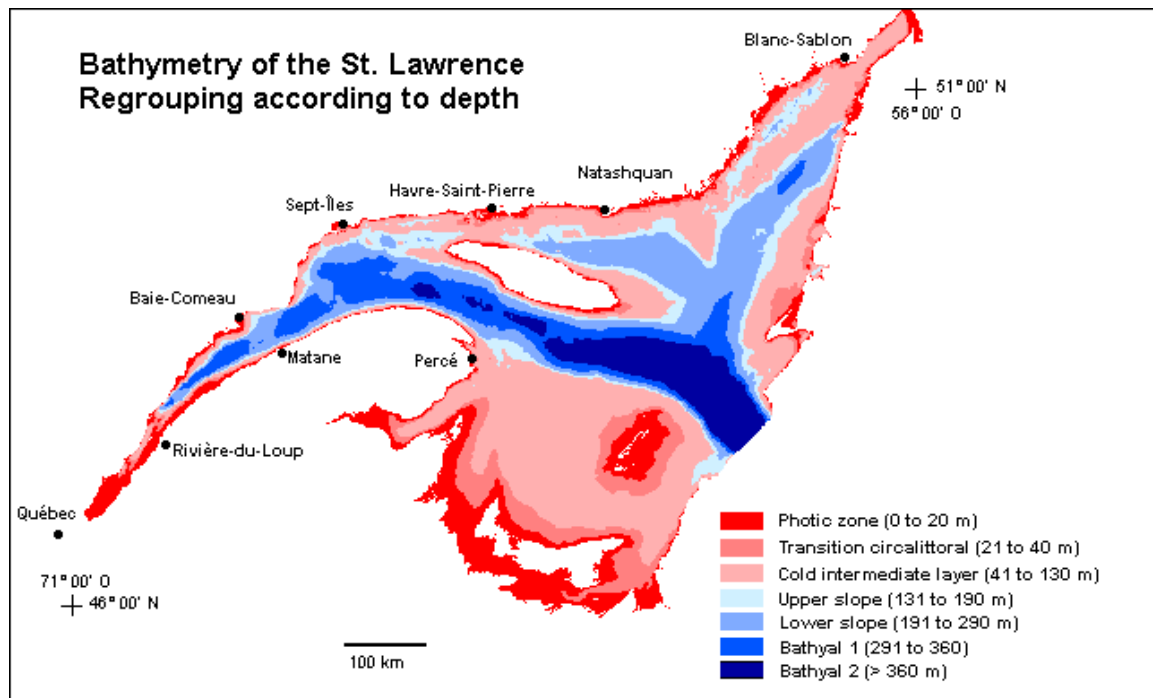


Overview of Marine Biodiversity Information on the St. Lawrence Ecosystem

Introduction

The St. Lawrence marine ecosystem is a semi-closed oceanographic system that is described as either a large estuary or a small ocean. It extends more than 1000 km from the brackish-water Estuary of the St. Lawrence River to the Strait of Belle Isle, near Labrador. At its widest, the Gulf extends roughly 500 km from north to south. Mixing between the in-flowing marine waters of the North-Atlantic continental shelf and the fresh water input of the St. Lawrence, combined with harsh winter conditions and bathymetric features such as the Laurentian Channel, result in a complex mosaic of diverse habitats. Its latitudinal position between the Acadian and the Labrador North Atlantic biogeographical regions largely explains the variety of species present, although some are shared with the distant Arctic as well as with the tropical waters of the south-east coast of the USA.



Many coastal marine environments around the world have been more deeply affected by environmental problems than the St. Lawrence, which has not been identified as a region at risk on the international scale. Nevertheless, it is subjected to significant human activities ranging from fisheries to navigation and toxic contamination. The impacts of these activities on the ecosystem must be monitored and managed. For that purpose, scientific information on biodiversity is needed.

The characteristics of the information needed to monitor and support conservation of the marine biodiversity in Canada is an objective of this workshop. This presentation attempts to describe briefly the scope of the available information for the St.Lawrence ecosystem.

Historical Perspective

Anecdotal information on the wildlife of the St.Lawrence can be found as early as in the 16th century and later accounts of the European exploratory travels to North America. But true scientific data collection is essentially from the 20th century, except perhaps for some observation on salmon in the Miramichi dating from 1874.

More than 20 scientific institutions have been involved during the 20th century in the study of biodiversity and the collection of organisms from the St.Lawrence. Some were academic and private institutions, others were governmental, federal and provincial. One of the oldest to be located on the shores of the St.Lawrence was the « Station biologique du Saint-Laurent » in Trois-Pistoles, on the south shore of the St.Lawrence maritime estuary. It opened in 1929 and was relocated in 1951 in Grande-Rivière, on the Gaspé coast of Baie-des-Chaleurs, under the name of « Station de biologie marine ».

Expertise

DFO's expertise on the St.Lawrence is mainly at the Maurice-Lamontagne Institute, in Mont-Joli on the south shore of the St.Lawrence maritime estuary. Some scientists in Moncton, St.John's and Halifax research centers are also involved in the Gulf of St.Lawrence..

The main academic institutions with past or on-going research projects in the St.Lawrence are:

- Institut des sciences de la mer (ISMER-UQAR) in Rimouski
- Université Laval (GIROQ) in Québec city
- Université de Montréal (GIROQ)
- McGill University (GIROQ and Institute of Oceanography) in Montréal
- Memorial University in St.John's
- Dalhousie University in Halifax
- Université de Moncton

Some provincial governments and private institutions are also active in the St.Lawrence but their expertise in biodiversity study is more limited, their focus being mostly fisheries, aquaculture, marine mammals and education.

Specific diversity

Two recent and major publications have assembled the current knowledge on the diversity of phytoplankton (Bérard-Therriault, L., M. Poulin, and L. Bossé. 1999) and invertebrates (Brunel, P., L. Bossé, and G. Lamarche. 1998) in the St. Lawrence marine ecosystem. These two groups of organisms are the largest in terms of species (499 species of phytoplankton, and 2214 species of invertebrates) and biomass. Very likely, there are still other species present and not yet described or confirmed in the St. Lawrence.

Unicellular or very small organisms have been poorly studied. Very little is known on planktonic and benthic bacteria diversity. Virus and pathogen bacteria have been studied on host species used in aquaculture (salmonids and mollusks essentially) and on marine mammals.

Macrophytes such as algae have been well studied but there is no recent update on their species diversity in the St. Lawrence as a whole. In the 1960's, it was determined that 720 varieties (species and sub-species) existed on the Atlantic coast of Canada (Cardinal, A. 1968). A likely smaller number exists in the St. Lawrence.

Fishes and marine mammals are well documented. But some rare or exotic species can sometimes be added to the known list of species. For instance, a recent observation of walrus, probably a vagrant, was confirmed in the southern Gulf although that species is considered extinct in the St. Lawrence.

The following table presents a general estimation of the number of species in each of 8 groupings of phyla, with a selection of some relevant documents :

Phyla groups	Species nb	Selected Monographs
Bacteria-virus	?	Lovejoy, C. <i>in</i> Bérard-Therriault, L., M. Poulin, and L. Bossé. 1999. (Planktonic bacteria) Fish Health Manual, DFO. (Pathogens)
Protozoa	123	Bérard-Therriault, L., M. Poulin, and L. Bossé. 1999. Guide d'identification du phytoplancton marin de l'estuaire et du golfe du Saint-Laurent (incluant également certains protozoaires). Conseil national de recherches du Canada (Publ. spéc. can. sci. halieut. aquat., 128), 387 p.
Phytoplankton	499	Idem
Macrophytes	< 720 (nb covers Atlantic coast)	Cardinal, A. 1968. Répertoire des algues marines benthiques de l'est du Canada. Cahiers d'information (Province de Québec). Station de biologie marine (Grande-Rivière; Québec); 48.
Invertebrates	2214	Brunel, P., L. Bossé, and G.Lamarche. 1998. Catalogue des invertébrés marins de l'estuaire et du golfe du Saint-Laurent. Conseil national de recherches du Canada (Publ. spéc. can. sci. halieut. aquat., 126), 405 p.
Fishes	201	Scott, W.B.and Scott, M.G. 1988. Atlantic fishes of Canada. University of Toronto Press; Minister of Fisheries and Oceans; Canadian Government Publishing Centre, 731 p. Canadian bulletin of fisheries and aquatic sciences;219. General Status of Wild Species in Canada, Fishbase: www.fishbase.net
Birds – and turtles -	? 1 (leatherback)	Canadian Wildlife Service O'Boyle, R. 2001. Meeting on turtle by-catch in Canadian Atlantic fisheries. Proceedings series (Canadian Science Advisory Secretariat); 2001/17.
Marine mammals	18	Sylvestre, J-P. 1998. Guide des mammifères marins du Canada. Éditions Broquet inc. L'acadie, Québec. 330 p. Fontaine, P-H. 1998. Les baleines de l'Atlantique Nord. Biologie et écologie. Éditions MultiMondes, Sainte-Foy, Qc.

Registry of metadata

DFO's information on the existence of data sets and associated metadata has been compiled recently under the National Science Data Inventory initiative. This inventory is a good starting point to build a Registry on marine biodiversity in Canada. An effort will be needed to classify, validate and keep the information up to date.

DFO's research centers in Mont-Joli and Moncton together report the existence of 472 series of data sets covering the St. Lawrence, 359 sets at Maurice-Lamontagne Institute (MLI) and 113 sets at the Gulf Fisheries Center (GFC). About 42 of the series from MLI and 9 from GFC are physical data on oceanography, contaminants, cartography, hydrography, etc. But most are biological.

Out of the 359 data sets in MLI, 47 only could be identified as having biodiversity study as a goal. The others are either multispecific (97 sets) because they concern 2 or more species in association (e.g. competition-distribution of scallops or seals; predator-prey such as cod and seal; etc), or specific (169 sets) on abundance, distribution, ecology or biology of various species. Some sets of data are from a single project very limited in time and space, while others are very large in scope, including the whole Gulf or covering periods up to 30 and 50 years.

These data sets are compiled as a metadata bank, the persons identified in the inventory keeping possession of the raw data themselves. The main fields for the metadata information are the following :

- Broad phylum (invertebrates, fishes, mammals, etc.)
- Level of, and taxonomic identification (e.g. species, crabs)
- Reliability degree of identification (expertise, controls, etc.)
- Period (year, season, month)
- Geographical location (locality, bay, island, fishing zone, etc.)
- Data substrate (electronic or paper)
- Owner or custodian of the data
- Existence of an associated collection
- Publications on the data (references)
- Location of the data (physical address)

Other institutions own series of data on marine biodiversity. Only their existence is mentioned in the following table, not the size of their series. This table presents the partition of the metadata series between the major phyla groups.

Phyla groups	Owners of Data Series	Nb of series
Bacteria-virus	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • Laval University 	5 ?
Protozoa - Phytoplankton	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • DFO – Gulf Fisheries Center 	20 1
Macrophytes	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • DFO – Gulf Fisheries Center • Provincial fisheries departments • Laval University 	9 1 ? ?
Invertebrates	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • DFO – Gulf Fisheries Center • ISMER and UQAR (Rimouski) • McGill (?) • Laval University • Provincial fisheries departements 	186 41 ? ? ? ?
Fishes	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • DFO – Gulf Fisheries Center • Provincial fisheries departments • Laval University 	111 74 ? ?
Birds – and turtles -	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • Canadian Wildlife Service (EC) 	2 ?
Marine mammals	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • GREMM (Groupe de recherche et d'éducatons sur les mammifères marins) • MICS (Mingan Islands Cetacean Station) 	43 ? ?

Collections

There were at least 51 different projects in Québec with series of samples still kept in collections of marine fauna from the St.Lawrence ecosystem. The oldest project dates from 1929 to 1935. Other collections with samples from the St.Lawrence may also exist in the Maritimes or in Newfoundland.

One of the important collections is the reference collection at Maurice-Lamontagne Institute. It contains over 10278 different entries of specimen covering 25 different phyla. Other projects on various phyla also contributed samples kept in collections at MLI.

Professor P. Brunel holds another significant collection of marine organisms from the St.Lawrence, mainly invertebrates. Many more specimen have been deposited at the Canadian Museum of Nature, from a large variety of phyla. Other institutions are known to keep collections of marine organisms from the St.Lawrence but their nature is not well documented, and they are probably not as large.

Marine mammals collections are essentially of tissues such as skin, fat, bones and teeth.

Phyla groups	Institutions	Nb of collections	Nb of publications
Bacteria-virus	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • Pathology Labs (Vet Schools and Provinces) 	1 ?	2 ?
Protozoa - Phytoplankton	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • University of Montreal (J. Brunel collection) 	8 1	37 ?
Macrophytes	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) 	1	20 ?
Invertebrates	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • University of Montreal (P. Brunel collection) • DFO – Gulf Fisheries Center • Canadian Museum of Nature (Ottawa) 	17 ? ? ?	28 ? ? ?

Fishes	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • FAPAQ (Québec dept. of wildlife and parks) • Canadian Museum of Nature 	21 ? ?	17 ? ?
Birds – and turtles -	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • Canadian Wildlife Service (EC) 	1 ?	1 ?
Marine mammals	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) • GREMM (Groupe de recherche et d'éducatons sur les mammifères marins) • IleVerte private museum (squeletons) • Ontario museum of natural history 	7 ? 1 1	7 ? ? ?
Multi-phylum	<ul style="list-style-type: none"> • DFO – Maurice-Lamontagne Institute (MLI) 	n/a	23

Publication of data

There is a large set of publications about marine biodiversity in the St.Lawrence and an exhaustive review was beyond the scope of this overview. Nevertheless, two sources of information, the MLI publications list and the ASFA (Aquatic Science and Fisheries Abstract), were examined for such documentation. The partition of the publications among the various groups of phylum provides an approximate measure of research effort between them, in the upper table. The period covers from the mid-20th century until 1999.

Information accessibility

The information on biodiversity in the St.Lawrence is essentially scattered and available to experts knowing its existence and developing a contact with the owner or custodian of the data. Much of the information is not even compiled and verified in sets of metadata, or registries, either on paper or preferably in electronic format.

Internet sites are being developed that will eventually be able to provide to a wide scientific audience a direct link to the sources of this information. DFO maintains a site known as l'Observatoire du Saint-Laurent (the St.Lawrence Observatory). This site is dedicated to broadcasting information on the St.Lawrence and is a likely prime access to DFO's scientific information on the marine biodiversity of the St.Lawrence.

Environment-Canada, under the inter-governmental St.Lawrence Vision 2000 Program have developed a site entitled : *Portrait of biodiversity in the*

St. Lawrence, at the address : www.qc.ec.gc.ca/faune/biodiv. This site presents general information on the River ecosystem as well as on the marine component of the St. Lawrence.

Likewise, the *Centre de données sur le patrimoine naturel du Québec*, member of Nature Serve like other north american Conservation Data Centers, is open to collaboration and linkage of sites on biodiversity. This Centre is run by the two wildlife departments of the Province of Québec and collaborates already with Environment-Canada on biodiversity data in Québec.