LE FLEUVE

NEWSLETTER
ST. LAWRENCE VISION 2000

VOLUME 12 — ISSUE 3 — SEPTEMBER 2001

IN TUNE

Biodiversity

Atlantic Sturgeon: new knowledge has made it possible to improve management of the Atlantic Sturgeon, a vulnerable species in Quebec waters.

Navigation

St Lawrence Observatory (OSL): a scientific portal devoted to the exchange of data on and the development of the St Lawrence, a vast natural laboratory.

Human health

Though two studies comparing water disinfection procedures and their effect on babies' health were reassuring, further studies have been recommended.

The Atlantic Sturgeon is slowly yielding up the secrets of its movements in the St Lawrence

In spite of its large size, the Atlantic Sturgeon in the St Lawrence has remained highly elusive. After several years of research under Phases II and III of the St Lawrence Vision 2000 Action Plan (SLV 2000), biologists from the Société de la faune et des parcs du Québec *have succeeded in identifying some of the species' essential habitat. This new knowledge has made it possible to improve management of the Atlantic Sturgeon, a vulnerable species in Quebec waters.*

The Atlantic Sturgeon is found only on the east coast of North America, and its northernmost population is in the St Lawrence. It is subject to a variety of pressures: overfishing, pollution, and habitat loss as a result of dredging and damming, so that it is now found in only 25 of the 40 or so watercourses that it used to inhabit, and it almost completely disappeared from the St Lawrence in the 1970s.

Th Atlantic Sturgeon spends most of its life in salt water, but migrates to fresh water to breed. Thus, the biologists of the Société first spent a decade working on the St Lawrence's tributaries to locate and characterize the breeding grounds of the sturgeon population.

Since their searches of the tributaries proved fruitless, the biologists set their nets in the St Lawrence itself, between the western tip of Île d'Orléans and Portneuf in the summer of 1997. Thirteen breeding males were taken near Portneuf, suggesting that spawning grounds may lie close at hand. On the basis of this information, the biologists applied a strategy: by following the movements of these specimens, they might be able to pinpoint their preferred habitat.

SUMMARY

Canada

Saint-Laurent Vision 2000

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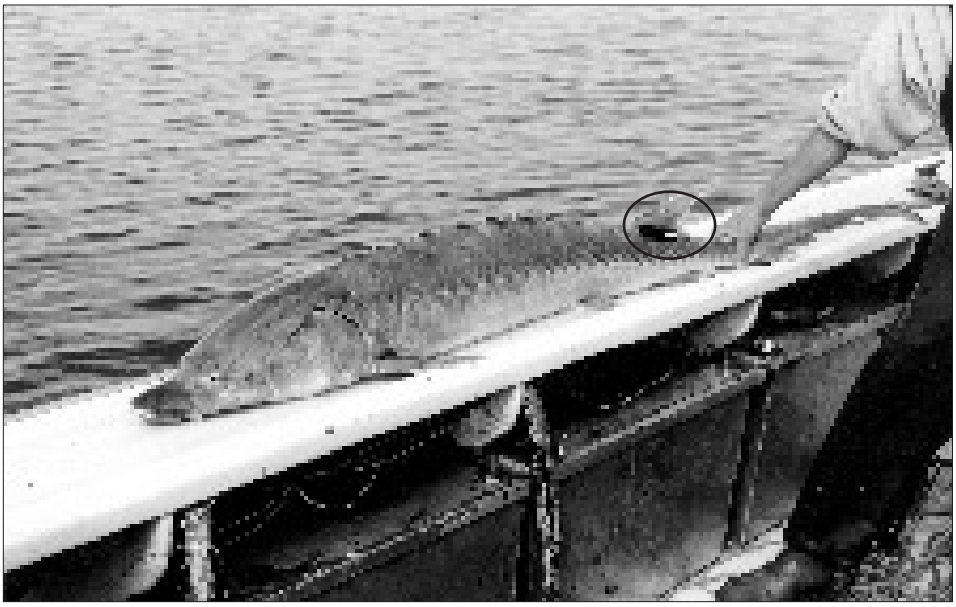

[Atlantic sturgeon]
The body of the Atlantic Sturgeon is covered by five rows of protective bony plates. It is the largest freshwater fish found in Quebec or anywhere on the eastern seaboard of North America. Visible here on the dorsal fin is the radio tag used to monitor the fish's movements for the purposes of the study. (Photo: François Caron, *Société de la faune et des parcs du Québec*)

Close on the trail in the St Lawrence

In 1998, at the start of Phase III of SLV 2000, a five-year research project was launched to locate areas where adult surgeon congregate, in particular breeding and feeding grounds. Nets were again set at Portneuf, but this time the adults taken were tagged with radio transmitters, attached at the base of the dorsal fin, so that their movements in the River could be monitored.

Most of the sturgeon tagged in fresh water were male, and only one mature female was tagged during the summer of 1998. This scarcity of females in the catches may be due to the fish's life cycle and the different behaviour of the females during the spawning season. Males reach breeding age earlier than females and breed more often. They also arrive on the breeding grounds earlier and stay longer, whereas the females make only very short forays into fresh water, just long enough to lay their eggs, which takes only a few hours or a few days at most. As the nets were moved to brackish waters, the proportion of females taken increased.

Thus, over a three-year period, the research team tracked the movements of 69 Atlantic Sturgeon, including 21 females. To do so, they used a boat and a submersible receiver to register the presence of any tagged sturgeon within a radius of one kilometre. A fixed tracking station was also installed at the end of the Irving jetty (about one kilometre downstream from the Quebec Bridge) and now continuously monitors the passage of any sturgeon heading for the spawning grounds.

Biologists find several schooling areas

Six sites where adult Atlantic Sturgeon gather have so far been located. Three of these are in fresh water and are believed to be breeding grounds: the Richelieu Rapids, upstream from Portneuf, discovered in 1997; a section of the River off St Antoine de Tilly; and the mouth of the Chaudière River. Since the breeding grounds of most Atlantic Sturgeon stocks throughout the species' range remain unknown, this discovery delighted biologists.

Atlantic Sturgeon do not feed while migrating to the spawning grounds, nor during spawning. Monitoring of their movements as they leave the spawning grounds has made it possible to locate three feeding areas. Initially, it was thought that these would all be in brackish waters, as was the case of the site located north of Île aux Grues and another off Sault au Cochon. Surprisingly, though, the third feeding area was in fresh water: the mouth of the St Charles River, right in Quebec harbour. Many sturgeon stop there on the way from the spawning grounds to saltier habitat to take advantage of the rich supply of invertebrates.

The monitoring of tagged specimens has also helped determine the period of the summer most conducive to breeding. In the St Lawrence, this seems to occur between late June and mid July, when the water temperature ranges between 15° and 23°C. Various other characteristics of the species have been determined, among them the weight, length, age and sex of breeding specimens. It takes males at least 16 years to reach breeding age and females even longer, and rather than breeding every year like almost all other fish, the

males breed only every third of fourth year and the females at even longer intervals.

As well as yielding information on where sturgeon congregate and what they do there, the research has shed light on the migratory movements of the species. On average, sturgeon cover 11.3 km per day, but the maximum daily distance recorded is 64.8 km, eloquent testimony to the Atlantic Sturgeon's ability to cover long distances in the St Lawrence in a short time.

New management based on better knowledge

Thirty-five commercial fishermen operating between Quebec City and Rivière du Loup take nearly 6,000 sturgeon a year. How is it that breeding specimens have never been found in catches? The study has shown that older specimens dwell in the deeper parts of the St Lawrence, especially in the channels and trenches, and since the fishermen set their nets in shallower water, they take only fish between the ages of 4 and 20 years and not yet sexually mature.

According to François Caron, biologist with the Société de la faune et des parcs du Québec, our ignorance of the Atlantic Sturgeon's biology and habitat has made sound management difficult, but the data that have now been gathered will enable us to implement improved management measures. For example, schooling areas can be protected. He explains that in the past such operations as dredging and spoil dumping may have compromised the integrity of essential sturgeon habitat simply because we knew so little about it; now, though, the knowledge we have gained will enable managers to make more informed decisions on where to authorize the dumping of spoil from the dredging of harbours and the shipping channel. Moreover, the SLV 2000 Biodiversity and Shipping consultative committees are currently working together on a wide-ranging study of this issue, and some schooling areas may be closed to commercial operations while breeders are present, thus protecting those individuals on which the future of the St Lawrence population depends.

What is certain is that the Atlantic Sturgeon has not yet yielded up all its secrets. Biologists now plan to pinpoint breeding areas more precisely, since sturgeon cover relatively large distances, even in fresh water. We would like to determine the breeding success rate and find the preferred habitat of young sturgeon leaving the place where they hatched.

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Source:

HATIN, D., and F. CARON. Pending. *Déplacements et caractéristiques des esturgeons noirs* (Acipenser oxyrinchus) *adultes dans l'estuaire du fleuve Saint-Laurent en 1998 et 1999*, (Movements and characteristics of adult Atlantic Sturgeon in the St. Lawrence estuary in 1998 and 1999), Société de la faune et des parcs du Québec, Wildlife Research Branch.■

The marine environment at your fingertips… thanks to the St Lawrence Observatory

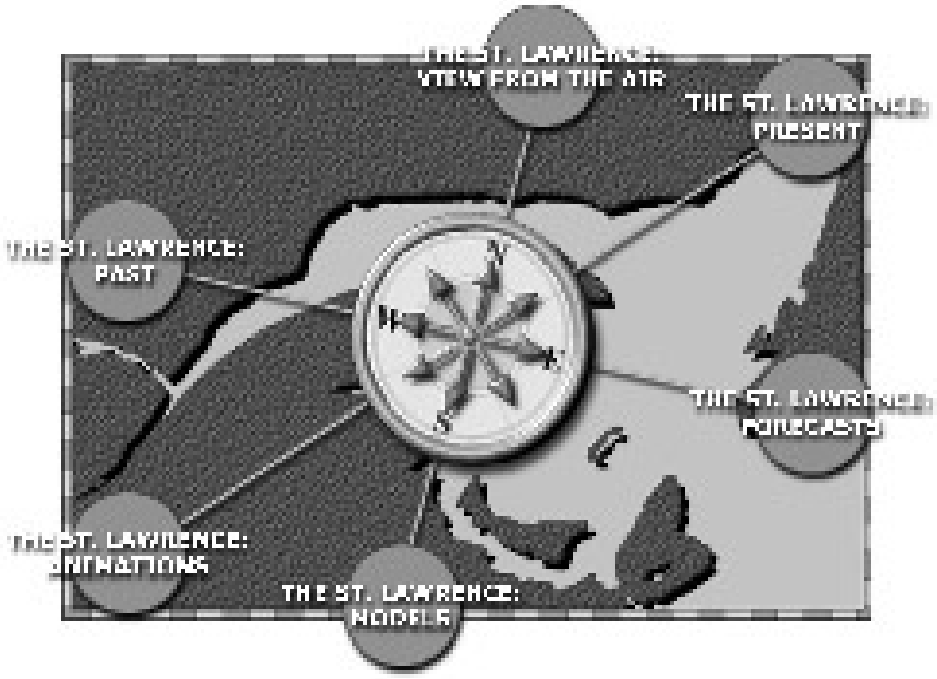

Illustration: Johanne Noël, OSL — DFO

On the one hand, Department of Fisheries and Oceans (DFO) scientists gather and process innumerable data on the Estuary and Gulf of St Lawrence. On the other hand, many potential users seek reliable information on this ecosystem. The St Lawrence Observatory (OSL) aims to promote data on the Estuary and Gulf of St Lawrence and make them available in a user-friendly way to interested users. Several thousands of Internet users have already visited this portal, which was developed under the Navigation component of Phase III of the St Lawrence Vision 2000 Action Plan (SLV 2000).

Boating enthusiasts planning their next outing, researchers testing the validity of a model using archived data, or teachers preparing their ecology class can all benefit from information made available by the OSL. “Our mission is to offer an Internet portal completely devoted to the exchange, distribution and presentation of data on the St Lawrence marine ecosystem,” explains Robert Siron, the project’s scientific co-ordinator at the DFO’s Maurice Lamontagne Institute. He specifies that part of the information available online meets the specific needs of scientists, while other sections provide information explained in simpler terms for other categories of users such as the general public, the media or educational institutions.

A portal combining user-friendliness and scientific reliability

The OSL features oceanographic and hydrographic data and several DFO products. Its server contains no database, but instead serves as a gateway to scientists’ computers on which information is stored. Though they only provide a brief overview of the potential of the OSL, the applications mentioned in this article are good examples of the variety of information made available to Internet users through this portal.

“The St Lawrence: View from the Air” section features numerous satellite images of the temperature of Gulf surface waters. The images are produced by the MLI’s Remote Sensing Laboratory. Visitors can also see an aerial photograph of a red tide, caused by the toxic algae Alexandrium tamarense, observed in July 1998. “From this photograph, Internet users wishing to obtain images of other microalgae toxic bloom can contact the MLI’s Toxic Algae Research Group,” said Mr. Siron, illustrating the site’s potential for creating contacts between those holding the information and a whole variety of users.

“The St Lawrence: Present” section provides the results of the Shipboard Thermosalinographs project. Visitors can find out about temperature, salinity and fluorescence fluctuations along the route of two commercial ships and a Canadian Coast Guard scientific research vessel. Thermosalinographs that are installed on ships navigating the St Lawrence pump water and transmit values obtained every two to three weeks as they pass the MLI. For example, an increase in salinity and water temperature fluctuations can be

observed aboard commercial ships travelling from Montreal to St. John's, Newfoundland. The data enable scientists to correct or supply values for their models. They are also used in ice forecasting calculations.

"The St Lawrence: Monitoring" section provides access to results of the Laurentian Region's Sentinel Fisheries Program, which was established in 1994 to monitor the trends in cod stocks on Canada's Atlantic coast with the help of a number of fishers' associations in Quebec and Newfoundland.

Valuable historical data, notably that on the flow of fresh water at Quebec City dating back to 1955, have been archived in "The St Lawrence: Past" section. The data, provided by the MLI's Physical Modelling Section, play a leading role in the study of climate change and water level fluctuations. Visitors can also find out about temperature and salinity changes in the St Lawrence recorded off the coast at the MLI between May 2000 and November 2000. Electronic and computer expertise needed to transmit data in real time were acquired for the St Lawrence On-line project.

Teachers will be happy to find that "The St Lawrence: Models" section features a tool that helps explain concepts related to the carbon cycle in the St Lawrence, including particle sedimentation, photosynthesis and food chains. Boating enthusiasts will find maps illustrating current forecasts.

"The St Lawrence: Animations" section provides access to animations produced by the MLI's Digital Forecast Laboratory. Created using innumerable data, visitors can see tidal propagation in the St Lawrence and the meeting of fresh and salt water in the estuary of the Saguenay River.

Expertise that benefits others

All data gathered on the MLI's oceanographic missions have been available on-line since the fall of 2000 thanks to the Oceanographic Data Management System (ODMS), which compiles data for archival and distribution purposes. It currently contains more than 12,000 files.

Because of the expertise it has acquired, the OSL team was mandated to develop websites for other organizations and agencies. It thus created the web interface for the official website of the Canadian Hydrographic Service's Canadian Tide Tables. Tidal predictions are issued in response to user enquiries and are available for more than 700 Canadian locations. High and low waters and hourly height values are given in graph form for 30-day periods. This is one of the OSL's most popular products.

The OSL is a real hub for exchanging data over the Internet. Half of OSL website visitors are DFO employees; the other half are from outside DFO (e.g. other departments, consultants, general public). Anyone interested in the Estuary and Gulf of St Lawrence will find what they are looking for.

The OSL is run by the Data Management Section of the MLI's Division of Ocean Sciences. The project also received funding from Canada Economic Development and SLV 2000 to get off the ground. All partners are aware of the value of the oceanographic data and the need to make them available so that a greater number of users can benefit from them.

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Comparison of drinking water disinfection procedures and their effect on the health of babies in three Quebec municipalities

Photo : Benoit De Serres

Drinking water of Quebec municipalities drawn from the St Lawrence and its tributaries is treated to meet public health standards. A team of researchers at the Public Health Research Unit of the Centre hospitalier universitaire de Québec (CHUQ) has conducted two studies to compare the effects that products used to disinfect water have on the thyroid gland in newborns and nursing infants. Conducted as part of the Human Health component of the St Lawrence Vision 2000 Action Plan, the studies were reassuring, even though more extensive research was recommended.

In Quebec, the last step in eliminating bacteria from water taken from the St Lawrence and its tributaries and making it fit for human consumption generally consists in adding chlorine to the water. However, this procedure forms numerous chlorinated by-products suspected of causing cancer in humans.

Faced with the potential risks associated with using chlorine, management at certain water treatment plants has turned to chlorine dioxide, a more efficient product for disinfecting drinking water. In 1999, 12 water treatment plants serving more than 600,000 people (i.e. approximately 10% of Quebec's population) used chlorine dioxide.

Alternative to unknown side effects

Chlorine dioxide does not create the by-products most commonly associated with chlorine. However, few studies have been conducted on the effects its chronic toxicity and that of its by-products on humans. There is currently no Quebec standard for either chlorine dioxide or chlorine dioxide by-product levels in drinking water.

The hypothyroidal effect chlorine dioxide has on animals exposed to the chemical has been well documented. Hypothyroidism is the insufficient production of thyroid hormone. When suffered during foetal life or at birth, the condition is defined as congenital. Without early treatment, children with hypothyroidism can suffer from slow growth and serious intellectual impairments.

Congenital hypothyroidism was a serious health problem in Quebec until a screening program for this disease was established in the 1980s. Since then, blood samples have been taken from all newborns in Quebec on the day they are born to measure TSH (thyroid stimulating hormone) levels. A high concentration of TSH indicates a defect in the secretion of thyroid hormones and leads to the detection of hypothyroidism.

Babies' health: the subject of two studies

Since babies are very vulnerable to a drop in thyroid hormones, a pilot project was undertaken in 1998 to verify the possible effects chlorine dioxide and its by-products have on the thyroid gland in some 40 nursing infants aged between 2 and 3 months. Three municipalities were studied: Trois Rivières, where chlorine dioxide is mainly used, Beauport, where chlorine dioxide is used only as a

secondary disinfectant, and Quebec City, where chlorine dioxide is not used at all.

A slightly higher average concentration of TSH was observed in nursing infants in Trois Rivières, who were most exposed to chlorine dioxide. The difference observed was not significant, but further studies were recommended because of the small sample size.

A new study was thus conducted to verify the possible links between intra-uterine exposure to the disinfectant and an increase in TSH concentration, and subsequently, the increased prevalence of hypothyroidism in newborns. Data gathered under the province's congenital hypothyroidism screening program between 1993 and 1998 were used. This new study involved 10,550 newborns whose mothers resided in one of the areas targeted by the pilot project.

Reassuring conclusions

At the end of the study, researchers noted that the average TSH blood level was statistically higher among newborns in Trois Rivières, who were most exposed, than in newborns in Beauport or Quebec City, who were barely exposed or not exposed at all. As in the pilot project, results confirm the theory of a possible link between exposure to water disinfected with chlorine dioxide and a slight thyroidal dysfunction in newborns.

Patrick Levallois, scientific advisor at the National Institute of Public Health in Quebec, is nevertheless reassuring. "Congenital hypothyroidism cases were not excessive in Trois Rivières. Nothing leads us to believe that the thyroidal dysfunction that was observed is harmful to children's development."

However, because chlorine is being increasingly replaced by other disinfectants such as chlorine dioxide, and in light of the results of the two studies, researchers recommend that further studies be conducted on the matter. A complete analysis of the Quebec hypothyroidism screening program database would help verify whether results obtained for these three municipalities are in line with those obtained for all Quebec municipalities.

"In the event that the trends are confirmed on a larger scale, a study conducted among mothers would help us better interpret the results," explained Mr. Levallois. It would then be a matter of gathering information on the mothers' water consumption. They would be asked about certain factors such as whether they smoke, take medication or are exposed to environmental contaminants. "It would thus be possible to verify whether consumption of water disinfected with chlorine dioxide is truly responsible for the thyroidal dysfunction observed, or whether the dysfunction is attributable to other factors," said Mr. Levallois.

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Source:

CHARTRAND, Josée, Patrick LEVALLOIS and Suzanne GINGRAS. 2000. *Étude descriptive des résultats du programme de dépistage de l'hypothyroïdie congénitale de trois municipalités québécoises en fonction de l'utilisation du dioxyde de chlore comme d ésinfectant de l'eau potable (1993-1998)*, the Public Health Research Unit of the Centre hospitalier universitaire de Québec, 26 p. + appendices.■

News *in* BRiEF

Quebec's First Shipping Policy

On Wednesday, August 22, Transport Quebec Minister Guy Chevrette and his colleague Jacques Baril, Minister responsible for Transportation and Marine Policy, announced Quebec's first shipping policy.

The new policy's strategy is based on four main approaches: increase shipping and navigation on the St Lawrence; turn the benefits of the St Lawrence into socio-economic development tools for Quebec regions; expand promotion of navigational activities and develop the St Lawrence; and promote Quebec know-ho and labour force training.

The provincial government will take better account of the environmental and social benefits of shipping and port activities to favour the river's sustainable development. It thus plans on reinforcing its support to the Navigation Committee until the end of the Phase III of the St Lawrence Vision 2000 Action Plan.

The *Shipping Policy* is available on the Ministère des Transports du Québec website, in French only, at the following address:
http://www.mtq.gouv.qc.ca/marchandises/maritime/index.htm#politique

For information:
Service du transport maritime
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LE FLEUVE

NEWSLETTER
ST. LAWRENCE VISION 2000

Le Fleuve is jointly published by St. Lawrence Vision 2000 partners.

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Translation from French to English:
PWGSC—Translation Bureau

The *Le Fleuve* Newsletter is published on the SLV 2000 Internet Site at:
www.slv2000.qc.ec.gc.ca/index_a.htm

ISSN 0847-5334

Legal deposit:
National Library of Canada,
Bibliothèque nationale du Québec
Volume 12, issue 3

Le Fleuve est aussi disponible en français.