Overview of the State of the St. Lawrence River

Water, Sediments, Biological Resources and Uses

Monitoring the State of the St. Lawrence River

Canada

St. Lawrence Vision 2000

Québec

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INTRODUCTION

In the last few centuries, human beings have exploited, transformed and polluted the St. Lawrence. It is only in the past thirty years that protection and conservation efforts have been introduced. What is the state of the St. Lawrence now, as we enter the 21st century? How is the system evolving: have things begun to improve or are they continuing to deteriorate? To answer these questions, a long-term program to monitor the state of the St. Lawrence was developed and launched in February 2003 within the framework of the St. Lawrence Action Plan, a Canada–Quebec co-operation agreement.

The information gathered in the course of ongoing monitoring activities is used to achieve an overview of the state of the St. Lawrence. For this purpose, environmental indicators pertaining to water, sediments and biological resources have been identified. Other data shed light on human use of the river for swimming or fish consumption.

The first part of this document describes the State of the St. Lawrence Monitoring Program. The second part deals with the state of the St. Lawrence and how the system is evolving. Part three focuses on toxic contamination. Finally, part four discusses future prospects for the St. Lawrence.

The present overview is based on the indicators covered by the 16 fact sheets that accompany this document. The indicators point to some overall improvement in the state of the St. Lawrence. However, the data also reflect the vulnerability of this environment, particularly with respect to water quality, certain wildlife species and wetlands.

1. THE STATE OF THE ST. LAWRENCE MONITORING PROGRAM

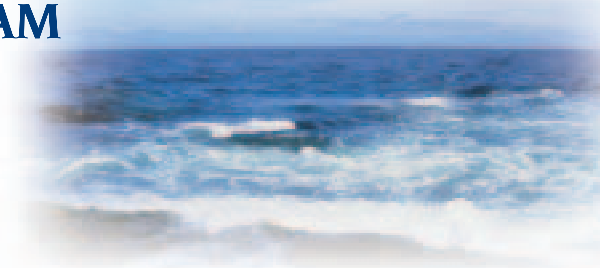


Photo: Canadian Wildlife Service

Background

The State of the St. Lawrence Monitoring Program (SSLMP) was developed within the framework of the St. Lawrence Vision 2000 Action Plan, phase I of which was launched in 1988. Two other phases followed in 1993 and 1998. In phases I and II of the Action Plan, environmental indicators were identified for the purpose of achieving an overview of the state of the St. Lawrence and the main issues affecting it. With this experience behind them, the Action Plan partners agreed during phase III to introduce a long-term monitoring program for the purpose of reporting on the state of the St. Lawrence on a regular basis.

The partners in the program are:

- Environment Canada (EC)
- Ministère de l'Environnement du Québec (MENV)
- Fisheries and Oceans Canada (DFO)
- Société de la faune et des parcs du Québec (FAPAQ)

The SSLMP is based on environmental monitoring activities now being conducted by the above organizations. *Stratégies Saint-Laurent*, a non-governmental organization that co-ordinates action by communities along the river and supports the Priority Intervention Zone (ZIP) committees, is also associated with the program.

Objectives

The aim of the program is to report on the state of the St. Lawrence and changes in the system by means of environmental indicators pertaining to the main components of the ecosystem. The environmental indicators may be divided into three categories: indicators of the **state** of the biophysical environment and natural processes (e.g. number of belugas in the estuary, PCB concentrations in sediments in Lake Saint-François, and fluctuations in the river's flow rate), indicators of environmental **pressures** resulting from human activities or extreme events (e.g. toxic effluent loads in the river and the Saguenay flood), and **response** indicators, which comprise action taken by society to protect the environment or allow it to recover. Only state indicators are documented by the program. The territory covered by the program extends from the Ontario-Quebec border to the Gulf of St. Lawrence. While the St. Lawrence is indistinguishable from its watershed, the program does not cover the tributaries.

Frame of Reference

The St. Lawrence ecosystem is complex. It consists of riverine lakes, the fluvial section, a very long estuary, and a gulf with marine characteristics. The physical characteristics (currents, depths, salinity, tides) change enormously as the river makes its way to the Atlantic. Lake Saint-Pierre is 50 kilometres long and just a few metres deep on average, while the Laurentian Channel, which extends almost 800 kilometres from the mouth of the Saguenay Fjord to the Atlantic Ocean, reaches depths of 300 to 500 metres. The St. Lawrence contains a broad range of freshwater, estuarine and marine habitats, and a rich diversity of flora and fauna.

This complexity may be apprehended by means of a simple frame of reference, comprising five basic ecosystem components. These are **water, sediments,**

biological resources, shoreline and **uses**. All state indicators used in the monitoring program fall under one of these biophysical components. When the indicator is associated with a public use guideline, it is also identified with this component. This is the case, for example, with contamination of swimming and shellfish gathering areas by fecal coliforms, or contamination of freshwater fish and marine resources by toxic substances.

Monitoring Activities

Table 1 lists the 21 environmental monitoring activities included in the program. These are regular data-acquisition activities carried out by program partners as part of their mandates. These activities were selected because they provide useful information for establishing indicators that are pertinent for monitoring the state of the St. Lawrence. The indicators are described in the 16 fact sheets that accompany this document.

The monitoring activities selected for the program are related to a number of major environmental issues of current concern, including:

- contamination of water, sediments and biological resources by toxic substances;
- physico-chemical and bacteriological quality of water;
- recovery of uses;
- biodiversity, specifically wetland vegetation, fish, birds, marine mammals and various exotic species;
- fluctuations in physical processes (water level and flow, water mass movements);
- climate change.

TABLE 1. MONITORING ACTIVITIES REGISTERED UNDER THE PROGRAM

Component	Monitoring Activity
Water	Hydrometric network (water level and flow) – Various partners
	Toxic substances at the inlet (Wolfe Is.) and outlet (Lévis) of the fluvial section – EC
	Organic toxic substances at the mouths of the Richelieu and Yamaska rivers – MENV
	Physico-chemical and bacteriological parameters of water (river)* – MENV
	Physico-chemical parameters of water (estuary and gulf) – DFO
	Quality of shellfish waters in the estuary and gulf * – EC
	Water quality in potential freshwater swimming areas * – MENV
Sediments	Contamination of sediments in Lake Saint-François by toxic substances – EC
Biological Resources	Surface area of freshwater wetlands – EC
	Invasive plant species in freshwater wetlands – EC
	Monitoring of freshwater fish communities – FAPAQ
	Contamination of freshwater fish by toxic substances* – MENV
	Contamination of marine resources by toxic substances* – DFO
	Phytoplankton communities in the estuary and gulf – DFO
	Zooplankton communities in the estuary and gulf – DFO
	Monitoring of toxic algae in the estuary and gulf – DFO
	Status of seabird populations – EC
	Status of the Northern Gannet population – EC
	Status of the Great Blue Heron population – EC
	Status of the Beluga Whale population – DFO
	Reintroduction of Striped Bass – FAPAQ

* Linked to guidelines for use.

2. THE CHANGING STATE OF THE ST. LAWRENCE

Photo: The Biosphere

Coverage of the biophysical components of the St. Lawrence over space and time is uneven. Several monitoring activities cover water and biological resources. However, there is just one indicator characterizing sediments in Lake Saint-François, and none that applies to the shoreline. Furthermore, some monitoring activities were only undertaken very recently, which means that the time series are short and do not yet provide a long enough history to show a trend in the indicator. However, the information available has been used to establish an overview of the state of the St. Lawrence, and, to some extent, of the changes taking place.

This information is summarized in Table 2 in the form of a general assessment of the state of the indicators. Where data permit, the direction of the trend is indicated with an arrow. It is difficult to make a qualitative assessment of the river's water levels and flow rates. This is also true of the state of the Striped Bass population, which can only be studied once the project to reintroduce this fish is more advanced.

TABLE 2. INDICATORS OF THE STATE OF THE ST. LAWRENCE

Component	Indicator (reference years)	State: Poor		State: Intermediate		State: Good
Water	Water level and flow (1932–2002)	?		?		?
	Contamination by toxic substances, fresh water (1995–2002)				●	
	Physico-chemical and bacteriological parameters, fresh water (1995–2001)				←●	
	Oceanographic processes, estuary and gulf (multiple–2001)				●	
	Water quality in potential swimming areas, fresh water (1999–2001)			●		
	Shellfish area water quality (1988–2002)			●		
Sediments	Contamination of sediments by toxic substances, Lake Saint-François (1979–1999)			●→		
Biological Resources	Wetlands and exotic plants (1976–2002)			●		
	Freshwater fish communities (1995–1997)		●			
	Contamination of freshwater fish by toxic substances (1976–1995)			●→		
	Contamination of marine resources by toxic substances (1990–2001)				●→	
	Great Blue Heron (1977–2001)				●	
	Seabirds (1925–1999)			●		
	Northern Gannet (1887–2001)					●
	Beluga Whale population of the estuary (1988–2000)		●			
	Reintroduction of Striped Bass (2002 on)			**To follow**		

Water: Quantity and Quality

The river

The St. Lawrence River is regulated, so that fluctuations in water levels during the year are reduced. The river's hydrological regime comprises a cycle of low and high flow rates. Low flow rates in the neighbourhood of 6000 m^3/s were recorded in the mid-1930s and the mid-1960s, followed by high flow rates (about 20 000 m^3/s) in the mid-1940s and 1970s. The low flow rates measured at the end of the 1990s and the beginning of this decade are consistent with the pattern of the 20th century, but are slightly above the rates recorded in the 1930s and 1960s. The high flow rates that would normally be expected to occur later in this decade may be offset by the climate warming that is also forecast. Climate models call for increased evaporation from the Great Lakes, less precipitation, and therefore a lower flow in the St. Lawrence River.

The water quality of the river varies considerably over time and space. In many places, the bacteriological quality of the water is usually good enough for swimming. Nearly half of the 44 sites studied between Montreal and Île d'Orléans have good swimming potential, because bacterial contamination there is below the quality guideline for swimming more than 70% of the time. At other sites, the water quality is so poor that no recreational use is possible. Along the shoreline close to urban areas, storm sewer overflows during rainfalls are the chief cause of contamination. In the shipping channel, discharges of wastewater that has been treated but not disinfected by Montreal, and to a lesser extent by Longueuil, are the main source of contamination. Most of the stations monitored posted good or satisfactory results with respect to physico-chemical water quality. However, recent data (1995–2001) point to deteriorating water quality at many of the stations because of the lower flow rates of the last few years. The data therefore indicate that hydrological and climatic factors can exacerbate the negative effects of human activity on water quality in the fluvial section.

The estuary and gulf

In the Estuary and Gulf of St. Lawrence, the physico-chemical properties of the water masses are chiefly governed by weather and climate phenomena and by inflows of fresh and salt water, rather than by human activities. However, human activities influence freshwater inflows, and, in the long term, the climate. The information gathered so far reveals wide spatial and temporal variations in the physical and chemical characteristics of the estuary and the gulf. For example, ice coverage and duration in the gulf vary tremendously from one winter to the next. In the years from 1998 to 2000, the ice cover was far less extensive and shorter lived than in previous years.

These variations have an impact on plankton communities, whose productivity, abundance, distribution and specific composition are determined by the physico-chemical characteristics of the environment. Thus, the distribution of the toxic algae *Alexandrium tamarense*, which occurs naturally in the estuary and gulf, is linked to freshwater inflows. Because of the water flow pattern in the estuary and gulf, this algae is particularly abundant in the Lower St. Lawrence and Gaspé regions. Oceanographic monitoring therefore allows us to understand how the physico-chemical characteristics of the environment are related to biological resources. In the long term, such monitoring will pinpoint the impact of climate change on the St. Lawrence marine ecosystem.

Coastal waters are far more vulnerable to the impacts of human activities. Bacterial contamination by humans causes the major loss of uses such as clam and mussel gathering. The problem is worse in the Gaspé region and Lower St. Lawrence than in the Magdalen Islands and along the North Shore.

Photo: Bruno Lafortune, Environment Canada

As in the fluvial section, wastewater from municipalities and isolated residences is the main source of contamination. Although efforts have been made to treat wastewater since 1992, no shellfish areas have been reopened. This shows how difficult it is to solve some water pollution problems and restore uses entirely. Where public health is concerned, very stringent water quality guidelines must be respected.

Photo: Fisheries and Oceans Canada

Biological Resources: Diversity and Abundance

Information about biological resources in the St. Lawrence is plentiful and detailed in some cases and highly fragmented in others. For example, in the case of Northern Gannets, data on bird abundance go back to 1880, and statistics on contamination date from the 1960s. By contrast, in the case of freshwater fish, inventories of various sectors were conducted between 1965 and 1975, but it was only between 1995 and 1997 that the first comprehensive study was carried out on the entire fluvial section. It is therefore difficult to diagnose the state of all biodiversity components in the St. Lawrence and how they are changing.

Freshwater fish: a diverse but disturbed community

Data gathered between 1995 and 1997 on freshwater fish show a relatively diverse community, especially around the islands of Lake Saint-Pierre and in Lake Saint-Louis. The diversity of fish communities is determined by natural factors such as the presence of diverse, high-quality habitats, water-level variations and hydrodynamic conditions. In some sections, however, the deterioration and destruction of habitats (encroachment, dredging) have impacted negatively on fish diversity. In Lake Saint-François, in particular, the lack of diversity may have resulted from dams, which have blocked migration routes, and the stabilization of water levels, which was intensified with the construction of the St. Lawrence Seaway.

The Biotic Integrity Index combines several characteristics of fish communities (biomass, diversity, number of pollution-sensitive species, prevalence of anomalies). The index generally falls into the "intermediate" and "poor" categories, pointing to deterioration in the health of the fluvial ecosystem. Lake Saint-François, where habitats have undergone significant modification, is the most disturbed sector. Other zones have been heavily polluted by industry and are also in a deteriorated state. Such is the plight of the Îles de la Paix near the south shore of Lake Saint-Louis.

Downstream, the state of the St. Lawrence is such, however, that the Striped Bass could be reintroduced. This fish vanished from the river in the late 1960s. Various hypotheses have been posited to explain its disappearance, including overfishing, construction of the waterway, pollution, and the destruction of spawning grounds. A more recent analysis of biological data gathered between 1944 and 1962 has shed new light on the extinction of the Striped Bass and pinpointed the circumstances. Major dredging work in the North Traverse, a section of the St. Lawrence Seaway east of Île d'Orléans, displaced and confined the species to a restricted area south of the channel. This exposed the bass more to fishing, and the population finally disappeared in 1968. The reintroduction of this species represents an important milestone in restoring biodiversity in the St. Lawrence. The Striped Bass is the only fish population to be eradicated from the Quebec portion of the river in the 20th century. Considering the efforts already devoted to restoring the St. Lawrence, experts believe that improved management of dredging operations and better oversight of the fishery will make it possible to bring back the Striped Bass.

Birds: sensitive populations

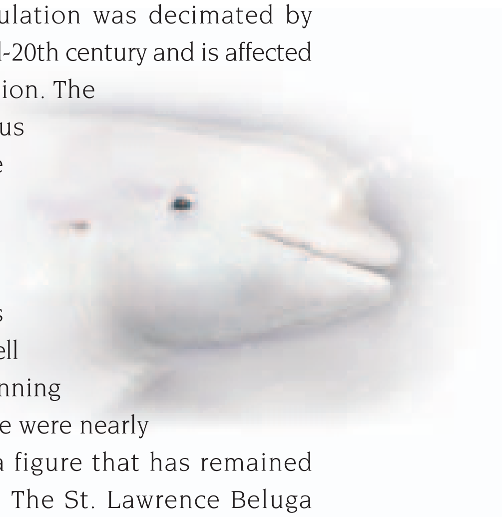
Some data show that St. Lawrence bird populations that worried researchers in the past are now fully recovered or showing signs of recovery. For instance, in the 1960s, there were fears that seabirds such as Northern Gannets would not survive because of DDT contamination of the environment. However, with more than 35 000 breeding pairs on Bonaventure Island in 1999 and a breeding success rate of over 67%, there is no longer any cause for concern about the Northern Gannet's survival. The population of Great Blue Herons, which are distributed the whole length of the St. Lawrence, has also increased since the 1960s. There are now some 25 000 birds and the number seems to be holding steady. With a breeding success rate of 58% in 2001, the species is healthy, despite the presence of contaminants in eggs and in the blood of young herons.

At the same time, the populations of other seabirds such as Herring Gulls, Caspian Terns and alcids, whose fluctuations are affected by fishing and hunting activities, demonstrate the extent to which biological species and communities can be affected by human activities. The disappearance of the only Caspian Tern breeding site, located on Île à la Brume in the Gulf of St. Lawrence, in the 1990s, proves that the biodiversity of the St. Lawrence is still under threat.

Photo: Pierre Brousseau, Canadian Wildlife Service

The beluga: a stable population

The St. Lawrence Beluga Whale is something of a bellwether species for the marine portion of the St. Lawrence. The population was decimated by overhunting until the mid-20th century and is affected by chemical contamination. The Committee on the Status of Endangered Wildlife in Canada still considers the St. Lawrence beluga population to be in danger of extinction as its numbers continue to be well below those at the beginning of the 20th century. There were nearly 1000 belugas in 2000, a figure that has remained stable since the 1980s. The St. Lawrence Beluga Recovery Plan was created in 1996. Population dynamics clearly show that, despite efforts to protect and conserve the beluga since the 1980s, the species' recovery is a long-term undertaking. Significant population changes will probably only be measurable in the long term because of the species' low reproductive rate. It will take decades, not years, before the impact of efforts to restore the species can be observed.



Wetlands: essential but vulnerable habitats

The recovery and conservation of wildlife species depend on the presence of habitats where they can complete all the stages in their life cycles. Wetlands are essential to the survival of a large number of aquatic species. An estimated 80% of wetlands have disappeared because of various types of encroachment since the St. Lawrence Valley was colonized by Europeans. Although less subject to encroachment today, wetlands remain vulnerable to the invasion of exotic species, an irreversible process. Of the 285 plant species identified in St. Lawrence wetlands, 37 are considered exotic and cover up to 44% of the wetlands between lakes Saint-Louis and Saint-Pierre.

On many of the islands in the sector, exotic species are found in over half of the wetlands. The main invasive exotic species are Flowering Rush, Purple Loosestrife, Common Frog-bit and Eurasian Water-milfoil.

Invasive exotic species can have a major impact on the quality of wetland habitats. Data gathered since the 1970s show that wetlands are dynamic, fast-changing ecosystems, both in terms of area and plant composition.

Photo: Martin Jean, St. Lawrence Centre

3. CHANGES IN TOXIC CONTAMINATION FROM YESTERDAY TO TODAY

Photo: Normand Gariépy, Lake Saint-Pierre Biosphere Reserve

For over a century, a growing number of toxic substances were discharged into the environment. Awareness of environmental contamination in the 1960s brought about a number of measures aimed at reducing or eliminating toxic discharges. Increasingly strict regulations on the production, use and discharge of contaminants have been gradually introduced. What has been the overall effect of these measures? Is the St. Lawrence less contaminated by toxic substances? Is contamination still a cause for concern? And are some areas more contaminated than others? An integrated monitoring program covering all the components and various trophic levels of the St. Lawrence both upstream and downstream would give us some answers to these questions. The integration of existing data does, however, provide a good overview of the situation. Two contaminants in particular, mercury and polychlorinated biphenyls (PCBs), have been studied extensively since the 1970s in every section of the St. Lawrence. Their concentrations in water, sediments and animal species can serve as an indicator of environmental contamination and how it is evolving.

Water and Contaminants

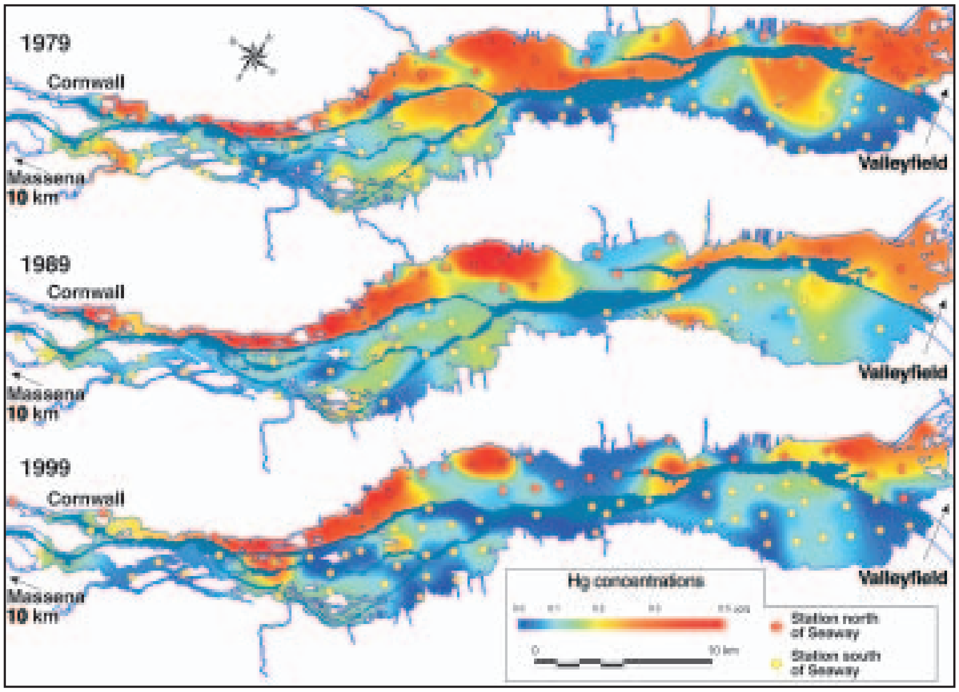
There is little toxic contamination of water in the fluvial section of the St. Lawrence and the levels measured are significantly below the strictest quality guidelines. At the Quebec City reference station, which combines different sources of upstream contamination, metal concentrations are generally low and reflect the composition of the Earth's crust. Concentrations vary according to the proportion of water from the Great Lakes and the rivers draining the Canadian Shield. However, mercury is on the rise, and likely comes from anthropogenic sources.

Concentrations of organic contaminants, which are clearly of human origin, are also low. For example, polycyclic aromatic hydrocarbons (PAHs) show a strong seasonal variation related to the burning of wood and fossil fuels. Pesticide levels also vary according to when fertilizer is spread on the St. Lawrence Lowlands. PCB levels are low and falling. All the substances measured are at concentrations significantly below the quality guidelines for the protection of aquatic life. The mean concentration near Quebec City is between two and 6000 times lower than the guidelines, depending on the substance. Overall, we can conclude that water quality in the St. Lawrence River is relatively good in terms of the toxic substances that have been monitored.

Sediments in Lake Saint-François

Current data show that contaminant concentrations are very small in the water, but much higher in the sediments. Monitoring of sediment quality under the SSLMP focuses on Lake Saint-François. Its sediments are contaminated, primarily by mercury and PCBs. However, core samples of sediments and surface sediments taken between 1979 and 1999 show a marked decrease in contamination since the 1970s (Figure 1). According to mercury and PCB profiles obtained by core sampling, the main surge in chemical contamination occurred between 1950 and 1980, reaching its peak around 1970. Present concentrations of mercury and PCBs in surface sediments have returned to levels similar to those observed in the

FIGURE 1. SPATIAL DISTRIBUTION OF MERCURY (Hg) IN SEDIMENTS IN LAKE SAINT-FRANÇOIS BETWEEN 1979 AND 1999



early 1950s. These concentrations are near the minimal effect threshold for mercury and the no-effect threshold for PCBs. The data thus suggest that the potentially harmful effects of sediment contamination on the ecosystem's health are decreasing significantly with time.

A number of substances are not very soluble in water and are mostly found in suspended solids and sediments. Water and suspended particles from the Great Lakes carry some contaminants to the St. Lawrence River. However, a large proportion of the toxic substances generated in the Great Lakes basin remain trapped in the sediments. The same phenomenon is at work in the St. Lawrence; sediments accumulate and retain most of the contaminants. The deep sediment layers in sediment accumulation areas of riverine lakes, the Saguenay Fjord and the Laurentian Channel are sinks for toxic contaminants. Despite the presence of a relatively uncontaminated surface layer, these sinks will remain a threat to the St. Lawrence. Various natural and anthropogenic processes can cause sediments and their associated contaminants to be recirculated. Once the contaminants are released, they are absorbed by benthic organisms and eventually spread throughout the food chain.

Biological Resources: Proximity of Contaminant Sources and Bioaccumulation

Although only low levels of contaminants have been observed in the water and surface sediments,

Photo: Fisheries and Oceans Canada

they are not insignificant. A number of contaminants are bioaccumulable, which means that even when present in small quantities, their potential impact on biological communities, commercial and sport fishing, and human health is still a concern. It is important to monitor their pathway in the food chain and to have a good understanding of their concentrations in relation to the quality guidelines for the protection of aquatic life and human health.

Contamination trends and levels

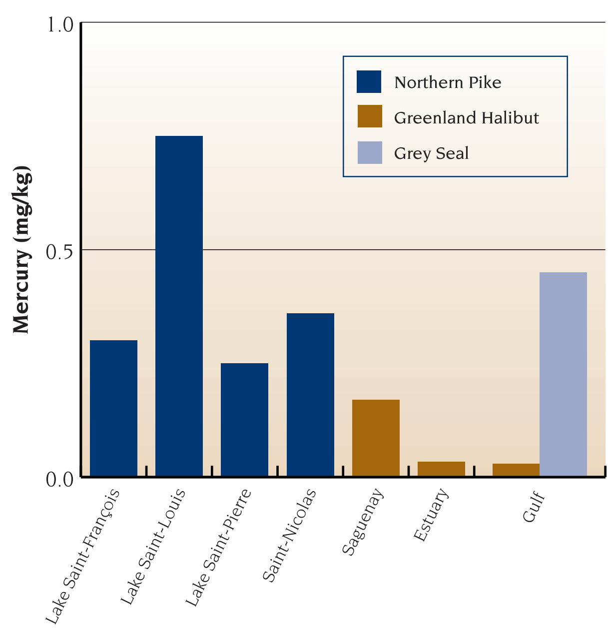
Data on contamination in freshwater fish and marine biota are very revealing in many regards. They show a significant decrease in contamination since the 1970s. Only mercury contamination in Lake Saint-Louis did not decline between the 1970s and 1990s. Furthermore, present levels are generally below the acceptable limits established for human consumption. Mercury and PCB levels are generally below Health Canada guidelines for commercial fishery products (0.5 mg/kg for mercury; 2000 µg/kg for PCBs), but exceed the guidelines for the protection of fish-eating wildlife (0.057 mg/kg for mercury and 160 µg/kg for PCBs). Eating freshwater fish does not endanger human health if the frequency of consumption does not exceed the recommendations of the Quebec guide to eating freshwater sport fish (*Guide de consommation du poisson de pêche sportive en eau douce*).

Contamination of marine and freshwater environments

It is very difficult to compare the contamination of marine and freshwater environments on the basis of contaminant levels in fish. Such an exercise would require a comparison of various species that occupy different ecological niches. In addition, different analysis methods are used for some toxic substances such as PCBs, which complicates the comparison. Nevertheless, to provide a general picture of contamination levels in marine and freshwater environments, mercury levels in the tissue of two fish species are presented in Figure 2. The species in question are the Northern Pike, a freshwater fish, and the Greenland Halibut, a marine species. Both fish are mainly piscivorous and widely distributed throughout their respective environments. The data show that contamination is greater in fresh water and clearly lower in the estuary and gulf. The high mercury levels in Lake Saint-Louis compared to other freshwater environments, and in the Saguenay Fjord compared to the estuary and gulf, reflect the presence of point sources of contamination.

The distribution of blood mercury and PCB levels measured in young herons living between Lake Saint-François and the Gulf of St. Lawrence is similar to what is observed in fish. Taken together, the data clearly show that environmental contamination is not homogeneous and depends on the proximity of the sources. The marine environment is relatively uncontaminated because of dilution, sedimentation and the distance of the sources. However, mercury levels observed in Grey Seals show that even if contamination of the marine environment is low, contaminants accumulate and concentrate in long-lived predators at the top of the food chain, such as marine mammals.

FIGURE 2. CONCENTRATIONS OF MERCURY (mg/kg, WET WEIGHT) IN THE TISSUE OF FISH AND GREY SEALS IN THE ST. LAWRENCE



N.B. The horizontal line represents the guideline for commercial fishery products.

Does the contamination in marine organisms, particularly mammals, affect them? Is their survival threatened? The marine mammals most exposed to contaminants are those living close to sources of contamination. Belugas and Harbour Seals in the St. Lawrence Estuary are examples. In the case of the beluga, the population has yet to show obvious signs of recovery, but does not seem to be declining, either. As for birds, growing populations of two sentinel species in the St. Lawrence, the Northern Gannet and Great Blue Heron, demonstrate that contamination is not hampering the breeding success of the two species in marine and freshwater environments.

Contamination: new concerns

Since the early 1990s, the scientific community has been worried about new aspects of toxic contamination, including the effects of some organic substances on the endocrine system. It has been shown that these compounds affect development and reproduction in animals and humans. Hormone-disrupting chemicals include long-studied toxic substances such as PCBs, dioxins and furans, and organochlorine pesticides, as well as other compounds that researchers have only recently become interested in, such as organotins (biocides used in paint for boat hulls), phthalates and alkylphenols (two groups of substances used as additives in plastics manufacturing), organobromines (used as flame retardants), pharmaceuticals and various substances derived from industrial processes. These substances are thought to act even at very small concentrations and after a very long exposure period (decades).

Although incomplete, data on toxic substances in water, sediments and organisms lead us to conclude that the state of the St. Lawrence with respect to chemical contamination has improved over the last three decades, although some issues remain unresolved and need special attention. Vigilance and prudence are still required to manage potentially toxic substances for humans and wildlife.

Photo: Michel Leblond, © Le Québec en images, CCDMD

4. OUTLOOK

Photo: Yves Lamontagne, Environment Canada

The data presented in this profile give us an overview of the state of the St. Lawrence, particularly its water and biological resources. They show that the St. Lawrence River is in better shape now at the beginning of the 21st century than it was during the second half of the 20th century. Toxic contamination has decreased and some animal populations are recovering or on their way to recovery. Marine organisms and freshwater fish are safe to eat. The quality of the river's water is relatively good and bacterial contamination is below the quality guideline for swimming most of the time at nearly half the sites studied between Montreal and Île d'Orléans. Freshwater fish communities remain quite diverse and vast areas of wetlands have been maintained along the St. Lawrence, providing favourable habitats for abundant and diverse wildlife species to breed and feed.

However, many problems remain. Bacterial contamination continues to significantly restrict recreational activities in the fluvial section of the St. Lawrence and shellfish harvesting in marine coastal waters. Contaminants present in sediments remain a long-term threat to the St. Lawrence. Biodiversity continues to be affected by human activities such as land use, harvesting of biological resources, disturbances, and the invasion of exotic species. The beluga's recovery will require sustained effort for many years to come. Species also remain fragile in the face of human-induced stresses (habitat loss, disturbances, contamination, etc).

Toxic Substances are Decreasing

Toxic contamination, which was a major cause of concern in the 1960s and 1970s, seems to be on the wane. Concentrations of toxic substances in freshwater fish and marine organisms are low enough that they can be eaten safely. However, some substances are occurring at even higher concentrations in marine mammals as a result of bioaccumulation. Experts are increasingly interested in many emerging substances and some byproducts of the biological conversion (metabolization) of toxic substances. The long-term impacts of contaminants remain a source of concern. Some substances, such as endocrine-disrupting compounds, have become worrying because of their suspected impact on the metabolism of living organisms.

Biodiversity Vulnerable to the Invasion of Exotic Species

The biodiversity of the St. Lawrence River could be transformed in the future by invasive exotic species, changes in the hydrological regime and climate change. The invasion of exotic species in the Great Lakes has had an enormous ecological and economic impact. In the St. Lawrence, two invasive species of exotic fish, the Round Goby, observed in the area of Quebec City, and the Tench, which has a strong foothold in the Richelieu River, could negatively affect the freshwater fish community. Commercial and sport fish and threatened fish species could suffer if exotic species invade their habitats. The composition of plant life in wetlands is vulnerable to invasive species and to changes in the hydrological regime. The impact of changes to wetland plant communities on their status as wildlife habitats has yet to be evaluated.

Recovering Uses

In terms of use, improvements to the state of the St. Lawrence have yet to produce the hoped-for gains. Swimming remains limited in the fluvial section. In the estuary and gulf, shellfish harvesting is still restricted to the same sectors, while many productive sectors are closed because of bacterial contamination. Ten or so sites could be reopened in the Gaspé region in the next few years. However, lower environmental contamination encourages the consumption of freshwater fish and marine organisms, which could promote a popular pastime: sport fishing.

Integrating Information and Co-operation

The main challenge of the State of the St. Lawrence Monitoring Program is to combine the data obtained from each indicator to arrive at a better understanding of the state and dynamics of the St. Lawrence River. To meet this challenge, the partners intend to improve the spatial and temporal coverage of certain indicators, develop new ones, and join forces with additional collaborators.

Photo: Jean Guénette

Government of Canada
Gouvernement du Canada

Environment Canada
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