Suivi de l'état du SAINT-LAURENT

Toxic Contamination of Freshwater Fish–4th edition

Status: Moderate Trend: Deterioration since 2002 for mercury, improvement for PCBs and penta-BDEs and stable for dioxins and furans

Overview

Over the years 2016-2019 and for the species of fishes and sizes studied, only mercury levels in flesh exceeded standards or criteria, and only occasionally. In 2016, mercury levels in the flesh of Northern Pike on the south shore of Lac Saint-Louis greatly exceeded the Canadian standard.

Change since 1996-2002: the recent trend is upward for mercury on the north and south shores of Lac Saint-Pierre and the north shore of Lac Saint-Louis. Concentrations of other substances are decreasing or stable.

Issues

Various contaminants, such as mercury and other metals, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs) and dioxins and furans, were measured in the flesh of St. Lawrence fish (Figure 1). Among the fish species studied for contaminant levels in flesh were Walleye, Northern Pike and Yellow Perch, which are all game fishing species. Whole White Sucker specimens were also analyzed to gauge exposure to contaminants in fish-eating terrestrial wildlife through consumption of whole fish.

Only mercury was present in concentrations that sometimes exceeded standards for human consumption, especially in larger specimens. The level of other contaminants in fish flesh remained generally low.

After a significant drop in mercury and PCB levels in the 1980s in the four fish species that were studied, contaminant concentrations remained relatively stable or were slightly down since 1996-1997, with the exception of mercury on the north and south shores of Lac Saint-Pierre and on the north shore of Lac Saint-Louis, where a recent increase has been observed in Walleye.







Fish from the St. Lawrence can be safely consumed, provided that the recommendations in the *Guide de consommation du poisson de pêche sportive en eau douce* (Guide to eating freshwater game fish–French only), prepared jointly by the Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC) and the Ministère de la Santé et des Services sociaux (MSSS), are followed.



Figure 1: Fish sampling stations in the St. Lawrence

This fact sheet presents only the state of contamination in fish caught in the three fluvial lakes of the St. Lawrence: Lac Saint-François (stations 1 and 2), Lac Saint-Louis (stations 5, 6 and 7) and Lac Saint-Pierre (stations 13, 14, 15 and 16). All are important game fishing areas. It should be noted that stations 4, 8 and 9 are not shown due to insufficient numbers of fish specimens at those locations.

Key measures

Categories used to assess contamination in fish flesh

Good: all measured concentrations in fish flesh were below the standards-not of concern.

Moderate: concentrations measured in fish flesh are close to the standards, but one species may exceed standards locally–monitoring is needed.

Poor: several species have flesh concentrations that exceed the standards or one species has concentrations that exceed standards throughout the River corridor–of concern.

The Canadian marketing standard for fisheries products is 0.5 mg/kg of flesh for mercury. The European Union standard is 125 μ g/kg of flesh for polychlorinated biphenyls (PCBs), while the Canadian standard of 2000 μ g/kg is currently under review). There is no current standard for polybrominated diphenyl ethers (PBDEs). The European Union standard for dioxins and furans expressed in toxicity equivalence is 3.5 ng/kg of flesh.

Status and trends

Mercury

Over the 2016-2019 period and for the four species studied, average mercury levels in fish flesh were generally below the Canadian marketing standard (0.5 mg/kg), with the exception of Northern Pike (0.54 mg/kg) on the south shore of Lac Saint-Pierre, Walleye (0.52 mg/kg) on the north shore of Lac Saint-Louis, and Northern Pike (0.80 mg/kg) and Yellow Perch (0.53 mg/kg) in the Îles de la Paix sector on the south shore of Lac Saint-Louis (Figure 2). In this latter sector, local contamination from past industrial activities seems persistent and continues to impact the level of mercury contamination in fish.

Mean mercury levels for all four species exceed the 0.057 mg/kg criterion for the protection of terrestrial fish-eating wildlife at all sites. This criterion is exceeded for most fish species and at many locations in Québec, due to atmospheric transport of mercury.

Results obtained in 2019 on the north and south shores of Lac Saint-Pierre for Walleye (425 mm), Northern Pike (600 mm), Yellow Perch (215 mm) and White Sucker (425 mm) show a significant increase in mercury levels compared to 1995-2002 (Figure 2). The increase in levels could be due to several factors, including the fact that, for the same size category, Walleye, Northern Pike, and Yellow Perch caught in 2019 were older than in past years and had more time to absorb contaminants.

Fish growth rates are a function of water temperature and quality, and access to food resources high in energy, among other factors. Intensive land use can promote, especially during precipitation events, suspended solid input in streams and lower retention of atmospheric mercury by lands that are bare and drained (Collin A. Eagles-Smith et al., 2016).

The same trend was observed in 2019 on the north shore of Lac Saint-Louis in Walleye, with an increase in mercury levels as compared to 1997. There was no significant difference between years for other species in the same area. However, on the south shore of Lac Saint-Louis, mercury levels in 2016 compared to 1997 for Northern Pike dropped, while there was no significant difference for the other species in the study.

On the south shore of Lac Saint-François, mercury levels measured in 2014 decreased in Walleye and Northern Pike compared to 1996. No significant difference was detected in the other two species.



Figure 2: Average mercury levels in the flesh of Walleye (425 mm), Northern Pike (600 mm), Yellow Perch (215 mm) and White Sucker (425 mm) in the St. Lawrence River, 1995-2019

Polychlorinated biphenyls (PCBs)

Average PCB levels in the flesh of fish caught in 2014, 2016, and 2019 were all below the European Union 125 μ g/kg standard. Similarly, in whole White Suckers, all average PCB levels were below the MELCC 160 μ g/kg terrestrial fish-eating wildlife protection criterion (Figure 3).

For 2013-2019, average PCB levels in the flesh of Walleye, Northern Pike, and Yellow Perch were relatively comparable among the study areas, given the variability introduced by the percentage of fat in the flesh and the small number of samples, which precluded statistical analysis. However, during the same period, average PCB levels in whole White Suckers on the north shore of Lac Saint-Pierre and on the south shore of Lac Saint-François were similar, although they were significantly higher than on the south shores of Lac Saint-Pierre and Lac Saint-Louis, the latter two showing similar PCB levels.

It should be noted that PCB levels generally increase with the percentage of fat in flesh, which is usually less than 0.5% for Walleye, Northern Pike and Yellow Perch, but around 4.5% in whole White Suckers. As a result, whole White Suckers have higher levels of PCBs than the flesh of other species in the study.

Compared to 1996-1997 or 2002, average PCB levels on the south shore of Lac Saint-François in 2014, on the south shore of Lac Saint-Louis in 2013-2019, and on the north and south shores of Lac Saint-Pierre in 2013-2019, generally trended downward. For the north shore of Lac Saint-Louis, insufficient data was available in 2019 to discern a trend.



Figure 3: Average PCB levels in the flesh of Walleye, Northern Pike, Yellow Perch and whole White Sucker in the St. Lawrence River, 1996-2019

Polybrominated diphenyl ethers (PBDEs)

Analysis of PBDE levels in the flesh of St. Lawrence fish began in 2002. There is no current standard for the level of PBDEs in fish flesh deemed acceptable for human consumption.

However, criteria have been set by Environment and Climate Change Canada for different groups of PBDE congeners to protect terrestrial wildlife and fish-eating birds. For the three main congener groups typically detected in fish (tetra-BDE, penta-BDE, and hexa-BDE), the criteria are 44 μ g/kg, 3 μ g/kg, and 4 μ g/kg, respectively (Environment Canada, 2013). In 2014, 2016, or 2019, depending on the site, average levels for these congener groups all remained below the criteria in the flesh of Walleye, Northern Pike, Yellow Perch and whole White Suckers. Figure 4 shows penta-BDE levels based on the strictest criterion–3 μ g/kg.

Average levels of penta-BDEs measured in fish flesh at all sites for 2013-2019 did not exceed 1.2 μ g/kg, whereas in 2002, average levels in Walleye ranged from 6.2 to 21 μ g/kg on the north and south shores of Lac Saint-Pierre. The downward trend observed in Lac Saint-Pierre downstream from Montreal is a result of action taken by the Canadian government since 2006 to ban the importation and use of PBDEs (Government of Canada, 2019-02-08).

In whole White Suckers, on both shores of Lac Saint-Pierre as well as on the south shore of Lac Saint-François, significantly lower average levels of penta-BDEs were measured for 2013-2019 compared to 2002-2004. On the north and south shores of Lac Saint-Louis, although levels are currently low, insufficient data is available prior to 2013 for comparative purposes.

For 2013-2019, average levels of penta-BDEs in whole White Suckers from the north and south shores of Lac Saint-Pierre, while lower than in earlier years, remained significantly higher than on the south shores of Lac Saint-François and Lac Saint-Louis, the latter two areas having similar PBDE levels.



Figure 4: Average penta-BDE levels in the flesh of Walleye, Northern Pike, Yellow Perch and whole White Suckers in the St. Lawrence River, 2002-2019

Dioxins and furans

Exploratory analysis of dioxins and furans in the flesh of St. Lawrence River fish began in 1991. Given the relatively low levels that were found, subsequent analyses were limited to only a few species, generally focussing on the largest specimens.

From 2013 to 2019, dioxin and furan levels in fish flesh remained low and were relatively similar (Figure 5). Because the Canadian standard of 20 ng/kg for 2,3,7,8 TCDD has been under review for several years, the European Union standard of 3.5 ng/kg for marketing fish products was instead used in the study. All 2,3,7,8 TCDD toxicity equivalence levels measured in the flesh of Walleye, Northern Pike and Yellow Perch in the St. Lawrence River were below the EU standard and are not considered to pose a significant risk to human health (Figure 5).

In whole White Suckers, for 2013-2019, average 2,3,7,8 TCDD toxicity equivalence levels were all below the 0.66 ng/kg criterion used for the protection of terrestrial fish-eating wildlife and fish-eating birds. For 2013-2019, average toxicity equivalence levels in Lac Saint-Pierre White Sucker were significantly higher on the north shore than on the south shore. However, the levels measured on the north shore of Lac Saint-Pierre and on the south shores of Lac Saint-François and Lac Saint-Louis were similar. Only the south shore site of Lac Saint-Pierre showed a significant decrease in inter-annum measured levels.



Figure 5: Average levels of total 2,3,7,8-TCDD toxicity equivalence in the flesh of Walleye, Northern Pike, Yellow Perch and whole White Suckers in the St. Lawrence River, 2002-2019

Perspectives

Stricter regulations and several government programs have significantly reduced contaminant discharge into the St. Lawrence-Great Lakes system. The current level of toxic contamination is low enough to allow Quebecers to continue their traditional use of the River, i.e. for fishing and fish consumption. Available data indicates that toxic substance levels are compatible with moderate consumption of fish from the River, thus allowing fishers to benefit from the health effects related to fish consumption.

Learn more

Eagles-Smith, Collin A., et al., 2016. Mercury in western North America: A synthesis of environmental contamination, fluxes, bioaccumulation, and risk to fish and wildlife. *Science of The Total Environment*, Volume 568, 15 October 2016, pp. 1213-1226.

Environment Canada, February 2013. *Canadian Environmental Protection Act*, 1999: Federal Environmental Quality Guidelines, Polybrominated Diphenyl Ethers (PBDEs), 28 pp., [Online], <u>https://ec.gc.ca/ese-ees/default.asp?lang=En&n=05DF7A37-1</u>.

Government of Canada (2020-07-28): *Polybrominated diphenyl ethers (PBDEs)* - Information Sheet, [Online], <u>https://www.canada.ca/en/health-canada/services/chemical-substances/fact-sheets/chemicals-glance/polybrominated-diphenyl-ethers-public-summary.html</u>.

LALIBERTÉ, D. 2011. *Teneurs en polybromodiphényléthers (PBDE) dans les poissons du fleuve Saint-Laurent et des lacs et rivières du Québec (2002-2008).* Québec, ministère du Développement durable, de l'Environnement et des Parcs, Direction du suivi de l'état de l'environnement, ISBN 978-2-550-60987-2 (PDF), 48 p.

Ministère de l'Environnement et de la Lutte contre les changements climatiques et ministère de la Santé et des Services sociaux, *Guide de consommation du poisson de pêche sportive en eau douce*, Québec, Guide to eating freshwater game fish; available in French only [Online], <u>www.environnement.gouv.qc.ca/eau/guide/index.htm</u>.

State of the St. Lawrence Monitoring Program

The State of the St. Lawrence Monitoring Program brings together five government partners— Environment and Climate Change Canada (ECCC); Fisheries and Oceans Canada (DFO); Parks Canada and Québec's Ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC); Ministère des Forêts, de la Faune et des Parcs (MFPP); as well as Stratégies Saint-Laurent (SSL), a non-governmental organization working with riverside communities. The partners pool their expertise and efforts to report regularly to the citizenry on the state of the St. Lawrence and how it is changing in the long term.

More information about the State of the St. Lawrence Monitoring Program is available on our website: <u>https://www.planstlaurent.qc.ca/en/developing-knowledge/state-st-lawrence-monitoring-program</u>.

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