

I N T U N E

Shipping industry introduces a concrete measure for reducing shoreline erosion

The Navigation Committee, working in co-operation with several partners, has proposed a voluntary measure designed to lessen the effects of ship-generated waves in biologically significant sectors of the river.

Enhanced detection of pathogenic micro-organisms in the bivalve molluscs of the lower estuary of the St Lawrence

A study on the detection of pathogenic micro-organisms in bivalve molluscs of the lower estuary of the St Lawrence has confirmed the importance of complying with notices indicating that harvesting areas are closed and the recommendation about boiling molluscs directly in water to kill pathogens.

The presence of chloroform in drinking water taken from the St Lawrence and the related health effects

Research on the risk of exposure to chloroform in the residential water supply, conducted under the Human Health component of SLV 2000, has yielded reassuring results.

Shipping industry introduces a concrete measure for reducing shoreline erosion

As part of the activities carried out under St Lawrence Vision 2000 (SLV 2000), the Navigation Committee has launched several studies and projects aimed at finding concrete solutions to the issues to be addressed in the sustainable navigation strategy, slated for 2003. One of these issues concerns the shoreline erosion associated with the waves generated by commercial ships and recreational boats. The Committee's efforts are already bearing fruit, as shown by an innovative measure put in place by the shipping industry, which is designed to lessen the risk of erosion.

The Navigation Committee is made up of representatives from the commercial shipping sector, from community and environmental groups and from six departments in the federal and Quebec governments. It has set the ambitious objective of jointly developing and implementing a strategy to promote sustainable navigation on the St Lawrence. Key issues addressed in the Committee's work include the following:

- integrated management of dredging and sediments;
- protection of shorelines against navigation-induced erosion;

- control measures to prevent the introduction of exotic species in ships' ballast water discharges;
- enhanced management of environmental risks and hazards.

Some sectors of the St Lawrence are more vulnerable to wave action

Shoreline erosion along the St Lawrence is a complex phenomenon caused by many factors,

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Photo : Denis Lehoux, Canadian Wildlife Service (CWS)

both natural and anthropogenic. Natural factors may include the scouring effect of ice, river currents, storm surges, snowmelt, ice jams and even the tides. As for the anthropogenic, or human-caused, factors, they include water level fluctuations induced by water control structures and wave action resulting from the passage of commercial ships and pleasure boats.

Several studies aimed at preparing a report on erosion problems along the river were conducted during Phase II of SLV 2000. The Navigation Committee has drawn on this work to carry out an in-depth study of the relationship between shipping and recreational boating and shoreline erosion in the Cornwall–Montmagny stretch of the river. This study and another one were done in 1999 under the supervision of the Quebec Department of Transport, in keeping with the objectives of the Navigation component of SLV 2000.

Based on data collected between 1964 and 1983, the study showed that ship-generated waves have an impact on shorelines when the ships are travelling within 800 m of the coast. In the sector under study, only 250 km or 15 percent of the shoreline area is affected by waves generated by commercial ships. It also appears that 85 percent of the erosion observed in the study area is concentrated in the Montreal–Sorel section.

An initiative benefiting the health of the St Lawrence

With the aim of lessening the erosion caused by ship-generated waves and protecting biodiversity, the Navigation Committee set up a project to bring about a reduction in ship speed in sensitive zones. A special working group was formed to carry out this project, and included representatives of the Corporation des pilotes du Saint-Laurent central, the Port of Montreal, the St Lawrence Ship

Operators' Association, the Shipping Federation of Canada, the Société de développement économique du Saint-Laurent and the Canadian Coast Guard.

The shipping industry was very receptive to the idea of finding a solution to reduce the effects of wave action. It is impossible at present to determine the precise contribution that commercial ships make to the erosion problem. However, in some river sections, the degree of blame that can be attributed to ships is about 60 percent.

In September 2000, the working group set out to promote an innovative measure within the shipping industry aimed at reducing the speed at which ships travel. This measure applies to ships travelling in a section of river about 25 km long, encompassing the Contrecoeur, Varennes and Verchères zones along with the Sorel archipelago. In this zone, serious erosion has been noted which threatens important biological components, as identified on the basis of field work and photographic analyses done during the period 1983-1997. This measure should help to reduce the effects of ship-generated waves in nearly 50 percent of the biologically significant sectors of the stretch of river considered.

The prescribed speed was set at a maximum of 10 knots in an upstream direction and 14 knots downstream¹. This optimal speed should help to lessen wave action while permitting the manoeuvrability necessary for the safe passage of ships. The Canadian Coast Guard has responded very favourably to this initiative, and it is continuing its collaboration with the working group by conducting systematic surveys of ship speed and other activities.

This voluntary reduction in speed is already proving to be very successful. After a few weeks of observation, it was found, based on the speed surveys provided by the Coast Guard, that ships are generally complying with the proposed limits. Nonetheless, this measure spells not inconsiderable costs for some ships that for example have to change their fuel whenever they reduce their engine speed.

"This initiative is a very good example of a concrete application of research conducted under Phase III of SLV 2000. The concerted efforts underpinning the measure have fostered rapid acceptance and implementation. As well, the voluntary nature of this program shows that a non-regulatory action may be accepted by the shipping sector and also meet the need to protect the river," said Jérôme Faivre, Committee co-chair for Quebec.

Pleasure boating also a focus of the Committee's action

Since the study overseen by the Navigation Committee showed that some stretches of river may be degraded by waves generated by pleasure boats, a similar approach was taken with the representatives of this sector. "The Navigation Committee recently met with recreational boaters to inform them about the fragility of the shores of islands and the impacts of vessel-generated waves," notes Gervais Bouchard, Committee co-chair for Canada. "We are now prepared to support this community's efforts to introduce measures that will foster behaviour among motorboat and personal watercraft users that can protect shorelines."

The results of the study supervised by the Navigation Committee will

be available on the Internet shortly. This will enable shipping industry representatives, mariners and pleasure boaters to consult maps showing the most erosion-sensitive areas between Cornwall and Montmagny.

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Enhanced detection of pathogenic micro-organisms in the bivalve molluscs of the lower estuary of the St Lawrence

On the North Shore, shellfish harvesting is a very popular activity that provides local residents with a greatly appreciated food source and sustains a tradition connected with the St Lawrence. A number of government agencies share responsibility for monitoring the quality of shellfish in harvesting areas. The North Shore public health branch has carried out a study as part of the activities of the Human Health component of St Lawrence Vision 2000. This research was aimed at assessing the validity of the indicators that are used to estimate the level of pathogen contamination in molluscs and other shellfish.

Molluscs, which live buried in sediments or attached to rocks and reefs, feed on phytoplankton and other substances which they filter from the water. They may therefore absorb certain contaminants that could make them unfit for human consumption. Bivalve molluscs may, for example, be contaminated with pathogenic micro-organisms (bacteria, viruses and protozoans) released into the water through the discharge of human and animal faecal waste.

The consumption of molluscs contaminated with these pathogens generally leads to gastro-intestinal problems lasting from a few hours to a few days. However, more serious illnesses such as salmonellosis and Hepatitis A infection, as well as chronic infections like giardia, can also result from the ingestion of shellfish contaminated with pathogenic micro-organisms.

Monitoring of shellfish harvesting areas

Monitoring the contamination levels in shellfish and shellfish harvesting areas, including faecal contamination, is the key activity of the program administered by a number of federal and Quebec government agencies. In the 46 harvesting areas on the north shore of the St Lawrence Estuary, the bacteriological quality of the water is assessed on a regular basis in order to formulate recommendations on whether to authorize shellfish harvesting in given areas, approve this activity on a conditional basis or prohibit it. The quality of commercially harvested shellfish is assessed in seafood processing plants.

The assessment of faecal contamination of shellfish and shellfish harvesting areas centres on detecting the micro-organism *Escherichia coli* and measuring the concentration of faecal coliforms and total coliforms.

Validity of indicators called into question

The findings of a 1999 study by the North Shore public health branch raised questions about the reliability of the indicators that are currently used to assess

faecal contamination of shellfish and harvesting areas on the north shore of the lower estuary of the St Lawrence.

A subsequent research project was undertaken to evaluate the validity of using specific micro-organisms as indicators of the quality of shellfish and harvesting areas. This was done by taking account of the impact of certain environmental parameters. The study area in this project consisted in the ZIP (Area of Prime Concern) territory on the north shore of the estuary, stretching from Tadoussac to Baie-Trinité. Nearly 4,000 soft-shell clams were harvested in nine shellfish areas between Pointe-aux-Outardes and Grandes-Bergeronnes. All of the water samples (total of 28) were taken in a single location, specifically at Baie-Laval.

The analyses performed on the water samples and the soft-shell clams that were collected were used to detect the presence and measure the abundance of six micro-organisms likely to serve as indicators of faecal contamination. Two of these micro-organisms, namely *Escherichia coli* and faecal coliforms, are already used in the existing monitoring programs, whereas the other four organisms represent potential indicators. The analyses also made it possible to check for the presence in soft-shell clams of four pathogens that pose a risk for public health under certain conditions.

Care is required in selecting and employing indicators

Based on this research, it appears that the frequency of detection of pathogens in soft-shell clams is high, since 90 percent of the samples turned out to be contaminated. Although contamination was identified in the clams from six sectors closed to harvesting, the contaminated clams also included samples from the three areas that were open to harvesting.

This confirms the fact that shellfish contamination may represent a significant route of exposure to pathogenic micro-organisms of faecal origin.

Furthermore, *Escherichia coli* and faecal coliforms appeared to be poor indicators of the presence of pathogens. In fact, the detection frequency for *Escherichia coli* and faecal coliforms, estimated at 14 percent and 21 percent respectively, was well below the general detection frequency for pathogens. In addition, *Escherichia coli* and faecal coliforms were not detected in nearly 80 percent of the samples which were in fact contaminated with pathogens. "These results tend to confirm the hypothesis that *Escherichia coli* and faecal coliforms are not sufficiently sensitive parameters to serve as valid indicators of faecal contamination of shellfish on the North Shore," said Alexandra Valentin, project leader for this study by the North Shore public health branch. According to Mrs Valentin, an effort should be made to verify whether the use of a lower detection threshold than that used in this research, like the levels applied in some monitoring programs, would help to raise the indicators' sensitivity to a satisfactory level.

Research into the impact of environmental parameters on the abundance of indicator micro-organisms may provide an explanation for the poor performance of *Escherichia coli* and faecal coliforms as indicators of the presence of pathogens. Indeed, results suggest that the salinity of the water in shellfish areas favours the rapid elimination of *Escherichia coli* and coliforms.

Among the four potential indicators considered in the study, somatic coliphages were identified as a

promising candidate for detecting faecal contamination in shellfish. These organisms appeared to be sensitive, that is, they are readily detected in pathogen-contaminated shellfish. They also appear not to be affected by environmental conditions to a great extent.

"At the time when *Escherichia coli* and faecal coliforms were selected as indicators of faecal contamination in shellfish, scientists were unaware of several of the pathogenic micro-organisms that are now known to occur in harvesting areas," explained Mrs Valentin. She emphasized the importance of continuing the research aimed at assessing the quality of existing and potential indicators. The study states that the establishment of an effective tool for evaluating the risks associated with shellfish consumption must in future be based on epidemiological studies, research on micro-organisms and increased knowledge of interactions among micro-organisms and between them and the environment.

It goes without saying that this research underlines how important it is for harvesters to comply with the notices and signs indicating that a shellfish area is closed. It is also important to boil all shellfish in water for at least five minutes before eating them, as this serves to guarantee that a high enough internal temperature has been reached to destroy the majority of pathogenic micro-organisms.

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F. GAGNON et J.F. Cartier. 2000.
*Évaluation de la validité des
indicateurs de contamination fécale
des mollusques bivalves et des eaux
coquillières de la rive nord de
l'estuaire maritime du Saint-Laurent.*
Régie régionale de la santé et des
services sociaux de la Côte-Nord,
Direction de la santé publique, 90 p.
+ annexes.■

The presence of chloroform in drinking water taken from the St Lawrence and the related health effects



Photo : Pierre Marin

Municipalities that draw their drinking water from the St Lawrence have to treat it so that it meets strict public health standards. The last stage in water treatment generally consists in adding chlorine to destroy bacteria. A team of researchers from the public health research unit at the Centre hospitalier universitaire de Québec (CHUQ) conducted a study in municipalities that obtain their drinking water from the St Lawrence, in order to determine to what extent taking showers and baths in this water could increase the absorption of chloroform, a by-product of chlorination. This study was done under the Human Health component of St Lawrence Vision 2000.

The chlorination processes used to disinfect drinking water result in the formation of by-products, some of which may contaminate drinking water supply systems. Chloroform is one of the most abundant chlorination by-products in drinking water. This compound is known to be carcinogenic in animals, and suspected to have the same effect in humans. Government agencies set standards related to the maximum acceptable concentration of chloroform in water supply systems. However, in setting these standards, consideration is given only to exposure through ingestion, not to inhalation or absorption through the skin. Yet, chloroform can be absorbed through inhalation or through the skin when people wash dishes or take a bath or shower.

A study on the different routes of absorption of chloroform

A team with the public health research unit at CHUQ undertook a two-part study to estimate the combined effect of all routes of absorption of chloroform. First,

under actual exposure conditions, the researchers set out to measure the internal chloroform doses resulting from showers and baths taken by adults and children in Great Quebec City municipalities that get their drinking water from the St Lawrence or one of its main tributaries. The internal dose corresponds to the quantity of chloroform absorbed by the body; it is assessed by measuring the chloroform concentrations in exhaled air.

Then, based on the internal doses obtained, the research team designed a health risk analysis model for assessing chloroform exposure linked to residential water.

In summer 1996, 18 adult males and 19 boys and girls participated in the research project. The dwellings studied receive their drinking water from the distribution systems of Sainte-Foy, Lévis, Saint-Romuald and Charny. The researchers measured a large number of parameters during baths and showers; these ranged from the height of bath water and duration of the bath to the brand of soap used. A lot of data were collected: the age, size and weight of the subjects, the size of the room and of the shower or bathtub, water temperature, and so on.

For the group of participants, the researchers measured the chloroform concentration in exhaled air before and immediately after the bath or shower, as well as 15 and 30 minutes later. The participants had to breathe into a bag, and the trapped air was then analysed to determine the chloroform concentration. Most chloroform is eliminated by the body via the lungs. This reading thus constitutes a biological indicator of exposure to chloroform. The reading taken before the bath or shower provided a baseline internal dose for the participants. The difference between the chloroform concentration

expelled before and then after the bath or shower indicated the internal dose associated with the shower or bath. Similarly, the difference between the concentrations measured 15 and then 30 minutes later and the baseline reading were used to determine the residual internal doses for those periods.

Reassuring results in relation to public health

The internal doses recorded were used to design a model that was subsequently employed in estimating the cancer risk for all routes of exposure to chloroform contained in the drinking water of dwellings. Since the carcinogenic potential of chloroform has not been studied in humans, the concentrations of chloroform metabolites bound to hepatic tissue that were measured with the model had to be compared with those obtained in studies on the onset and development of cancer in animals.

"The results observed with respect to chloroform exposure are very reassuring," said Benoît Lévesque, the researcher who directed the project. At the exposure concentrations studied, the highest internal dose of chloroform was about six thousand times smaller than the lowest dose found not to produce tumours in all the laboratory animal studies."

In addition, the chloroform concentrations measured in the participants' dwellings were comparable to those reported in the literature for a large proportion of water supply systems in Quebec. "This means that, for a large percentage of Quebec's population, exposure to chloroform in residential water presents a very low risk of cancer," noted Mr Lévesque.

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Source:

LÉVESQUE, B., P. AYOTTE, R. TARDIF, L. FERRON, S. GINGRAS, E. ACHLOUCH, G. GINGRAS, P. LEVALLOIS et E. DEWAILLY. 2000. *Évaluation de la charge corporelle de chloroforme induite par la douche et le bain pour les citoyens des municipalités utilisant le fleuve Saint-Laurent comme source d'eau potable*. Centre de santé publique de la région de Québec, 30 p. + tableaux.■

News

in BRIEF

On February 7, the Sud de l'estuaire ZIP Committee held its first general meeting. The area covered by this 14th ZIP committee goes from Montmagny to Matane. The Chairperson is Doris Labrie, and the Co-ordinator is Françoise Bruaux. The contact information for the office is as follows: 88, rue Saint-Germain ouest, Rimouski, Quebec, G5L 4B5. The phone number is (418) 722-8833; fax: (418) 724-2216 and email address: zipse@globetrotter.net. We extend a warm welcome and good luck to this new ZIP committee!

The SLV 2000 Consultative Committee will be staging a forum in Montreal on Tuesday, February 20. The theme is "Managing the St Lawrence: Partnering Challenges." The objectives of this event are to analyse the concerted action approaches adopted under SLV 2000, determine the related strengths and weaknesses and examine the types of partnership that can be developed for the future management of the St Lawrence. You can register by phone, (418) 872-8110, or by fax, (418) 872-6912, or by email: info@transenvironnement.qc.ca. For more information, see the SLV 2000 Web site at this address: <http://slv2000.qc.ec.gc.ca>.

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