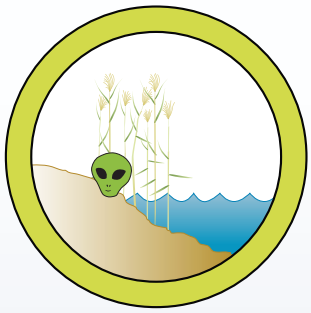
Monitoring the State of the
ST. LAWRENCE RIVER

WATER | SEDIMENTS | SHORELINES | BIOLOGICAL RESSOURCES | USES



2008-2014

Invasive alien plant species of the St. Lawrence wetlands

Current status: Intermediate*
Trend: Stable*

* These observations vary by species and sector.

Highlights

This fact sheet provides an overview of the evolving status of invasive alien plant species (IAPS) in the St. Lawrence wetlands from 2008 to 2014. The present status of the St. Lawrence regarding IAPS invasion is considered **intermediate**. The overall IAPS trend, assessed across three-year intervals between data inventories, is considered **stable**. By species and sectors however there are variations.

Problem

An invasive alien species (IAS) is a plant, animal or microorganism (virus or bacterium) that has moved outside its natural range and becomes established in a new location, where its spread can have significant ecological, economic and social consequences. The impacts of IAS on ecosystems are often major and irreversible; this makes them a real threat to biodiversity, particularly for threatened and vulnerable species, and to the integrity of ecosystems. IAS represent a growing problem for aquatic and shoreline ecosystems around the world, in both marine and freshwater environments. Besides their impact on biodiversity, IAS can be detrimental to important socioeconomic activities, including recreational, commercial and subsistence fishing and a variety of recreational/tourism activities. By impairing the quality and appeal of such activities, IAS can lead to lost incomes while also requiring major and recurrent expenditures for prevention and control, when these are possible.

Canada
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Québec

Characteristics

Plants considered as IAS have attributes that facilitate their establishment and propagation in new environments. Such species generally tolerate a range of environmental conditions, grow and reproduce rapidly, and adapt readily to different environments. Often they have few or no predators, parasites or competitors to limit their numbers.

Pathways of introduction and spread

There are multiple ways in which IAPS can be introduced into a new environment and spread. The mechanism that allows a species to move from its point of origin to a new location is called a "pathway of introduction or spread". While the introduction and spread of such species can be due to natural phenomena such as currents, floods, wind or migration, human activities are the main culprit. The main pathways of human origin include horticulture, commercial shipping and recreational boating, and the aquarium trade. Additionally, any disturbance of the soil or vegetation creates a favourable environment for colonies of IAPS to become established and to expand. Anthropic pathways give IAPS a much greater ability to spread than they would have on their own.

Monitoring programs

As part of the St. Lawrence Action Plan, indicators have been developed by provincial and federal ministries to monitor IAS in and along the St. Lawrence. The indicators were chosen based on the following monitoring programs: 1) invasive aquatic species in marine environments; 2) IAPS in wetlands; and 3) invasive aquatic animal species in freshwater environments. This fact sheet summarizes results from monitoring IAPS in the St. Lawrence wetlands, as performed in collaboration with local groups from 2008 to 2014.

IAPS Wetland Monitoring Network

The IAPS monitoring network for the St. Lawrence wetlands works to profile the distribution and abundance of the principal IAPS and to assess their evolution over time. It depends on monitoring carried out by local organizations. The territory they cover extends from the United States border to the St. Lawrence maritime estuary. It is divided into seven sectors (Figure 1), each of which is covered by a partner organization. From 2008 to 2014, the priority invention zone committees (ZIP committees) for Haut Saint-Laurent, Jacques-Cartier (Montréal sector), Seigneuries (since 2012, Contrecœur sector), Lac Saint-Pierre, Deux-Rives (Trois-Rivières sector) and Sud-de-l'Estuaire* (since 2014), along with the Société d'aménagement de la baie Lavallière (SABL), monitored more than 380 sites divided among five types of wetland environment: shallow water, low marshes and high marshes, shrub swamps and treed swamps. The following species were monitored: reed canarygrass (*Phalaris arundinacea*), flowering-rush (*Butomus umbellatus*), water chestnut (*Trapa natans*), European frog-bit (*Hydrocharis morsus-ranae*), Eurasian water-milfoil (*Myriophyllum spicatum*), Japanese knotweed (*Reynoutria japonica*), European reed (*Phragmites australis var. australis*) and purple loosestrife (*Lythrum salicaria*). The monitoring plan requires that all sites be visited at three-year intervals. From 2008 to 2014, two inventory cycles were carried out, with 209 sites being inventoried twice, 177 sites just once. The first visits took place between 2008 and 2010, the second between 2012 and 2014. In total, nearly 600 visits were made to sampling stations in the network.

*The Sud-de-l'Estuaire sector covers the south shore of the middle and maritime St. Lawrence estuary.

Flowering-rush

Water Chestnut

Water chestnut is a formidable IAPS that reproduces rapidly, forming dense floating mats at the surface of the water. At present, there are no known colonies along the St. Lawrence, but a close watch must be kept for it. There are major infestations in Rivière du Sud, a tributary of Rivière Richelieu, and in Lac des Deux-Montagnes, a widening of Rivière des Outaouais. Control efforts since 2000 have reduced its abundance in infested areas and have limited its spread. However, monitoring and control activities remain a necessity.

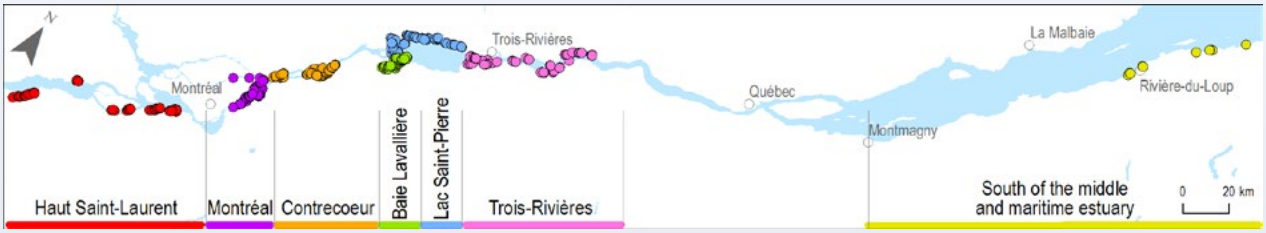

Figure 1. Sites visited by partners in their respective sectors of the St. Lawrence Wetlands IAPS Monitoring Network in 2008-2014

Data collection and analysis

The sampling stations measure 50 by 100 metres. Within each, the coverage of each IAPS is estimated, i.e. the proportion of the surface area occupied by that species, broken into five classes: 0% (not found); 1 to 25%; 26 to 50%; 51 to 75%; over 75%. From these data, an abundance index is calculated for each IAPS, with the level of invasion (see insert on key measurements). The data recorded for each station also include the type of wetland, the dominant plants and any environmental disturbances (Environment Canada, 2010).

The data was analyzed to get a portrait of the current status and to see what changes occurred between inventory cycles, i.e. to look for trends. The current status is based on the most recent visit to each site (between 2008 and 2014), while the trend assessment only concerns sites that were visited twice in that period. Thus there is no trend analysis for either the Contrecœur or Sud-de-l'Estuaire sectors, where monitoring began in 2012 and 2014 respectively.

Key Measurements

The following key measurements were used to draw a portrait of the status of IAPS in the St. Lawrence wetlands, by species, by sector and for the entire territory covered by the monitoring network.

Coverage per species

The abundance of an IAPS is first evaluated within a given station by measuring its coverage (the proportion of the station area occupied by that species), divided into five classes.

0 % (not found)	1 – 25%	51 – 75%	51 – 75%	Over 75%

Abundance index per species per sector

For a given sector, the abundance index of an IAPS is calculated by averaging the median coverage scores of all stations in the sector. The index is expressed as one of five classes, from "Nil" to "Very high". The thresholds for these classes are defined arbitrarily, based on the distribution of abundance index values. "Nil" means that the IAPS is absent from that sector, while "Very high" indicates that the average abundance of that IAPS is among the highest.

Nil	Slight	Moderate	High	Very high

Invasion rate

This measurement concerns the space taken up by all IAPS combined. First it is calculated for each station, by adding up the median coverage scores for all IAPS present. Averages are then calculated to obtain the invasion rate for each sector, then for the entire area covered by the monitoring network. Invasion rate scores are also expressed in five classes from "Nil" to "Very high". Again, the thresholds for these classes are defined arbitrarily based on the distribution of overall invasion rates. "Nil" means that no IAPS are present, while "Very high" indicates that the invasion rate is among the highest and that the plant cover is dominated by IAPS.

Nil	Slight	Moderate	High	Very high


Eurasian water-milfoil


European frog-bit

Results

Coverage and abundance index of each IAPS

Reed canarygrass is the second most common IAPS in the wetlands sampled, after purple loosestrife. A member of the grass family, it was found in 51% of stations in the monitoring network (Figures 2, 3 and 4). Present in every sector studied, its abundance index is generally Moderate to High (Table 1). When all sectors are put together, it is the only species with a High abundance index. Reed canarygrass chiefly grows in high marshes. Between the two sampling cycles, there was no change in the number of stations where it was found, but in some sectors its abundance index changed, rising in Haut Saint-Laurent but falling in the Montréal and Trois-Rivières sectors.

Found in 40% of stations, **flowering-rush** is another common species along the St. Lawrence (Figures 2 and 4). Yet it was not found in any stations in the Sud-de-l'Estuaire sector. It grows primarily in low marshes, where its abundance index is Slight, except in the Lac Saint-Pierre sector where the index is Moderate. The trend for flowering-rush is stable in all sectors except Baie Lavallière, where its abundance index has fallen.

European frog-bit was found at 21% of stations (Figures 2 and 4). The proportion varies by sector, and it was not found at all in the Sud-de-l'Estuaire sector. Growing in shallow water and low marsh sites, generally it has a coverage score of Slight to Moderate. The trend for European frog-bit is stable in all sectors.

Eurasian water-milfoil was found in shallow water at around thirty stations, mostly in the Montréal, Contrecœur and Trois-Rivières sectors (Figures 2 and 4). Its coverage scores vary. Although the data indicate an abundance index of Nil to Slight, this must be interpreted with caution, since few shallow-water sites were sampled, being less accessible. The results indicate little change in the abundance of Eurasian water-milfoil between monitoring cycles.

Japanese knotweed was observed only a few times during the second monitoring cycle (Figures 2, 3 and 4). Its abundance index is therefore Slight to Nil for all sectors. This species is described as being very invasive, and is known to be present in the parts of the St. Lawrence under study (Groeneveld et coll., 2014; Aubin and Bibeau, 2016). However, Japanese knotweed chiefly grows on banks and in terrestrial environments. A more recent arrival than the other species, it is likely to spread more rapidly in the coming years.

European reed was found in 31% of stations in the monitoring network (Figures 2, 3 and 4). Its abundance index varies by sector, being High in the Haut Saint-Laurent and Montréal sectors. It is the IAPS of greatest concern in the Sud-de-l'Estuaire sector, based on data from the first year of sampling there. It was found in several types of wetlands, mainly marshes and shrubby swamps. In the trend assessments across monitoring cycles, the abundance index for European reed rose more sharply than any other species. The number of sites where it was found nearly doubled, from 34 to 62. This rising trend was noted in several sectors, with the exception of Trois-Rivières and Lac Saint-Pierre where it was infrequent.

Lastly, **purple loosestrife** was found more often than any other IAPS in the wetlands studied, showing up at 62% of monitoring stations (Figures 2, 3 and 4). Yet it is rarely dominant at a given station, and its abundance index is Slight to Moderate depending on the sector. It was found at fewer stations in 2012-2014 than in the first sampling cycle, primarily in the Haut Saint-Laurent sector.

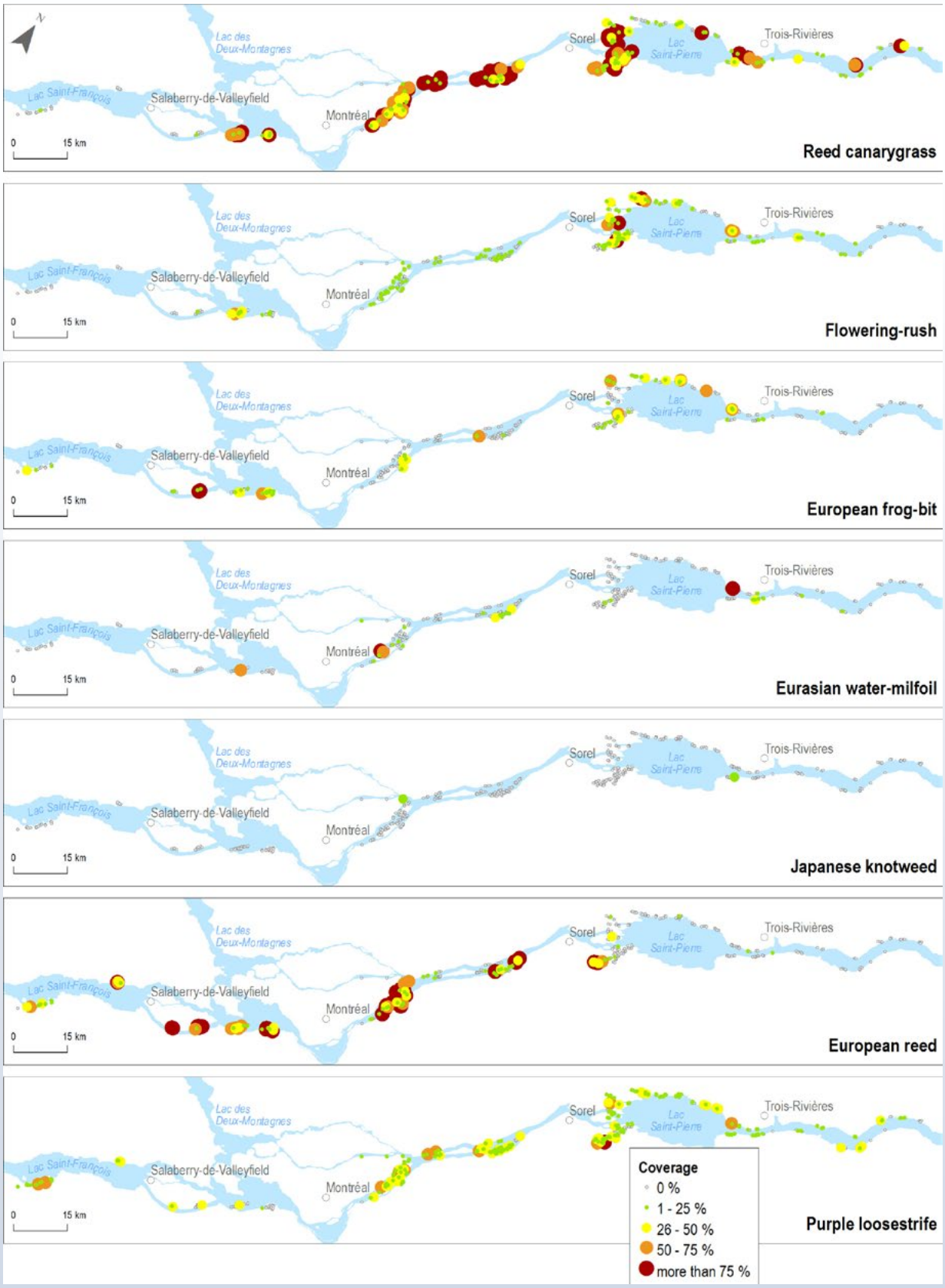

Figure 2. Coverage of invasive alien plant species at stations in the St. Lawrence Wetlands Monitoring Network, 2008-2014

Figure 3. Coverage of invasive alien plant species at stations in the St. Lawrence Wetlands Monitoring Network, Sud-de-l'Estuaire sector (south shore of the middle and maritime estuary), 2014

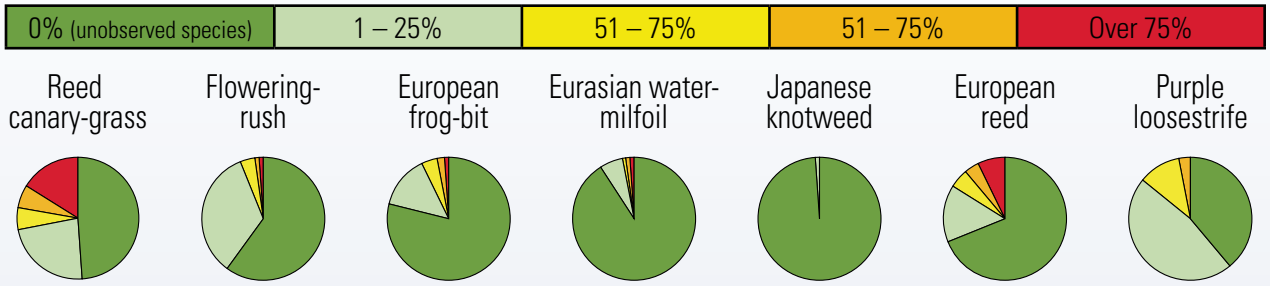

Figure 4. Proportion of stations with IAPS in the St. Lawrence Wetlands Monitoring Network, 2008-2014 (N = 386).

		Haut Saint-Laurent		Montréal		Contrecœur		Baie Lavallière		Lac Saint-Pierre		Trois-Rivières		Sud de l'estuaire*		All sectors	
		Status	Trend	Status	Trend	Status	Trend	Status	Trend	Status	Trend	Status	Trend	Status	Trend	Status	Trend
Abundance index	Reed canarygrass		↑		↓		NA		–		–		↓		NA		–
	Flowering-rush		–		–		NA		↓		–		–		NA		–
	European frog-bit		–		–		NA		–		–		–		NA		–
	Eurasian water-milfoil		–		–		NA		–		–		–		NA		–
	Japanese knotweed		NA		NA		NA		NA		NA		NA		NA		NA
	European reed		↑		↑		NA		↑		–		–		NA		↑
	Purple loosestrife		–		–		NA		–		–		–		NA		–
Invasion rate per sector			–		–		NA		–		–		↓		NA		–

* Based on data from a single sampling year

Table 1. Status and trends of IAPS at stations in the St. Lawrence Wetlands Monitoring Network, 2008-2014

Status: Abundance index per species and invasion rate per sector

Nil	Slight	Moderate	High	Very high

Trend: Abundance index trend per species, comparing 2008-2010 to 2012-2014 data
↑ Increase ↓ Decrease – Stable NA Not available (data for a single monitoring cycle)

Invasion rate

The most recent data (between 2008 and 2014) indicate a Moderate invasion rate for the St. Lawrence as a whole, and in all individual sectors except Montréal (Table 1). The invasion rate for the Montréal sector is High. Looking at all stations, 93% were affected by at least one IAPS. In about 3% of stations the invasion rate is Very High, in 33% it is High, Moderate in 36%, and Slight in 22% (Figure 5). Many stations with a High or Very High invasion rate are in upper sectors of the St. Lawrence, while there are few in the lower sectors.

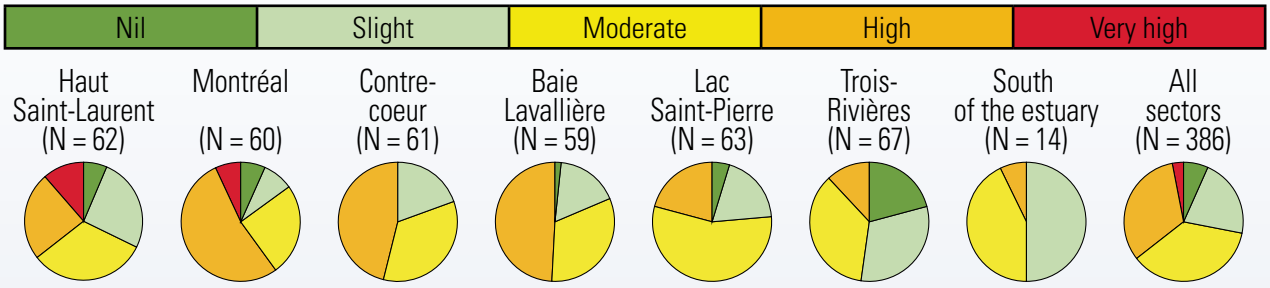

Figure 5. Invasion rates per sector in the St. Lawrence Wetlands Monitoring Network, 2008-2014.

Between sampling cycles, different sectors presented slight variations (higher or lower) in the invasion rate (Figure 6 below). Nonetheless the trend for the average invasion rate is stable (Table 1). The Trois-Rivières sector is an exception, since its invasion rate showed the greatest decline. The invasion rate for Haut Saint-Laurent showed the greatest increase, but not enough for the class to change or for the trend to be seen as rising.

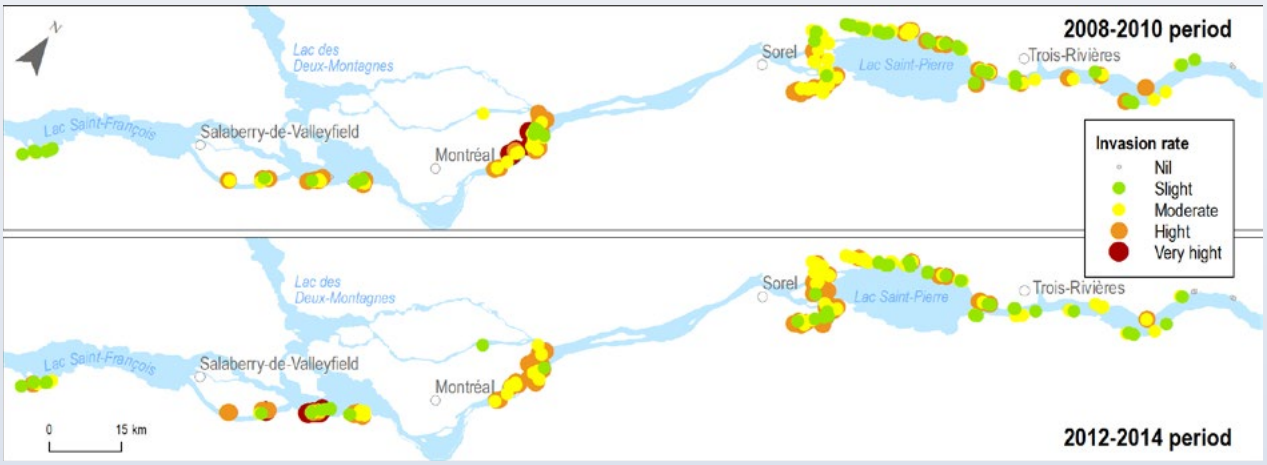

Figure 6. Invasion rates per sector in the St. Lawrence Wetlands Monitoring Network, 2008-2011 and 2012-2014.

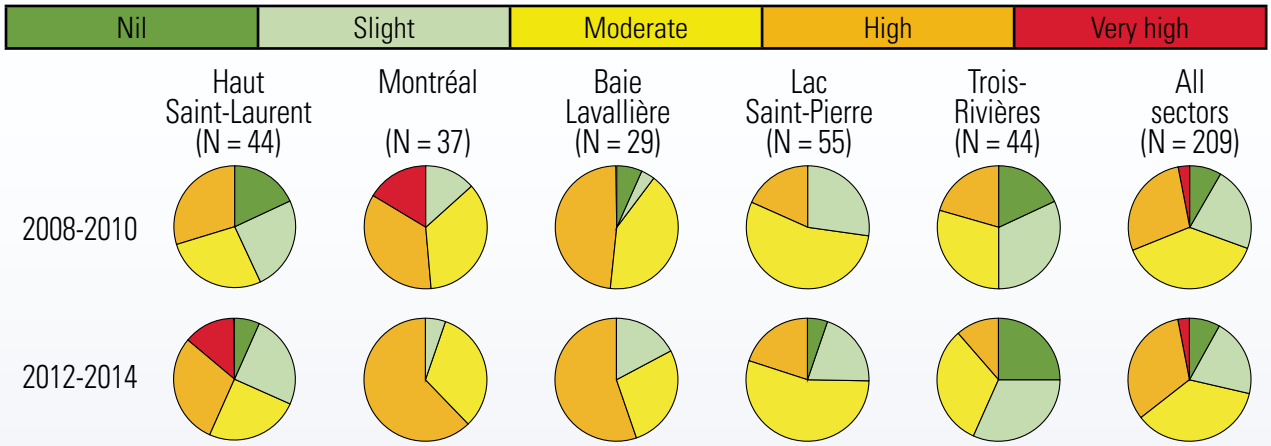

Figure 6. (Continued)

Discussion and Conclusion

This review of six years of monitoring (2008-2014), comprising two inventory cycles, shows that IAPS are an important factor in the St. Lawrence wetlands. They were found in all sectors studied, at Moderate invasion rates except for Montréal, where the invasion rate is High. Overall, purple loosestrife was found at the most stations, while reed canarygrass had the highest abundance index. These results are similar to those from earlier inventories carried out in the St. Lawrence wetlands (Lavoie et al., 2003; Savage and Jean, 2008).


Purple loosestrife

In the three years between the two sampling exercises, slight variations developed in the abundance index of each IAPS, rising or falling depending on the species and sector, yet stable overall. Only European reed saw its abundance index rise significantly in the wetlands studied, in just a few years. A close watch must be kept on Japanese knotweed. Though its presence at sampling stations from 2008 to 2014 was only marginal, there is an elevated risk that it will spread along the shores of the St. Lawrence and its tributaries.

In some cases, stations found to be heavily invaded in the first inventory saw their invasion rate decline (Figure 6). Similarly, in some sectors the abundance index of some species went down between the two inventory cycles (downward trends in Table 1). The decline in invasion rates could be explained by the spread of one IAPS at the expense of others, or by the loss of wetlands. Riparian wetlands are dynamic ecosystems, always subject to the effects of variations in water level. High water levels were in fact observed, and could have led to plant cover disappearing, replaced by open water. Other factors that could explain the changes observed include discrepancies in the positioning of stations between visits, and differences related to the observer.

Once an IAS becomes established in an ecosystem, it is difficult or impossible to eradicate it. The most effective and least costly way to fight these invaders is to prevent their introduction and spread. A precautionary approach can avoid the considerable expenditures required to eradicate, control and manage IAS. Reducing the risk of them spreading naturally would be difficult, but we could exert better control over human behaviours that favour their introduction and spread, whether through public awareness activities, voluntary measures or regulatory tools.

Prevention, raising public awareness and continuing the IAS monitoring program remain priority actions. It is also essential to involve numerous partners in early detection and in carrying out action plans to control IAS. Lastly, more knowledge is needed about IAS, to develop or improve methods of detection and control, and to better understand their impacts on ecosystems.

Outlook

Deployed in collaboration with local organizations, the IAPS monitoring network continues to grow. New partners have joined the network to cover two additional sectors, to the north and east: the north shore of the maritime estuary and the north shore of the gulf, covered respectively by the ZIP committees of Rive Nord-de-l'Estuaire and Côte-Nord du Golfe. At the same time, four more species have been added to the plants that will be monitored: rough mannagrass (*Glyceria maxima*), yellow iris (*Iris pseudacorus*), glossy buckthorn (*Frangula alnus*) and amphibious yellowcress (*Rorippa amphibia*).

To Learn More

Ministère de l'Environnement et de la Lutte contre les changements climatiques – Les espèces exotiques envahissantes http://www.environnement.gouv.qc.ca/biodiversite/especes-exotiques-envahissantes/index.asp

Ministère de l'Environnement et de la Lutte contre les changements climatiques – Sentinelle – Outil de détection des espèces exotiques envahissantes http://www.environnement.gouv.qc.ca/biodiversite/especes-exotiques-envahissantes/sentinelle.htm

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Paradis, Y. 2017. Aquatic invasive animal species in the freshwater section of the St. Lawrence River. Monitoring sheet in the collection "Monitoring the State of the St. Lawrence".

European reed

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Reed canarygrass

State of the St. Lawrence Monitoring Program

Five government partners—Environment and Climate Change Canada, Fisheries and Oceans Canada, Parks Canada, the Ministère de l'Environnement et de la Lutte contre les changements climatiques du Québec and the Ministère des Forêts, de la Faune et des Parcs du Québec—and 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 longterm water-quality changes.

Data sources and writing:
Writting: Marie-Eve Tousignant
Direction de la protection des espèces et des milieux naturels
Ministère de l'Environnement et de la Lutte contre les changements climatiques

Cartography: Sophie Benoit, Direction de la connaissance écologique, Ministère de l'Environnement et de la Lutte contre les changements climatiques

Data collection: Haut Saint-Laurent ZIP committee, Jacques-Cartier ZIP committee, Seigneuries ZIP committee, Société d'aménagement de la baie Lavallière, Lac Saint-Pierre ZIP committee, Deux-Rives ZIP committee and Sud-de-l'Estuaire ZIP committee.

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Japanese knotweed