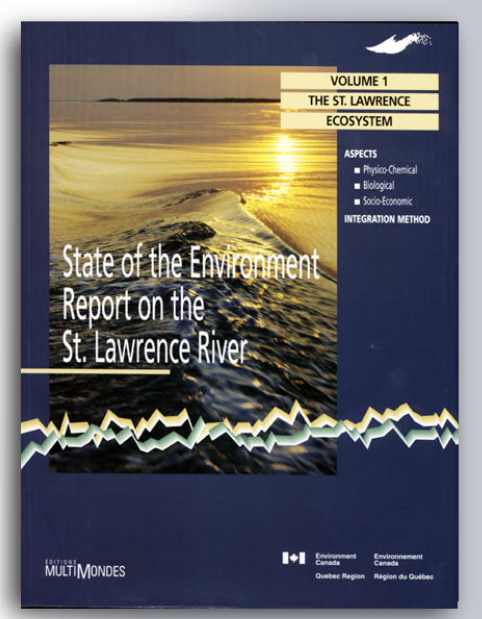
Welcome to

The State of the Environment Report on the St. Lawrence' CD-ROM



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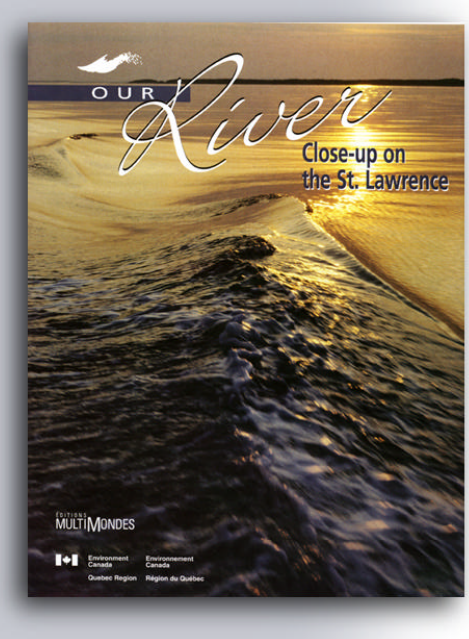
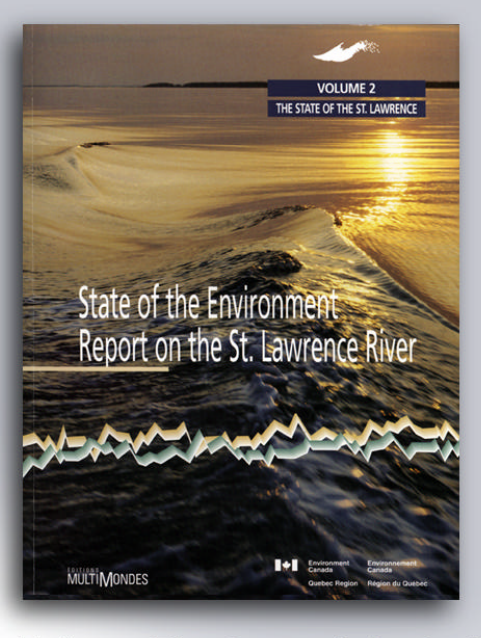
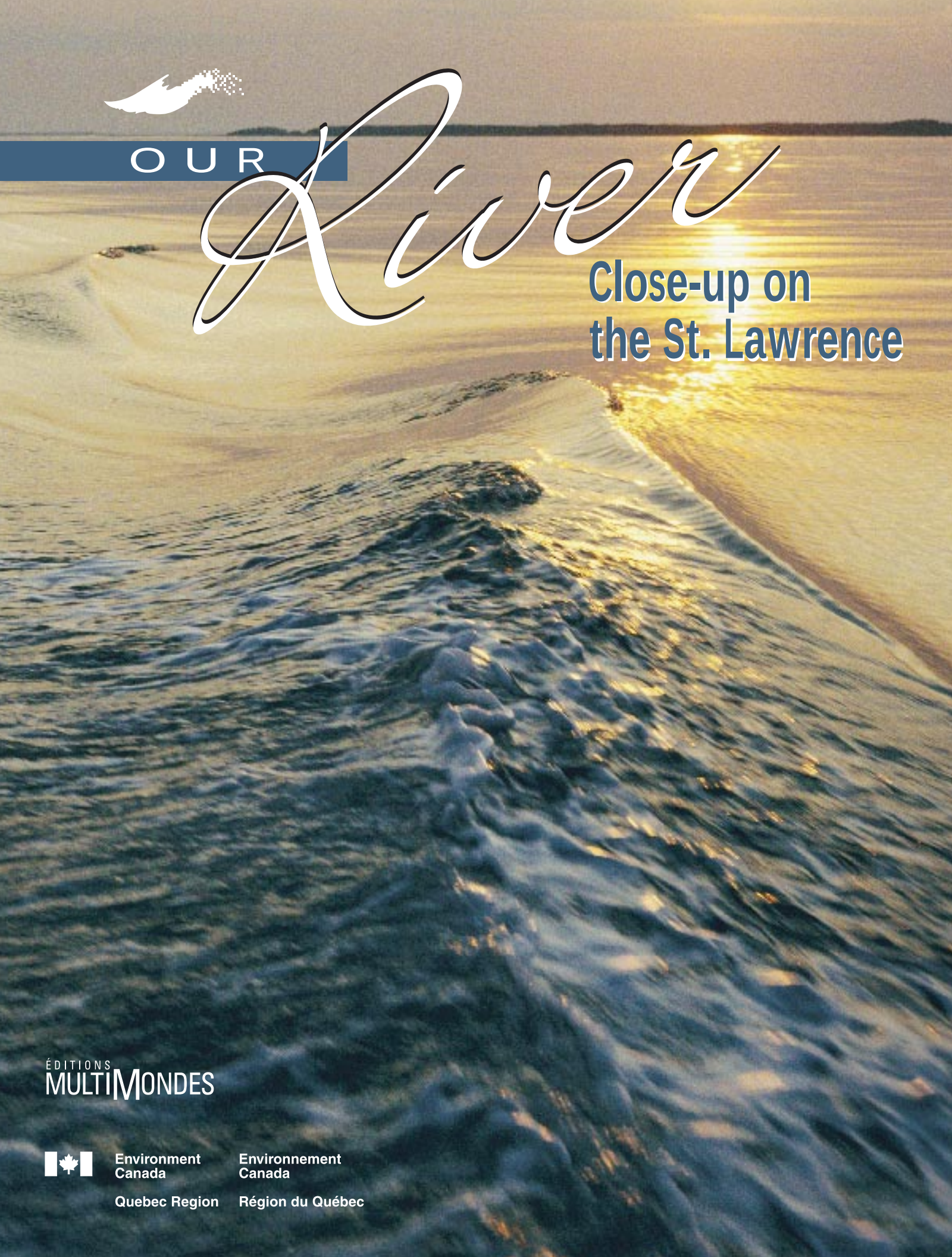


Brochure – Our River



Vol. 2 – The State of the St. Lawrence



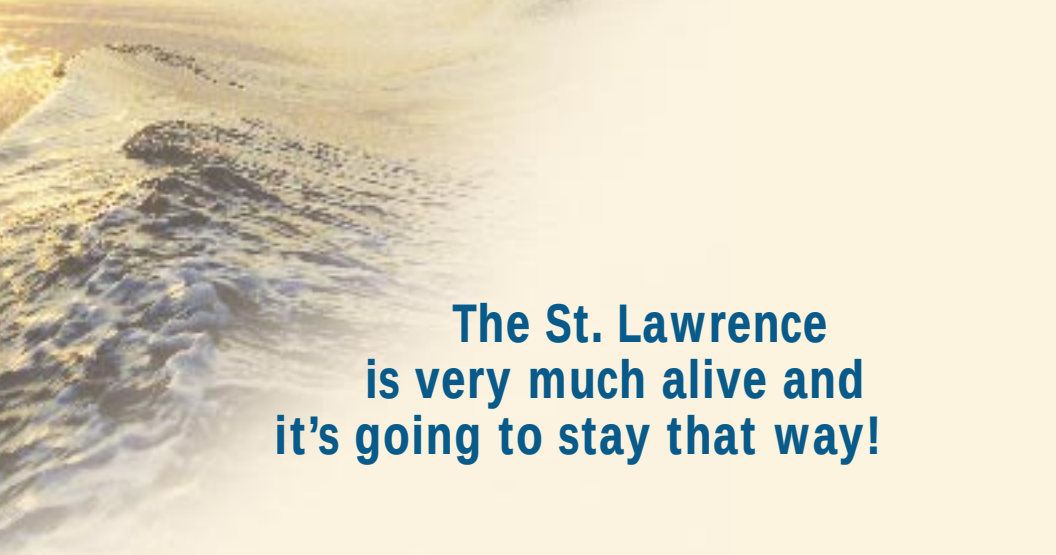
OUR River

Close-up on the St. Lawrence

ÉDITIONS MULTIMONDES

Environment Canada
Quebec Region

Environnement Canada
Région du Québec



The St. Lawrence is very much alive and it's going to stay that way!

The St. Lawrence River has been harnessed, harassed and put to a variety of uses, some of them more damaging than others. We have attempted to master the River, to manage it, to involve it in schemes intended to improve our own well-being, however short-sighted or conflict-riddled they were. We can find good examples in practices associated with shipping, with industrial, commercial and municipal development, with fishing and the construction of access infrastructures.

But who benefits from using the St. Lawrence as a garbage dump? Surely only those who wish to spare themselves the time and expense of finding a more ecological disposal method. Human beings, whether in the form of a large corporation, an organization dedicated to the "betterment of society", or simply as individuals, are the main source of the degradation of the River. The solution is for all of us to become aware of this reality and to take responsibility for it.

Yet while some remain passive, others have chosen to act. To their minds, the St. Lawrence hasn't yet succumbed, it lies at the very heart of their daily concerns. They refuse to accept that we knowingly pursue activities granting human beings the right to destroy the St. Lawrence and its resources. These individuals place the well-being of the River first, initiating projects as their talents and abilities allow. Each of them deserves our respect, whatever form their activities take.

It is to these individuals, and to all those who have acted in favour of our majestic river, that we at the St. Lawrence Centre of Environment Canada dedicate this document.

Lynn Cleary
Director, St. Lawrence Centre

The diagnosis was arrived at by synthesizing research findings and observations on the state of the St. Lawrence provided by members of the scientific community. It was prepared by the St. Lawrence Centre of Environment Canada under the St. Lawrence Action Plan, a program launched in 1988 by the governments of Canada and Quebec and then renewed in 1994 under the name St. Lawrence Vision 2000. The objective of the plan is to restore, protect and conserve the environment of the St. Lawrence River.

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Our River

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THE RIVER UNDER STUDY

The St. Lawrence River is one of the largest rivers in the world, ranking 13th overall by virtue of its mean annual discharge, which totals 13 million cubic metres of water. All along the length of its course, the appearance of the River changes constantly. Between Quebec City, for example, and the eastern tip of Île d'Orléans, just downstream, the St. Lawrence widens markedly from 870 metres to 15 kilometres. Likewise, considerable variability is seen in the River's state of health from one region to the next.

The St. Lawrence has played a pivotal role in the history of North America, beginning with the earliest settlers who found refuge along its shores. Today, more than 60% of Quebec's population lives near the River, and every day, some three million Quebecers use two billion litres of water drawn directly from the St. Lawrence. As a major navigable waterway, the St. Lawrence has contributed much to Canada's prosperity, and it continues to play a central role in the country's economic development.

Over the past 30 years or so, a number of measures have been implemented to try and improve the state of the St. Lawrence. But just as a doctor would not prescribe medication without first determining what is ailing a patient, a diagnosis, or assessment, of the River's state of health is a necessary first step.

Casting a watchful eye

To make this assessment as precise as possible, a multidisciplinary team of scientists was commissioned to study the main aspects of the River's state of health. Their objective was to determine the condition of the River, analyse the changes it has undergone and try to identify the causes. In other words, their goal was to paint an accurate picture of the St. Lawrence. The data were drawn from the following:

- **Physical aspects:** the dimensions of the River, current patterns, tides, and so on;
- **Chemical aspects:** the natural salinity of the water, levels of organic substances, like pesticides, and of inorganics, such as metals;
- **Biological aspects:** the plant and animal life;
- **Socio-economic aspects:** the various uses of the River, including shipping, water supply commercial fishing, recreation and tourism activities.

Signposts along the way

Fourteen broad characteristics of the River were selected to assess its condition. Researchers then applied specific indicators and evaluation measures to each characteristic. These indicators reflect the improvement, deterioration or stability of the 14 characteristics. Knowledge gaps are also acknowledged and explained. The results presented in this document were obtained by analysing these indicators.

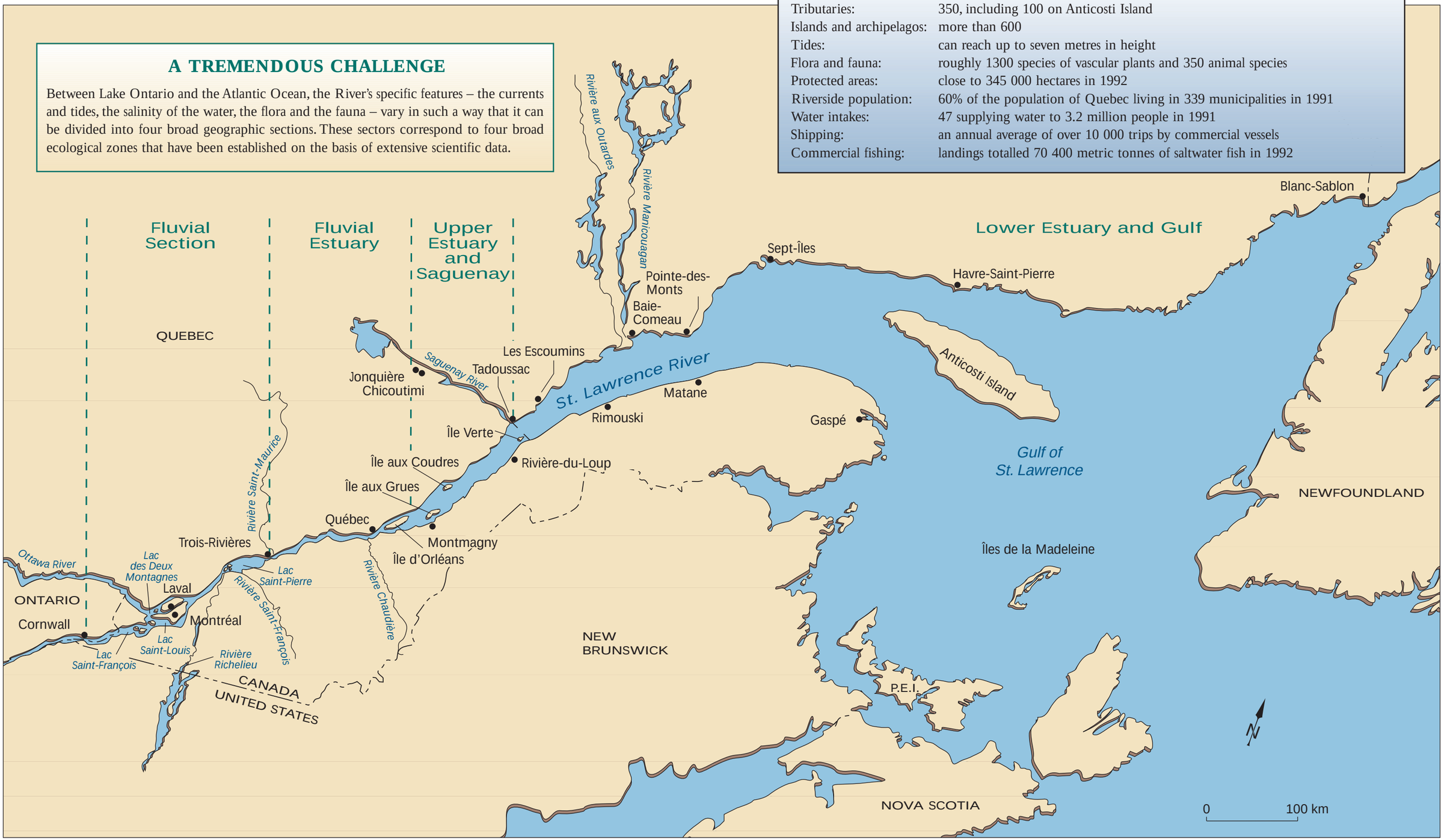
CONTENTS

OUR River

Length:	1600 km from the outlet of Lake Ontario to the Atlantic Ocean
Tributaries:	350, including 100 on Anticosti Island
Islands and archipelagos:	more than 600
Tides:	can reach up to seven metres in height
Flora and fauna:	roughly 1300 species of vascular plants and 350 animal species
Protected areas:	close to 345 000 hectares in 1992
Riverside population:	60% of the population of Quebec living in 339 municipalities in 1991
Water intakes:	47 supplying water to 3.2 million people in 1991
Shipping:	an annual average of over 10 000 trips by commercial vessels
Commercial fishing:	landings totalled 70 400 metric tonnes of saltwater fish in 1992

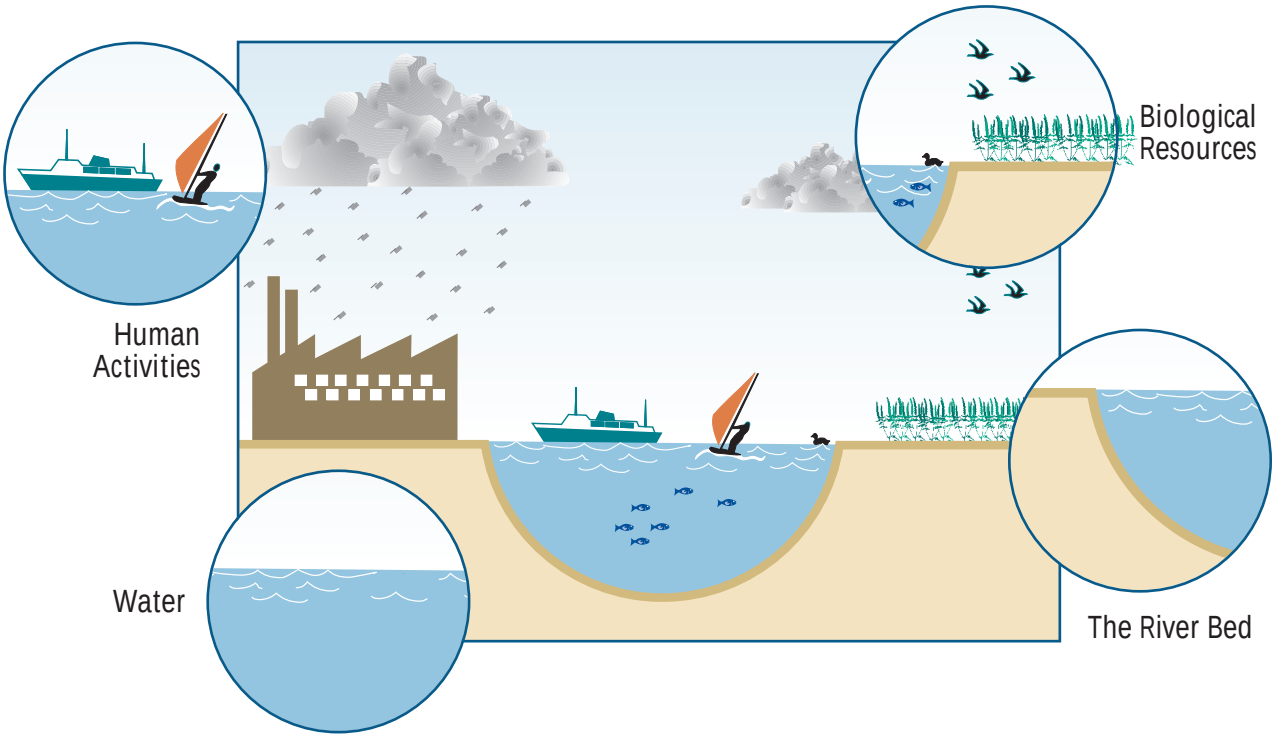
A TREMENDOUS CHALLENGE

Between Lake Ontario and the Atlantic Ocean, the River's specific features – the currents and tides, the salinity of the water, the flora and the fauna – vary in such a way that it can be divided into four broad geographic sections. These sectors correspond to four broad ecological zones that have been established on the basis of extensive scientific data.



THE 14 CHARACTERISTICS OF THE ST. LAWRENCE RIVER

Ecosystem Components of the St. Lawrence River



The characteristics selected to assess the state of health of the St. Lawrence River, based on components of its ecosystem

Fact Sheet

COMPONENT		CHARACTERISTIC
The River Bed	1	Sediment quality
Water	2	St. Lawrence water quality
	3	Tributary water quality
Biological Resources	4	Biodiversity
	5	Natural environments and protected species
	6	Condition of biological resources
Human Activities	7	Shipping
	8	Modification of the floor and of hydrodynamics (dredging)
	9	Shoreline modifications
	10	Urban wastewater discharges
	11	Industrial wastewater discharges
	12	Commercial fishing
	13	Sport hunting and fishing
	14	Accessibility of the banks and River

Fact Sheet 1

Sediment Quality

Improved

Contamination levels decreased, but sediments are still contaminated.

Sediments: A Sink for Toxic Substances

Sediments are particles that are deposited on the bottom of a water body. Some sediments have become contaminated with chemicals (DDT, PCBs, trace metals) and, in certain sections of the River, at levels as much as 100 000 times greater than in the surrounding water. Many of these contaminants can persist in the environment even after the sources of pollution have disappeared. In some regions, concentrations of metals which may be harmful to aquatic organisms (mercury, chromium, cadmium, nickel, lead, zinc, copper) have been found in localized areas. This is especially true of Lake Saint-Louis, the La Prairie basin, the upstream section of Lake Saint-Pierre, the sector between Quebec City and Île aux Oies, and the ports of Montreal and Quebec City.

Indicator used: toxicity level of sediments (toxic effect threshold).

Fact Sheet 2

St. Lawrence Water Quality

Improved

Discharges of toxic and bacterial contamination decreased, but restrictions on use are still in force.

Water to Meet Every Need

The quality of river water for different uses has improved over the past 15 years. There are two main reasons for this: discharges of toxic effluents by industrial plants have been reduced and a greater percentage of the riverside population is now served by municipal sewage treatment plants.

Four specific water uses have been evaluated: direct human consumption, recreational activities, aquatic life and shellfish harvesting.

Direct human consumption: The fresh water of the St. Lawrence is unsuitable for direct human consumption because of bacterial contamination associated primarily with the presence of fecal coliforms (excrement).

Recreational activities: The data for 1990 to 1993 point to a serious pollution problem, mainly in the stretch of river between the eastern tip of the Island of Montreal and Quebec City. Wherever an excessive quantity of coliform bacteria are present in the water, there is a risk of exposure to pathogenic agents (viruses and bacteria) which can have direct impacts on human health.

Aquatic life: The quality of the water for aquatic life has deteriorated in the River below Montreal, particularly in the mixing zone along the north shore – that is, at the mouths of rivers that empty into the St. Lawrence. A slight improvement has been observed in the mixing zone of the Quebec City area.

Shellfish harvesting: In 1992, the Gaspé and Bas-Saint-Laurent regions had the largest number of sites that exceeded bacteriological criteria. As a result, shellfish harvesting has been banned in some locations there.

Indicator used: the quality criteria exceedance index (CEI) for four uses: direct human consumption, primary-contact recreational activities, aquatic life and shellfish harvesting.

Fact Sheet 3

Tributary Water Quality

Stable

Urban, industrial and agricultural inputs continue to contribute to chemical and bacterial contamination.

All Tributaries Lead to the St. Lawrence!

Water quality in the tributaries that empty into the St. Lawrence has a direct influence on the quality of water in the River. In 1991, an estimated 29% of inputs of toxic substances to the St. Lawrence came from 50 tributaries located between Cornwall and Quebec City. This same year, the tributaries contributing the greatest annual toxic loadings were, in descending order, the Saint-Maurice, the Ottawa River, the Richelieu, the Saint-François, the Batiscan, the Yamaska and the Chaudière rivers.

► *Indicator used: estimate of the total load of toxic substances in the water (Chimiotox index).*

Fact Sheet 4

Biodiversity (biological diversity)

Undetermined

Although the number of species at risk seems to be increasing, lack of knowledge prevents an assessment.

Species at Risk and Exotic Species

In 1993, there were 32 animal species, including the Beluga whale, and 246 plant species at risk, or about 9% of the wildlife species and 19% of the species of flora associated with the St. Lawrence River. These species live mainly in the main course of the River, especially in Lake Saint-Pierre, and in the Fluvial Estuary. The effects of the introduction of exotic, or non-native, species like the Zebra mussel are difficult to evaluate. This phenomenon is nonetheless a cause for considerable concern.

► *Indicators used: the number of species at risk; the invasion of exotic species.*

Fact Sheet 5

Natural Environments and Protected Species

Improved

Protected areas and species increased.

Shelter for Living Species

The surface area of protected natural environments has expanded in recent years. The increase recorded for the Fluvial Section and the Fluvial Estuary has been deemed insufficient, however, given the distribution of species and communities at risk in these sectors.

Indicator used: the surface area of protected environments.

Fact Sheet 6

Condition of Biological Resources

Undetermined

Too many species-to-species fluctuations were found to make an evaluation.

The Highs and the Lows

There are no clear-cut trends, but the situation is worrisome. Some populations of sport and commercial fish, along with ducks and amphibians, have been steadily declining. Other species have been growing in number, including seabirds in the estuary and Gulf, Atlantic salmon, and Greater snow geese.

Between 1986 and 1992, the level of commercial fishing activity was moderate at best, and serious declines were noted in the abundance of particular species or stocks of freshwater and marine fish species, some of which are at risk. This is so for Rainbow smelt, American eel, Atlantic salmon and cod.

American eels caught off Kamouraska have shown a gradual decrease in mirex contamination. A similar trend has been noted for DDE and PCB levels in the eggs of Northern gannets on Bonaventure Island and mercury concentrations in Saguenay Fjord shrimp. Nonetheless, the nine animal species studied in the late 1980s were all still found to be contaminated with persistent toxic substances such as hexachlorobenzene (HCB), dieldrin and cadmium.

Indicators used: the abundance of certain species (the number of individuals caught or inventoried and the estimate of total biomass); the degree of contamination (levels of various contaminants in the flesh, liver or eggs).

Fact Sheet 7

Shipping

Stable

The number of ships has remained constant and risks have not increased.

The St. Lawrence, a Busy Waterway

Both the tonnage of ships navigating the St. Lawrence River and the overall number of trips made are quite substantial. More than 10 000 vessel trips were made in 1991. In 1992, 97.2 million tonnes of various foodstuffs were transported on the River. Nearly one-fifth of this cargo, including 16% of the petroleum products, consists of dangerous goods. Shipping takes place throughout the St. Lawrence. In light of the navigation hazards and the transport of hydrocarbons, the areas most at risk are the Fluvial Section and the Fluvial Estuary. Many of the tankers passing just off Île d'Orléans have a draft that exceeds the guaranteed water depth. Most of the spills reported between 1991 and 1993 involved oil. From 1978 to 1988, 307 spills of hazardous substances were reported.

► *Indicators used: the total tonnage and the percentage of dangerous goods handled in commercial ports; the percentage of trips made by merchant ships and tankers with a draft exceeding the guaranteed depth in two sections of the ship channel; the number of accidental spills inventoried.*

Fact Sheet 8

Modification of the Floor and of Hydrodynamics (dredging)

Improved

The floor of the River was modified in specific areas only.

Dredge with Care

When dredging work is carried out in areas of contaminated sediment, toxic substances can be remobilized and dispersed. Dredging causes the resuspension of solid matter, thereby altering the characteristics of the water and the flow regime. Dredging also causes many physical changes to habitats, the effects of which are not well understood. This activity, which is essential to allow navigation on the River, is done mainly in the Lower Estuary, the Gulf and the major ports. Every year, an average 600 000 cubic metres of sediments are dredged – the equivalent of 60 000 truck trips.

► *Indicator used: volumes dredged.*

Fact Sheet 9

Shoreline Modifications

Undetermined

The floor of the River was modified in specific areas only.

The Kidneys and Lungs of the St. Lawrence

In 1989, it was estimated that wetlands made up 86 920 hectares, on merely 5%, of a 10-km-wide strip of shoreline on either side of the St. Lawrence between Cornwall and Tadoussac.

In view of the limited area of wetlands and their ecological importance, the encroachment that has taken place all along the river banks – in the form of residential construction, roads and wharves – has had major consequences. Among them are the loss of essential riparian habitats for wildlife, the disappearance of plant species, a reduction in the water's ability to filter out impurities, and declining biological diversity. Encroachment has been so widespread that all sections of the River are affected to some extent.

Indicator used: the surface area of wetlands (in hectares).

Fact Sheet 10

Urban Wastewater Discharges

Improved

Contamination by organic and inorganic substances and bacteria was reduced.

From the City to the River...and Back Again

Between 1986 and 1992, the percentage of riverside residents being served by a wastewater treatment plant jumped from 10% to 65%. This means that, in 1992, 1.35 million people, or 33% of the riverside population, continued to discharge raw (untreated) sewage into the St. Lawrence. Another 2% of these residents, not connected to sewer systems, used septic tanks.

Bacterial contamination of the water continues to restrict uses of the River. Little is known about the contribution of domestic wastewater to chemical contamination (solvents, ions, pigments) of the St. Lawrence. The associated effects of this pollution have been noted in the main course of the River and the Fluvial Estuary, particularly near large urban centres.

Indicators used: the percentage of riverside residents whose wastewater is treated; the percentage of the riverside population served by a treatment plant compared with the total population.

Fact Sheet 11

Industrial Wastewater Discharges

Improved

Discharges of liquid toxic wastes decreased.

"Not in My River!"

During the period 1988-1993, 49 of the 50 plants considered the most polluting cut their discharges of effluent to the River by 74%. The metallurgical and organic chemicals sectors posted the most significant progress. In 1993, discharges of toxic effluents by pulp and paper mills were the highest of all other industrial sectors.

From 1988 to 1993, oils and greases, as well as heavy metals (mercury, arsenic, chromium, nickel, silver, beryllium) topped the list of pollutants, making up 32% and 29%, respectively, of the total toxic loadings from these industrial plants. They were followed by other metals like aluminum, iron and manganese (8.8%), PCBs (polychlorinated biphenyls, 1.4%) and PAHs (polycyclic aromatic hydrocarbons, 0.4%).

The relative importance of the toxic effluents discharged by the other riverside industrial plants has not been evaluated.

Studies conducted between 1989 and 1992 measured the response of organisms to exposure to various industrial effluents. Higher potential toxicity levels were recorded in effluent of the pulp and paper and the inorganic chemicals sectors.

► *Indicators used: estimate of the total load of toxic substances in the water (Chimiotox index); evaluation of potential ecotoxic effects (PEEP).*

Fact Sheet 12

Commercial Fishing

Deteriorated

Certain fish stocks collapsed.

Will the Little Fish Grow into Big Fish?

Landings of certain freshwater species such as Lake sturgeon and Yellow perch have declined since 1986. In salt water, the commercial fishery for groundfish like Greenland halibut, Canadian plaice, redfish and Atlantic cod has been in a rapid decline since 1987. Since 1985, however, lobster catches have been on the rise and landings of shrimp and several mollusc species have been stable.

Declines have been noted in some stocks of fish such as sturgeon in fresh water, and cod in the marine environment. Populations of other commercial species, such as American shad and Striped bass and forage fish like Rainbow smelt, do not appear to be rebuilding. Furthermore, the American eel is at risk.

► *Indicator used: total landings.*

Fact Sheet 13

Sport Hunting and Fishing

Stable

Contamination of species fished means restrictions on consumption are still necessary. Waterfowl harvest remained steady or increased slightly.

A Question of Scale

Hunting: In 1990, 570 000 game birds were harvested, primarily ducks and geese.

Fishing: From 1983 to 1988, some 212 000 sport fishermen caught an average of 3260 tonnes of fish per year, with 80% of those catches occurring in the Montreal area.

Some species of game fish, including Rainbow smelt, are affected by the deteriorating water quality of the St. Lawrence and the destruction of habitats.

Restrictions on the consumption of fish: In 1992 and 1993, the consumption guideline was eased from two meals to a maximum of four meals per month for Walleye and Smallmouth bass caught between Trois-Rivières and Quebec City. This was also the case for Yellow perch caught in Lake Saint-Louis, for which the recommended monthly rate increased from two meals to eight. Northern pike and Walleye caught, respectively, in Lake Saint-Louis and the Repentigny-Sorel stretch of the River were subject to the most stringent restriction during this same period, or a maximum of one meal per month.

Indicators used: the number and species of birds killed during the hunting season; catches of certain species of fish; the maximum number of meals recommended per month for various species of fish.

Fact Sheet 14

Accessibility of the Banks and River

Undetermined

Recreational and tourist activities increased; however other facets of accessibility were not considered.

Wading into the St. Lawrence

The bacteriological quality of water at the 21 public beaches has generally improved since 1991, thus promoting access to the River for recreation and tourism activities. Between 1989 and 1992, the largest declines in fecal coliform counts in the Fluvial Section were registered at 13 public beaches in the Lake Saint-François and Lake des Deux-Montagnes areas.

A total of 456 access facilities were counted along the River between 1987 and 1991. Pleasure boating infrastructures (boat launching ramps, marinas and wharves) appear to be concentrated along the main course of the River. By contrast, landscape and nature watching facilities, such as roadside rest areas, observation sites and lookouts, are located primarily downstream from Quebec City, in the Côte-Nord, Bas-Saint-Laurent, Gaspé and Îles-de-la-Madeleine regions.

Indicators used: the number of public beaches open; the number of recreation and tourism facilities: boat ramps, marinas, wharves, roadside rest areas, lookouts and observation sites.

Encouraging Results

The studies that have been conducted on the St. Lawrence River have yielded encouraging results and, despite some concerns, the River's future looks promising. However, these positive results should not allow us to lose sight of continuing problem areas. Reductions in the amount of toxic effluents discharged by the 50 industrial plants studied must not overshadow the reality that another 6300 industrial plants are located in riverside municipalities, including 4000 in the Montreal Urban Community alone.

Furthermore, it will be a few more years before we know the real impacts on the environment of these reduced contaminant loads. Some contaminants, trapped in sediments for decades, will be making their way along the food chain for some time to come before they are eliminated. Nevertheless, there is every indication that pollution abatement efforts are on the right track.

There has been considerable improvement in the area of domestic wastewater as well. The major urban centres of Montreal and Quebec City collect and treat their sewage before channeling it back to the River. In 1992, 107 of the 339 riverside municipalities were treating their wastewater before releasing it to the River. In addition, the dumping of snow into the St. Lawrence and its tributaries is slated to be reduced. This is an appreciable source of pollution.

All these clean-up measures are already producing tangible results in protecting St. Lawrence biota. For example, the ban on the manufacture and use of organochlorine compounds – PCBs and various insecticides, including DDT and its residues – has been linked to the restored fecundity of Northern gannets on Bonaventure Island.

Moreover, mercury concentrations declined in several components of the marine food web, including shrimp and groundfish, after the discharge of mercury into the Saguenay Fjord was halted in the early 1970s. This toxic metal is slowly being cycled out of the ecosystem and gradually becoming trapped in the bottom sediments of the fjord. Over the past 10 years, mercury levels in the flesh of seabirds have also dropped.

FOR MORE INFORMATION

THE ST. LAWRENCE ECOSYSTEM

Presents the physico-chemical, biological and socio-economic aspects of the St. Lawrence River based on the latest information.

Includes the 14 characteristics selected to assess the state of health of the River, the matrix of their influences and diagnostic indicators of the state of the environment.

21.5 × 28 cm, 684 pages, 145 maps and figures, printed in three colours.
ISBN 2-921146-31-2, Catalogue No. En 153-70/1-1996E.

A reference and analytical document intended for scientists, students, environmental groups, government departments and businesses.

Cause for Concern

Although the situation appears to be improving for some of the 14 characteristics selected here, a number of concerns remain with respect to others. Many people have sounded the alarm over the decline in fish stocks. Species like Striped bass have nearly disappeared, and the stocks of other species appear to have been permanently destabilized.

The economic consequences of this phenomenon may be enormous. In the marine fishery, the collapse of Atlantic cod stocks has had a ripple effect on the entire regional economy. The gradual decline in catches of Snow crab are also becoming worrisome. The steady drop in catches of Atlantic sturgeon, and the domination of certain fisheries by sexually immature fish, point to abusive fishing practices.

The catch volume of the commercial fishery in the freshwater St. Lawrence is minimal compared to that of the marine sector. However, the few hundred tonnes of Yellow perch, Lake sturgeon and sucker caught each year in the main course of the River, especially on Lake Saint-Pierre, are just a fraction of the catches that would be possible in a healthy fishery.

Time and a great deal more research are needed before we can measure the relative importance of the reasons for our current situation. We do not yet have an answer, for example, to the question of whether the degradation of fish spawning grounds is due to excessive sedimentation or to an excessive mortality rate among juveniles resulting from the presence of toxic substances in the food chain.

With regard to the treatment of urban wastewater, we must also bear in mind that, despite the progress made, a great deal of work remains to be done. In 1992, 140 riverside municipalities still were not treating their wastewater. This represents a daily discharge of some 500 million litres of raw sewage into the River.

Respecting and restoring the St. Lawrence River is everyone's business, and must be made an integral part of any strategy for sustainable development. After all, the St. Lawrence River is not only a precious part of our heritage, it is a vital link to our future.

These publications are available in bookstores or by calling Éditions MultiMondes toll free at 1 800 840-3029.

THE STATE OF THE ST. LAWRENCE

An assessment of the state of health of the River.

A diagnosis of the St. Lawrence River based on a combination of 14 influential characteristics and indicators of the state of the environment.

21.5 × 28 cm, 172 pages, 49 figures, printed in two colours with 3 appendix maps. ISBN 2-921146-32-0, Catalogue No. En 153-70/2-1996E.

An analytical document containing useful information for decision makers and concerned citizens.

St. Lawrence UPDATE

Whether in its role as vital artery, international shipping route or economic engine, the St. Lawrence River captures our attention in a number of ways. Due to the complex nature of this mighty river, 14 characteristics have been selected to review its state of health.

The brochure, ***Our River – Close-up on the St. Lawrence,*** presents a summary of this environmental assessment in the form of 14 fact sheets**.** It answers some of the main concerns expressed by the population about this river that is so closely linked to our quality of life. This brochure is part of a series of three publications comprising the *State of the Environment Report on the St. Lawrence River.*

Published by authority of the Minister of the Environment.

Aussi disponible en français sous le titre:
Notre fleuve – Le Saint-Laurent sous observation.

Saint-Laurent Vision 2000

The **St. Lawrence Centre** is a research and scientific information centre working in the development of analytic and diagnostic tools applicable to river ecosystems. The state of the environment report on the St. Lawrence River is produced as part of the SLV 2000 action plan.

Environment Canada Environnement Canada

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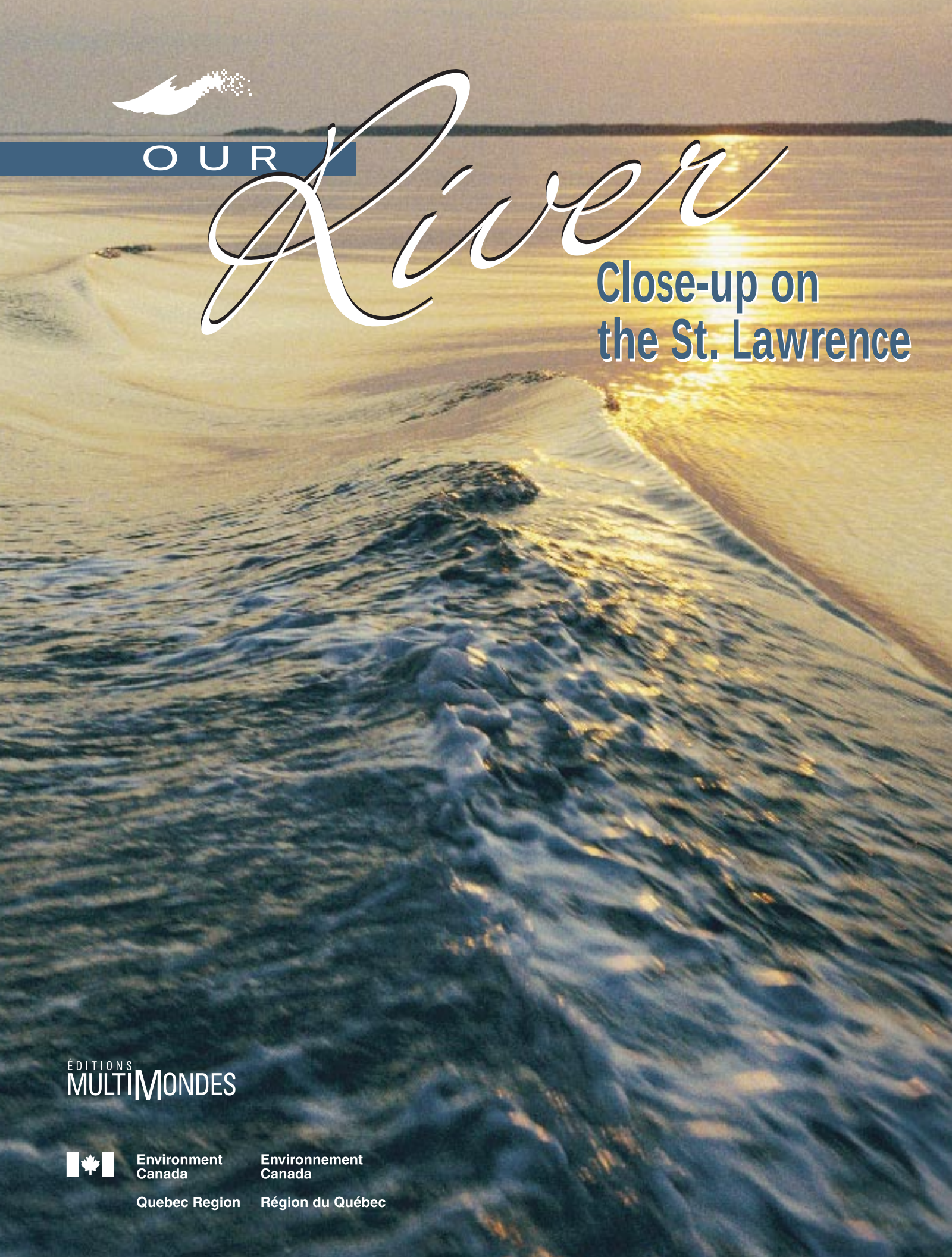

OUR River

Close-up on the St. Lawrence

ÉDITIONS MULTIMONDES

Environment Canada
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Région du Québec

OUR *River*