A MULTIDISCIPLINARY, COMMUNITY-BASED STUDY OF THE ENVIRONMENTAL HEALTH OF THE RIDEAU RIVER: FINAL REPORT

PRESENTED TO THE
EJLB FOUNDATION

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EXECUTIVE SUMMARY

The *Rideau River Biodiversity Project* (RRBP) was a three-year multidisciplinary study of the environmental health of the Rideau River undertaken by the Canadian Museum of Nature in partnership with governmental bodies, non-governmental organizations, educational institutions and community groups. The project's goals were to assess the biodiversity of the Rideau River, from Smiths Falls to Ottawa, and to reconcile local needs with long-term sustainable management of its biological diversity.

The general objectives for each of the eight biological components being studied were to document the biological diversity, to monitor indicator species, to identify sensitive areas and to recommend remedial actions. The study was undertaken in 1998 and continued in 1999 through to the fall of 2000. Several Museum staff members, assisted by university summer students and Museum and public volunteers, collected samples at various sites along the river. Laboratory measurements then identified specific concerns and research results were analyzed and shared with the partners.

The community-based approach of this study allowed for the integration of local knowledge with scientific research. It also paved the way for the creation of a community-based roundtable that will implement the recommendations of the study and assume the long-term responsibility for biodiversity protection of the Rideau River.

Report highlights:

Science:
- multi-year samplings at more than 150 sites;
- more than 30,000 laboratory measurements;
- identification of close to 600 species.

Community consultation:
- creation of two Advisory Groups;
- two preliminary meetings and six meetings in urban and rural areas;
- two one-day mapping workshops for the community;
- three joint rural/urban meetings;
- development of a Roundtable.

Public awareness:
- development of curriculum-based educational programmes;
- broad local, regional and national news coverage;
- establishment of a Turtle Hotline for turtle sightings and crossings for two years;
- lectures and a one-day forum;
- production of three newsletters, a tabloid and a documentary;
- production of a website feature;
- production of an exhibit for the Rideau Canal Museum and of a small external exhibit;
- partnership for monitoring and scientific activities for students;
- training in biodiversity for university students;
- publications and conferences.

INTRODUCTION

In early spring of 1998, the Canadian Museum of Nature, in Ottawa, in partnership with government agencies, educational institutions and community groups began a three-year multidisciplinary, community-based study of the environmental health of the historic Rideau River in eastern Ontario. The Rideau River Biodiversity Project (RRBP) used different scales of the river's biodiversity to assess its water quality and aquatic biodiversity. Rather than assessing water quality at the level of single molecules, the RRBP used biological diversity as a measure of the health of this waterway. The process, aimed to link the science with the public by using a team work approach among science experts and community partners.

Since the inception of the RRBP, innovation has been the *modus operandi* of our team members and partners. The project has delivered products and activities that have gone far beyond original expectations. The creative thinking of our many colleagues and partners contributed to make the RRBP more appealing to the general public who were our main clientele. In addition to the scientific aspect of the project conducted by the Canadian Museum of Nature, our lead partner, the Rideau Valley Conservation Authority, greatly assisted us in establishing a community consultation process. Additional support was given to the RRBP by the Region of Ottawa-Carleton, the Canadian Wildlife Service of Environment Canada, the Rideau Canal Office of Parks Canada, the Ontario Ministry of the Environment, the University of Ottawa, the Big Rideau Lake Association, and various other community groups. Several stakeholders from the government, the private sector, businesses, schools and non-governmental organizations were highly supportive of the project long before it began which indicates the tremendous interest that it generated.

In order to solve global problems of loss of biodiversity, it is necessary to begin with local projects like the RRBP that link scientific research with public awareness and community action. The backyard living laboratory represented by the Rideau River is under some pressure from natural events (e.g., flooding, storms events) and human-induced activities (e.g., damming, agricultural practices, urban development, recreation). Today it is recognized that ecosystem health cannot be accurately assessed without the direct involvement of local people.

The main goals of the Rideau River Biodiversity Project were to:

1. Assess the biodiversity of the Rideau River, from Smiths Falls to Ottawa, and
2. Reconcile local needs with long-term sustainable management of its biological diversity.

This final report summarizes the achievements of the RRBP in fulfillment of our funding agreement with the EJLB Foundation. It provides comprehensive results of the scientific research, the community consultation process and the public awareness program. Project activities that developed beyond the expectations of the original proposal are also highlighted.

SCIENCE

The Rideau River flows over one hundred kilometres between Smiths Falls and Ottawa, and is fed by three headwater lakes: Upper Rideau, Big Rideau and Lower Rideau (see map below). As part of the original proposal presented to the EJLB Foundation, the project investigated the changes in the biodiversity of six taxonomic groups (microalgae, aquatic plants, molluscs, fishes, amphibians and reptiles) within the Rideau River ecosystem. Water chemistry was also measured at each site for which samples of microalgae were taken. During the first year of the project, collaboration was established with the Canadian Wildlife Service to assess the biological diversity of the waterfowl along the Rideau River. Invertebrates associated with plant beds were added to the list of research activities by the Canadian Museum of Nature in 1999 (see *Appendix 4* for the composition of the science team, as well as other RRBP team members).

The scientific success of the project can be attributed not only to the experts themselves, but also to all of the people that contributed time and resources to the RRBP. Students, non-scientific Museum staff and public volunteers were instrumental in helping the science team with field sampling. It is fair to say that a true team approach is what made this project work.

The general objectives for each of the biological groups studied were:

1. Document the biological diversity,
2. Monitor indicator species,
3. Identify sensitive areas, and
4. Recommend remedial actions.

Details pertaining to each taxonomic group studied are presented in the following pages of the report. The water chemistry of the Rideau River is discussed first followed by the eight taxonomic groups studied. At the end of this three-year study, we can report that a total number of 584 organisms have been identified from the Rideau River, which makes this aquatic ecosystem diverse and comparable to other larger Canadian rivers. It is to be understood that research results are still being analysed and their interpretations will follow.

Water Chemistry

In order to evaluate the environmental health of the Rideau River through a biodiversity assessment, it is essential to have a good knowledge of its water chemistry. Therefore, a thorough three-year sampling program was undertaken to assess the water quality of the river. Twice a month from May to September water samples from 18 sites along the river were collected at a 0.5-m depth using a Beta bottle. Three additional sites in the headwater lakes were also sampled. At each site, temperature, oxygen, pH, conductance and REDOX data were measured from the bottom of the river to the surface with a Hydrolab® field meter. Additional samples were collected in sterilized bottles and returned to the Region of Ottawa-Carleton chemistry laboratory for analysis. A summary of the over 30,000 chemical measurements are listed below for nutrients (fertilizer), major ions, trace metals, algae and *E*. coli bacteria.

		1998			1999			2000		
Parameters	**Freshwater Guidelines**	**Max.**	**Min.**	**Average**	**Max.**	**Min.**	**Average**	**Max.**	**Min.**	**Average**
Fertilizer (nutrients)										
Ammonia (mg/L)	**1.37**	0.069	0.003	0.014	0.103	0.003	0.017	0.108	0.003	0.026
Nitrate + Nitrite (mg/L)	**No limit**	0.35	0.003	0.025	1.04	0.003	0.044	0.560	0.003	0.050
Total Kjeldahl Nitrogen	**No limit**	1.36	0.23	0.52	0.96	0.3	0.56	0.88	0.3	0.61
Phosphorus (mg/L)	**0.03**	0.099	0.002	0.030	0.077	0.005	0.028	0.058	0.007	0.024
Reactive Phosphorus (mg/L)	**No limit**	0.057	0.002	0.008	0.036	0.002	0.009	0.045	0.002	0.009
Total Phosphorus (mg/L)	**0.03**	0.118	0.005	0.026	0.079	0.007	0.028	0.135	0.005	0.025
Ions (Salts)										
Alkalinity (mg/L-CaCO30	**not established**	187	75	102	199	67	99	153	80	110.5
Calcium (mg/L)	**not established**	64.2	20.5	30.4	58.2	18.2	30.4	47.7	21.1.	34.6
Chlorine (mg/L)	**not established**	33	6.2	12.5	35	7	14.7	25	4.3	11.4
Conductance (uS/cm)	**?**	470	180	260	490	176	254	380	188	262
Potassium (mg/L)	**?**	2.97	0.2	1.03	2.52	0.22	1.11	1.58	0.44	1.14
Magnesium (mg/L)	**not established**	15.6	5.83	10.0	20	6.3	10.7	16.4	4.6	9.8
Sodium (mg/L)	**not established**	20.4	3.47	6.67	18.8	4.06	8.33	13.5	3.2	6.4
Sulfate (mg/L)	**not established**	47	3	7.8	27	4.6	8.1	13.1	4.2	6.9
pH	**5 to 9**	8.93	7.85	8.28	9.09	7.45	8.28	8.51	7.89	8.19
Metals										
Aluminium (mg/L)	**0.005 - 0.100**	0.356	0.001	0.042	0.221	0.001	0.055	0.106	0.047	0.073
Cadmium (mg/L)	**< 0.020**	0.0030	0.0001	0.0005	0.0024	0.0001	0.0001	0.0005	0.0001	0.0004
Cobalt (mg/L)	**< 0.020**	0.0037	0.0004	0.0008	0.0086	0.0004	0.0006	0.0065	0.0004	0.0028
Chromium (mg/L)	**< 0.020**	0.0364	0.0006	0.0013	0.0256	0.0006	0.0009	0.0104	0.0005	0.0033
Copper (mg/L)	**0.002 - 0.004**	0.0090	0.0005	0.0021	0.0148	0.0005	0.0012	0.0101	0.0005	0.0033
Iron (mg/L)	**0.3**	0.244	0.0002	0.0487	0.255	0.0002	0.0627	0.1340	0.0620	0.0889
Manganese (mg/L)	**< 0.020**	0.0934	0.0001	0.0244	0.0838	0.0024	0.0237	0.0455	0.0313	0.0381
Molybdenum (mg/L)	**< 0.020**	0.0055	0.0005	0.0008	0.0061	0.0005	0.0006	0.002	0.0010	0.0018
Nickel (mg/L)	**< 0.020**	0.0063	0.0006	0.0010	0.0171	0.0006	0.0013	0.0088	0.0006	0.0040
Lead (mg/L)	**< 0.020**	0.0077	0.002	0.002	0.008	0.002	0.002	0.01	0.002	0.004
Silica (mg/L)	**No limit**	1.56	0.09	0.56	1.36	0.01	0.45	1.68	0.01	0.53
Vanadium (mg/L)	**not established**	0.0045	0.0005	0.0010	0.002	0.0005	0.0008			
Zinc (mg/L)	**0.030**	0.0070	0.0001	0.0010	0.0259	0.0001	0.0045			
Bacteria Algae Carbon										
***E. coli* (CFU/100ml)**	**100**	200	2	7	200	2	9	380	1	13
Algae (Chlorophyll ug/L)	**<10**	26.31	0.09	3.70	33.75	0.24	5.61	43.47	0.52	4.22
Dissolved Organic Carbon (mg/L)	**No limit**	10	0.4	7.5	9.1	0.5	6.6	12.7	3.7	8.2

Total Suspended Solids (mg/L)	**No limit?**	22	0.4	1.5	23	0.5	2.1	8	0.8	2.1

Both nitrogen and phosphorus (nutrient fertilizer) levels were generally high, although the average values fall below the Canadian Water Quality Guidelines. The ratios of total nitrogen to total phosphorus (18.6-27.5) indicate that phosphorus was the limiting nutrient throughout the Rideau waterway. A closer examination of the more serious phosphorus problem (see graph below) shows that nutrient fertilization exceeded the guidelines in the lower stretch of the river, especially in the Ottawa Region. The levels were caused by a steady increase in phosphorus along the downstream flow of river water. Increased growth of microalgae and aquatic plants resulted from high phosphorus levels. Algae are a good measure of microorganism concentrations and as the chlorophyll from the microalgae in the water showed, there was a wide range of growth with average summer levels falling between fair and good within the Canadian Water Quality Guidelines for freshwater aquatic life. The other microorganism of interest was *E. coli*. The average levels observed (7, 9 and 13) fall well below the local swimming guidelines established at 100. The river within the city limits of Ottawa had the highest *E. coli* levels, except for one sample taken below the sewage plant of Smiths Falls on July 9, 1998. There was no evidence that *E. coli* were related to the virulent H-0157 strain.

The ion results highlight well-buffered waters flowing over limestone bedrock, with typical pH readings that fall within the Canadian Water Quality Guidelines for freshwater aquatic life.

Calcium dominated the cations followed by sodium, magnesium and potassium. High rain and snowmelt will lower the ion levels and decrease pH. Although there was a significant increase in rainfall during the summer of 2000, it was not enough to lower ion levels or pH in the Rideau River. There was no evidence in the summer samples of high sodium and chlorine levels as a result of winter road salt application. The calcium rich waters are favourable for zebra mussel shell formation, which is discussed later.

Average concentrations of trace metals in the Rideau River were generally well below the Canadian Water Quality Guidelines. Over the two years that metals were studied in detail, copper and aluminium went above freshwater quality guideline levels, 29 and 24 times, respectively, which represent 7% of the samples. In the case of copper, the high concentrations were throughout the entire river system on scattered sampling dates. The elevated aluminium levels were more localized within the city of Ottawa during winter months. In both cases human activity can be attributed to the elevated levels.

In summary, the waters of the Rideau River are nutrient enriched (fertilized), have good ion levels and, on rare occasions, have higher than recommended levels of metals, more specifically aluminium and copper. When compared to European rivers, the Rideau River is very “clean” with nutrient levels 5 to 10 times lower. However, when compared to other Canadian rivers, the Rideau River is relatively nutrient rich. *Escherichia coli* levels are surprisingly low considering the human activity on and adjacent to the river. Remedial actions include reducing phosphorus input from human activity all along the river and assessing the potential problem with inputs of aluminium and copper at selected sites.

The team responsible for the sampling of water chemistry and also for phytoplankton (see next section) consisted of Museum science experts (P. Hamilton, L. Ley, and M. Poulin), summer students (G. Bouchard, M. Hewitt, and S. Jackman) and several Museum staff and public volunteers.

Paul Hamilton and Michel Poulin

Phytoplankton

The main objectives of the phytoplankton study were to assess the diversity of floating microalgae, to determine species composition through the season, and to correlate fluctuations in phytoplankton assemblages with water chemistry. The sampling of phytoplankton paralleled the water chemistry sampling protocol.

Over the course of the project, a total of 314 species of phytoplankton were identified from the Rideau River with another 40% still undescribed or awaiting identification (see *Appendix 1* for the full species list). Microalgae are to aquatic ecosystems what flowering plants are to terrestrial environments. They flourish in freshwater ecosystems through solar energy and nutrients such as phosphorus-related compounds. For instance, in the winter phytoplankton are scarce in rivers while in summer they are found in great abundance contributing to an occasional green coloration of the surface waters. Phytoplankton assemblages of the Rideau River are composed of one-celled microalgae belonging to the Bacillariophyta (diatoms, 52 species), Chlorophyta (green algae, 172 species; see illustration below), Chrysophyta (golden brown algae, 33 species), Cryptophyta (13 species), Cyanoprokaryophyta (blue green algae, 30 species), Euglenophyta (4 species), Pyrrhophyta (dinoflagellates, 7 species) and Xanthophyta (3 species).

Lobomonas ampla *Lobomonas stellata*

Lobomonas sp. *Lobomonas* sp.

During the 1970's, a microtoxin isolated as microcystin was identified from the Rideau River, and since then, it has been reported in freshwater basins around the world. The microcystin is known to be a dangerous neurotoxin affecting both wildlife and humans. Therefore, an assessment of *Microcystis aeruginosa*, a cyanoprokaryote producing microcystin, was undertaken. It happened that this guilty species was rarely observed during the three years of the project (refer to the purple area in the graph below). Recently, an introduced species, *Cylindrospermopsis raciborskii*, which produces another microtoxin, was observed in local lakes. There are some concerns about a possible invasion into the Rideau River as it has been recorded in Australia.

The graphs below show species variation and growth patterns from site to site. Microorganisms with a silica or glass house, known as the diatoms (in blue), dominated the summer phytoplankton assemblages followed by cryptophytes (no common name), chrysophytes (golden-brown algae) and chlorophytes (green algae). The blue peaks parallel periods of nutrient enrichment (fertilization) and were the result of one diatom species, *Skeletonema potamos*. This planktonic diatom is a common "bloomer" in many eastern North American rivers and is therefore a good indicator of river health (i.e. slightly nutrient rich). *Skeletonema potamos* was consistently observed over the three years of the project highlighting stability in the water quality of the river. Data from the Rideau River suggest that if the species is not present during the summer, it can be concluded that water quality has changed. Therefore, we

recommend that the monitoring of *Skeletonema potamos* be implemented to assess subtle changes in nutrient addition.

Phytoplankton represent an important part of the biodiversity of the Rideau River and comprise the largest number of known species that make up the river's biodiversity. Phosphorus levels are easily tracked using these microorganisms and any changes in seasonal variation from year to year can be used to accurately assess the changing health of the Rideau River.

Paul Hamilton, Linda Ley and Michel Poulin

Skeletonema potamos

Aquatic Plants

The main objectives of the aquatic plant team were to document the diversity and distribution of aquatic plants along the Rideau River and to assess the environmental factors affecting species diversity and abundance. The zone from shore to 2 m deep, rich in plant life, was the main research focus. The study was divided into three main components. The first was an intensive sampling at 22 sites from upstream of Smiths Falls to Ottawa to document the diversity and distribution of aquatic plants. The second component involved the establishment and monitoring of long-term biodiversity plots. Nine 1-metre square quadrats were established at each of six sites along the river, chosen to be representative of urban versus rural and disturbed versus more natural areas. The plots were monitored in late spring, mid summer and early fall during the 1999 season to examine seasonal fluctuations in aquatic plant diversity and abundance. They were also monitored yearly to study annual variations in aquatic plant diversity and abundance, and to provide baseline data for long-term studies on potentially invasive species. The third component was an investigation into the factors affecting the diversity and distribution of aquatic plants. In 2000, transects were made at 25 sites, perpendicular to the shore along a depth gradient of 0.5-2 m. Along each transect, species diversity and cover were measured in six 1-metre square quadrats. In addition, water quality, current velocity, substrate type and slope were measured, while shoreline characteristics and adjacent land use were documented.

The aquatic plant team consisted of Museum science expert (L. Gillespie), one graduate student (K. Makkay), summer students (M. Richard, R. Boles) and several Museum as well as public volunteers.

The three-year sampling resulted in the identification of 59 aquatic plants including 49 species of flowering plants, one species of horsetail, one fern, two aquatic moss and six species of charaphytes (macroalgae) (see Appendix 2 for the full species list). Four of the flowering plant species are introduced, naturalized and invasive or potentially invasive. The one aquatic fern found was previously unknown to the river and appears to be a one-time introduction that has not persisted. The most frequently encountered species were the native Tape grass, Waterweed, Coontail and Water star-grass. Among the most interesting native species are the edible Wild rice, Watermeal, the smallest flowering plant in the world, and the yellow-flowered Bladderwort, which traps and digests microscopic invertebrates.

Rideau River
Common native aquatic plants

Coontail
Tape grass
Common Waterweed
Northern water milfoil
Star duckweed
White water lily
Water star-grass

Introduced aquatic plants

Eurasian water milfoil
Curly pondweed
European frogbit
Flowering rush

The monitoring of the long-term biodiversity plots showed that the diversity and abundance of aquatic plants was very dynamic at the quadrat level. The aquatic plant species shift around in position and rapidly change in abundance by active growth or die back. At the site level species composition was much more stable, with the highest diversity levels in mid summer or early fall. While overall aquatic plant abundance was greatest in early fall, individual species peaked at different times with no seasonal consistency. Generally species peaked in abundance either in mid summer like the White water lily or in the fall.

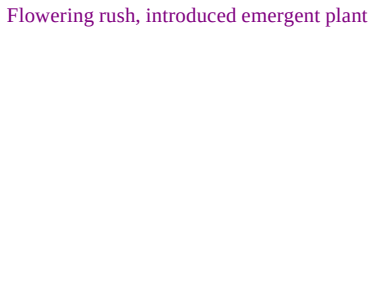
The 25 sites sampled in 2000 showed aquatic plant diversity ranging from 0 to 15 species per site. Species diversity was highest in the rural areas with a peak between Kars and Kilmarnock and lowest in the downstream sites between Ottawa and Manotick. Species diversity was found to increase as the slope between the shoreline and main water channel decreased. Sites with the most gradual slopes generally provided the largest suitable aquatic plant habitat, while steeply sloped sites often had unstable substrates poorly suited to aquatic plants. Likewise, species diversity was found to increase as the

water current speed decreased. Areas of swift water, which are unusable by boat traffic, were either unvegetated or vegetated primarily with Tape grass. This submerged aquatic plant with long tape-like leaves is well adapted to swift water, but can grow equally well in still or slow moving water. No correlation was shown between aquatic plant species diversity and nutrient levels (nitrogen, phosphorus) in the river.

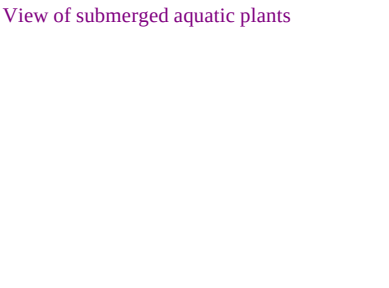
Native aquatic plants were generally not threatened by exotic species at sites studied on the Rideau River. While the Eurasian water milfoil is invasive and a major hindrance to boat traffic in the deeper navigation channels of the river and on the canal portion, it has not become a problem in the species rich shallower water areas. The species was found at about half the sites sampled, and, while often common at these sites, was never the dominant species. The European frogbit, a small introduced plant floating on the water surface, was found at about 20% of the sites and was rarely abundant. Although invasive on the shallow still water of nearby lakes and ponds, the species appears to be less well adapted to flowing water. In contrast, the Flowering rush is frequently common and invasive in the shallow water emergent plant zone adjacent to shore, and was the only emergent plant commonly found in the submerged aquatic plant zone in water over 1 m deep.

Lynn Gillespie

Frogbit, introduced floating plant



Flowering rush, introduced emergent plant



View of submerged aquatic plants

Freshwater Mussels

The main objective of the mollusc study was to document the status of the native mussels (Unionidae) found in the Rideau River during the ongoing invasion by the exotic zebra mussel, *Dreissena polymorpha*. Populations of native freshwater mussels were recorded, from Smiths Falls downstream to Ottawa, in terms of diversity (number of species) and abundance (density). The main criteria for site selection were based on riffle versus lotic (slow moving waters) sectors of the river and areas located immediately downstream of dams. Twenty-three sites along the river, including an intensive survey in Mooney's Bay, were sampled for freshwater mussels, while eleven lock stations, two natural limestone reefs, and off the docks of a marina at Kars were sampled for zebra mussels during the three years of the project. The sampling protocol used to collect freshwater mussels consisted of time searches using view-boxes, and assessments using 0.5 m^2 quadrats, snorkelling and SCUBA diving. Zebra mussel densities were estimated based on the annual rate of recruitment measured as the density of organisms at the end of the settlement season. Various sized quadrats were used to collect zebra mussel samples.

The mollusc team consisted of Museum science experts (D. Pathy, J. Madill, and A. Martel), summer students (K. McKendry, D. Spooner) and several volunteers who gave time in the field and in the laboratory. The three-year sampling of molluscs in the Rideau River confirmed the identification of eight species of native freshwater mussels and one introduced species.

During the three years of the RRBP, the diversity and abundance of live freshwater mussels has always been highest at the upstream locations (e.g., Burritts Rapids, Andrewsville, Old Slys), with a minimum of six unionid species and between 2 to 23 freshwater mussels per square metre, respectively. In contrast, the lowest diversity was observed within the city of Ottawa. For example, no live freshwater mussels were observed at the Sandy Hill site. The abundance of dead freshwater mussels was highest at the downstream sites (e.g., Manotick, Billings Bridge).

Native mussels of the Rideau River

Alasmidonta marginata	Ridged Wedge-Mussel
Elliptio complanata	Eastern Elliptio
Lampsilis ovata	Pocket-Book
Lampsilis radiata	Eastern Lamp-Mussel
Lasmigona costata	Fluted Shell
Ligumia recta	Black Sand-Shell
Pyganodon species	Floaters
Strophitus undulatus	Squaw-Foot

Introduced mussel in the Rideau River

Dreissena polymorpha	Zebra Mussel

At all the sites surveyed the diversity and abundance of freshwater mussels was consistently greater below the dams (riffle habitats) compared with above the dams (lotic habitats), with an average of 15 and 1 freshwater mussel per square metre, respectively.

At Mooney's Bay, located within the city of Ottawa, for instance, the mean densities of three freshwater mussel species (*Elliptio complanata*, *Lampsilis radiata* and *Pyganodon* sp.) have declined significantly from 1994 to 1997. By 1997 the only live freshwater mussel species found in Mooney's Bay was *Elliptio complanata* and in 2000 no live freshwater mussel species were observed in Mooney's Bay despite an intensive search. Since 1994 we can confirm that the above mentioned three freshwater mussel species have been extirpated from Mooney's Bay, most likely as a direct result of the zebra mussel invasion. The general trend over the three-year study was a sharp upstream-downstream gradient in diversity and abundance of live native freshwater mussels in the Rideau River. Diversity and abundance of live freshwater mussels was highest at upstream riffle sites between Smiths Falls and Burritts Rapids, and lowest downstream towards the city of Ottawa. Alternatively, the diversity and the abundance of dead freshwater mussels increased at downstream sites. Presently, the greatest threat to the native populations of freshwater mussels in the Rideau River is from zebra mussels.
The spread of the exotic zebra mussel, *Dreissena polymorpha*, throughout the Rideau Canal waterway is well documented. Dispersal downstream by floating larvae is rapid while the dispersal upstream by

attachment to boats occurs more slowly. By the time of the 1998 lock surveys, zebra mussels were already well established in downstream sectors of the Rideau Canal from Kars to Ottawa. The lowest density of zebra mussels (3 per square metre) was observed at Smiths Falls and the highest densities (87,000 per square metre) were seen in the downstream sectors between Long Island and Ottawa. Since 1999 the densities of zebra mussel increased in all sections of the river, with an average of 75 per square metre at upstream sites between Smiths Falls and Burritts Rapids, and 126,000 per square metre for the downstream section between Long Island and Ottawa. The pattern of settlement and abundance of zebra mussels in the main channel of the Rideau River paralleled the overall pattern in the canal lock system. From 1998 to 2000, in the riffle zones, zebra mussel densities were highest downstream from Kars to Ottawa, while only a handful of zebra mussels were visually observed upstream between Burritts Rapids and Smiths Falls. The general trend shows that the highest densities of zebra mussels are found downstream between Kars and Ottawa where the abundance of live freshwater mussels is lowest. In contrast, the lowest densities of zebra mussels appear upstream from Burritts Rapids to Smiths Falls where the abundance of live freshwater mussels is highest. Previous studies showed that zebra mussel densities in the Rideau River, near Ottawa, reached peak densities from 1995-1997. Since 1998 density estimates suggested that zebra mussel densities in the Rideau River appeared to be stabilizing. In addition to natural and human-induced dispersal, other potential environmental threats, including siltation, deterioration of the natural riparian (or buffer) zone, could also negatively affect native freshwater mussels.

Healthy native mussels (*Elliptio complanata)*

Native mussel infested with zebra mussels

Jacqueline Madill, André Martel and Diane Pathy

Aquatic Invertebrates

During public consultation meetings, it was evident that the public was concerned about the abundance of aquatic plants that grew along the Rideau shores in the summer. Public views were that the aquatic plants were a hazard and a nuisance. However, the public did not seem to have a concept of the biological value of the aquatic plant beds. The team leader concluded that a study of the biodiversity of the aquatic plant beds would be of use to river managers who may be required to both defend the value of the aquatic vegetation beds and to control their abundance. In 1999, the team sampled the aquatic plant-associated fauna in six sites that differed in amount of urbanization, river width, and current flow. Samples were taken by dip net sweeps through the plants from two depths at each of the six sites. Water chemistry was measured with a Hydrolab® field meter, from the surface to the bottom of the river.

Underwater view of the shoreline aquatic plant bed and the river channel.
Note zebra mussels on logs, rocks, and clams. Drawing by Susan Laurie-Bourque

In 2000, the objective shifted to determine whether the composition of non-aquatic plant-associated fauna correlated with environmental gradients along the river, such as chlorophyll levels, phosphorus concentrations, location of locks, heavy metals and organics in the sediment, and zebra mussel densities. Six-replicate bottom samples were taken at each of 27 sites located in a stratified-random pattern along the river from Ottawa to Smiths Falls. Percent cover of zebra mussels was determined from 50 underwater video quadrats at each site. Three sediment samples were taken for organic and heavy metal content and water chemistry and chlorophyll levels were also recorded. Habitat characteristics were recorded by underwater still photography and video.

A leech feeding on a snail
A damselfly nymph waiting to ambush prey

A female amphipod
A pygmy backswimmer feeding on a *Hydra*

Results from the 1999 study indicate that the emergent vegetation supports a diverse fauna consisting of 128 species of invertebrates (see ***Appendix 3*** for the full species list). Products from this study are a series of eight line drawings showing ecological interactions at various locations in the aquatic plant bed, and about 50 digital photographs to document the biodiversity. Collections made in 2000 are currently under analysis at the University of Ottawa and the Museum.

The scientific team consisted of Museum staff (K. Conlan, E. Hendrycks, J. Madill, and D. Pathy), one summer student (K. McKendry), and Museum volunteers, university students and public volunteers. A special note to Parks Canada who provided assistance with field logistics.

Kathleen Conlan and Ed Hendrycks

Fishes

The main objectives of this scientific component consisted in assessing the fish diversity within the Rideau River, examining the relationships between the fish community and adjoining agricultural, forested and urbanized habitats, and comparing the current fish community with 120 years of historical records. During the three years of the project, 20 sites along the Rideau River from downtown Ottawa to Smiths Falls were sampled in 1998 and 2000. Each site covered about 500 m of shoreline and was selected based on adjoining land use and easy accessibility. The five most important tributaries (Jock River, Kemptville Creek, Steven Creek, Mosquito Creek and Cranberry Creek) to the river were sampled in 1999 and 2000. Along each tributary, three sites were sampled and located close to its source, at its confluence with the Rideau River, and at its mid-course.

Fieldwork was conducted by Museum staff (N. Alfonso, C. Renaud), one graduate student (A. Phelps), and several Museum and public volunteers. A variety of sampling gear was used to maximize all sizes of fish captured and to reduce the sampling bias. Therefore, at each site along the river, trap net, hoop/fyke net, 10-m seine, 30-m boat seine, unbaited minnow trap, and DC backpack electrofishing were used. The sampling in the tributaries was conducted with hand seine, boat seine, unbaited minnow trap, and DC backpack electrofishing. All fish were identified to species, fork and total length (as appropriate) and weight were measured on each fish captured, and the general health of each fish and the presence of abnormalities or parasites were also recorded. Fishes were released at the same location where they were captured immediately after recording the data.

Scientific names	Common names	Rideau River	Tributaries
Esox lucius	Northern pike	+	+
Esox masquinongy	Muskellunge	+	+
Umbra limi	Central mudminnow	+	+
Cyprinus carpio	Common carp	+	
Hybognathus hankinsoni	Brassy minnow		+
Notemigonus crysoleucas	Golden shiner	+	+
Notropis atherinoides	Emerald shiner	+	
Luxilus cornutus	Common shiner	+	+
Notropis heterodon	Blackshin shiner	+	+
Notropis heterolepis	Blacknose shiner	+	+
Notropis hudsonius	Spottail shiner	+	+
Notropis rubellus	Rosyface shiner		+
Notropis volucellus	Mimic shiner		+
Pimephales notatus	Bluntnose minnow	+	+
Semotilus corporalis	Fallfish	+	+
Catostomous commersoni	White sucker	+	+
Moxostoma anisurum	Silver redhorse	+	+
Moxostoma valenciennesi	Greater redhorse	+	
Ameiurus nebulosus	Brown bullhead	+	+
Noturus gyrinus	Tadpole madtom	+	+
Fundulus diaphanus	Banded killifish	+	+
Labidesthes sicculus	Brook silverside	+	+
Ambloplites rupestris	Rock bass	+	+
Lepomis gibbosus	Pumpkinseed	+	+
Lepomis macrochirus	Bluegill	+	+
Micropterus dolomieu	Smallmouth bass	+	+
Micropterus salmoides	Largemouth bass	+	+
Pomoxis nigromaculatus	Black crappie	+	+
Etheostoma olmstedi	Tessellated darter	+	+
Perca flavescens	Yellow perch	+	+
Percina caprodes	Logperch	+	+
Stizostedion vitreum	Walleye	+	+
Aplodinotus grunniens	Freshwater drum	+	
Cottus bairdi	Mottled sculpin	+	
Astronotus ocellatus	Oscar	+	

During the three-year survey, nearly 15,000 fish were captured and measured from the Rideau River and its five major tributaries representing 35 species out of 59 fish species reported from the literature since 1880. Three species were reported for the first time in the Rideau River waterway: the Freshwater drum, the Tadpole madtom, and the exotic Oscar. Research data revealed that the abundance of small-bodied fishes, such as minnows, and insectivorous fishes, such as suckers, was positively correlated with the abundance and diversity of deep aquatic plants as well as with the diversity of substrate types. Furthermore, urbanized and agricultural sites can be discriminated by the abundance of insectivorous fishes, with urbanized and agricultural sites having low and high abundance, respectively. Additionally, agricultural and forested sites can be distinguished by the abundance of young-of-the-year fishes, with agricultural sites having high and forested sites having low abundance.

The Brook silverside was chosen as a health indicator of the Rideau River fish community because it is sensitive to disturbance and is easy to recognize. We conclude that the Rideau River is in a healthy condition because the Brook silverside is found along the entire waterway.

Anne Phelps and Claude Renaud

A Brook silverside

An exotic Oscar

Amphibians and Reptiles

The main objectives of the amphibians and reptiles component were to assess the current biological diversity of the herpetofauna in the Rideau River and to evaluate the health of selected populations, namely Bullfrogs, Green Frogs, Leopard Frogs and Painted Turtles. The herpetofauna team consisted of Museum research associates (F. Cook, M. Rankin, and F. Schueler), Big Rideau Lake Association summer staff, as well as Museum, university and public volunteers.

Frog auditory surveys were conducted in spring and at evenings of every year of the project throughout the entire Rideau River and the Big Rideau Lake. Amphibian and reptile visual were also conducted at specific sites along the river (e.g., Andrewsville, Burritts Rapids, downtown Ottawa). As part of an ongoing amphibian-monitoring project, daily auditory and observational data were gathered on Kemptville Creek, a major tributary to the Rideau River, from March to November. Chorus Frogs, Wood Frogs, Spring Peepers, Leopard Frogs, American Toads, Grey Treefrogs, Green Frogs, Mink Frogs, and Bullfrogs initiated calling in that order with much overlap between species.

Basking sites were monitored for numbers of turtles during the three years of the project in Big Rideau Lake with observations of 10 Painted Turtles and one each of Red-eared Slider, Musk Turtle and Snapping Turtle. Trapping with funnel trap was conducted in the Rideau River and its tributaries, and yielded an additional 61 Painted Turtles (4 juveniles, 5 females, and 49 males); three were recaptures. A suite of 14 morphometric characters was recorded for each turtle captured. Results showed that male Painted Turtles mature at about 5 years of age in the Rideau River at carapace length of 90-100 mm and females attain 158 mm which is normally expected from a healthy population at this latitude.

Mark-recapture studies were performed at Big Rideau Lake monitored three frog species (Bullfrog, Green Frog, Leopard Frog) by individually marking them by toe-clipping for small individuals and tagging with microchips for larger specimens. A total of 1077 captures were made consisting of 973 individuals and 104 recaptures. Bullfrogs with 334 captures and 74 recaptures represent the most interesting species because of its apparent decline in some areas of Ontario due to human harvesting. Green Frogs totalled 492 captures and 28 recaptures while Leopard Frogs amounted for 147 captures and 2 recaptures. Bullfrogs transformed after two winters as tadpoles which grew typically 0.2-0.3 mm per day or about 20-30 mm between May and September for two years before reaching maturity at about 90-100 mm. The largest Bullfrog was 171 mm and weighed 429 g. Green Frogs spent one winter as a tadpole and they grew to about 25-35 mm before maturity. The largest Green Frog was 104 mm. Leopard Frogs breed in April and early May and the tadpoles transformed the same year, at 30-35 mm. These are values expected to be found in healthy frog populations.

Of the 36 species of amphibians and reptiles reported from eastern Ontario and western Quebec, 33 have historically been recorded from the Rideau River watershed. Only nineteen species were surveyed during the course of the RRBP. For instance, the Pickerel Frog, present in the early 1900s has now been eradicated at Ottawa. The aquatic Mudpuppy likely occurs throughout the Rideau River but was only captured at the mouth of Kemptville Creek. The Musk Turtle, assumed to be one of the rarest turtles in the Rideau River and recorded previously from a few sites (Beckets Landing, Manotick, Kemptville Creek), was found at three additional localities (Port Elmsley, Burritts Rapids, Barnes Island). The introduced Red-eared Slider, a pet trade species, was found at Port Elmsley and reliably reported from the Green Island area. An aquatic species, it may overwinter successfully in the Rideau River but it is unlikely that it can reproduce at this latitude, as its natural range is to the south. A surprise was the scarcity of sightings during the RRBP of the Snapping Turtle, which was, and likely still is, relatively abundant in the area. Of the species recorded, Painted Turtles, Bullfrogs, Green Frogs, and American Toads occurred throughout the area. Leopard Frogs may be absent or at least

uncommon in the Ottawa city area, but are frequent above Ottawa were they breed in large choruses in April particularly in cattail stands all along the river, and forage in adjacent fields in summer.

Amphibians / reptiles of the Rideau River

Scientific names	Common names
Frogs	
Bufo americanus	American Toad
Hyla versicolor	Gray Treefrog
Pseudacris crucifer	Spring Peeper
Pseudacris triseriata	Chorus Frog
Rana pipiens	Leopard Frog
Rana sylvatica	Wood Frog
Rana septentrionalis	Mink Frog
Rana clamitans	Green Frog
Rana catesbeiana	Bullfrog
Salamanders	
Necturus maculosus	Mudpuppy
Ambystoma laterale	Blue-spotted Salamander
Turtles	
Chelydra serpentina	Snapping Turtle
Sternotherus odoratus	Musk Turtle
Emydoidea blandingii	Blandings' Turtle
Chrysemys picta marginata	Midland Painted Turtle
Trachemys scripta elegans	Red-eared Slider
Snakes	
Thamnophis sirtalis sirtalis	Common Garter Snake
Nerodia sipedon sipedon	Northern Water Snake
Storeria occipitomaculata	Redbelly Snake

The lower than expected population numbers in Bullfrogs and Green Frogs compared to historical accounts in the Rideau River could be due to past collection for human food (frogs legs, especially in Bullfrogs) or recreation (juveniles for fish bait), and/or the extensive development of shorelines and seasonal manipulation of water levels, or within normal cyclic variation of numbers. Occasional deformities were noted on few frogs (missing eye, missing toes) but are within normal expectations in natural populations. Where high incidence has been reported it appears to be a reaction to chemical pollutants or trematode infestations, so relative absence is a positive environmental indicator.

Francis Cook and Mike Rankin

Bullfrog

Leopard Frog

Aquatic Birds

This scientific component of the Rideau River Biodiversity Project was made possible through collaboration with colleagues from the Canadian Wildlife Service of Environment Canada. The team conducted a series of aerial surveys to determine use by migrant waterfowl of the Rideau River section under study. Assisted with a Transport Canada helicopter during the first two years of the project, eleven aerial surveys of the whole river were carried out in the fall and the spring migration periods. Twenty species of waterfowl were identified along the river during these surveys. The data have since been entered into a database and a georeferenced layer has been prepared for the various survey sectors. Biodiversity indices have been calculated for the migrant waterfowl assemblages in each survey sector, and these results will contribute to the production of an atlas depicting the biodiversity of the Rideau River. One significant result has been the identification of the Rideau River, between Smiths Falls and Merrickville, as a regionally important fall staging area, principally for diving ducks.

Ken Ross

Waterfowl of the Rideau River

Scientific names	Common names
Aix sponsa	Wood Duck
Anas acuta	Northern Pintail
Anas americana	American Wigeon
Anas clypeata	Northern Shoveler
Anas crecca carolinensis	American Green-winged Teal
Anas discors	Blue-winged Teal
Anas platyrhynchos	Mallard
Anas rubripes	American Black Duck
Anser caerulescens	Snow Goose
Aythya affinis	Lesser Scaup
Aythya americana	Redhead
Aythya collaris	Ring-necked Duck
Aythya marila	Greater Scaup
Aythya valisineria	Canvasback
Branta canadensis	Canada Goose
Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Cygnus olor	Mute Swan
Lophodytes cucullatus	Hooded Merganser
Mergus merganser	Common Merganser

COMMUNITY CONSULTATION

The goal of community involvement in research and conservation is to build community capacity and to promote local participation in ecosystem management. Community involvement encourages different stakeholders to better appreciate the complexities of environmental problems. Participants become aware of the values and needs of others and learn to work toward a common goal. Another important aspect of community involvement is the integration of local knowledge with scientific research. Residents along the river possess a wealth of local knowledge about species behaviour and habitat, and environmental changes that may complement the scientific information.

Early on in the RRBP, the Canadian Museum of Nature teamed up with the Rideau Valley Conservation Authority whose mandate is to establish partnerships with government authorities, special interest groups and the local population to promote the sustainable use of natural resources within the Rideau Valley watershed. The community consultation process of the RRBP aimed to open up a two-way dialogue between the science team and the general public. It had four objectives:

1. Incorporate community concerns into the science design
2. Communicate science issues and recommendations to the community
3. Build a self-sustaining community biodiversity action plan
4. Foster community responsibility and advocacy for the health of the river.

Soon after receiving the EJLB grant, two Community Advisory Groups (CAGs) were established on the basis of geographical boundaries. The southern CAG reflected the rural lifestyle from Smiths Falls to Kars, while the northern CAG represented the more urban/suburban communities of the region of Ottawa (see *Appendix 5* for the affiliation of CAGs members). The CAGs' membership consisted of representatives from schools, governments, tourism, business, special interest groups, agriculture and landowners. The CAGs had four objectives:

1. Facilitate the documentation of local knowledge.
2. Communicate research results to the community.
3. Develop recommendations to local / regional authorities for action.
4. Solicit community involvement in the project.

Prior to the first field season, two CAG meetings were held in the rural and urban settings to introduce the science team, to describe the project objectives and to get a sense of the public concerns that should be included in the science research design. Subsequently, six CAG meetings in each of the rural and urban areas were organized to inform the members about the progress of the research and to re-evaluate the future direction of the science and the role of the community groups. Research results were usually presented by the science experts and were followed by open discussion with the members. Finally, three joint CAG meetings were held in each year of the project to ensure a common understanding of science issues along the entire river and to discuss the future direction of the entire project.
In an attempt to incorporate local knowledge into the research design, two one-day community mapping workshops, one in the urban and one in the rural region, were organized before the start of the first field season. The attendance at these workshops went beyond expectations with over 100 residents sharing their observations and concerns about species and environmental changes with the science experts

present. This was one example of a good opportunity to establish a two-way dialogue between the scientists and the public and both groups recognized the success of this activity.

Another initiative to include local knowledge in the study was the establishment of a Turtle Hotline where residents were invited to share their personal observations on sightings, crossings and turtle nesting areas along the river. Hundreds of calls were received during the two years of the Hotline's operation. This was an initiative that captured the attention of the public and allowed them to contribute valuable information to the science project.

Despite these two successful initiatives, the local knowledge research component of the RRBP was not developed to its potential. No attempts were made to systematically analyze the nature and extent of the local knowledge along the river and its relevance to science and decision-making.

Towards the end of the second year, the CAGs started thinking about how to maintain the biodiversity momentum along the river after the project ended the next summer. In response to this issue, the Canadian Museum of Nature and the Rideau Valley Conservation Authority established a community working group to set the framework of what is now called the Rideau River Roundtable (RRR). The main goal of the RRR is to facilitate the coordination of research activities, educational projects and monitoring initiatives within a long-term planning framework.

RRR Interim Executive Committee

Name	Affiliation
Peter Au	Rideau Environmental Action League
Charles Billington	Rideau Valley Conservation Authority
Deborah Irwin	City of Ottawa
Frances Pick	University of Ottawa
Mike Lascelles	Environment Committee of Ottawa South
Jeff Kohl	RRR Manager

The composition of the RRR is drawn from the community, university, business, municipal government and regulatory agencies along the river. The EJLB Foundation will be pleased to know that the Rideau River Roundtable was awarded a grant of $134,000 in December 2000 from the Ontario Trillium Foundation for internal capacity building and planning of environmental projects along the Rideau River. The EJLB Foundation's investment in the community aspects of the RRBP is evolving into a permanent, community-based action platform that will ensure long-term biodiversity protection in the river.

Finally, we would add that the Canadian Museum of Nature, because of our heightened interest in and knowledge of the Rideau River through the Rideau River Biodiversity Project, was a supporter of the nomination of the Rideau Waterway as a Canadian Heritage River. The river became recognized as one of Canada's best rivers in August 2000 when Canadian Heritage Minister Sheila Copps announced that the Rideau had just become Canada's 25th Canadian Heritage River.

PUBLIC AWARENESS

An important aspect of the Rideau River Biodiversity Project was the dissemination of the science to the public. It is also an important element of the Canadian Museum of Nature's mandate, which states: "*to promote public understanding of Canada's natural environment through research, education and the maintenance of the country's natural collections*". The RRBP has not only fulfilled its obligation to the EJLB Foundation but through collaboration with many sponsors and supporters, it has increased its impact through the development of several outreach products for the general public. Through the involvement of various sectors within the Museum, the RRBP has moved toward a cross-sectoral project which contributed to the development of a series of activities targeted specifically to increase the public awareness about the importance of preserving and maintaining the biological diversity of the Rideau River. For this report, a broad definition of the word *education* has been adopted. Firstly, education is used as a means to provide new knowledge to students about biodiversity issues and sustainable resource use as they relate to the region. Secondly, the definition encompasses the dissemination of scientific knowledge to the people through the use of various means such as communications, exhibits and videos in order to increase public awareness about the conservation of natural resources. With this current context in mind, three main objectives should contribute to changing public attitudes toward the environment:

1. Sensitize the community to issues related to the health of the river.
2. Communicate research results.
3. Produce curriculum-based, educational materials related to biodiversity.

A cross-sectoral participation from the Museum and the involvement of many partners, sponsors and supporters resulted in the creation of many outreach products originating from the RRBP. This is one area where the RRBP greatly exceeded the expectations of the original project proposal to the Foundation. These achievements are summarized below.

Education

One aspect of increasing public awareness was the development of curriculum-based educational programmes with local schools to enable students to carry out scientific activities related to the Rideau River's ecosystem and to explore the challenges of maintaining a healthy river system. Partnerships were established with groups that had developed aquatic monitoring programmes for school audiences such as *Adopt a River*, a programme developed as part of the Ecowatch Network of the Biosphere for which the Museum is the coordinator in the Outaouais and Eastern Ontario regions (www.biosphere.ec.gc.ca/cea/roab/roab-fset_a.html) and Aquatox, a programme developed by IDRC (www.idrc.ca/aquatox/). These programmes encourage the direct involvement of students in monitoring and science activities. Interestingly, results are shared with other students and the scientific community within the Ecowatch Network of the Biosphere.

Additional educational activities occurred during the first two years of the project. Several science experts held microalgae, aquatic plant and freshwater mussel identification workshops in the communities. These initiatives were highly successful attracting a large audience and provided new

knowledge about taxonomic groups to people in the community interested in knowing more about aquatic organisms in their own backyard.

We can also report that that the true word *education* has been applied here in its original meaning, that is the training of people. During the three years of the RRBP, we have significantly contributed to the training in biodiversity and limnology of several students by providing them with a great opportunity to get involved in fieldwork, obtain experience in sampling methodology, manipulate different field gear and equipment, and sort organisms. Five university students were hired as summer assistants to the various science teams and to the design of a geographic information system, and one is enrolled in a Master's programme at the University of Ottawa to study aquatic vegetation. Anne Phelps recently received her Masters degree in Science for her research on the Rideau River fish community. The participation of students in the RRBP greatly enhanced the success of the fieldwork activities. Non-science staff from the Museum also benefited from the project by spending time in the field with the science experts. For many this was a great opportunity to understand scientific research and to have their first hands-on experience with science. Occasionally, public volunteers also contributed their time to assist science experts in fieldwork. Finally, high school students participated in different research activities during the summer 2000 as part of a partnership between the Museum and a local high school. Overall, the RRBP attracted a lot of attention and it was perceived as being a good experience for anyone interested in learning more about biodiversity.

Communications

Over the course of the Rideau River Biodiversity Project, the Museum coordinated broad media coverage in both official languages on different aspects of the project. The RRBP received local, regional and national news coverage in print media, radio and television programming. Several regional papers published a description of the project and several story lines appeared in national newspapers about interesting discoveries in the river. The Société Radio-Canada focused the most attention on the RRBP and its community consultation process. Several science experts were part of 15-minute and 10-minute interviews on radio programs *Les Années Lumières* (1999) and *D'un Soleil à l'Autre* (2000), respectively, as well as an 8-minute interview with RRBP footage on the television program *La Semaine Verte* (1999). From time to time, small interviews were given by several team members on various aspects of the project during regular radio and television programming.

The dissemination of information pertaining to the RRBP was also carried out by most science experts, collaborators and partners to a broad audience at local, regional, national and international public and scientific events (see *Appendix 6* for the complete list of publications and conferences). Conferences were regularly delivered to community interest groups (e.g., Friends of the Rideau, Rotary Clubs, Rideau Valley Field Naturalists, Friends of the Gatineau, Ottawa Chapter of Muskies Canada, Ottawa Valley Aquarium Society, Later Life Learning Seminar, Lake Owners Associations), as well as to government agencies (e.g., Region of Ottawa-Carleton, Canadian Museum of Nature, Biodiversity Convention Office of Environment Canada, National Ecosystems and Environmental Monitoring Office of Environment Canada, Canadian Wildlife Service of Environment Canada, Biosphère of Environment Canada, Rideau Canal Office of Parks Canada). The RRBP was also presented at several national science meetings (e.g., Ecological Monitoring and Assessment Network, Transitions in the St-Lawrence River, Canadian Society of Zoologists, Chapitre Saint-Laurent, Biosphère Ecowatch Network) and internationally in France, Mexico and the United States of America. In May 1999, the Museum hosted in Ottawa *La biodiversité de la rivière Rideau: la science à la portée du public*, a one-day forum within the 67th Congress of the Association canadienne-française pour l'avancement des sciences (Acfas).

Two *Rideau Biodiversity* newsletters were published in 1998 and 1999 to introduce the science team, present the various activities of the RRBP and disseminate some preliminary results to the people along the river. A final newsletter is planned to be out by March 2001. In the second year of the project, an eight-page tabloid, *Down by the Riverside*, addressed some specific issues and topics related to the biological diversity of the Rideau River. The Museum has also authored articles describing some particular aspects of the RRBP in popular magazines (e.g., *Biodiversity News*, *Global Biodiversity-La biodiversité mondiale*, *EcoWatcher-L'Observ-Acteur*, *Trail and Landscape*) while research results continue to be disseminated in scholarly journals. In addition, a scientific article is currently being prepared that will evaluate the lessons learned from the RRBP in the broader context of community-based research and ecosystem management.

Finally other public awareness activities included boat tours organized by our community partners near Smiths Falls and Ottawa to explain the biodiversity and the water chemistry that characterize the Rideau River.

Broadcast and Multimedia

A half-hour documentary titled *Rivers: Reflections of Life / Les rivières: reflets de la vie* about the Rideau River Biodiversity Project was completed in January 2000. It was produced by the Canadian Museum of Nature and Carleton Productions, with financial support from the Environment Committee of Ottawa South, Health Canada, Parks Canada, the Region of Ottawa-Carleton and the Rideau Valley Conservation Foundation.

Comments to CJOH Station's viewer line

1. When will the next episode be aired, we liked the story
2. Nice to watch a documentary about our rivers
3. I liked the photography work
4. I didn't know the Rideau was a clean river
5. Great show
6. Will this show be re-broadcast; I missed the start
7. The whole family could watch your show, thanks
8. Cool program on science, I thought the Rideau was like dirty, not biodiverse
9. The show as a nice change to negative news
10. Good job to whoever made the program
11. Great documentary
12. I didn't know CTV could produce such a good program. I think I was watching PBS – just kidding. Congrads to Parks Canada, the Nature Museum and the Region. I look forward the next show. Is this a series. If not you should do a whole science series.

The documentary was premiered in January 2000 at a Museum special event to an audience of over 120 people composed of project stakeholders, agency partners, Museum staff and other special guests. The English version was broadcast on the CTV stations in Calgary and Edmonton in June to a television audience of 70,000 viewers. It was also broadcast on CJOH in the Ottawa region in September to a viewing audience of 150,000 viewers. After this broadcast, the TV station received 12 calls on their viewer line (4 is more typical); all were positive and many commented on the quality of the documentary and asked if another episode was forthcoming (see insert text box). Future broadcasts in 2001 include the CTV affiliate in Vancouver and ATV in Halifax, while PBS and Rogers Television will be approached to determine their interest in broadcasting the documentary. Unfortunately, to date, there have been no broadcasts of the French version.

Trade Publishing

Another piece of the puzzle that was added to the RRBP by the Museum has been the creation of a website in both English and French (www.nature.ca/research/rideau/rrbp_f.cfm and www.nature.ca/research/rideau/rrbp_e.cfm). All aspects of the project are presented with links to other relevant websites on similar subjects. This innovation ensures Canadian citizens are connected with the Museum and, more particularly, the RRBP.

The analyses and interpretation of research data are still presently underway. However, some data have been made available in a format that will allow the production of two documents that are targeted to meet local community needs. The first document will consist of an atlas that will synthesize the accumulated research results from the study in a georeferenced mapping format. The second document will be the production of a field guide that will depict the biological diversity observed in the Rideau River. Financial support is being presently sought for the completion of these two popular documents.

Public Programming

In 1998, a small exhibit was produced for the Rideau Canal Museum in Smiths Falls and was exposed for two summers. The biodiversity of the Rideau River was presented and explained to the public through specimens and graphics. Over 100,000 visitors have walked through the exhibit since its installation.

The Museum also produced in 1999 a small travelling exhibit to be displayed at various community events along the Rideau River. The small RRBP kiosk was used at several venues including the Annual Workshop of the Biosphère Ecowatch Network, the National Capital Region Wildlife Festival, the Environment Week, the Oceans Day Event, and the Dragon Boat Festival. The kiosk was also part of the regular programming at the Museum since its creation.

On several occasions over the last three years, Museum science experts spent time at the Victoria Memorial Museum Building during regular programming to meet the public and discuss the various aspects of the RRBP. This was another opportunity to raise the public awareness for the preservation and maintenance of river's ecosystem.

Development

From the beginning of the project, this division of the Museum has continuously searched for financial grants or in-kind contributions from new sponsors and supporters (see *Appendix 7* for the list of RRBP partners). Our community partners greatly contributed to increase the public awareness about the Rideau River ecosystem through the production of a high diversity of outreach products of outstanding quality (see *Appendix 6* for the complete list of publications and conferences).

FINANCIAL REPORT

The following is the summary of all revenues and expenses associated with the Rideau River Biodiversity Project, including the research elements as well as the public awareness components.

Rideau River Biodiversity Project
Financial Results

	Total
Expenses	
Scientific services (note 1)	271,362
Interpretive services	28,311
Writing / Editing services	19,000
Scientific material and equipment	74,428
Marketing and Communications	26,390
Translation	5,585
Local Travel	8,314
Insurance	2,836
Other	2,608
	438,833
Revenues	
Grant from EJLB	150,000
Other	69,428
	219,428
Museum contribution (excluding salary)	219,405

Note 1 : Scientific services included phytoplankton and water chemistry analysis and summer students

CONCLUSION

Over the course of three years, the *Rideau River Biodiversity Project* became an innovative project in several areas, foremost being the team approach to scientific study paired with traditional knowledge. This approach translated into a thorough study of an important waterway based on a collaborative effort between the science experts and the community residents and partners who have a stake in understanding the river's ecosystem.

Project activities included scientific research, community consultation and public awareness. Results of the study include a list of specific recommendations for continued sampling and monitoring, as well as for further research activities.

However, the impact of the study goes beyond the important quantitative and qualitative results of research and awareness-building activities. The creation of the Rideau River Roundtable, whose goal is to facilitate the coordination of research activities, educational projects and monitoring activities within a long-term planning framework, attests to the success of the community-based approach to a scientific study. The creation of this committee is an acknowledgement by the community of the need to pursue the work undertaken over the last three years.

The success of the community-based approach for the *Rideau River Biodiversity Project* has been documented in various media and has been shared through many publications and conferences. It now constitutes a model for other communities across the country as a means to gather all the stakeholders in a concerted effort to share knowledge, to learn about biodiversity and to assume responsibility for the health of the environment in which they live, work and play.

Appendix 1: Diversity of phytoplankton in the Rideau River

Appendix 5: Affiliation of Community Advisory Groups' Members

Urban CAG	**Rural CAG**
Governments Canadian Museum of Nature City of Ottawa Region of Ottawa-Carleton Rideau Valley Conservation Authority	*Governments* Canadian Museum of Nature Parks Canada Region of Ottawa-Carleton Rideau Valley Conservation Authority Smiths Falls Water Commission
Interest Groups Action Sandy Hill Environment Committee of Ottawa-South Friends of the Rideau Manotick Kiwanis Muskies Canada Ottawa Field Naturalists' Club Rideau Glen Community Association Riverside Park Association Rideau Canoe Club	*Interest Groups* Canadian Biodiversity Institute Canadian Rivers Management Society Rideau Environmental Action League Grenville Stewardship Council Renegade Bass Tournament Association of Eastern Ontario
Business Paul's Boat Line Ottawa-Carleton Greenprint	
	Education Pat Hogan, educator
	Agriculture Paul Mussell, dairy farmer Clarence Mussell, retired farmer / trapper
Citizens	*Citizens*

Appendix 6: List of Publications and Conferences

Publications

In Press

Martel AL, DA Pathy, JB Madill, CB Renaud, SL Dean and SJ Kerr. Rapid and differential decline of freshwater mussels (Unionidae) following a population expansion of the zebra mussel in a small impounded river of eastern Ontario. *Canadian Journal of Zoology*.

2001

Johnson MJ and M Poulin. Bringing science to the public through biodiversity monitoring: lessons learned from the Rideau River Biodiversity Project. Report presented to the Biodiversity Convention Office, Environment Canada, Hull.

2000

Gosselain V, PB Hamilton and J-P Descy. Estimating phytoplankton carbon from microscopic counts: an application for riverine systems. *Hydrobiologia* 438: 75-90.

Hamilton PB, LM Ley and FR Pick. Phytoplankton densities and biomass in the Rideau River, Ottawa River, Constance Lake, Mud Lake and McKay Lake during 1999. Research Division, Centre for Aquatic Biology and Environmental Research (CABER), Canadian Museum of Nature, Technical Report 2000/1: 1-255.

Martel AL, DA Pathy, J Madill, CB Renaud, SL Dean and SJ Kerr. [Abstract] Extirpation of freshwater mussel (Unionidae) taxa in the northern part of the Rideau River, Eastern Ontario: urbanization followed by introduction of an exotic species. 6th National Science Meeting, Ecological Monitoring and Assessment Network. Abstracts for Oral Presentations, p. 17.

Pathy D, J Madill, K McKendry and A Martel. Status report on the abundance of native freshwater mussels (Unionidae) for selected locations of the Rideau River, Eastern Ontario. Rideau River Biodiversity Project, Canadian Museum of Nature, Internal Report.

Phelps A-M. Investigating the Rideau River, Ontario, fish community with respect to historical changes and current land-use practices. Master Thesis, University of Ottawa, Ottawa.

Phelps A, F Chapleau and CB Renaud. The Tadpole Madtom, *Noturus gyrinus*, a rarely seen fish of the Rideau River system, Ontario. *Trail and Landscape* 34: 30-34.

Phelps A, CB Renaud and F Chapleau. First record of a Freshwater Drum, *Aplodinotus grunniens*, in the Rideau River, Ottawa, Ontario. *Canadian Field-Naturalist* 114: 121-125.

Poulin M, PB Hamilton and C Billington. La biodiversité de la rivière Rideau, une étude pluridisciplinaire selon une approche communautaire. *Cryptogamie, Algologie* 21: 234-235.

1999

Hamilton PB, J Chetelat and FR Pick. A comparison of monthly, bimonthly and weekly sampling strategies for the Rideau River using 1995-1998 data: water chemistry and chlorophyll. Research Division, Centre for Aquatic Biology and Environmental Research (CABER), Canadian Museum of Nature, Technical Report 1999/1: 1-55.

Johnson M, H Hamilton and J Kohl. Towards a new model of cooperative environmental stewardship along the Rideau River. Environment Committee of Ottawa South, Ottawa.

Pathy D, J Madill, K McKendry and A Martel. Preliminary report on the abundance of native freshwater mussels (Unionidae) of the Rideau River, Eastern Ontario. Rideau River Biodiversity Project, Canadian Museum of Nature, Internal Report.

Phelps AM. [Abstract] Investigating the relationship between the Rideau River (Ontario, Canada) fish community and the habitat characteristics associated with land use. 79th Annual Meeting of the American Society of Ichthyologists and Herpetologists. Program Book and Abstracts, p. 184.

Poulin M. The Rideau River Project – making science make sense to the communities. *Biodiversity News* 8: 19.

Poulin M. A multidisciplinary, community-based study of the environmental health of the Rideau River: Progress Report (1998 and 1999) to the EJLB Foundation, Montréal, Québec. Canadian Museum of Nature, Ottawa.

Poulin M. [Chairperson]. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences. Programme général, p. 154.

Poulin M. The Rideau River Project – Making science accessible to the people. *The EcoWatcher* 5(1):3-4.

Poulin M. Le projet de la rivière Rideau, la science à la portée des gens. *L'Observ-Acteur* 5(1):3-4.

Poulin M, PB Hamilton and C Billington. [Abstract] The Rideau River Biodiversity Project: bringing science to the people. 5th National Science Meeting, Ecological Monitoring and Assessment Network. Oral Presentation Abstract, p. 31-32.

Poulin M, PB Hamilton and C Billington. [Abstract] The Rideau River Biodiversity Project: a case study bringing science to the people. 6th Annual International Conference on Transitions in the St. Lawrence River. Program Abstract, p. 21-22.

Poulin M, PB Hamilton and C Billington. [Abstract] La biodiversité de la rivière Rideau, une étude pluridisciplinaire selon une approche communautaire. 18è Colloque de l'Association des diatomistes de langue française. Programme scientifique, p. 44.

Renaud CB and A Phelps. Oscar-winning catch. *Trail and Landscape* 33: 178-180.

1998

Cook F, F Schueler and M Rankin. Rideau River Biodiversity Project: an initial report on the Rideau River Biodiversity Project. *Canadian Association of Herpetologists Bulletin* 12(2): 22-23.

Pathy D, D Spooner, J Madill and A Martel. Preliminary report on the diversity of native freshwater mussels (Unionidae) of the Rideau River, Eastern Ontario. Rideau River Biodiversity Project, Canadian Museum of Nature, Internal Report.

Poulin M. The Rideau River – an ecosystem to discover. *Global Biodiversity* 8(1): 32.

Poulin M. La rivière Rideau, un écosystème à découvrir. *La biodiversité mondiale* 8(1): 32.

Conferences

2001

Lauriault J and M Poulin. Rideau River Biodiversity Project. Réseau d'observation active de La Biosphère, La Biosphère, Montreal. January 29-30.

Makkay K, L Gillespie and F Pick. Patterns in aquatic macrophyte species diversity in the Rideau River. Annual Meeting of the Society of Canadian Limnologists, Toronto. January 4-6.

2000

Cook FR. Amphibians and reptiles of eastern Ontario. Herpetology Research Field Course, Queens University Biological Station, Chaffeys Locks. May 24.

Cook FR. Amphibians and reptiles of eastern Ontario. Public Lecture Series, Queens University Biological Station, Chaffeys Locks. July 24.

Dumouchel C. Le projet sur la biodiversité de la Rivière Rideau. First Colloquium of the Biosphère Ecowatch Network. Collège Saint-Paul, Varennes. January 28.

Gillespie LJ and P Martin. Aquatic plant identification workshop. Baxter Conservation Area, Ontario. June 17.

Hamilton PB. Water quality and aquatic plant identification field trip. Smiths Falls Heritage Days, Smiths Falls. August 9.

Hamilton PB. Wolfe Lake biodiversity and water quality. Wolfe Lake Owners Association. July 22.

Hamilton PB. Use of herbicides in small ponds and lakes in association with estate development. Lake Land Estate Home Owners Association, Greely. June 21.

Hamilton PB. Rideau River Biodiversity Project and the Rideau Canal. Rideau Canal, Parks Canada, Smiths Falls. May 2.

Lauriault J. La biodiversité de la rivière Rideau: la science à la portée du public. Biosphère Ecowatch Network, Annual Meeting. Biosphère, Montreal. November 3.

Lauriault J and C Dumouchel. The Rideau River Biodiversity Project. University of Toronto Museology Programme students, study tour. Canadian Museum of Nature, Aylmer. October 2.

Martel AL, DA Pathy, J Madill, CB Renaud, SL Dean and SJ Kerr. Extirpation of freshwater mussel (Unionidae) taxa in the northern part of the Rideau River, Eastern Ontario: urbanization followed by introduction of an exotic species. 6th National Science Meeting, Ecological Monitoring and Assessment Network. Delta Chelsea Inn, Toronto. January 18-22.

Poulin M. Panelist on *La qualité de l'environnement: jusqu'où faut-il aller?* 4è Colloque annuel du Chapitre Saint-Laurent, Château Bonne Entente, Québec. June 8-9.

Renaud CB, F Cook and M Rankin. Fishes, frogs and turtles of the Rideau River. Fall Meeting, Friends of the Rideau, Rideau River Canal Museum, Smiths Falls. October 28.

1999

Ahad G. La qualité des eaux de surface dans la Région d'Ottawa-Carleton: un programme qui va au-delà de la rivière Rideau. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Alexander A. La recherche sur la biodiversité à la portée de tous. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Billington C. La rivière Rideau: rivière du patrimoine canadien. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Cook FR. Amphibians and reptiles in the Rideau River system. Big Rideau Lake Association, Portland. June 14.

Degarie R. Les Cols verts au travail. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Gillespie L. Rideau River Biodiversity Project: aquatic plant diversity, distribution and monitoring. Urban Community Advisory Group, Sandy Hill Community Health Center, Ottawa. May 12.

Gillespie L. Rideau River Biodiversity Project: aquatic plant diversity, distribution and monitoring. Rural Community Advisory Group, North Grenville District High School, Kemptville. May 4.

Gillespie LJ and R Boles. Aquatic plant identification workshop. Baxter Conservation Area, Ontario. October 2.

Gillespie L and M Richard. Les plantes aquatiques de la rivière Rideau: inventaire et surveillance de la biodiversité. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Hamilton PB. Health of the Rideau-Cataraqui. River Care 2000 Public Lecture, Portland. July 28.

Hamilton PB. Rideau River Biodiversity Project: a community-based study on biodiversity. Seminar Series, Canadian Wildlife Service, Environment Canada, Hull. April 14.

Hamilton PB. Rideau River Biodiversity Project – water quality and algae. Urban Community Advisory Group, United and Anglican Riverside Churches, Ottawa. April 13.

Hamilton PB. The Rideau River Biodiversity Project. Restore the Rideau Workshop, Environment Committee of Ottawa South Millenium Project, Ottawa City Hall, Ottawa. April 10.

Hamilton PB. The Rideau River Biodiversity Project: conservation and biodiversity. Later Life Learning Seminar, Kingston. April 9.

Hamilton PB. Rideau River Biodiversity Project – water quality and algae. Rural Community Advisory Group, Trinity United Church, Smiths Falls. April 6.

Johnson M. Le rôle du savoir local dans la gestion communautaire des écosystèmes. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Lauriault J. Monitoreo de un ecosistema con la participación comunitaria. Mexico City, Mexico. June 2.

Madill J and D Pathy. Freshwater clam identification workshop. Victoria Memorial Museum Building, Ottawa. November 13.

Meilleur M. Une perspective municipale sur le volet économique-touristique de la rivière Rideau. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Messier L. L'histoire de la rivière Rideau et son canal. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Pathy D. 1998 diversity of native freshwater mussels in the Rideau River. Urban Community Advisory Group, Ottawa South Community Center, Ottawa. March 9.

Pathy D. 1998 diversity of native freshwater mussels in the Rideau River. Rural Community Advisory Group, Holy Trinity Anglican Church, Merrickville. March 2.

Phelps A-M. Fishes of the Rideau River. Ottawa Valley Aquarium Society, Jack Purcell Community Center, Ottawa. October 25.

Phelps A-M. Investigating the relationship between the Rideau River (Ontario, Canada) fish community and the habitat characteristics associated with land use. 79th Annual Meeting of the American Society of Ichthyologists and Herpetologists, Pennsylvania State University, Philadelphia, U.S.A. June 24-30.

Phelps A. Fishes of the Rideau River: 1998 results. Ottawa Chapter of Muskies Canada, Bells Corners Royal Canadian Legion Hall, Nepean. March 11.

Phelps A. Fish diversity in the Rideau River. Urban Community Advisory Group, Victoria Memorial Museum Building, Ottawa, February 10.

Phelps A. Fish diversity in the Rideau River. Rural Community Advisory Group, Baxter Conservation Area, Ontario. February 8.

Phelps A-M. and CB Renaud. Fishes of the Rideau River. Rideau Valley Field Naturalists, Perth Library, Perth. September 12.

Phelps A, C Renaud and F Chapleau. Étude comparative des communautés de poissons de la rivière Rideau en milieu agricole, urbain et forestier. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Phelps A, CB Renaud and F Chapleau. Over one hundred years of change within the fish community of the Rideau River/Canal system, Ontario, Canada. 38th Annual Meeting of the Canadian Society of Zoologists, University of Ottawa, Ottawa. May 5-8.

Poulin M. The Approach of the Rideau River Biodiversity Project. Friends of the Gatineau, Cantley. July 11.

Poulin M. Aperçu du projet de biodiversité de la rivière Rideau. Colloque sur *La biodiversité de la rivière Rideau: la science à la portée du public*, 67è Congrès de l'Association canadienne-française pour l'avancement des sciences, University of Ottawa, Ottawa. May 10-14.

Poulin M. The Rideau River Biodiversity Project: bringing science to the people. National Ecosystems and Environmental Monitoring Office, Environment Canada, Hull. February 18.

Poulin M. The Rideau River Biodiversity Project: a case study. Lecture on Research Issues, National Environmental Education Program for Indigenous Youth, Centre for Indigenous Environmental Resources, Winnipeg. February 17.

Poulin M, PB Hamilton and C Billington. La biodiversité de la rivière Rideau, une étude pluridisciplinaire selon une approche communautaire. 18è Colloque de l'Association des diatomistes de langue française, Conseil Général des Alpes-Maritimes, Nice, France. September 14-17.

Poulin M, PB Hamilton and C Billington. The Rideau River Biodiversity Project: a case study bringing science to the people. 6th Annual International Conference on Transitions in the St-Lawrence River, NAV CANADA Conference and Training Centre, Cornwall. April 26-28.

Poulin M, PB Hamilton and C Billington. The Rideau River Biodiversity Project: bringing science to the people. 5th National Science Meeting, Ecological Monitoring and Assessment Network, Victoria Conference Centre, Victoria. January 19-23.

Renaud C. The research aspects of the Rideau River Biodiversity Project. Rideau Valley Field Naturalists, Links 'o Tay Golf Club, Perth. April 17.

Ross K. Diversity of aquatic birds in the Rideau River. Urban Community Advisory Group, Ottawa South Community Center, Ottawa. March 9.

1998

Hamilton PB. Rideau River Biodiversity Project: a community-based approach to biodiversity assessments. CINVESTAV-IPN, Unidad Merida, Mexico. October 9.

Hamilton PB and M Poulin. The Rideau River Biodiversity Project. Rideau Canal Office, Parks Canada, Smiths Falls. April 22.

Hamilton PB and M Poulin. The Rideau River Biodiversity Project. How to Care for Ice-damaged Trees (Residential, Landscape and Street Trees) Workshop, Trinity United Church, Smiths Falls. April 4.

Poulin M and C Billington. The Rideau River Biodiversity Project. Canadian Biodiversity Forum, Federal-Provincial-Territorial Working Group on Biodiversity, Biodiversity Convention Office, Hull. November 6.

Poulin M. The Rideau River Biodiversity Project: an update. Rideau Valley Information Evening, Community Hall, Portland. June 25.

Poulin M. Overview of the Rideau River Biodiversity Project. Seminar Series, Canadian Museum of Nature, Aylmer. April 9.

Poulin M. The Rideau River Biodiversity Project. Management Committee, Canadian Museum of Nature, Aylmer. April 7.

Poulin M and C Billington. The Rideau River Biodiversity Project. Rural Community Advisory Group, Community Centre, Merrickville. March 10.

Poulin M and C Billington. The Rideau River Biodiversity Project. Rideau Valley Conservation Authority Board of Diectors Meeting, Sam Jakes Inn, Merrickville. February 26.

Poulin M and C Billington. The Rideau River Biodiversity Project. Rotary Club Meeting, Coach House, Kemptville. February 24.

Poulin M and C Billington. The Rideau River Biodiversity Project. Urban Community Advisory Group, Victoria Memorial Museum Building, Ottawa. February 23.

Poulin M and M Johnson. The Rideau River Biodiversity Project. Rural Community Consultation Workshop, Old Town Hall, Merrickville. March 28.

Poulin M and M Johnson. The Rideau River Biodiversity Project. Urban Community Consultation Workshop, Victoria Memorial Museum Building, Ottawa. March 21.

Poulin M, C Billington, A Martel and PB Hamilton. The Rideau River Biodiversity Project. Water Quality Committee, Regional Municipality of Ottawa-Carleton, Gloucester. February 5.

1997

Johnson M, M Poulin and PB Hamilton. Le développement d'une approche communautaire pour le projet de recherche sur la santé de la rivière Rideau. La Biosphère, Environment Canada, Montreal. April 10.

Poulin M, PB Hamilton and M Johnson. Community-based research looking at the water quality at Smiths Falls. March Meeting, Smiths Falls and District Chamber of Commerce, Smiths Falls. March 12.

Poulin M, A Martel, M Johnson and PB Hamilton. Environmental health of the Rideau River system. Spring Meeting, Friends of the Rideau, Sam Jakes Inn, Merrickville. May 10.

Appendix 7: RRBP Partners

RRBP Activities	**Funders, sponsors and community partners**
Science project	EJLB Foundation Rideau Canal Office, Parks Canada Region of Ottawa-Carleton Big Rideau Lake Association Hurst Marina Rideau Valley Conservation Authority Ontario Ministry of the Environment
Community consultation	Rideau Valley Conservation Authority
Communications	Friends of the Environment Foundation Mountain Equipment Co-op Rideau Valley Conservation Authority M.O.M. Printing
Broadcast and multimedia	Region of Ottawa-Carleton Rideau Canal Office, Parks Canada Rideau Valley Conservation Authority Environment Committee of Ottawa South Health Canada
Public programming	Rideau Canal Museum
Education	Rideau Environmental Action League