach. All reaches were dominated by a handful of species. Bluegill and pumpkinseed dominated the 3 upstream reaches, while pumpkinseed, rock bass and smallmouth bass dominated the 3 downstream reaches. Fish abundance was highest in the wide, shallow Kilmarnock reach between Smiths Falls and Merrickville.

- **Restrictions on fish consumption**

The recommended consumption of most fish in the Rideau River is restricted to 8 meals per month, with the exception of larger specimens of northern pike, largemouth and smallmouth bass, walleye, rock bass and yellow perch, for which 4 meals per month or fewer are recommended. In general, these recommendations compare favourably to those for fish in the Ottawa River, but are similar or slightly more restrictive than those for Upper Rideau Lake and the Trent River.

- **Aquatic plant diversity and abundance**

Thirty species of aquatic plants were found in 1998 and 1999 at six shallow sites along the Rideau River. Only 5 to 17 species were found at any one site, and a relatively few species dominated each site. The most abundant species were tape grass, common waterweed, coontail, horned pondweed, star duckweed, white water lily and Richardson' pondweed.

- **Aquatic plant harvesting**

Eurasian water milfoil and curly pondweed, two invasive introduced plant species, dominate deeper areas of the Rideau River, and are harvested annually in a few locations to keep the navigation channel open. The amount harvested between Smiths Falls and Burritts Rapids ranged from 13 to 28 tons between 1996 and 2000. Prior to 1999, no harvesting was carried out in the Ottawa region of the Rideau Canal. Since then, explosive growth of Eurasian water milfoil has made harvesting necessary (349 tons in 1999 and 173 tons in 2000), increasing the annual budget for plant removal by at least 5 times.

- **Non-native species: zebra mussels**

Zebra mussels have rapidly colonized the Rideau River since they were first found in 1990. Their density remains high in the lower section of the River, between Kars and Ottawa, and they continue to increase in abundance in the upper section of the River between Smiths Falls and Kars. The colonization of the Rideau by zebra mussels has been accompanied by the elimination of the native mussel species previously found there, and an increase in water clarity in the lower section of the Rideau River due to a steep decline in the concentration of phytoplankton.