



WATER

SEDIMENTS

SHORELINES

BIOLOGICAL RESOURCES

USES

TOXIC CONTAMINATION IN FRESHWATER FISH

Background

Since the turn of the 20th century, the Great Lakes and St. Lawrence River have been contaminated by hundreds of toxic substances used in industry or agriculture. Some of these substances accumulate in living organisms, including fish. Sport fishing is very popular in Quebec, with over 25% of the population engaging in this activity. Moreover, it is increasingly recommended that we should include fish in our diets due to its nutritional qualities and health benefits. A recent study carried out in

the Montreal region showed no dangerous levels of chemical contaminants in people who regularly eat fish caught in the St. Lawrence River.

A number of organic contaminants, such as organochlorine substances, and inorganic contaminants, such as metals, were measured in fish tissues and organs, with a focus on mercury and polychlorinated biphenyls (PCBs). Although mercury occurs naturally in the environment, various consumer goods, fossil fuels and industrial processes are major sources



White Sucker

of mercury. In its methylated form, mercury is harmful because it affects the nervous systems of living beings. PCBs belong to the family of organochlorines (DDT, dioxins, furans) and have many different applications. The production of PCBs has been prohibited in North America since 1977. Organochlorines have a variety of toxic effects, including skin irritation, effects on the liver, immune system, nervous system and reproductive system, and cancer. They are also suspected of mimicking the action of hormones and of disrupting the endocrine system.

Mercury and PCBs are widespread in the environment. Mercury and PCB contamination of fish is a good indicator of the state of contamination of the environment.

Overview of the Situation

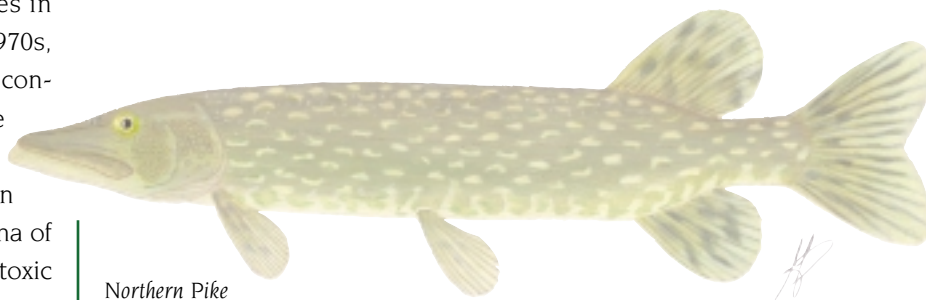
Data on fish contamination in the St. Lawrence River have been collected in studies since the 1970s. The data provide a relatively clear picture of toxic



Photo: Paul Grant. © Québec en images, CCDMD

contamination levels and changes in certain fish species. Since the 1970s, the studies show that the level of contamination of fish in the St. Lawrence has declined, although chemical contaminants are still detected. In the case of mercury, the phenomena of bioaccumulation (accumulation of toxic substances in the tissues of living organisms) and biomagnification (increasing concentrations of toxic substances as the fish moves up the food chain) result in higher contamination levels in older fish and piscivores (fish eaters), such as Northern Pike and Walleye. Mercury accumulates primarily in fish tissues, whereas organochlorines are found in higher concentrations in fatty tissues and organs such as the liver and gonads.

A recent study of PCB and mercury levels and fluctuations in fish in lakes Saint-François, Saint-Louis and Saint-Pierre illustrated the state of contamination of the St. Lawrence River and



Northern Pike

how it has changed since the 1970s. The species studied include Northern Pike, a piscivore and game fish, and White Sucker, which is prey for piscivores and which feeds on benthos and detritus. PCBs were analysed in whole White Suckers, while mercury was analysed only in Northern Pike tissues.

Mercury

On the whole, the data show that average mercury concentrations in Northern Pike were below Health Canada's guideline for mercury content in commercial fish (0.5 mg/kg) (Figure 1).

However, average values exceeding the guideline were observed in Lake Saint-Louis (Îles de la Paix sector). Individual values exceeding the guideline were



Photo: Denis Chabot, © Québec en images, CCDMD



Photo: Yvon Richard, MENW

Lake Saint-Louis — Îles de la Paix

also observed more or less throughout the study area in the larger, and thus older, specimens. With the exception of carp caught at Gentilly and Atlantic Sturgeon caught near Île d'Orléans, average mercury concentrations for all species and at all sites exceed the Quebec guideline of 0.057 mg/kg for the protection of fish-eating terrestrial wildlife.

Mercury levels in fish have dropped relative to 1976 values, except in Lake Saint-Louis (Figure 2). The data show that efforts to reduce environmental mercury contamination have resulted in significant declines in mercury concentrations in fish communities. However, it appears that there were active sources of mercury in Lake Saint-Louis between 1976 and 1996, in the area of the Îles de la Paix. A chlor-alkali plant that used mercury technology operated in this sector until 1990. Thus, despite the downward trend, fish contamination continues to be a concern with respect to the health of piscivores. Moreover, mercury concentrations exceeding the Canada Health standards for marketing fishery products were observed in Lake Saint-Louis.

PCBs

In the St. Lawrence River, average PCB concentrations in fish tissue samples taken from different species and size classes of fish are generally well below Health Canada's guideline of 2000 µg/kg for BPC content in commercial fish. However, concentrations observed in whole White Suckers generally exceed the guideline for the protection of terrestrial piscivores (160 µg/kg), except in the northern sector of Lake Saint-Louis (Figure 3). These concentrations likely



Photo: Yvon Richard, MENV

Figure 1. Average mercury concentration in Northern Pike tissue samples between 1995 and 1997 at various stations in lakes Saint-François, Saint-Louis and Saint-Pierre

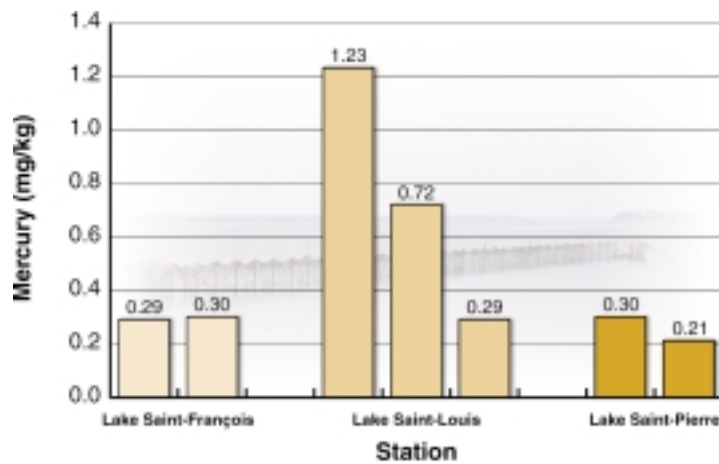
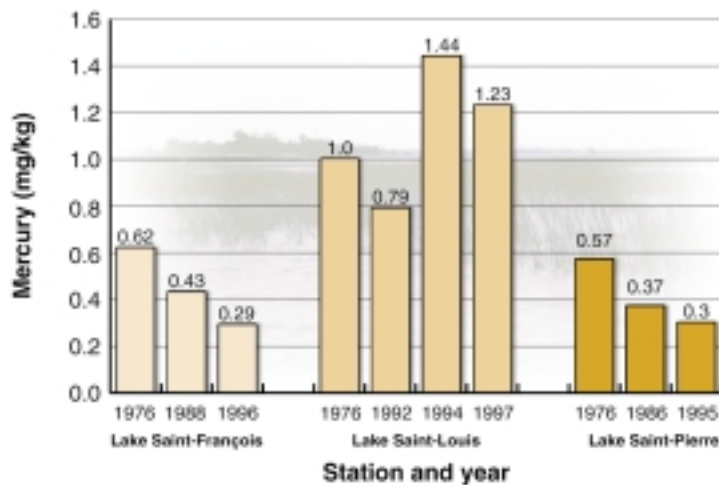


Figure 2. Average mercury concentration in Northern Pike tissue samples between 1976 and 1995-1997 in lakes Saint-François, Saint-Louis and Saint-Pierre



pose a risk to fish-eating terrestrial wildlife and, therefore, to the entire food chain, since White Suckers make up a large part of the diet of many species of animals.

Nonetheless, considerable reductions in PCB levels in White Suckers have been observed in the three lakes since 1976 (Figure 4). These reductions show that the ban on PCB and the PCB recovery and destruction efforts have been effective in significantly reducing contamination levels in the St. Lawrence.

Another study was conducted from 1994 to 1996 on the contamination of fish caught at a reference site near Quebec City, in Saint-Nicolas. Located at the mouth of the fluvial system, this site has the advantage of integrating all contamination from upstream. Once again, the results at this site show that contaminant concentrations (trace metals, PCBs, chlorobenzenes, organochlorine pesticides) in fish tissue are low and are generally well below the guidelines for consumption. However, much higher concentrations are found in organs like the liver (Figure 5).

Outlook

Various contaminants are detected in fish from the St. Lawrence. Only mercury, however, is present at concentrations that occasionally exceed the guideline for consumption, particularly in older specimens. The current contamination level must therefore not be ignored. On the whole, however, concentrations are generally down and the data show that there is not a high level of bioconcentration of contaminants in fish tissues. In addition, the contamination trend has clearly been on the decline since the 1970s, particularly for

Figure 3. Average PCB concentration in whole White Suckers between 1995 and 1997 at various stations in lakes Saint-François, Saint-Louis and Saint-Pierre

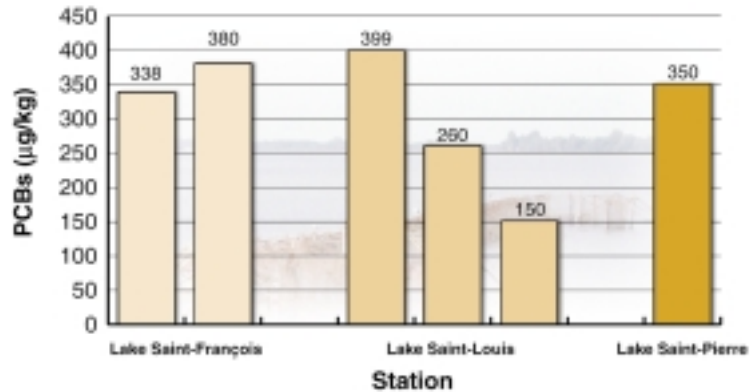


Figure 4. Average PCB concentration in whole White Suckers between 1976 and 1995–97 in lakes Saint-François, Saint-Louis and Saint-Pierre

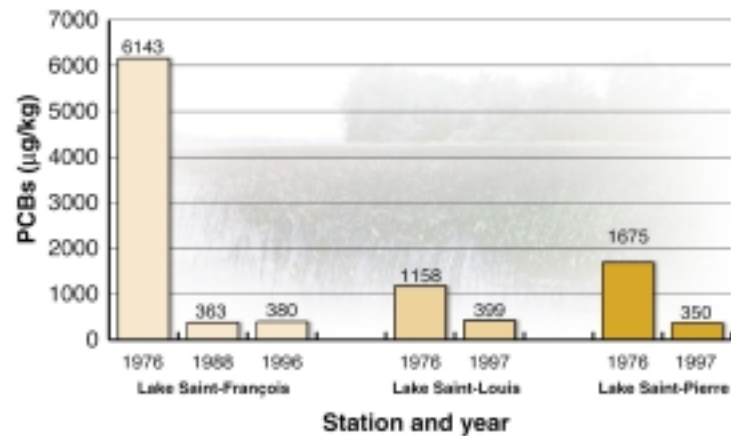


Figure 5. Average PCB concentration in the tissues and liver of five species of fish caught at Saint-Nicolas between 1994 and 1996

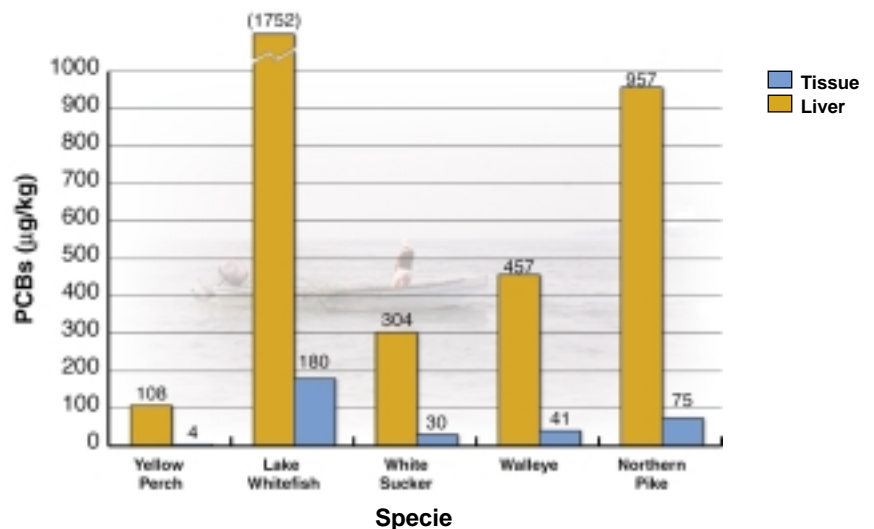




Photo: Yvon Richard, MENV

Eel fishing in Portneuf

KEY VARIABLES

Health Canada's administrative guidelines for the commercial sale of fish products are intended to protect the health of consumers of fish. The allowable concentration is 0.5 mg per kilogram of tissue for mercury and 2000 µg/kg of tissue for PCBs. Other reference values are the guidelines for the protection of terrestrial piscivores, which are aimed at fish-eating mammals and birds. The allowable concentrations are 0.057 mg per kilogram of tissue for mercury and 160 µg/kg of tissue for PCBs. The concentrations recommended for the protection of wildlife are lower than those for the protection of human health, because fish make up a large part of the diet of wildlife species, but only a small part of the normal human diet.

mercury and PCBs. The consumption of fish from the St. Lawrence poses no risk, provided the recommendations of the Quebec ministries of Environment and Health and Social Services are adopted. To that end, the two ministries have jointly published guidelines for the consumption of freshwater fish in recent years (www.menv.gouv.qc.ca/eau/guide/index.htm).

Through tighter regulations and a number of government programs, it has been possible to significantly reduce contaminant releases into the St. Lawrence River. Upstream, in the Great Lakes, considerable efforts have also been made to reduce toxic releases and to clean up contaminated sites. Other programs are contributing to reducing toxic loadings. For example, under the Mercury Action Plan of the Conference of New England Governors and Eastern

Canadian Premiers, adopted in 1998, it should be possible to significantly reduce anthropogenic mercury releases in eastern North America. The issue of toxic contaminants is still a concern, but it is likely that the downward trend in toxic substances in the environment and fish communities can be maintained. However, it is important to bear in mind that contaminants from distant sources can reach the St. Lawrence basin by atmospheric transport.

The current level of toxic contamination is low enough that the public can resume their traditional uses of the St. Lawrence — that is, catching and eating fish from the river. However, such uses will have to remain at moderate levels, given the presence of low concentrations of various chemical contaminants in fish tissues. The contaminants will likely be present, but in declining



Photo: Yvon Richard, MENV

Lake Saint-Pierre archipelago



Photo: Yvon Richard, MENV

Eel fishing in Portneuf

quantities, in the water, sediments and biological communities of the St. Lawrence for decades to come. However, the available data show that their presence does not preclude eating fish from the river at this time and that it may even be possible to derive health benefits from doing so, given the recognized nutritional value of fish.

To Know More

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State of the St. Lawrence Monitoring Program

Four government partners — Environment Canada, the ministère de l'Environnement du Québec, the Société de la faune et des parcs du Québec, and Fisheries and Oceans Canada — are pooling their expertise and efforts to provide Canadians with information on the state of the St. Lawrence and long-term trends affecting it. To this end, environmental indicators have been developed on the basis of data collected

as part of each organization's ongoing environmental monitoring activities. These activities cover the main components of the environment, namely water (quality and quantity), sediments, biological resources (species diversity and condition), uses and, eventually, shorelines.

For additional copies or the complete collection of fact sheets, contact the

St. Lawrence Vision 2000 Coordination Office:

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The fact sheets and additional information about the program are also available on the Web site: www.slv2000.qc.ca .

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