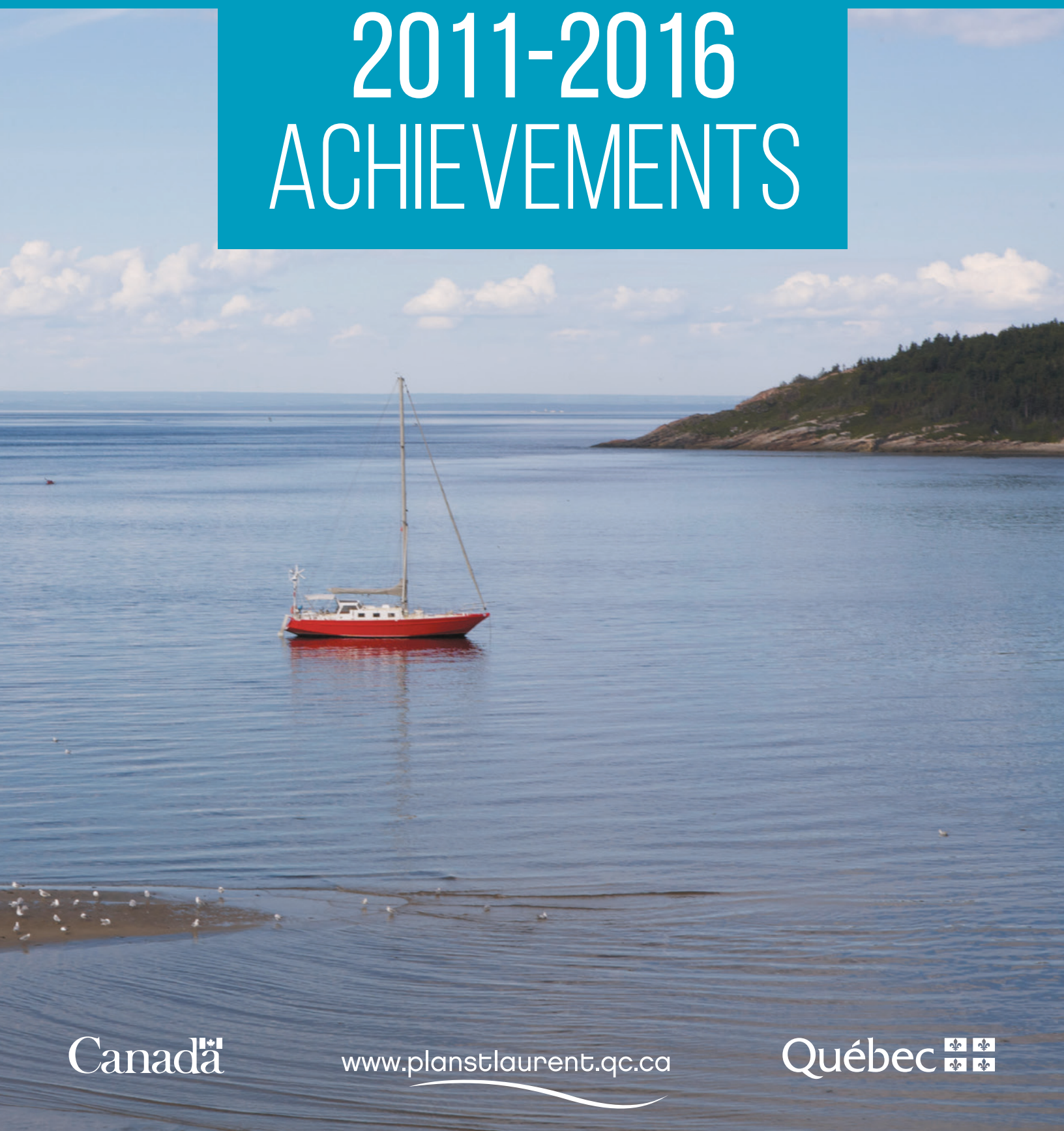
Plan d'action SAINT-LAURENT 2011-2026

2011-2016 ACHIEVEMENTS



Canada

www.planstlaurent.qc.ca

Québec

Visit the St. Lawrence Action Plan website
It provides detailed descriptions of the projects and work carried out.

COORDINATION AND WRITING

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MESSAGE FROM THE FEDERAL MINISTER

The St. Lawrence River is one of the jewels of this country. In 1988, the governments of Quebec and Canada committed to work together to raise awareness about this invaluable natural resource and to enhance and preserve it for the benefit of present and future generations. Both governments have reaffirmed their engagement with the signing of the Canada-Quebec Agreement on the St Lawrence 2011-2026.

This document presents all of the initiatives for the protection and sustainable use of the St. Lawrence River implemented since 2011. An impressive record of achievement! The document highlights scientific achievements and advances that will allow decision makers to base future decisions on what is really happening in the river's water and on its shores.

Over forty projects were jointly carried out by scientific experts from the eighteen federal and provincial departments that signed the action plan. Two programs were implemented to monitor the health of the river and develop forecasting models to better predict future changes in water and ecosystem quality.

Riverside communities took on some sixty projects that have led to improving, at the local level, several sectors of the St. Lawrence. Through regional round tables, the Areas of Prime Concern (ZIP) program, and the Forum on the St. Lawrence, numerous organizations work together to preserve the river. The cooperation between the various levels of government and stakeholders from riverside communities has led to significant remarkable advances for the health of the St. Lawrence and its riparian areas and the sustainability of its use.

In spite of this, the river still remains a sensitive area. Nothing is certain. We must continue to be vigilant to safeguard its future *together*. I would like see the next five-year action plan to implement with as much—if not more—determination, drive and cooperation on the part of all concerned.

I am extremely proud of the work accomplished, and I thank all of those who participated. I hope all readers of this report will appreciate fully the value of each and every accomplishment achieved in the last five years. I invite all potential players in the next *St. Lawrence Action Plan* to come forward and be a part of the next wave of accomplishments.

Catherine McKenna
Minister of Environnement
and Climate Change

MESSAGE FROM THE PROVINCIAL MINISTER

Stretching from the Great Lakes to the Atlantic, the St. Lawrence River is an exceptional ecosystem. Historically, it forms the core of our economic, social and cultural development. More than 80% of Quebecers live on the shores of the St. Lawrence and its tributaries. Moreover, its basin accounts for 40% of Québec's renewable fresh water. The river supplies nearly 2.5 million people with drinking water. Our drinking water, maritime activities, tourism industry, cities, natural resources, energy and ecosystems are dependent on a healthy St. Lawrence. Its conservation, restoration and development are therefore fundamental. The quality of life and access to water of our children and future generations are at stake!

The St. Lawrence has continually undergone transformation over the centuries, but this phenomenon is accelerating because of climate change, which constitutes a threat to both water quantity and quality. It is altering the biodiversity, composition and structure of ecosystems and, as a result, threatening the river's capacity to ensure the sustainability of the opportunities and uses it offers Quebecers. As an example, variations in water levels, sudden heavy rainfall and changes in water quality due to rising water temperatures could put major pressure on our drinking water treatment facilities. Climate change is also having impacts on riverside communities. They are concerned about the erosion of their shorelines and must deal with increased risks of flooding – which explains the importance of continuing our work under the St. Lawrence Action Plan.

Collaboration on the part of governments and water stakeholders is essential if we are to face the new challenges our river is experiencing. Since 1988, the governments of Canada and Québec have taken numerous actions to protect this collective resource and encourage the mobilization of all those affected by water-related issues. With the support of specialists from both governments, we are continuing our efforts to ensure a better quality of the St. Lawrence's water, in addition to ensuring aquatic biodiversity, the sustainable management of the river's fishery resources, the maintenance and development of its public access points as well as sustainable commercial and recreational navigation practices.

The document titled Achievements of the St. Lawrence Action Plan 2011-2016 highlights some of the projects that have been implemented under this agreement since 2011. These projects aptly illustrate the way in which, together, we can act effectively and concretely to ensure the preservation of the treasure that is our St. Lawrence River.

David Heurtel
Quebec Minister of Sustainable Development,
Environment and the Fight against Climate Change

MESSAGE FROM THE CO-CHAIRS OF THE AGREEMENT

We are pleased to submit the report on achievements for the period 2011–2016 under the St. Lawrence Action Plan (SLAP), which is the first phase of a 15 year agreement that will run from 2011 to 2026. The governments of Canada and Quebec, together with numerous stakeholders committed to protecting the St. Lawrence River now and into the future, have implemented a multitude of projects aimed at conserving, restoring, protecting and enhancing the rich diversity of our great river.

This action plan, the fifth since 1988, gave rise to some remarkable initiatives to protect and enhance the St. Lawrence River. Three major issues—water quality improvement, conservation of biodiversity and sustainable use—were the focus of all the initiatives implemented by federal and provincial departments and agencies, as well as by many stakeholders from riverside communities.

Thanks to the collaborative efforts of the government agencies involved, more than 40 projects were undertaken to enhance water quality and riparian areas and protect the sustainable uses of the St. Lawrence River. In one project, for example, researchers discovered that deep-water areas of the St. Lawrence shipping channel are used by juveniles of a number of fish species. The new knowledge acquired about the coexistence of wildlife and vessel traffic will influence future decisions concerning sustainable use of the St. Lawrence River. Another success story is the creation of an interactive map of all the protected areas on public and private land along the river; it can be accessed from the SLAP website.

Many local and regional initiatives were carried out in areas along the river thanks to the participation of a variety of organizations, companies and local residents. More than 60 restoration, protection, awareness and research projects were implemented, generating a wide range of benefits for the health of the St. Lawrence, its habitats and its wildlife. They include a project undertaken to remove a huge accumulation of logs in the Saint-Jean River which created an obstacle that researchers believed could threaten the survival of salmon. And in the Montreal area, an awareness campaign was carried out to prevent the spread of Japanese knotweed, one of the most invasive plants on Earth.

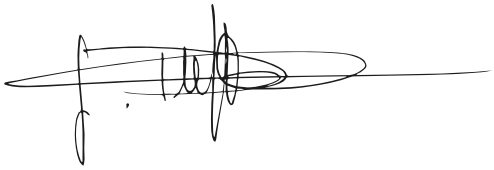
Important knowledge has been acquired through two key programs: the State of the St. Lawrence Monitoring Program and the Numerical Environmental Prediction Program for the St. Lawrence. The state of the St. Lawrence monitoring indicators, together with the numerical prediction models developed

under those programs, have made it possible to gain a better understanding of the factors influencing the health of the river and to predict changes in its ecosystems. A report titled *Overview of the State of the St. Lawrence* was produced, along with some fifteen monitoring sheets, and the Rendez-vous Saint-Laurent event provided an opportunity to disseminate recent findings from these initiatives. The results have been used to identify priority actions for promoting the health of the St. Lawrence River and its uses.

Lastly, the St. Lawrence Action Plan 2011–2016 has helped to implement integrated management of the St. Lawrence which will continue into the future. Six regional round tables were established which benefit from the participation of nearly 120 organizations. The Forum Saint-Laurent provided the opportunity for about 100 stakeholders to engage in discussions, share knowledge and reflect on ways to take action together. Also, ZIP (area of prime concern) committees and the organization Stratégies Saint-Laurent continued their efforts to inform, raise awareness and mobilize local stakeholders around collaborative projects related to one of SLAP's three priority issues.

Accordingly, we are pleased to present this fifth report on achievements under the St. Lawrence Action Plan, which provides many examples of notable achievements. Many challenges remain, and others will inevitably arise in the years ahead. To marshal the most efficient and creative approaches for meeting these challenges, we need to build on our collaborative efforts and make the best use of our complementary expertise. Let us embark on the next action plan with the same determination to preserve the sustainable uses of the St. Lawrence for the benefit of Canadians and to ensure that the river's rich diversity will enrich the lives of both present and future generations.

Marie-Christine Tremblay
Environnement et Changement climatique Canada



Jacques Dupont
Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques

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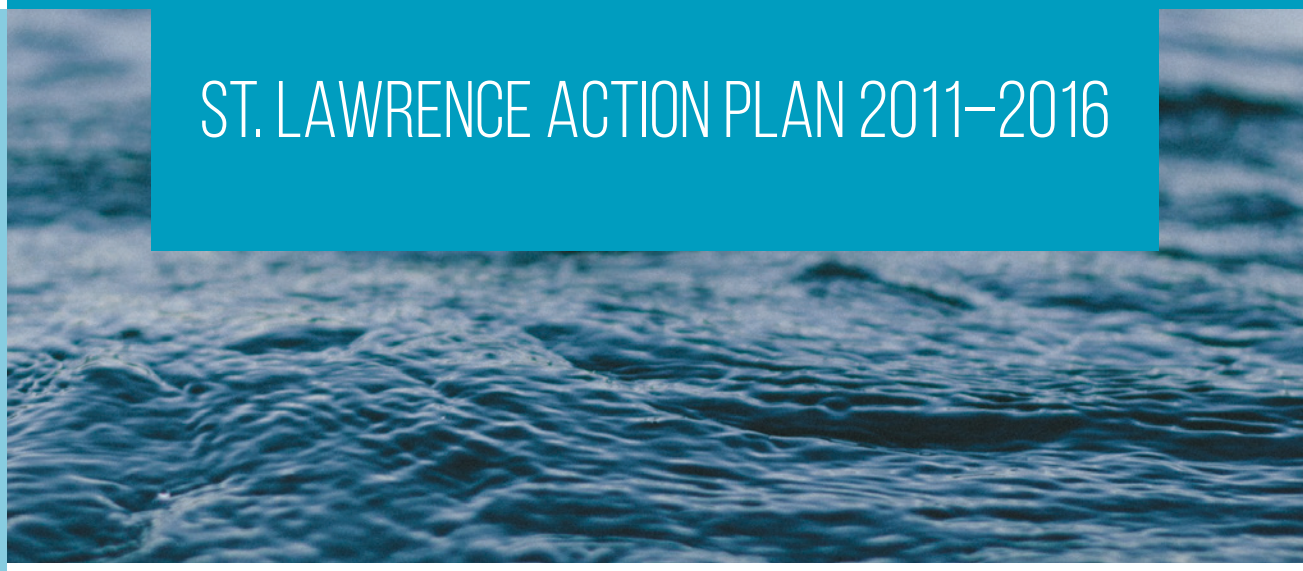


Forward looking

In 1988, the governments of Canada and Quebec began to work collaboratively with various stakeholders in order to conserve, restore, protect and enhance the St. Lawrence River. With the aim of continuing this work while also adapting to emerging issues facing the St. Lawrence, the governments of Canada and Quebec made a commitment in 2011 to renew this partnership, the St. Lawrence Action Plan, for a period of 15 years. This plan is also known as the Canada–Quebec Agreement on the St. Lawrence.

Since 1988, five successive five-year plans have provided a coordinating framework for government actions related to the St. Lawrence. This document describes the main projects carried out from 2011 to 2016 under the St. Lawrence Action Plan.

Between 2011 and 2016, the Government of Canada invested more than $43 million in the Agreement and the Government of Quebec $16 million, for a total of nearly $60 million invested. Thanks to the pooled expertise of specialists from many government partners, the St. Lawrence Action Plan 2011–2016 has resulted in 43 joint projects related to three priority issues: **conservation of biodiversity, sustainable use and water quality improvement**.

SLAP has a funding program, called the **Community Interaction Program** (CIP), which supports the participation of riverside communities. Between 2011 and 2016, 66 projects focusing on ecosystem enhancement, biodiversity conservation, sustainability of uses and water quality improvement were funded.

In addition to implementing these joint projects, the St. Lawrence Action Plan (SLAP) has made it possible to expand our knowledge about the St. Lawrence. **The State of the St. Lawrence Monitoring Program** launched in 2003 continues to play a leading role by providing information on more than 20 indicators related

to water quality, sediments and biological resources. The third Overview of the State of the St. Lawrence, published in 2015, provides an accounting of all these indicators.

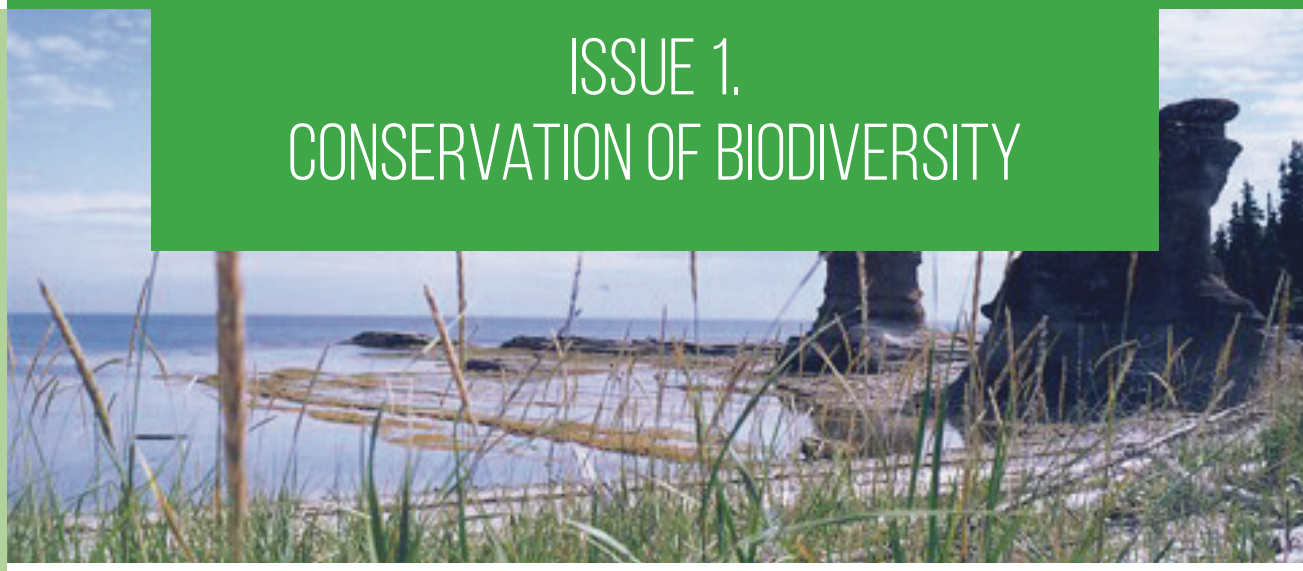
The new **Numerical Environmental Prediction Program for the St. Lawrence** also harnesses the collective expertise and data of the various participants by using their prediction models in order to improve predictions and gain a better understanding of the hydrological regime and the ecosystem of the St. Lawrence.

Implementation of **integrated management of the St. Lawrence** (IMSL) has been ensured through the gradual creation of six regional round tables since 2012, and through the Forum Saint-Laurent, an annual gathering attended by many of the stakeholders involved in protecting and enhancing the St. Lawrence.

The **ZIP (Area of Prime Concern) Program**, which fosters co-operation among regional stakeholders and tackles local issues affecting the St. Lawrence, has also continued its work through the activities of the ZIP committees and Stratégies Saint-Laurent (SSL).

Visit the website of the St. Lawrence Action Plan for detailed descriptions of the projects and other activities.

ISSUE 1.
CONSERVATION OF BIODIVERSITY



The biodiversity of the St. Lawrence provides many ecosystem services that benefit communities. In spite of its richness, this biodiversity faces considerable pressures and is still fragile in many respects. Habitat loss and alteration due to human activities as well as the introduction of invasive exotic species are the main threats to the biodiversity of the St. Lawrence. That is why, in 2011, the governments of Canada and Quebec agreed to make biodiversity conservation one of the priority issues of the St. Lawrence Action Plan (SLAP). The government participants agreed on the need to continue their efforts to develop integrative tools in order to address biodiversity problems collaboratively. Their activities during the period 2011–2016 were guided by three orientations, each with its own specific objectives and associated projects.

Ecosystem services, also called ecological services, are natural processes that provide important benefits for communities. An example is wetlands that prevent flooding, purify water, reduce erosion and protect shorelines.

Orientation 1.
Identify, protect, restore and enhance areas of ecological interest

Develop common planning tools for identifying areas of interest

Achievements for 2011–2016

- Unified habitat mapping covering the St. Lawrence Lowlands
- Interactive map of the conservation measures implemented on public land and private land in the St. Lawrence Lowlands
- Online atlas of ecologically significant fish habitats in the freshwater and marine portions of the St. Lawrence
- Integrated plan for priority conservation areas in the St. Lawrence Lowlands
- Ecological monitoring program for National Wildlife Areas in Quebec

Consolidate the network of protected areas

Achievements for 2011–2016

- Preliminary studies for the creation of three marine protected areas

Develop and restore areas of interest

Achievements for 2011–2016

- Model interventions for the conservation of biodiversity in an agricultural setting in the Baie-du Febre area on the south shore of Lake Saint-Pierre
- Online interactive version of the Atlas of Bank Restoration Sites of the St. Lawrence

Orientation 2.
Prevent the introduction and control the spread of invasive exotic species

Put in place tools for preventing the introduction of invasive exotic species

Achievements for 2011–2016

- Coordination of efforts by government stakeholders involved in identifying and implementing actions to prevent the introduction of invasive exotic species in the St. Lawrence
- Development of information and awareness tools for preventing the introduction of invasive exotic species in the St. Lawrence

Control the abundance and spread of invasive exotic species

Achievements for 2011–2016

- Harmonization of monitoring practices and activities carried out by government stakeholders to control and prevent the spread of invasive exotic species in the St. Lawrence
- Joint action and rapid-response plan in the event that invasive exotic species are detected in the St. Lawrence

Manage and disseminate information and data on invasive exotic species

Achievements for 2011–2016

- Identify joint databases and parameters for the dissemination of harmonized information
- Preliminary work for the creation of a harmonized database on invasive exotic species in the St. Lawrence for the St. Lawrence Global Observatory

Gain a better understanding of the effects of invasive exotic species

Achievements for 2011–2016

- Research aimed at evaluating the effect of invasive exotic fish species on native freshwater mussels in the St. Lawrence

Orientation 3.
Assess the impact of climate change on ecosystems

Assess the impact of climate change on wetlands

Achievements for 2011–2016

- Research aimed at assessing the impact of climate change on high marshes in the freshwater estuary of the St. Lawrence

Participants

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC)
- Department of Forests, Wildlife and Parks (MFFP)
- Department of Agriculture, Fisheries and Food (MAPAQ)

Government of Canada

- Environment and Climate Change Canada
- Fisheries and Oceans Canada
- Parks Canada
- Agriculture and Agri-Food Canada

Examples of projects

Integrated biodiversity conservation plan for the St. Lawrence Lowlands and coastal zones in the estuary and the Gulf of St. Lawrence

St. Lawrence Lowland

Despite ongoing efforts to protect natural habitats in southern Quebec, conservation actions need to be taken to safeguard the habitats of hundreds of plant and animal species. Several types of habitat in this region are under threat: forests, wetlands, open habitat (e.g., agricultural land), aquatic habitats and the St. Lawrence River system.

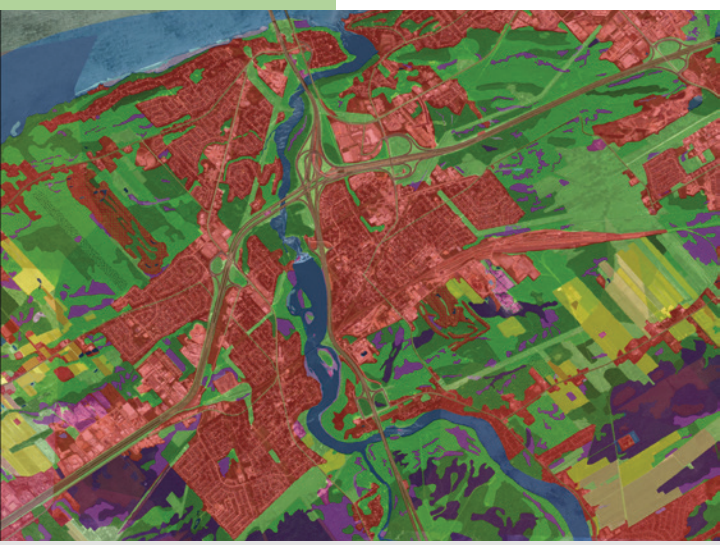
Three of the projects carried out under the objective "Develop common planning tools for identifying habitats of interest for conservation" will make it possible to prepare an **integrated biodiversity conservation plan for the St. Lawrence Lowlands** as part of the 2016–2021 programming. This plan will give rise to an atlas of habitats of interest with detailed maps of sites that are a priority for conservation. It will also include methodology documents. The tools that are developed will be made available to regional stakeholders.

1. **Unified habitat mapping covering the St. Lawrence Lowlands**

   This project involving detailed mapping of land use and natural habitats (forests and wetlands) used recent numerical data from satellite images, aerial photographs and ecoforestry maps. The maps will be available to the public in 2016–2017.

   A fact sheet concerning this project is provided on the SLAP website.

2. **Interactive map showing the conservation measures implemented on public and private land in the St. Lawrence Lowlands and along the estuary and the Gulf of St. Lawrence**



Example of updated land use map, Lévis area.

This project involved developing a portrait of existing protected areas on public and private land. Considerable efforts have been made to collate information concerning various conservation measures implemented on privately owned land (e.g., trusts, servitudes/easements, leases, etc.). This portrait was considered crucial for more effective planning of interventions under the integrated conservation plan for natural habitats in the St. Lawrence Lowlands.

It can be accessed from the fact sheet about this project on the SLAP website.

In addition, as part of this project, an **inventory of conservation plans for natural habitats of interest** developed between 2000 and 2013 in the St. Lawrence Lowlands was also carried out. These conservation plans

were analyzed in detail to identify the most commonly used criteria for prioritizing conservation of natural habitats in Quebec.

A description of the plans can be accessed from the fact sheet about this project on the SLAP website.

3. **Creation of an online atlas of areas of interest for freshwater and marine fish species in the St. Lawrence**

   This project involved identifying critical fish habitats in order to ensure their conservation and better protect their connectivity in the St. Lawrence River basin.

   Historical data from inventories and monitoring of the health of fish communities in the St. Lawrence can be accessed from the fact sheet about this project on the SLAP website.

This work was coordinated by a team composed of representatives from various government agencies, non-governmental conservation organizations (Nature Conservancy of Canada, Bureau d'écologie appliquée) and independent experts.

Coastal zones in the estuary and the Gulf of St. Lawrence

An initial draft of the atlas of natural habitats of interest for conservation in the estuary and the Gulf of St. Lawrence was developed as part of the 2011–2016 programming. The atlas and the associated conservation plan will be completed during the 2016–2021 programming period. The conservation plan covers coastal and nearshore terrestrial habitats in the upper and lower estuary and the Gulf of St. Lawrence, including riparian wetlands. It can be used to identify priority areas for conservation of natural habitats and to foster the engagement of the regional stakeholders involved in conservation activities.

To find out more, see the fact sheet about this project on the SLAP website.

Participants

Government of Canada

- Environment and Climate Change Canada

Government of Quebec

- Department of Forests, Wildlife and Parks
- Department of Sustainable Development, Environment and the Fight Against Climate Change

ISSUE 2.
SUSTAINABLE USE

The diverse uses of the St. Lawrence, including navigation, fishing and water supply, are central to the quality of life of many communities in Quebec. As these uses have expanded, the pressure exerted on the river by human activities such as urban development, artificialization of shorelines and overfishing has also increased. Some recreational, commercial, industrial and public uses of the St. Lawrence have been compromised by degradation of water quality and natural habitats associated with bank erosion, major water-level fluctuations and climate change. In an effort to address this problem, the two governments adopted four orientations and four areas of intervention to guide their joint activities during the period 2011–2016: fishery resources, access to the St. Lawrence, navigation and water supply.

Orientation 4.
Promote sustainable management of fishery resources

Inventory and share information on the state of fishery resources in the St. Lawrence

Achievement for 2011–2016

- Creation of an online database on the state of fishery resources in the St. Lawrence

Share expertise and promote co-operation among stakeholders involved in fishery resource management

Achievement for 2011–2016

- Joint workshop on management of the recreational fishery
- Creation of a liaison committee for government stakeholders and fishing industry stakeholders to address policies concerning marine resource harvesting

Orientation 5.
Identify and promote public access points

Consolidate the inventory of public access points

Achievement for 2011–2016

- Development of a methodology for using Earth observation technologies to identify, validate and characterize sites with public access to the St. Lawrence

Orientation 6.
Maintain and promote sustainable navigation

Maintain and increase co-operation among stakeholders of the St. Lawrence, as well as with Great Lakes stakeholders, concerning navigation

Achievement for 2011–2016

- Co-operation among navigation stakeholders
- Development of a sustainable navigation strategy
- Co-operation among stakeholders involved in management of dredging and sediments

Develop information and awareness tools related to navigation

Achievement for 2011–2016

- Development of an information guide on marine transportation titled: “Navigation on the St. Lawrence: Echo of the Past, Path to the Futur”

Develop and promote integrated management of dredging

Achievement for 2011–2016

- Online dredging activity planning registry
- Research on the use of the shipping channel by fish

Develop concrete ways to reduce shoreline erosion along the St. Lawrence

Achievement for 2011–2016

- Monitoring of the voluntary measure for reducing vessel speeds

Orientation 7.
Promote sustainable management of water levels and flows

Produce information and tools to support decision making related to water management

Achievement for 2011–2016

- Study of the impact of climate change on water levels
- Integration of Earth observation technologies in emergency preparedness activities
- Creation of a climate change coordination committee

Participants

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change
- Department of Forests, Wildlife and Parks
- Department of Agriculture, Fisheries and Food
- Department of Municipal Affairs and Land Occupancy
- Department of Tourism
- Department of Transport, Sustainable Mobility and Transport Electrification
- Department of Public Security

Government of Canada

- Environment and Climate Change Canada
- Fisheries and Oceans Canada
- Canadian Space Agency
- Public Services and Procurement Canada
- Parks Canada
- Transport Canada
- Canadian Environmental Assessment Agency

Examples of projects

Research on use of the shipping channel by fish

Marine transportation of cargo is a major component of Quebec's economy. To allow ships to navigate the St. Lawrence, a series of dams and locks were constructed along the river, and millions of cubic metres of sediment had to be dredged from the river bottom to create the shipping channel. All this construction permanently altered the various wildlife habitats along the St. Lawrence River.

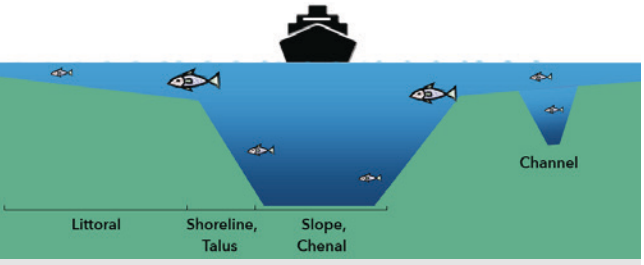
Research vessel LAMPSILIS.
Photo : Andrea Bertolo, Université du Québec à Trois-Rivières

In spite of the paucity of data, the shipping channel was long considered a biologically impoverished environment. This perception can be explained in part by the difficulty of safely sampling this portion of the St. Lawrence, where the current is strong and vessel traffic is heavy. Under the St. Lawrence Action Plan, Environment and Climate Change Canada, together with the Quebec Department of Forests, Wildlife and Parks, carried out research to gain a better understanding of the use of the channel by fish.

From 2007 to 2009, the research vessel *Lampsilis*, which belongs to the Université du Québec à Trois-Rivières, was used to explore a long stretch of the St. Lawrence shipping channel to learn more about its use and its importance in the life cycle of the fish species that inhabit the St. Lawrence River.

For comparison, three other types of habitat were also sampled: channel slopes, deep natural trenches and shoreline. The results showed that the shipping channel is a habitat frequented by a diverse community of fish (27 species) which is distinct from the communities found in the other habitats studied. Lake sturgeon, walleye, sauger and channel catfish are among the species found in the channel.

The results also show that the deep-water habitats are used by juveniles of several species, including lake sturgeon, channel catfish and American shad. This pioneering inventory of the fish community in the shipping channel raises the question of the coexistence of aquatic fauna and vessel traffic—an important issue for the St. Lawrence fisheries in the context of sustainable development of the shipping industry.



Different types of fish habitat in the St. Lawrencet

To find out more, see the fact sheet about this project on the SLAP website.

Participants

Government of Canada

- Environment and Climate Change Canada

Government of Quebec

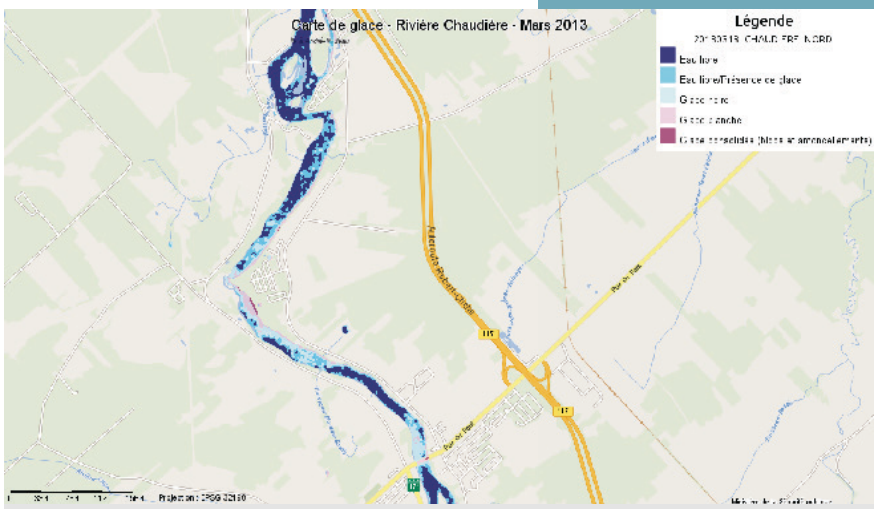
- Department of Sustainable Development, Environment and the Fight Against Climate Change
- Department of Forests, Wildlife and Parks

Earth observaton technology and emergency preparedness

For several years now, thanks to collaboration with the Canadian Space Agency, Quebec and federal emergency preparedness authorities have used satellite data and other means to prevent ice jams. More specifically, **RADARSAT-2** images are used to plan interventions and manage ice problems in rivers in certain hydrographic regions.

RADARSAT-2 is a Canadian radar satellite that was developed through collaboration between the Government of Canada and industry and was launched in 2007. It is one of the most advanced Earth observation systems in the world. For more information, please visit the website of the Canadian Space Agency.

Regional emergency preparedness advisers with the Quebec Department of Public Security (MSP) have had access to RADARSAT-2 images for several years. The imagery is delivered to the MSP by the Canadian Space Agency and processed by a geomatics team. The team uses an algorithm developed by the remote sensing laboratory of the Centre Eau Terre Environnement of the Institut national de la recherche scientifique (INRS) to process the satellite data and produce ice charts.



Example of an ice chart, Charny area, Quebec

The satellite images can be used to identify the type of ice present, frazil ice, ice ridges, ice jams and open-water leads. From this information, a snapshot of the situation along an entire watercourse can be obtained. The MSP covers most of the regions in Quebec, enabling it to analyze conditions in dozens of rivers affected by recurrent ice jams and flooding. This approach provides a more accurate assessment of the risk of flooding based on the presence of ice and open water, thereby helping to support emergency management operations and decision making by emergency preparedness and response authorities in the municipal government and at other levels of government.

The same RADARSAT-2 images can be used to evaluate the extent of flooding and thus produce more accurate maps of flood zones, as was done during the floods in the Montérégie region in 2011. As well, optical images

from the Pleiades 1A and Pleiades 1B satellites were used to assess the progress of reconstruction work in downtown Lac-Mégantic, near the site of the train derailment that occurred in 2013. The operations perimeter and the impact radius of the accident were also determined using images from the DigitalGlobe satellite.

The ice charts and complementary information, as well as information on related products, can be accessed from the fact sheet about this project on the SLAP website.

Participants

Government of Quebec

- Department of Public Security

Government of Canada

- Canadian Space Agency

ISSUE 3.
WATER QUALITY IMPROVEMENT

Water quality can be improved by tackling various types of pollution. The St. Lawrence Action Plan water quality committee decided to adopt three broad orientations to guide the selection of scientific research projects and activities aimed at improving water quality in the St. Lawrence River. The three orientations are management of non-point-source pollution, contaminated sediment and toxic substances.

Non-point-source pollution, which is caused by inputs of nutrients from agricultural areas and by atmospheric inputs, is not well documented. In addition, water quality is affected by the growing presence of contaminants associated with wastewater discharges and resuspension of contaminated sediments. Their effects on the environment and on human health remain poorly understood. Water quality is also affected by toxic substances of chemical and bacteriological origin.

In keeping with the three broad orientations, during the period 2011–2016, eight objectives were addressed through 17 projects aimed at improving water quality in the St. Lawrence

Orientation 8.
Reduce agricultural non-point-source pollution

Act, support and coordinate actions aimed at reducing agricultural non-point-source pollution

Achievements for 2011–2016

- Conservation and restoration of riparian strips adapted to the terrain in order to reduce pollution and create an ecological corridor across the Richelieu River watershed
- Restoration of fish habitats through projects undertaken to maintain watercourses in the Lake Saint-Pierre flood plain

Identify the effects of agricultural non-point-source pollution on aquatic ecosystems

Achievements for 2011–2016

- Numerical prediction tools that can be used to better understand the role that rivers play in terms of supplying inputs of organic carbon and nutrients in relation to the phenomena of hypoxia, acidification and toxic algae blooms in the St. Lawrence estuary
- Characterization of microbial contamination in tributaries of Lake Saint-Pierre
- Study on harmful and toxic algae and on their use as indicators of water quality and as a tool for monitoring eutrophication

Orientation 9.
Improve contaminated sediment management

Enhance the tools available for assessing the risks associated with contaminated sediment

Achievements for 2011–2016

- Preliminary research to develop a guide for assessing the ecotoxicological risk and the health risks associated with contaminated sediment sites
- Identify the environmental issues related to the presence of contaminated sediment
- Development of guidelines for recommending toxicity tests to assess sediments in the brackish water zone

Improve and standardize contaminated sediment management rules

Achievements for 2011–2016

- Preliminary research to establish a decision-making framework for contaminated sediment management

Orientation 10.
Assess the presence and impact of toxic substances on the ecosystem

Assess the presence and effects of toxic substances from municipal effluents

Achievements for 2011–2016

- Study to identify the presence of pharmaceutical products and other emerging substances in municipal effluents in the Montreal area
- Study to increase knowledge about concentrations of pharmaceutical and personal-care products found in the St. Lawrence and some of its tributaries
- Assessment of the environmental and health risks associated with urban effluents in the Quebec City area

Characterize the contamination in Lake Saint-Pierre

Achievements for 2011–2016

- Preliminary research with a view to combining the use of environmental prediction tools and state of the St. Lawrence monitoring tools
- Analysis to determine contamination levels in the wetlands of Lake Saint-Pierre
- Creation of a discussion group on the ecosystem integrity of Lake Saint-Pierre and staging of a workshop for researchers and experts

Assess the effects of toxic substances on the food chain

Achievements for 2011–2016

- Assess the impact of an invasive species (round goby) on the trophic transfer of contaminants

Coordinate research and monitoring initiatives related to emerging contaminants in the St. Lawrence as a whole

Achievement for 2011–2016

- Fact sheet on emerging contaminants in the St. Lawrence

Participants

Government of Canada

- Agriculture and Agri-Food Canada
- Environment and Climate Change Canada
- Fisheries and Oceans Canada
- Health Canada
- Parks Canada
- Public Health Agency of Canada

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change
- Department of Forests, Wildlife and Parks
- Department of Agriculture, Fisheries and Food
- Department of Health and Social Services (INSPQ)
- Department of Public Security

Examples of projects

Richelieu corridor vert et bleu

The Corridor Vert et Bleu is a green infrastructure project aimed at improving both wildlife habitat and water quality in the Richelieu River and its tributaries as well as in Lake Saint-Pierre. It involves preserving, restoring and linking natural spaces within the watershed while giving priority to streams and sensitive habitats.

To support biodiversity conservation in the Richelieu River watershed, which is home to 43 at-risk wildlife species and 140 rare plant species, the project has three main components:

- Restoring banks by planting native trees, shrubs and herbaceous plants (width of riparian strip and types of plants adapted to the terrain);
- Connecting the natural spaces in the Richelieu River watershed to enhance habitat quality;
- Continuing efforts to improve agricultural and municipal practices with the aim of reducing inputs of suspended solids and other contaminants.

More specifically, the Corridor Vert et Bleu aims to enhance:

- aquatic habitat by improving water quality;
- riparian habitat by restoring banks;
- terrestrial habitat by increasing forest area;
- connectivity between the different natural habitats.

Results achieved

The project has conserved and restored sections of riverbank by creating riparian buffer strips to reduce pollution and create an ecological corridor in the Richelieu River watershed. It involved partnering with numerous stakeholders and resulted in interventions at several priority sites. Examples are provided below.

Restored shorelines

In urban and agricultural areas, the number of riparian strips was increased and their efficiency increased through restoration work which included planting of native trees and shrubs to filter water and improve riparian and aquatic habitat.

Sustainable agricultural practices

Implementation of sustainable agri-environmental practices was continued to support soil conservation and water quality improvement.

Productive riparian buffers

On some sites, agroforestry crops or shrubs and herbaceous vegetation were planted on riparian strips in order to provide a source of income for riverside property owners.

Planting established along the riparian strip of branch 27 of Ruisseau à l'Ours, in St-Jean-Baptiste. Photo: Chantale Soumahoro, Fédération de l'UPA de la Montérégie

Preservation and linking of natural spaces

A wider natural corridor adjacent to sensitive habitat or habitat used by species at risk was created.

Renaturalization of stream channels

Measures were taken to allow streams to flow more freely without being restricted to a human-made channel.

Water retention (riparian marsh or inlet well)

Some projects were carried out to preserve wetlands, develop retention structures (inlet wells, basins, marshes, etc.) and restore flood plains in order to mitigate flooding and capture sediment.

To find out more, see the fact sheet about this project on the SLAP website.

Participants

Government of Canada

- Environment and Climate Change Canada
- Agriculture and Agri-Food Canada
- Fisheries and Oceans Canada

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change
- Department of Forests, Wildlife and Parks
- Department of Agriculture, Fisheries and Food

Identifying the key environmental issues related to the presence of contaminated sediment

Beginning in the 2000s, various initiatives were carried out under the St. Lawrence Action Plan to enhance management of dredging, particularly with regard to the disposal of contaminated sediment. However, some problems relating to the management of contaminated sediment sites were never properly addressed.

Sediments collected at Beauharnois.
Photo: Simon Blais,
Environment and Climate Change Canada

Results achieved

A number of interrelated avenues of research were pursued in this project which helped to more accurately identify the environmental issues related to the presence of contaminated sediment. First, sediment sampling was carried out at several sites in the St. Lawrence, and the degree of contamination of the sediments was assessed using the criteria for the assessment of sediment quality in Quebec. These initial steps led to the following results.

1. **Determination of the contamination level in stretches of the St. Lawrence**

   The areas where sediment quality had improved were identified (e.g., areas along the St. Lawrence in Quebec City and Lévis, the Îles-de-la-Paix area of Lake Saint-Louis), along with areas where sediment quality was deemed to be of concern (e.g., Île aux Veaux channel, at Contrecœur, and the riverside industrial area in Lake Saint-Louis, at Beauharnois).

2. **Assessment of toxicity to users**

   On the basis of these results, some issues related to the presence of contaminated sediments were evaluated. For example, research was undertaken to determine whether sediment contamination at various sites was severe enough to present toxicity risks for users, specifically:

   - fish that feed and spawn there;
   - humans who swim, fish or hunt waterfowl in those areas;
   - municipalities that draw their drinking water from those areas.

3. **Identification of priority sites and action plan**

   The above-mentioned research results were used to update information on contaminated aquatic sites and to prioritize the actions to be taken, if any.

Sampling of fish (sauger, Sander canadensis), at Varennes.
Photo: Simon Blais, Environment and Climate Change Canada

Summary

The project aimed at identifying the main environmental issues related to the presence of contaminated sediment yielded the following results:

- A more comprehensive and cohesive picture of contaminated sediment sites was produced.
- Data were collected to permit monitoring of the chemical quality of sediments in some areas.
- The quality of the drinking water supply was assessed by the proper authorities.
- The industrial discharges in some areas were evaluated and found to be safe for local populations and ecosystems.

To find out more, see the fact sheet about this project on the SLAP website.

Participants

Government of Canada

- Environment and Climate Change Canada
- Health Canada (advisory activities)

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change
- Department of Forests, Wildlife and Parks

Documenting the presence of pharmaceutical products in municipal effluents in the Montreal region and assessing their effects on aquatic fauna

The discharge of urban effluents is a major source of pollution for the St. Lawrence River. These effluents contain large quantities of chemical substances, including pharmaceutical products. The study on the presence of pharmaceutical products in Montreal municipal effluent sought to understand what happens to pharmaceutical products in wastewater treatment plants, how they are transformed, and their toxicological effects on receiving waters and aquatic fauna.

Using a net to catch fish exposed to municipal effluent.
Photo: Magali Houde, Environment and Climate Change Canada

Activities carried out

Methods were developed for identifying and quantifying the pharmaceutical products (e.g., anti-inflammatories, antidepressants and antibiotics) and various emerging substances found in wastewater discharges. In addition, toxicological testing was carried out in the wastewater dispersion zone. The objective was to determine the relationships between potential accumulation of some of these substances in biological tissues and their effects on mussels, fish and birds. This made it possible to identify the bioindicators of exposure to pharmaceutical products and the products' effects

Dissecting fish exposed to municipal effluent.
Photo: Christian Gagnon, Environment and Climate Change Canada

Results achieved

The research enabled identification of the various pharmaceutical degradation products that are present in waters where municipal effluent is discharged. It also made it possible to determine the concentrations of the contaminants studied in yellow perch tissues, measure the biological responses to prolonged exposure to Montreal municipal effluent, and calculate the correlations between those two parameters.

Summary

The study showed that municipal effluent has a real impact on the health of yellow perch living in the river. The complex mixture of organic substances present in the effluent affects the diet and size of the fish. Yellow perch exposed to effluent eat at lower trophic levels and weigh more than other specimens of the same size.

It was also discovered that municipal effluent is a major source of polybrominated diphenyl ethers (flame retardants whose production and use are now regulated) and of iron from the ferric chloride used in treating the water. These substances were found in higher concentrations in yellow perch living in the effluent plume.

Together, these results provide enhanced knowledge for assessing the environmental impacts of pharmaceutical products and other emerging substances in the river and the risks to the environment and human health from municipal effluents.

To find out more, see the fact sheet about this project on the SLAP website.

Flame retardants stop or slow the spread of fire. They are found mostly in computers, textiles, mattresses and upholstered furniture. These compounds are persistent, and many are present in the environment in increasing concentrations.

Participants

Government of Canada

- Environment and Climate Change Canada

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC)

COMMUNITY INTERACTION PROGRAM (CIP)

Objectives

The CIP seeks to improve the St. Lawrence River ecosystem by supporting projects spearheaded by riverside communities and implemented by not-for-profit and non-governmental organizations. The projects are organized into four large categories (restoration/protection, study/action, awareness, study), and all of them are aimed at conserving biodiversity, ensuring sustainable use and improving water quality in the St. Lawrence.

Participants

The product of a partnership between Environment and Climate Change Canada and the Quebec Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques [department of sustainable development, environment and the fight against climate change], the CIP has received $3,828,084 in investments over the past five years from the two governments. This funding has helped in the development of 66 projects through 44 organizations between 2011 and 2016 for a total value of close to $8.5 million, including investments from its partners.

Number of new projects funded for the period 2011–2016 (by category)

Restoration/ protection	Study/action	Awareness	Study	Total
20	15	12	19	66

Examples of projects

Removal of the log jam from the Saint-Jean River
(restoration/protection)

The Saint-Jean River, in the Gaspé region, with its crystal-clear water and its naturally forested banks, is one of the best salmon-fishing rivers in Quebec. However, the presence of salmon in the river was threatened by a major obstacle. Every year, the salmon were prevented from swimming upstream to spawn because huge quantities of logs were blocking the mouth of the river.

n the bitterly cold winter of 2015, the Société de gestion des rivières de Gaspé undertook a large-scale project to clean up this waterway by removing the accumulation of wood in the south arm with heavy machinery. In all, it took more than 1,000 truckloads to haul away approximately 10,000 m3 of wood. Today, there is no danger of salmon getting caught in the log jam, but vigilance is still required. Every spring, the managers of the Saint-Jean River ensure that maintenance is performed on its delta.

before removal of the logs.
Photo: Société de gestion des rivières de Gaspé Inc..

Experimenal restoration of an eelgrass bed in Mitis Bay
(study/action)

Mitis Bay, in the Lower St. Lawrence region, has exceptional ecological characteristics and diverse natural habitats. For example, there is a bed of eelgrass (Zostera marina), an aquatic plant that plays an important role in the marine ecosystems of the St. Lawrence. Eelgrass beds are essential to aquatic and terrestrial fauna, offering them feeding, breeding and nursery habitat and shelter. Without the presence of these eelgrass beds, fine grains of sand are washed away and carried offshore, eroding coastlines.

The eelgrass in Mitis Bay grows slowly, and over the past decade the bed has shrunk considerably. The Sud-de-l'Estuaire ZIP Committee ran a study/action project to characterize the site and restore optimal sites around the bay. Through this project, a picture was produced of the ecological diversity and the disturbances (of both human and natural origin) in the area. In addition, more than 1,300 eelgrass plants were moved from one natural site to another using various transplanting techniques.

Eelgrass bed.
Photo: Étienne Bachand, Sud-de-l'Estuaire ZIP Committee

Colony of Japanese knotweed.
Photo: Valérie Aubin, Jacques-Cartier ZIP Committee

Preventing the spread of japanese knotweed in the Montreal metropolitan community (awareness)

Japanese knotweed *(Fallopia japonica)* is a veritable plague. According to the World Conservation Union, it is one of the 100 worst invasive species on the planet. Its rhizomes can extend as much as two metres deep and seven metres laterally, and the plant can colonize ditches, wetlands, shorelines, roadsides, and even urban areas. It forms dense clumps that choke out indigenous species, impoverishing the biological diversity of our ecosystems and cutting off access to waterways such as the St. Lawrence River.

In recent years, the plant has been spreading in the Montreal region, so the Jacques-Cartier ZIP Committee worked with several other organizations on a large-scale awareness project. The objective was to create a working committee to lead prevention, detection and rapid-response activities along the main routes by which Japanese knotweed was entering the Montreal Metropolitan Community. The project achieved several goals:

- Improve knowledge of this plant;
- Document its distribution in southern Quebec;
- Create awareness tools for decision makers and nursery operators;
- Establish measures for controlling and eradicating the plant in fragile environments such as wetlands.

Feasibility study on the installation of an eel ladder and assessment of the abundance, distribution and quality of habitat in the St. Charles River (study)

The Saint-Jacques dam
on the St. Charles River: a barrier to eels.
Photo: Amélie D'Astous,
Huron-Wendat Nation Council

For as long as anyone can remember, the American eel *(Anguilla rostrata)* has been fished in the St. Lawrence River and its tributaries. Over the past 30 years, American eel numbers have decreased upstream from the Gulf of St. Lawrence. In response to the species' drastic decline in abundance, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed the American eel as "threatened".

To shed light on the mystery of this little-known fish and uncover the possible causes of its decline, the Huron-Wendat Nation Council conducted a study of the eels' habitat in the St. Charles River, near Quebec City. It evaluated the species' abundance and the passability of dams, culverts and natural barriers, then attempted to find ways to restore the connectivity of the eels' habitat.

This project contributed to the recovery of the American eel population in the St. Lawrence River. It also made the members of the Huron-Wendat Nation stewards for the protection of the species, which was once a food source and an important cultural symbol for this First Nation.

STATE OF THE ST. LAWRENCE MONITORING PROGRAM

Objectives

The State of the St. Lawrence Monitoring Program is a decision support tool for tracking the state of and changes in the St. Lawrence. Its aims are as follows:

- Pool the data collected and knowledge acquired by participants and collaborators during their ongoing environmental monitoring activities.
- Report on the state and evolution of the St. Lawrence using the scientific information generated.
- Regularly disseminate information to decision makers and riverside communities about the state and evolution of the St. Lawrence using means that are tailored to their needs and that facilitate access to information.

The program is based on about 20 environmental indicators corresponding to the following components:

- Water
- Sediment
- Biological resources
- Uses
- Shorelines

Participants

Government of Canada

- Environment and Climate Change Canada
- Fisheries and Oceans Canada
- Parks Canada

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC)
- Department of Forests, Wildlife and Parks

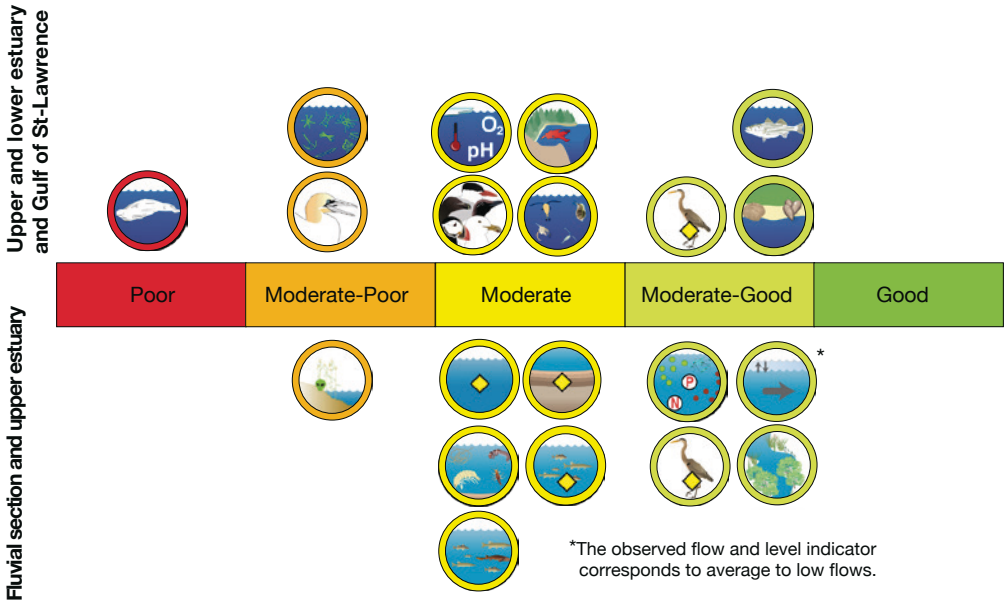
Collaborator

- Stratégies Saint-Laurent

Key Findings

Overview of the state of the St. Lawrence 2014

The third *Overview of the State of the St. Lawrence River*, published in 2015, provides decision makers and riverside communities with an assessment of the state and evolution of the St. Lawrence, while also addressing broad environmental issues and the future outlook.



For descriptions of the pictograms, see the St. Lawrence Action Plan website, in the section titled "A Thorough Monitoring of the State of the St. Lawrence River": http://planstlaurent.qc.ca/en/state_monitoring/monitoring_sheets.html.

In 2014, the St. Lawrence River was found to be in a fragile balance. The majority of the indicators remained "moderate." Following the reintroduction of striped bass, significant progress was observed in the natural reproduction, growth and distribution of this species in the river. However, the St. Lawrence as a whole remains vulnerable. The beluga whale and northern gannet populations have shown a significant decline.

From 2003 to 2014, 67% of the indicators used in the three previous overviews (2003, 2008 and 2014) were assessed as "moderate" or "moderate to good."

From 2008 to 2014, 43% of the common indicators remained stable. Of the remaining 57%, half deteriorated and half improved.

Rendez-vous Saint-Laurent

The Rendez-vous Saint-Laurent is one of the dissemination mechanisms for the State of the St. Lawrence Monitoring Program. It is an event held every three years that brings together experts and stakeholders from communities, non-governmental organizations, industry, universities, and the municipal, provincial and federal governments. Its objectives are as follows:

- Communicate the most recent results of the monitoring activities and the new elements of the State of the St. Lawrence Monitoring Program.
- Communicate new knowledge about the St. Lawrence generated by those results.
- Obtain feedback from users of the data and information.

The fourth edition of this event, whose theme was Rendez-vous Saint Laurent: Un flot de connaissances, was held in March 2013 in Montreal, with 115 participants. The proceedings of the 2013 meeting are available on the SLAP website.

Monitoring sheets

Monitoring sheets present and analyze the data gathered by monitoring the state of the St. Lawrence for each environmental indicator. During the St. Lawrence Action Plan's 2011–2016 programming cycle, 24 monitoring sheets were produced. They are available on the SLAP website.

The following are some of the monitoring sheets that have been published:

- Toxic Toxic Contamination of Freshwater Fish, 3rd ed., 2016 of Freshwater Fish, 3rd ed., 2016
- Marine Water Quality Monitoring in Shellfish Areas, 2015
- Water Quality of the Fluvial Sector, 3rd ed., 2015

- The Great Blue Heron: A Sentinel Species for the St. Lawrence River, 3rd ed., 2015
- St. Lawrence Estuary Beluga Whale, 3rd ed., 2015
- Water Quality in the Fluvial Section: Physicochemical and Bacteriological Parameters, 4th ed., 2015
- Water Quality of the Richelieu and Yamaska Rivers, 3rd ed., 2015
- Changes in Water Levels and Flows in the St. Lawrence River, 2nd ed., 2015
- Butyltins in Sediments of the St. Lawrence River, 2014
- Northern Gannet: A Sentinel Species for the Gulf, 3rd ed., 2014
- Seabirds: Sentinel Species for the Gulf, 3rd ed., 2014
- Freshwater Wetlands, 3rd ed., 2014
- Oceanographic Processes in the Estuary and Gulf, 3rd ed., 2014
- Benthic Macroinvertebrate Communities, 2nd ed., 2013
- Water Quality in the Fluvial Section: Physicochemical and Bacteriological Parameters, 3rd ed., 2013
- Polybrominated Biphenyl Ethers in the Suspended Matter and Sediments of the St. Lawrence River, 2013

Photo: Caroline Savage,
Environment and Climate Change Canada

Monitoring sheets will continue to be published as part of the 2016–2021 programming period. Upcoming titles include the following:

- St. Lawrence Freshwater Fish Communities, 3rd ed.
- Toxic Contamination in Sediments: The Port of Quebec
- Toxic Contamination in Sediments: The Fluvial Section
- Benthic Macroinvertebrate Communities, 3rd ed.
- Reintroduction of the Striped Bass into the St. Lawrence, 3rd ed.
- Land Cover along the Great Lakes and the St. Lawrence River, 2nd ed.
- Invasive Species

In addition to the monitoring sheets, the results of the State of the St. Lawrence Monitoring Program have provided material for numerous presentations and scientific posters at conferences, forums and other public activities. Scientific and technical reports have also been published using these results.

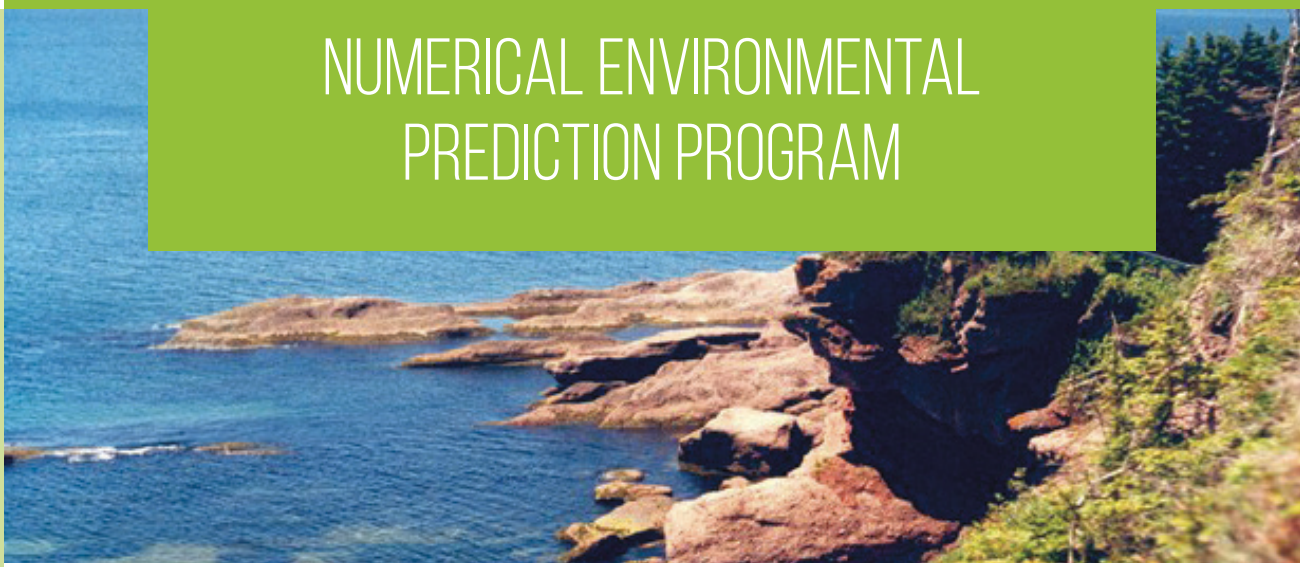
Photo: Martin Jean,
Environment and Climate Change Canada

Photo: Magella Pelletier, Environment and Climate Change Canada

Lastly, to ensure continuous improvement, a few modifications were made to the State of the St. Lawrence Monitoring Program during the 2011–2016 programming cycle:

- Addition of new water-quality monitoring stations in the St. Lawrence River at Lavaltrie and Bécancour, and at the mouths of the Richelieu, Yamaska, Saint François, Nicolet and Saint Maurice rivers.
- Expansion of sediment characterization work to the Montreal–Sorel section and the Quebec City area.
- Addition of monitoring of invasive animal species found in saltwater.
- Expanded monitoring of benthic communities from Lake Saint François to Lake Saint Pierre.
- Improved dissemination tools: pictograms were created for each indicator, the content of the sheets was standardized, and results were presented in the form of conceptual diagrams.

NUMERICAL ENVIRONMENTAL PREDICTION PROGRAM



Objectives

The Numerical Environmental Prediction Program for the St. Lawrence develops numerical models to simulate the changes in physical, biological or chemical processes in the St. Lawrence and its watershed, in order to predict the state of their terrestrial and aquatic environments. Its objectives are as follows:

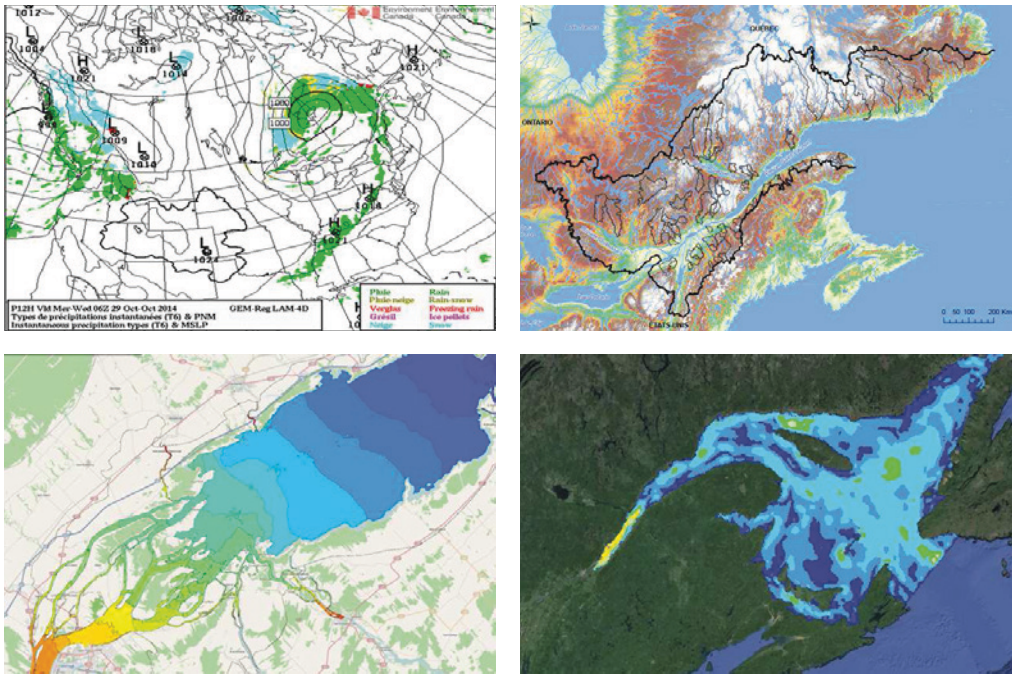
- Improve predictions and gain a better understanding of the St. Lawrence ecosystem and flow regime;
- Provide a decision support and planning tool for integrated management of the St. Lawrence.

Many activities are carried out as part of the Numerical Environmental Prediction Program, including the following:

- Representing and predicting the dynamics and state of the ecosystem to facilitate adaptation to future conditions and analyze the impact of climate change.
- Supporting public security responses to environmental emergencies: for example, during an accidental spill that could contaminate the water, during high-flow and low-flow periods, or during search and rescue activities.
- Facilitating environmental assessment by analyzing the impacts of potential engineering works, particularly on the erosion and sedimentation processes.
- Supporting socio-economic activities: for example, by enabling predictions of the clearance and channel depth that would be required for commercial shipping according to different climate change scenarios.

The Numerical Environmental Prediction Program is able to integrate the following elements into its models:

- water – currents, temperature, waves, levels, flows, quality and salinity;
- ice and snow – cover, thickness, temperature and density;
- health of the ecosystem;
- precipitation;
- soil and vegetation conditions – temperature and moisture content.



The upper left image shows a low-pressure weather system affecting the Great Lakes–St. Lawrence basin. The colours represent different types of simulated precipitation, while the isolines represent the mean sea level pressure field. The upper right image shows the coverage provided by the hydrological modelling. The lower left image shows the isoareas for the water levels simulated by the hydrodynamic model in the Lake Saint-Pierre region. The lower right image shows a surface temperature field simulated by the oceanographic model.

Participants

Government of Canada

- Environment and Climate Change Canada
- Fisheries and Oceans Canada

Government of Quebec

- Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC)

Examples of projects

The establishment of an environmental prediction system is a long-term undertaking that requires a long-term commitment. The program extends over a 15 year time horizon (2011–2026). Its first phase (2011–2016) began with pilot studies of the watersheds of tributaries and of selected sections of the St. Lawrence. The next step will be to cover the entire St. Lawrence watershed.

The following three projects were undertaken during the 2011–2016 phase of SLAP.

1) Water balance of the fluvial section of the watershed

Hydrological forecasting makes it possible to predict the water level and flow rate a few days in advance. Forecasts must include snow measurements in the data: they are difficult to predict for a specific location, but they have a major influence on streamflows. Environment and Climate Change Canada and the Quebec Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC) must meet the challenge of harmonizing their hydrological forecasting models and the information technology tools they use to exchange meteorological and hydrological data. By developing common forecasting tools, the two departments will be able to improve real-time decision making for the St. Lawrence and its tributaries, better predict their behaviour and respond quickly.

Photos: Amandine Pierre, Université Laval

Monitoring solid precipitation and snow cover at the experimental weather station in Montmorency Forest. At left, a 103-cm cross-section shows the main characteristics of the snow cover, including the height, density and temperature of each snow layer. Those measurements are used to evaluate the snow cover monitoring algorithms developed by Environment and Climate Change Canada for the purposes of weather forecasting and by Quebec's Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC) for hydrological forecasting. At right is the Double Fence Intercomparison Reference (DFIR), the only reference device of its kind in Quebec, which enables unbiased measurement of solid precipitation. There are only a few of these in Canada. Montmorency Forest is now one of the best-equipped sites for measuring solid precipitation with reference instruments, and it is the only place where there is both a Canadian climate reference station and a Quebec government climate monitoring station.

2) Streamflows in the Montreal archipelago

Two-dimensional hydrodynamic models (i.e., numerical models of the streamflow processes and the variables involved) exist for a number of sections of the St. Lawrence River, but none of them encompass the entire Montreal archipelago. Therefore, models of sections of the St. Lawrence in the Montreal archipelago will be revised, developed and harmonized to create a common model representing current and predicted conditions in that part of the St. Lawrence

3) Integration of tools for the Richelieu River watershed

The flooding of the Richelieu in 2011 was among the all-time worst natural disasters in Quebec. Forecasting of water flows and levels is an essential tool for predicting this type of threat and preparing for it. The project combines observed data, forecasts, existing hydrological models (of flows) and hydraulic models (of depth, flow rate and area flooded) to create as complete a picture as possible of the watershed. It will enable better prediction of significant changes and thus better preparation for them, while exploring processes for collaboration between the federal and provincial governments within a smaller geographical area than the St. Lawrence.

IMPLEMENTING INTEGRATED MANAGEMENT OF THE ST. LAWRENCE

Objectives

Faced with increasingly complex and serious issues affecting the St. Lawrence, the governments of Canada and Quebec worked together to set up an integrated management approach based on mechanisms for collaboration among all decision makers and users of the St. Lawrence. The process took the form of an annual forum and the successive implementation of six regional round tables.

Small-group discussion during the Forum Saint-Laurent 2015.
Photo: Andrée-Anne Labrecque, MDDELCC

The Forum Saint-Laurent: A venue for information sharing and collaboration

The Forum Saint-Laurent promotes concerted action by bringing together the various stakeholders involved in managing the St. Lawrence's resources and uses. Its purpose is to develop shared orientations for addressing issues affecting the St. Lawrence and to engage stakeholders in providing coherent management of the issues addressed. There are three main objectives:

- Engage in discussion.
- Combine knowledge, expertise, tools and resources.
- Reflect on ways to take action together.

From 2011 to 2016, the Forum Saint-Laurent focused on various themes:

- Collaboration
- Areas of ecological interest
- Access to the St. Lawrence
- Adapting to climate change
- Improving water quality

Participants at these meetings identified 10 problems that were particularly important to them and suggested potential solutions that were collaborative and creative. Close to 100 stakeholders participated, representing a variety of fields and interests (not-for-profit environmental, community and recreational organizations; private enterprises; industry; teaching and research; First Nations; municipal governments; and federal and provincial governments).

A number of presentations are given during the Forum Saint-Laurent.
Photo: Andrée-Anne Labrecque, MDDELCC

Regional Round Tables: An effective co-operation and coordination mechanism

The mission of the permanent and autonomous Regional Round Tables (RRTs) is to allow the various regional stakeholders concerned about the management of the St. Lawrence's resources and the uses of their respective sections of the St. Lawrence to plan and harmonize their actions so as to contribute to the integrated management of the St. Lawrence. Their efforts are channelled into developing and implementing a zone-level Regional Integrated Management Plan (RIMP) that represents the regional stakeholders' priorities and their desire to take action.

Investments of $1.7 million were committed for the gradual implementation of the RRTs. During the 2011–2016 period, six St. Lawrence integrated management areas were established (Haut-Saint-Laurent and Greater Montreal, Lake Saint-Pierre, fluvial estuary, Quebec City, southern part of upper estuary, and Magdalen Islands), and six organizations were designated to coordinate them (Jacques-Cartier ZIP Committee, Lac Saint-Pierre ZIP Committee, Les Deux Rives ZIP Committee, Quebec Metropolitan Community, Sud-de-l'Estuaire ZIP Committee, Îles-de-la-Madeleine ZIP Committee).

The RRTs' activities were enthusiastically received and led to collaboration with more than 180 organizations.

ZIP (AREA OF PRIME CONCERN) PROGRAM

Objectives

The ZIP Program supports collaborative activities implemented at the local level by the ZIP committees and Stratégies Saint-Laurent. These groups received approximately $5.5 million in contributions from 2011 to 2016, which enabled them to raise local issues concerning the St. Lawrence and to get local stakeholders involved in working together to seek solutions. Each of the collaborative activities addresses one of the St. Lawrence Action Plan's environmental priorities.

Partners

A number of partners participate in the activities of the ZIP committees and Stratégies Saint-Laurent. Their contribution is integral to achieving the desired results. They may be local environmental protection organizations, representatives of business or industry, or government partners (municipalities, government departments).

Examples of activities

Information dissemination by Stratégies Saint-Laurent and the ZIP committees

All the ZIP committees and Stratégies Saint-Laurent disseminate information on social media (Facebook, Twitter), online (each has its own website), and in local and regional newspapers, videos or corporate newsletters *(L'Écho des deux-rives, Le Héraut, Le Bouscueil, Du Fjord au fleuve, L'Écho du Golfe,*

etc.). These communications help them reach the local or regional population, stay connected with their partners and work together to seek solutions to the issues identified in the St. Lawrence Action Plan.

Local collaboration on the St. Lawrence Action Plan issues

Local collaborative activities on the issues addressed by the St. Lawrence Action Plan are by far the most important for the ZIP committees, given their expertise and knowledge of the issues and stakeholders in their respective communities. Every year, they participate in a dozen committees focused on conserving biodiversity, ensuring sustainable use, or improving water quality.

The following are a few examples of local activities undertaken:

- Rehabilitation of spawning areas;
- Enhancement of trails along shorelines;
- Raising awareness of risks to coastlines associated with climate change;
- Wastewater management;
- Upgrading and enhancement of sites and their uses;
- Decision making concerning the spread of invasive exotic species or the accumulation of sediment in specific habitats;
- Sound management of agricultural practices on the Lake Saint-Pierre flood plain;
- Participation in public consultations on industrial, mining and petroleum development projects;
- Establishment and updating of municipal land use and development plans, taking into consideration specific environmental issues.

Outreach and training activities on St. Lawrence Action Plan issues

Stratégies Saint-Laurent participates in visibility and awareness activities that reach thousands of people each year, including St. Lawrence Week and the Montreal–Quebec Desgagnés Kayak Challenge. It also organizes presentations and exhibitions during various events.

In addition, every year, Stratégies Saint-Laurent sets up commissions on freshwater, saltwater and brackish water to rally the entire ZIP network around themes and training (speakers, site visits). This work is a way of harmonizing the activities of the different ZIP committees, finding common solutions to the issues that have been identified and strengthening integration of all the committees' experience and know-how.

The ZIP committees also provide training to stakeholders in communities who are concerned about specific local or regional issues addressed by the St. Lawrence Action Plan. For example, this could include training for municipalities or regional county municipalities (RCMs) on the impacts of coastal erosion on shores and communities; integrating specific knowledge into tourist activities (specific wildlife areas); or the return of swimming in the St. Lawrence River.

CONCLUSION

By renewing the Canada–Quebec Agreement on the St. Lawrence in 2011, the governments of Canada and Quebec reaffirmed their mutual commitment to collaborate actively on the protection and enhancement of the St. Lawrence. The 15 year duration of the agreement is a first in the history of the St. Lawrence Action Plan. It will enable the two governments to pool their resources and expertise over the long term to conserve biodiversity, ensure sustainable use and improve water quality.

A number of joint actions were taken during the 2011–2016 phase of the St. Lawrence Action Plan. Others will follow in the 2016–2021 phase. The past five years of collaboration have also brought emerging issues to light. In the next few years, new projects—for example, involving transportation of hydrocarbons on the St. Lawrence—will be undertaken to deal with them.

The 2016–2021 phase will also be an opportunity for the two governments to continue their efforts in monitoring the state of the St. Lawrence and to learn more about the river's complex hydrological system. The two governments will also continue working to implement integrated management of the St. Lawrence, and that work will include establishing six new regional round tables.

We have come a long way since the first St. Lawrence Action Plan in 1988. The state of the St. Lawrence has improved, even though data gathered in recent years reveal that the river remains in a fragile balance. Overall, the same pressures on the ecosystem still exist, there are more and more stakeholders with varying interests, and the issues are continually becoming more complex. The challenges are numerous, and the participation of all stakeholders will be essential.

ANNEX

Government spending, 2011–2016

	IMSL	Biodiversity	Sustain-able use	Water quality	CIP	State of the St. Lawrence monitoring	Environmental prediction	Communications and coordination	TOTAL
Government of Canada									
Environment and Climate Change Canada	6,027.8	1,643.7	588.4	1,994.5	2,838.0	10,095.3	1,427.0	3,443.2	**27,635.9**
Fisheries and Oceans Canada	64.8	906.7	241.9	443.4		11,574.8	142.0		**13,373,6**
Parks Canada Agency		673.9	7.7	1.0		27.0			**709.6**
Canadian Space Agency			662.1						**662.1**
Agriculture and Agri-Food Canada		35.0		20.7					**55.7**
Transport Canada			311.2						**311.2**
Public Services and Procurement Canada			130.2						**130.2**
Health Canada				26.1					**26.1**
Public Health Agency of Canada				102.9					**102.9**
Canadian Environmental Assessment Agency			12.0						**12.0**
Subtotal, Canada	**6,092.6**	**3,259.3**	**1,953.5**	**2,588.6**	**2,838.0**	**21,697.1**	**1,569.0**	**3,443.2**	**43,346.1**

	IMSL	Biodiversity	Sustain-able use	Water quality	CIP	State of the St. Lawrence monitoring	Environmental prediction	Communications and coordination	TOTAL
Government of Quebec									
Department of Sustainable Development, Environment and the Fight Against Climate Change (MDDELCC)	1 996,9	996.2	352.5	1,331.5	990.0	3,323.6	617.1	848.4	**10,408.8**
Department of Forests, Wildlife and Parks (MFFP)		1,019.2	369.5	703.2		3,459.8			**5,551.7**
Department of Transportation (MTQ			182.4						**182.4**
Department of Public Security (MSP)			239.0	0.8					**239.8**
Department of Energy and Natural Resources (MERN)			0.9						**0.9**
Department of Agriculture, Fisheries and Food (MAPAQ)		169.5	21.9	21.9					**213.3**
Department of Municipal Affairs and Land du Occupancy (MAMOT)			0.0	0.0					**0.0**
Department of Health and Social Services (MSSS)				1.6					**1.6**
Department of Tourism (MTO)			7.7						**7.7**
Subtotal, Québec	**1,996.9**	**2,184.9**	**1,173.9**	**2,059.0**	**990.0**	**6,783.4**	**617.1**	**848.4**	**16,653.6**
in thousands of dollars (000s)	**8,089.5**	**5,444.2**	**3,127.4**	**4,647.6**	**3,828.0**	**28,480.5**	**2,186.1**	**4,291.6**	**60,094.8**

Canada

Québec