

# Monitoring the State of the ST. LAWRENCE RIVER

BIOLOGICAL  
RESOURCES

WATER

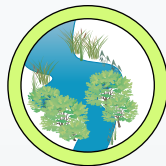
SEDIMENTS

SHORELINES

USES

## Freshwater Wetlands

Third Edition



### Background

Wetlands—ecosystems that occur where water meets land—are found along the entire length of the St. Lawrence River. They are unique, diversified areas, long recognized for the plant and animal habitat they provide. More recently, they have been recognized as providing other major ecosystem functions and services, including flood storage, erosion protection, and improvement of water and aquatic ecosystem quality.

Over the years, the wetlands of the St. Lawrence River watershed, as in many other parts of the world, have sustained substantial losses. Today's wetlands are a pale shadow of those of the past. Although the previous edition of this fact sheet (Jean *et al.*, 2005) showed a slowing of the rate of wetland loss, vegetation changes appear to indicate degradation, with implications beyond the mere size of wetlands.

To date, the primary indicator of wetland status has focused on wetland size alone. However, significant temporary changes can occur in estimates of wetland area, resulting primarily from water level fluctuations in the St. Lawrence River.



Photo: Martin Jean © Environment Canada

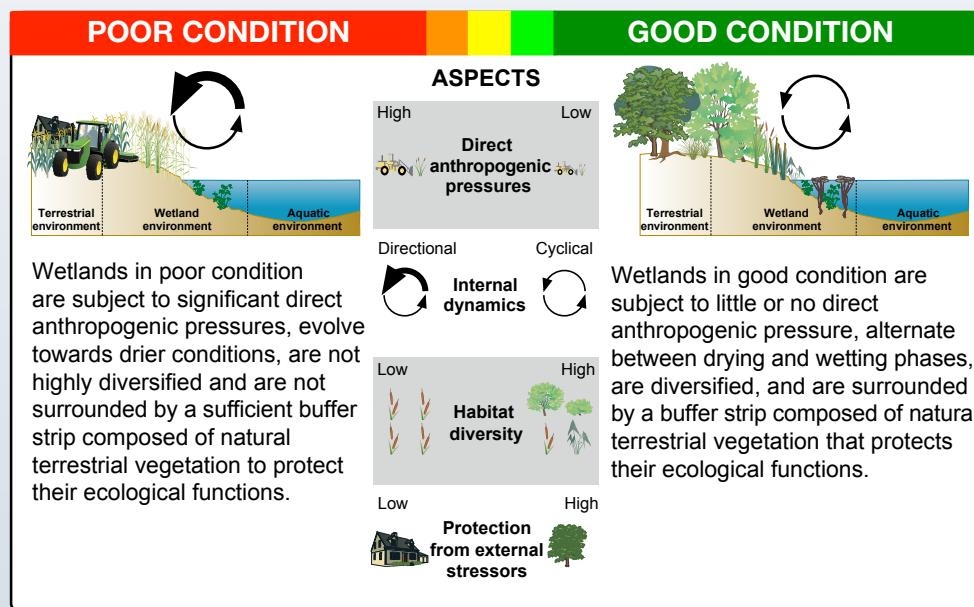
The indicator has been modified to provide a more comprehensive picture of the presence and status of wetlands. It consists of four aspects:

- the net balance resulting from direct anthropogenic pressure on size;
- internal wetland dynamics;
- wetland habitat diversity; and
- the protection of wetlands from external stressors.

See Figure 1 and the Key measures section for the description of the variables and their evaluation criteria.

The most recent variables are based on the analysis of high-resolution satellite images acquired in 2010 in partnership with Dr. Claude Lavoie of Université Laval's École supérieure d'aménagement du territoire et de développement régional. The images can be used in conjunction with earlier ones acquired in 1990 and 2002 as part of the State of the St. Lawrence Monitoring Program, and maps by Groupe Dryade (1980) to assess wetland status and trends.

This analysis focuses on Boucherville Islands and Lake Saint-Pierre, two sectors that have sustained net wetland losses since 1990.



**Figure 1** Conceptual diagram of the assessment of the health of wetland areas

## Overview of the situation

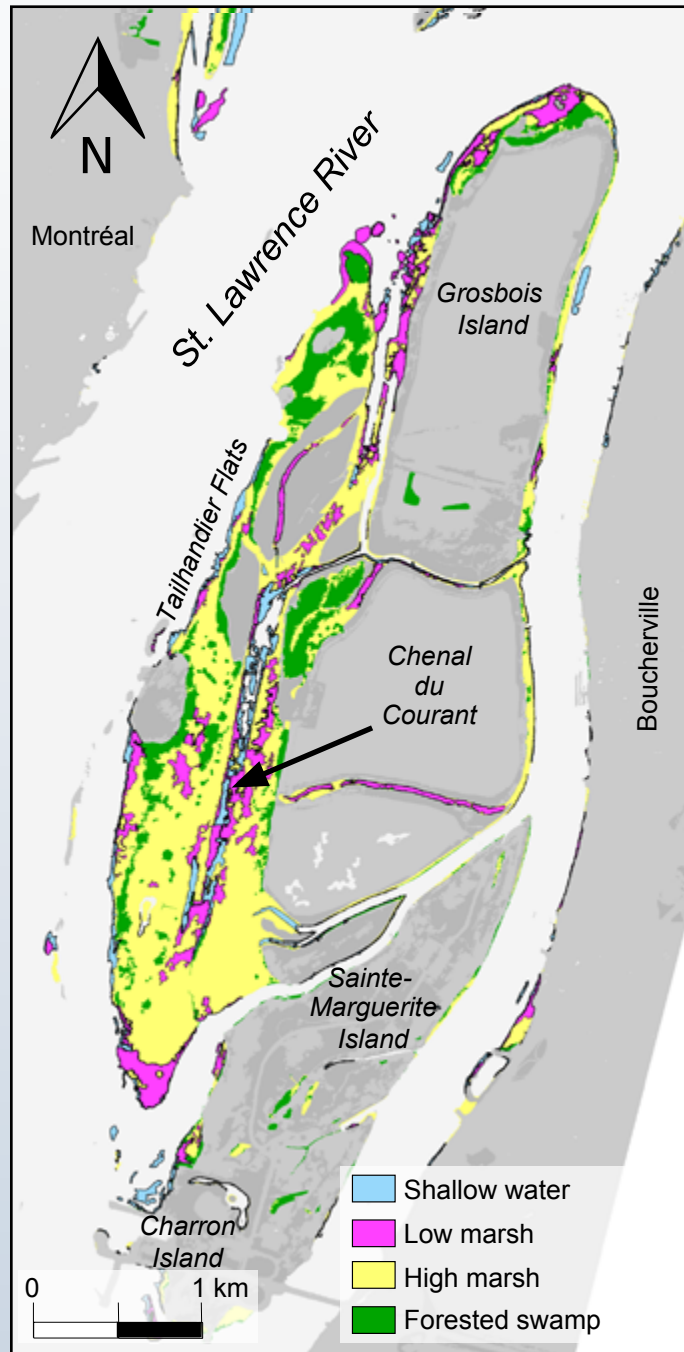
The overall status of the wetlands in the two sectors is fair to good, and the overall temporal trend is stable.

### Boucherville Islands sector

The status of the wetlands in the Boucherville Islands sector is fair to good, and the temporal trend is stable.

**Direct anthropogenic pressures** on the area between 2002 and 2010 are described as good, with a zero net gain or loss of wetlands, i.e., no lasting net loss or gain of wetlands caused by direct human activity has been observed. The area of wetlands was estimated at 541 ha in 2002 and 405 ha in 2010 (Figure 2). The 136-ha loss is the result of a decline in water levels between the two dates, which caused a significant decline in the area of shallow waters (following the terminology proposed by the National

Wetlands Working Group, 1997). This decline is evident around the Tailhandier Flats and at the northern tip of Grosbois Island and is not considered permanent.

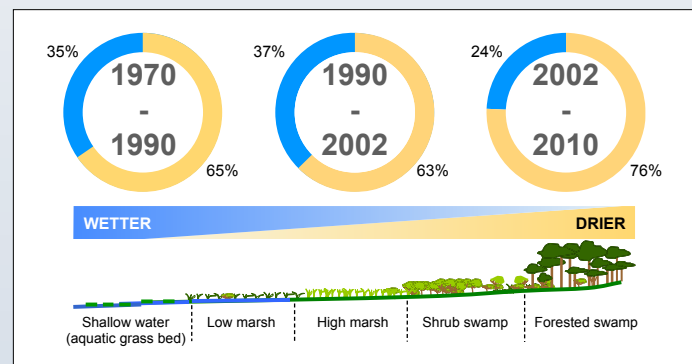


**Figure 2** Area of wetlands in 2010 in the Boucherville Islands sector

The temporal trend in direct anthropogenic pressures in the Boucherville Islands sector since 1990 is described as stable. Although there has been no lasting net loss or gain between 2002 and 2010, the 55 ha of wetlands lost between 1990 and 2002 have not been restored.

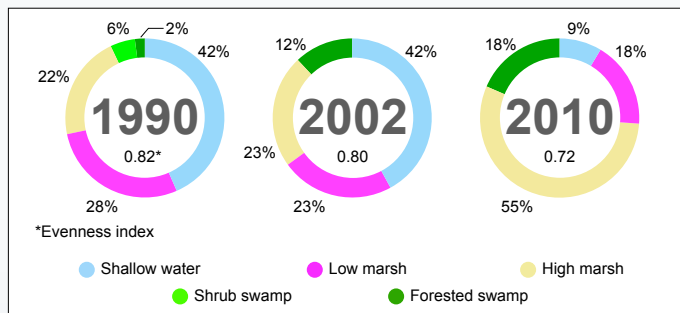
**The internal dynamics of the wetlands** in the Boucherville Islands sector between 2002 and 2010 are considered moderate. The area of wetlands that has dried up is three times larger than the area that has become more wet (Figure 3). The transition from low marsh to high marsh is the most important internal change in wetlands (64 ha), and has been observed in the Boucherville Islands, around the Tailhandier Flats and more specifically along Chenal du Courant.

The internal dynamics of the wetlands shows a deteriorating trend. Internal changes since the late 1970s (Figure 3) show three successive periods of drying and the absence of periods of wetting.



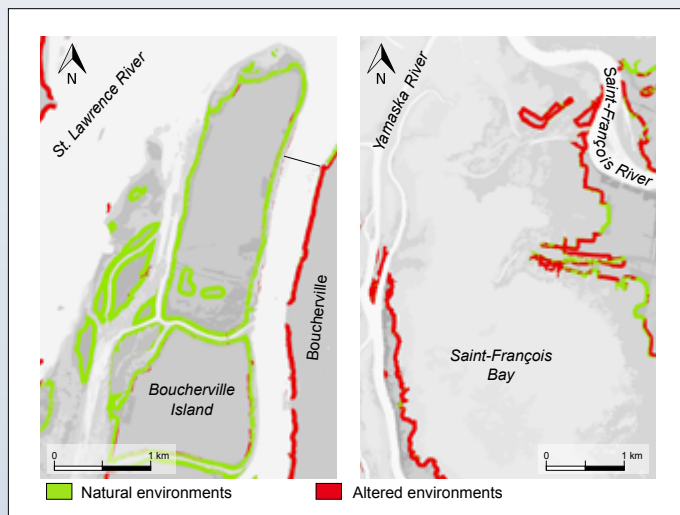
**Figure 3** Internal wetland dynamics in the Boucherville Islands sector

**The diversity of wetland habitats** in the Boucherville Islands sector in 2010 is classified as moderate. High marshes account for over half of the total area of wetlands in the sector, while no shrub swamps were detected (Figure 4).



**Figure 4** Diversity of wetland habitats in the Boucherville Islands sector

The temporal change in the diversity of wetland habitats is stable in this sector of the St. Lawrence River, as all wetland status values obtained since 1990 are classified as intermediate (Figure 4). The temporal trend shows a slight increase in the disparity between wetland classes, with a gradual decline in shallow water and low marshes in favour of open water or high marshes.

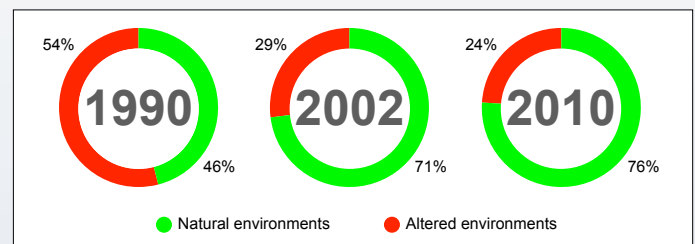


**Figure 5** Examples of buffer zones protecting wetlands from external stressors

**The protection of wetlands from external stressors** in 2010 in the Boucherville Islands sector is considered good. In 2010, a buffer zone was present around 76% of the wetland perimeters in this section of the St. Lawrence River (see example of part of the sector in Figure 5). At 47%, herbaceous plants occupy the largest

proportion of the buffer zone. In contrast, 19% of the wetlands perimeter is adjacent to urban areas, especially along the shoreline of the Island of Montréal and the City of Boucherville, as well as certain sectors of the Charron and Sainte-Marguerite islands.

The temporal trend in the protection of the wetlands against external stressors is improving in the Boucherville Island sector. The natural buffer zone has increased since 1990 (Figure 6).



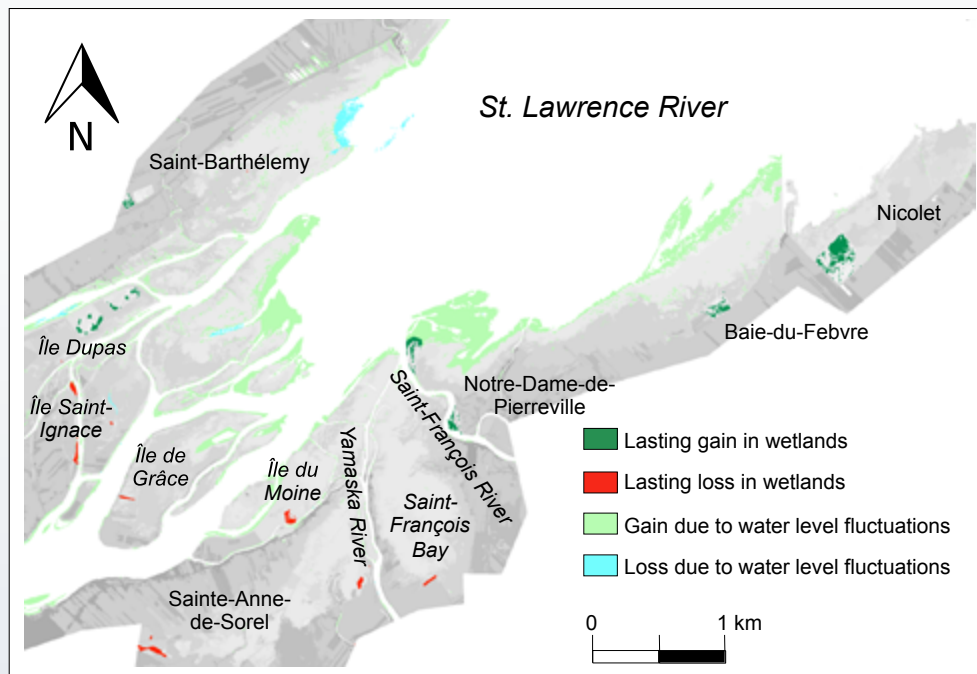
**Figure 6** Protection of wetlands from external stressors in the Boucherville Islands sector

### Lake Saint-Pierre sector

The status of the wetlands in the Lake Saint-Pierre sector is fair to good, and the temporal trend is stable.

**Direct anthropogenic pressure** on Lake Saint-Pierre between 2002 and 2010 was low, such that the status of the wetlands is classified as good. The net balance shows an increase of 64 ha of wetlands between 2002 and 2010. This gain is associated partly with the formation of 101 ha of wetlands in wildlife developments on Île Dupas and at Saint-Barthélemy, Baie-du-Febvre and Nicolet (Figure 7). In addition, an island formed in the Saint-François River, off Notre-Dame-de-Pierreville, and a delta expanded towards the confluence of the Saint-François and Yamaska rivers. All of these gains were made at the expense of open water and consist primarily of low marshes (71 ha) and shallow water (18 ha). In contrast, 37 ha of wetlands were lost to agriculture, distributed in 7 pockets on the south shore of the lake, near Sainte-Anne-de-Sorel, on the south shore of Île du Moine, south of Saint-François Bay, on Île de Grâce and on Île Saint-Ignace. These losses are largely associated with the use of high marshes for agricultural purposes (28 ha).



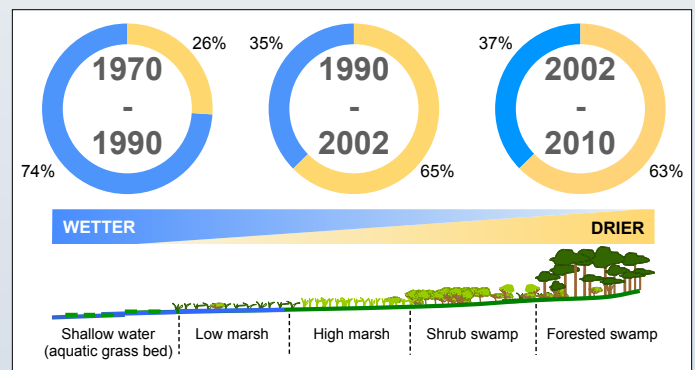


**Figure 7** Wetland gains and losses in Lake Saint-Pierre between 2002 and 2010

Since 1990, the temporal trend in direct anthropogenic pressure in this sector has been stable. The creation and development of wildlife habitat around Lake Saint-Pierre contribute to reducing anthropogenic stresses. However, it remains that the net gain observed does not compensate for the loss of 789 ha recorded between 1990 and 2002.

**The internal dynamics of the wetlands** of Lake Saint-Pierre between 2002 and 2010 are classified as moderate. A slight drying of wetlands was observed during that period (Figure 8). The area of wetlands that became drier was less than twice the area that became wetter. As in the case of the Boucherville Islands sector, the transition from low marshes to high marshes is the most significant change observed. In this case, a larger area, i.e., an estimated 1000 ha, was affected along the shores and in the main bays.

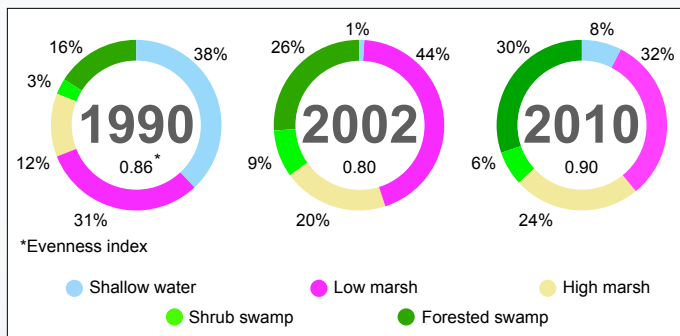
The temporal trend in the internal dynamics of the wetlands is stable, due to alternating low levels of drying and wetting. Since the late 1970s, there has been a moderate period of wetlands wetting, followed by two relatively good periods of drying (Figure 8).



**Figure 8** Internal wetland dynamics in Lake Saint-Pierre

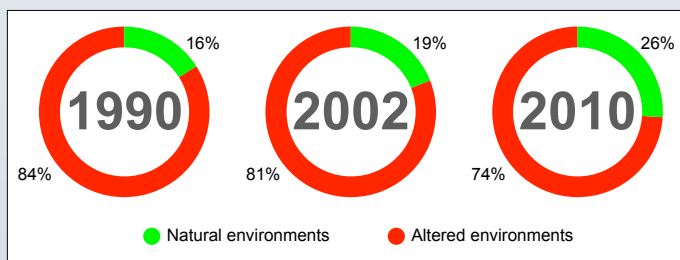
**The diversity of the wetland habitats** in Lake Saint-Pierre in 2010 is considered good (Figure 9). The five wetlands classes were well represented, with low marshes, high marshes and forested swamps present in almost equal proportions.

The temporal trend in the diversity of wetland habitats of Lake Saint-Pierre is considered stable (Figure 9). The relative distribution of the wetland classes in 2010 was slightly more uniform than estimated in 1990. That change can be explained by a slight decrease in low marshes coinciding with an increase in shallow water, high marshes and forested swamps.



**Figure 9 Diversity of wetland habitats in Lake Saint-Pierre**

**The protection of the wetlands at Lake Saint-Pierre from external stressors** in 2010 is considered poor. Only 26% of the wetlands present were surrounded by a buffer zone, which consisted almost exclusively of terrestrial forests that were concentrated primarily in the upper periphery of Lavallière and Saint-François bays, and near the mouth of the Nicolet River. As shown in the example of Figure 5, this is the result of the widespread presence of agricultural areas in the immediate proximity of the wetlands, and is in sharp contrast with what is observed in the Boucherville Islands sector.



**Figure 10 Protection of wetlands from external stressors in Lake Saint-Pierre**

The temporal trend in the protection of wetlands from external stressors at Lake Saint-Pierre is stable. Although the trend increased since 1990 (Figure 10), it did not reach the threshold value of 50%, which represents a significant change in status.

## Outlook

Wetlands are complex ecosystems, studied by many stakeholders within their respective areas of interest. One of the best ways to take account of these diverse interests is to assess complementary aspects of the status of the wetlands. It is desirable to maintain and expand the state of knowledge in order to provide an accurate and useful picture for interested stakeholders.

Despite the advantages of using indices to assess the status of the wetlands, such an approach has its limitations. First, the choice of aspects to be monitored is critical to accurately identifying the environmental issues at play. Second, it is also important to identify indices for the aspects selected that clearly reflect them. Last, evaluation criteria corresponding to each of these indices must be carefully selected in order to accurately determine wetland status and changes. Discussions with the various stakeholders are continuing with the aim of improving these choices on the basis of common environmental objectives.

To properly represent the complexity of the wetlands of the St. Lawrence River, it would be advisable to cover all ecosystems in the freshwater portion, from Cornwall to Québec.

The adoption of a sampling frequency more suited to the calculation of the selected indices would make it possible to better distinguish long-term trends with respect to variations in the short term and thus to provide a more accurate picture of the status of the wetlands of the St. Lawrence River. This is particularly important in the context of climate change, where the increased severity and frequency of extreme weather events will have impacts on these highly valuable riparian ecosystems.

## Key measures

The wetlands of the St. Lawrence River are evaluated on the basis of four aspects, representing four facets of these ecosystems.

### Direct anthropogenic pressure

Direct anthropogenic pressure on a wetland is estimated on the basis of the net balance of losses and gains in size. This calculation takes into account losses directly attributable to human activity (e.g., urban and agricultural expansion), and of the lasting gains resulting from the creation of wildlife habitats or the formation of wetland areas not attributable to annual water level fluctuations. The objective has been to achieve no net loss due to anthropogenic sources since 1990.

The temporal trend of this aspect can be defined on the basis of three classes:

- cumulative balance greater than 0 and greater than the balance for the 1990–2002 period: trend is improving;
- cumulative balance greater than 0 and less than the balance for the 1990–2002 period, or cumulative balance less than 0 and greater than the balance for the 1990–2002 period: trend is stable; and
- cumulative balance less than 0 and less than the balance for the 1990–2002 period: trend is deteriorating.

### Internal wetland dynamics

The estimation of internal wetland dynamics is based on the ratio between the total area that becomes drier and the total area that becomes wetter. The calculation uses the area of low marshes, high marshes, shrub swamps and forested swamps, excluding changes in open water and shallow water. A ratio greater than 1 indicates that the wetlands are drying out (e.g., low marshes becoming high marshes). A ratio of less than 1 indicates wetter conditions (e.g., transformation of swamps to marshes).

The desired situation is characterized by fluctuations leading to successive drier and wetter phases in the wetlands.

The current status of the wetlands is based, however, on the negative nature of the changes in the short term. This is expressed on the basis of three classes:

- a ratio between 0.5 and 2: good status;
- a ratio between 0.25 and 0.5 or between 2 and 4: average status; and
- a ratio of less than 0.25 or greater than 4: poor status.

The assessment of the temporal trend in internal dynamics is based on the positive aspect of longer-term fluctuations in the types of riparian wetlands. Taking a hydrologic cycle of approximately 30 years, it is proposed that at least 1 drying peak and 1 flooding peak should ideally be present. The temporal trend in internal dynamics is expressed by the following 3 classes:

- Three status values of fair or poor, with two wetter periods and one drier period, or two drier periods and one wetter period: the trend is good.
- One or two status values of fair or poor, with one wetter period and one drier period: the trend is fair.
- Three status values of good, regardless of whether the conditions are wetter or drier, or three status values of good, fair or poor, with all periods being either wetter or drier: the trend is poor.

### Diversity of wetland habitats

The diversity of wetland habitats is estimated by calculating the relative proportion of wetland classes. Five classes are used for the St. Lawrence River: shallow water, low marsh, high marsh, shrub swamp and forested swamp. Peatlands are not taken into account.

The objective is to maximize the diversity of habitats in a given sector through equal representation of the five wetland classes. An evenness index is used to assess the diversity of habitats.

The current status of the wetlands is characterized by the following classes:

- The evenness index is over 0.85: good status;
- The evenness index is between 0.56 and 0.85: average status; and
- The evenness index is below 0.56: poor status.

The assessment of the temporal trend in the diversity of wetland habitat is expressed as follows:

- The trend shows an improvement if the status class in 2010 is superior to the one in 1990.
- The trend is stable if both 2010 and 1990 status classes are the same.
- The trend shows a decline if the status class in 2010 is inferior to the one in 1990.

### Protection of wetlands from external stressors

The protection of wetlands from external stressors is assessed on the basis of the presence of a buffer zone of at least 50 m of natural terrestrial vegetation on the perimeter of the wetlands.

The objective is to maximize the buffer zone in order to maintain the potential ecological functions and services provided by wetlands.

The current status of the wetlands is determined according to the following classes:

- The status is considered good if the buffer zone exists on more than 75% of the wetland perimeter.
- The status is considered fair if the buffer zone exists on 50% to 75% of the wetland perimeter.
- The status is considered poor if the buffer zone exists on less than 50% of the wetland perimeter.

The assessment of the temporal trend is based on the following classes:

- The trend is improving if the buffer zone increases sufficiently to move to a higher status class.
- The trend is stable if the assessment of the buffer zone remains in the same status class, regardless of whether it increases or decreases.
- The trend is declining if the buffer zone declines to the point that it moves to a lower status class.



Photo: Martin Jean © Environment Canada



**For more information:**

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**State of the St. Lawrence  
Monitoring Program**

Five government partners—Environment Canada, Fisheries and Oceans Canada, Parks Canada, Quebec's Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques and the Ministère des Forêts, de la Faune et des Parcs—in collaboration with Stratégies Saint-Laurent, a non-governmental organization that works actively with riverside communities, are pooling their expertise and efforts to provide Canadians with information on the state of the St. Lawrence and its long-term changes.

To this end, environmental indicators have been developed on the basis of data collected as part of each organization's ongoing environmental monitoring activities over the years. These activities cover the main components of the environment, namely water, sediments, biological resources, uses and shorelines.

For more information on the State of the St. Lawrence Monitoring Program, please visit our website at **[www.planstlaurent.qc.ca](http://www.planstlaurent.qc.ca)**.

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