

# CHAPTER 6 SOUTHERN QUEBEC/ ST. LAWRENCE REGION

## Introduction

The National Programme of Action for the Protection of the Marine Environment from Land-based Activities (NPA) in the Southern Quebec Region<sup>1</sup> covers the marine area of the Saguenay fjord, the St. Lawrence estuary and the northwest part of the Gulf of St. Lawrence (along the north shore, Anticosti Island, the Gaspé Peninsula and the Magdalen Islands).

Land-based activities are relatively limited and are spread out over approximately 8000 km of shoreline. Fewer than 400 000 people live along the shores of this vast area and there are no urban centres with populations over 40 000.

The riparian population density averages three inhabitants per square kilometre. Agriculture is significant only along the south shore of the estuary and along Chaleur Bay. Heavy industry, consisting of 10 pulp and paper mills, three aluminum smelters and two ore pelletization facilities, is concentrated in a few urban centres (La Malbaie, Rivière-du-Loup, La Baie, Matane, Baie-Comeau, Port-Cartier, Sept-Îles, Chandler and New-Richmond). The impacts of these activities on the marine environment are often confined to the immediate vicinity of the local industries.

The area in question is downstream from highly urbanized, industrialized and

agricultural regions. The first part, the upper St. Lawrence basin (Great Lakes and southern Quebec), has approximately 40 million people (United States and Canada combined) and is one of the largest industrial and agricultural areas in the world (metallurgy, petrochemicals, pulp and paper). The second part, the upper Saguenay River basin, has three aluminum smelters and six pulp and paper mills. Adding to these two remote sources of persistent toxic substances is long-range transport of atmospheric pollutants from the entire northern hemisphere. The impact of remote sources of persistent pollutants is felt throughout the entire marine ecosystem of the St. Lawrence basin. The extent of the impact depends largely on how these substances can become magnified in the food chain.

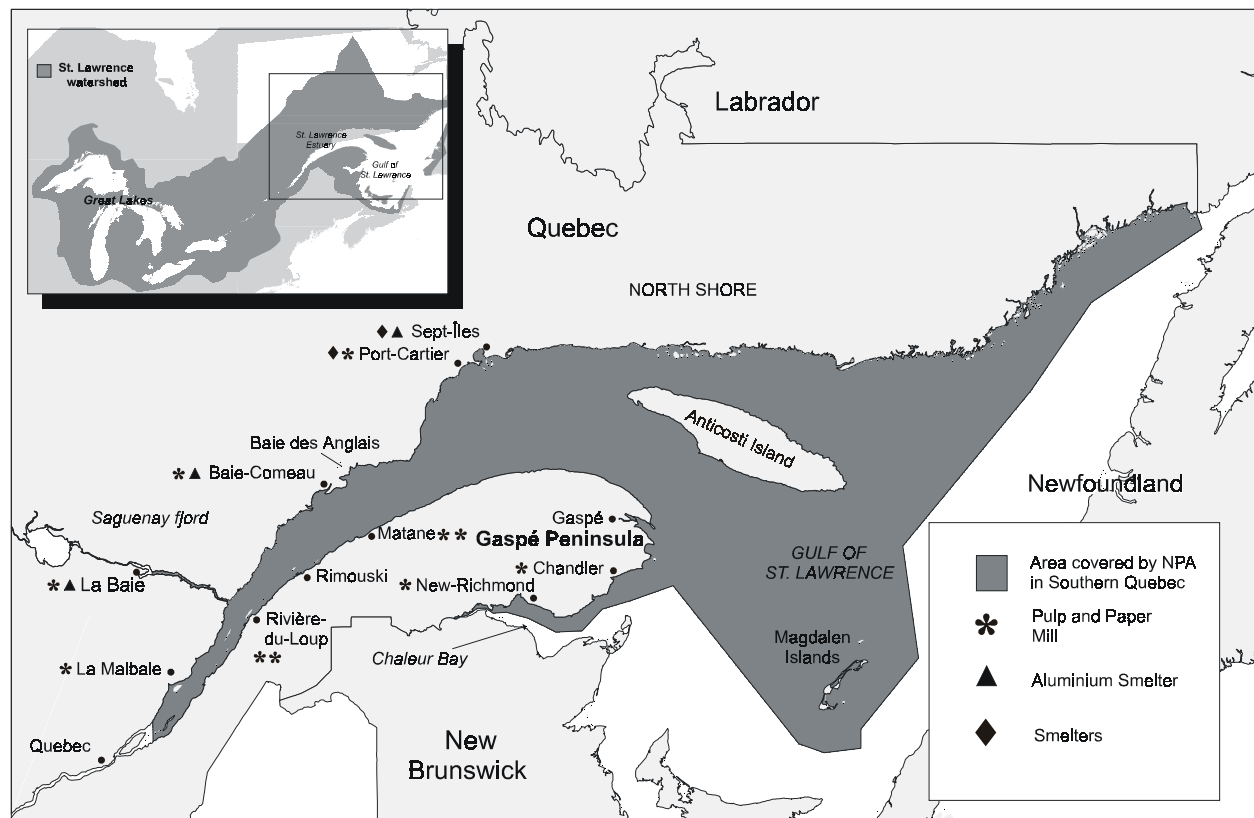
The coastal habitats of this area include a large variety of ecosystems. For example, the middle estuary, located upstream from Tadoussac, represents the mixing zone where freshwater from the river and seawater meet. This area is known for its high tides, relatively warm, turbid waters and inter-tidal marshes. The Saguenay fjord, on the other hand, is known for its rocky and very steep shores and for a layer of brackish water over deep basins of seawater. The Saguenay is home to marine wildlife with boreal and Arctic features, as well as a few relic populations of Arctic species, remnants of the last glacial stage. The lower estuary, located downstream from Tadoussac, and the Gulf have distinctly maritime features with rocky coasts intersected by large sandy deltas at the mouth of the main rivers. In

<sup>1</sup> Northern Quebec — the areas east of James Bay, Hudson's Bay and Ungava Bay — will be covered in a later version of the NPA.

these areas, the inter-tidal marshes are confined to environments sheltered from the waves, such as estuaries and the Gaspé sandbars. The Gulf region has the most diversified habitats and fishery resources. Many marine mammals come to this region to find food. The many lagoons are quite

productive, and large colonies of seabirds nest on islands. Finally, in the Magdalen Islands two large sets of sandbars, surrounding lagoons, connect the largest islands. These sandbars comprise a vast expanse of dunes that are partly held in place by vegetation.

**Figure 6-1 St. Lawrence River Drainage Basin: Area Covered by this Chapter and Key Industrial Facilities in the Area**



## 6.1 Identification and Assessment of Problems

### 6.1A Contaminants

#### Sewage

The contamination of the coastal zone by sewage was a major problem during the early 1990s. Contamination was mostly caused by untreated municipal sewage and overflows, during heavy rains, of combined

sewer systems linked to treatment plants (point sources) and individual septic tank systems (non-point sources).

In a few areas, runoff from inadequately installed storage facilities for livestock wastes also adds to contamination. The percentage of the riparian population in the region that is served by treatment plants has risen from less than 19% during the early

1990s to almost 50% in 1996, and reached 70% at the end of 1998.

The main problem associated with domestic sewage in the Quebec Region is the contamination of coastal environments with pathogenic micro-organisms. This type of contamination poses human health risks (through consumption of bivalve molluscs) and contributes to the overall degradation of the quality of coastal environments, for example, by limiting their use for swimming. Shellfish water quality in approximately 200 areas has been monitored for several years. The harvesting of molluscs is permanently or temporarily prohibited because of bacterial contamination in nearly half of all shellfish areas in the region. The problem is particularly acute along the south of the estuary and in the Gaspé Peninsula.

New treatment plants currently undergoing testing should help improve the aesthetic quality of most trouble spots and allow them to be used for recreational/tourism activities. They will also pave the way for the harvesting of molluscs in some shellfish areas currently closed by bacterial contamination. However, the shellfish in many other areas will remain unfit for harvesting because of combined sewer system overflows during heavy rains, inadequate septic tank systems and agricultural activities along the shores.

#### *Persistent Organic Pollutants*

Organochlorines that contaminate marine organisms in the region are largely transported by water from the upper St. Lawrence basin and the Saguenay and by long-range atmospheric transport. Depending on the kinds of substances in question, the relative importance of local and remote sources varies, along with the

importance of atmospheric and upstream sources.

For example, it has been estimated that 65% of the polychlorinated biphenyls (PCBs) found in the estuary and the Gulf of St. Lawrence at the end of the 1980s came from the St. Lawrence River and 35% from direct atmospheric pollution. The only major local land-based source of PCBs was an aluminum smelter located in Baie-Comeau, and its releases into Baie des Anglais were virtually eliminated at the end of the 1980s. Moreover, the only known sources of mirex are located in the Great Lakes Region. However, heavy DDT spraying of coastal forests in the estuary and the Gulf until the beginning of the 1970s was a major local source of toxic substances. The effects of the spraying can be found in the marine food chain to this day. Dioxins and furans enter the region's waters by fluvial transport and atmospheric pollution in proportions similar to those estimated for PCBs. Chlorine bleaching processes, an important source of organochlorines, are no longer used by pulp and paper mills located in the Quebec marine region. In general, the St. Lawrence estuary has been more contaminated by organochlorines than the Gulf of St. Lawrence. The only hot spot from these types of substances is in Baie des Anglais, which was contaminated with PCBs released from an aluminum smelter.

Local sources of polycyclic aromatic hydrocarbons (PAHs) are relatively important in comparison with organochlorine sources. The main ones are aluminum smelters located along the river shores and in harbours. PAH contamination is particularly severe in the Saguenay fjord and Baie des Anglais near Baie-Comeau. Contaminated sediments can also be found near wharves treated with creosote.

Since the 1970s, major industrial clean-up efforts have been made throughout the St. Lawrence basin and have had a beneficial impact on the marine environment.

Concentrations of PCBs, DDT, PAHs and other substances have decreased in water, suspended matter, surface sediments and marine organisms. Most of the persistent organic pollutants (POPs) introduced into the marine environment since the start of the industrial era are currently buried under less contaminated sediments in the main sedimentation zones of the ecosystem (Saguenay fjord and the lower estuary of the St. Lawrence).

Current levels of organochlorine contamination for most fishery resources in the region (molluscs, crustaceans and fish) do not pose a significant risk to human health. However, American eels migrating from Lake Ontario and the upper St. Lawrence are highly contaminated with PCBs, mirex and dieldrine. Species from the Baie des Anglais region (mussels, whelk, crab, herring, cod) are subject to consumption restrictions because of local sediment contamination with PCBs (Duchesne et al., 1996). Moreover, PAH levels are high in molluscs found in zones located close to local sources of these contaminants (i.e., in the Baie des Anglais and Saguenay fjord regions).

The level of organochlorine contamination in the region's fish-eating birds has decreased considerably since the 1970s and is currently halfway between that found on the Atlantic coast and in the Great Lakes Region. This level does not appear to have a significant impact on the health of these birds.

Because of biomagnification, organochlorines reach relatively high

concentrations in marine mammals, particularly in year-round species such as belugas and harbour seals. Organochlorine levels in the adipose tissue of beluga whales are 100 times higher than in Arctic populations. It is believed that the deaths of many of these whales may be linked to high levels of exposure to organochlorines through their diet.

Results on tributyltin (TBT) concentrations in surface sediments and mussel samples collected in four harbours of the St. Lawrence estuary have been recently reported (Saint-Louis et al., 1997). Results obtained for mussels and sediment are consistent and show that contamination levels were higher near harbour facilities and decreased rapidly outside these harbours. The harbour of Les Méchins was the most contaminated site with an average TBT concentration (dry weight) of  $40 \pm 12$  ng Sn  $g^{-1}$  in sediment and  $145 \pm 8$  ng Sn  $g^{-1}$  in mussels. These values suggest a moderately contaminated environment. However, lower contamination levels were found at the three other harbours investigated (Baie-Comeau, Rimouski-Est and Gros-Cacouna).

Butyltin concentrations (TBT, dibutyltin [DBT] and monobutyltin [MBT]) identified in liver and blubber samples from beluga whales found dead in the St. Lawrence estuary (Yang et al., 1998) suggest that these pollutants can accumulate in organisms higher up the food chain in this important coastal environment.

#### Radionuclides

Radionuclides, resulting from human activity and found in the region's sediments, originate primarily from long-range atmospheric transport, as no major local source has been identified. Levels in the marine environment are not a concern.

### Heavy Metals

In general, heavy metals from human activity, found in the waters of the St. Lawrence, come primarily from chlor-alkali plants located along the shores of the St. Lawrence and Saguenay rivers and the south shore of Chaleur Bay. These sources have been reduced considerably since the 1970s, and have been almost totally eliminated. Currently, mercury inputs to the St. Lawrence marine waters, particularly in the Gulf, are thought to come from atmospheric pollution. As for lead, the amount of atmospheric pollution in the St. Lawrence watershed has decreased considerably since 1970, with the introduction of unleaded gasoline.

The main problem associated with heavy metals and organometallics in the region is the mercury contamination of the Saguenay fjord. This contamination comes from a chlor-alkali plant that operated from 1947 to 1976 in the upper Saguenay basin. Since this plant was closed, the level of contamination in the water, surface sediments and in marine wildlife in the fjord has decreased considerably. The prohibition of crab and shrimp fishing in the Saguenay fjord is intended to prevent the resuspension of sediment.

The St. Lawrence estuary, particularly the marine estuary, is another area that has been heavily contaminated with mercury and lead. Once again, the level of contamination has decreased considerably since the 1970s. Heavy metal concentrations in fishery resources in the region (molluscs, crustaceans and fish) are usually low and do not pose significant human health risks. The exception is the Saguenay fjord, where mercury concentration levels in crab and shrimp are near the maximum acceptable levels set by Health Canada (SEBSC, 1984,

in Duchesne et al., 1996). The same is true of migratory eels from the upper St. Lawrence basin. Heavy metal concentrations in marine birds are low and do not appear to affect bird health. However, concentrations of mercury, lead and selenium in beluga whales are higher than those reported in Arctic populations.

### Oils/Hydrocarbons

Since 1970, six major oil spills (100-500 tonnes) off the coast and in ports have directly affected the area. There are also approximately 60 minor spills every year in ports along the St. Lawrence.

During the 1970s, most hydrocarbons found in the marine environment came from accidental or deliberate discharges by ships on the high seas. The situation has been greatly improved by measures to prohibit the discharges of petroleum in the Gulf and to reduce discharges in the Atlantic. However, large volumes of petroleum products are handled and stored in ports, thus creating a significant risk.

Following recommendations in the 1990 Brander-Smith report, there have been considerable improvements during recent years in the regional ability to prevent petroleum and chemical product spills in the marine environment, and to respond when spills occur or when habitats are contaminated by petroleum. The region has a new strategy to deal with emergency situations in the marine environment. It includes:

- high pollution alert systems, personnel and supply depots of intervention materials in many harbours (Québec-Lévis, Chicoutimi-La Baie, Tadoussac, Rimouski, Baie-Comeau, Sept-Îles, Havre Saint-Pierre and Gaspé); and

- bird-cleaning centres (Cap-Tourmente, Saint-Fulgence, Mont-Joli, Baie-Comeau, Gaspé [Forillon] and Cap-aux-Meules).

Research projects on the development of biotechnological restoration techniques for petroleum-contaminated coasts are under way.

### Nutrients

Nutrients from sewage, aquaculture and other land-based activities such as agriculture are not considered a threat to the Quebec marine ecosystem. Although it has been scientifically established that this type of pollution may promote algal blooms in plankton that are toxic to vertebrates, no such correlation has been found for the estuary and gulf of the St. Lawrence. This type of contamination is not considered a priority in the region.

### Contaminated Sediments

About 40 contaminated sediment sites have been inventoried in the Quebec portion of the St. Lawrence (river, estuary, northwest of the Gulf and Saguenay fjord) containing persistent and bioaccumulative toxic substances (PCBs, PAHs, hexachlorobenzene, mercury and lead). In the majority of cases, the land-based contamination sources have been eliminated or considerably reduced. As well, dredging and disposal of these sediments is subject to strict regulations that forbid any disposal of contaminated sediments in the marine environment. However, the contaminants found at these sites can be reintroduced into the food chain by natural, physical, chemical, biochemical and biological means that are difficult to control, and whose effects are not known.

### Litter

At the end of the 1980s, contamination of the St. Lawrence estuary shores by persistent solid waste was much less significant than on the beaches of the eastern U.S. coast. Close to 85% of the waste consisted of plastic originating from household sewage, storm sewers, snow disposal, illegal dumps and recreational/tourism activities along the shoreline. The primary impact of solid waste on the environment is that it is an eyesore. However, fish and marine mammals have been known to ingest litter or to get tangled up in it, with sometimes fatal consequences.

The situation is probably better now as many municipal sewage treatment plants have come on-line and there has been a gradual closing of illegal dumps located close to the shore. In addition, as of 1999, municipalities that continue to dump their snow in the water will have to pay compensatory fees. Recently, numerous clean-up projects have helped clear away litter along the shores.

## **6.1B Physical Alteration and Destruction of Habitat**

### Shoreline Construction/Alteration

For the most part, the shorelines have retained their natural features, particularly along the north shore and to a lesser extent along the south shore of the St. Lawrence and Chaleur Bay. Between 1945 and 1988, about 2063 ha (excluding marshes, estuaries, sandbars and lagoons) were affected by the development of harbour facilities, roads and residences. The artificial shores are mostly located in important harbours (La Baie, Matane, Baie-Comeau, Port-Cartier and Sept-Îles), in urban centres and on stretches of roads built along the coastline. This is particularly true along the north shore of the Gaspé Peninsula and along the Manicouagan Peninsula, where several kilometres of

shoreline have been reinforced to control erosion. Depending on the case, these alterations have modified natural environments, changed the heterogeneity of the coastal environment, or created or modified erosion/permanent deposition zones and thereby caused habitat modification. However, there are now several provincial and federal laws and regulations aimed at protecting the shoreline.

#### Inter-tidal and Sub-tidal Habitat Alteration

Very little seaweed harvesting is carried out in the region, and aquaculture is not highly developed. In contrast, the use of all-terrain vehicles in marshes, dunes and on beaches has become a major concern, especially in the Magdalen Islands. The misuse of these vehicles contributes to the destruction of dune and marsh vegetation, which can cause or aggravate erosion. In 1997, Quebec established a regulation on the use of motorized vehicles in certain fragile environments in order to reduce the impact of this kind of alteration.

#### Mineral and Sediment Extraction/Alteration

From 1983 to 1991, an average volume of 400 000 m<sup>3</sup> of sediments was dredged every year in regional ports, fishing harbours and marinas. The main potential physical impacts of these dredging activities are habitat destruction and temporary increases in water turbidity. However, dredging is done only when the environment is least likely to be harmed. The dredged areas are usually fairly unproductive, artificial habitats, and there are few disposal areas. Ongoing studies should shed more light on the rate of benthic organism recovery. Limited dredging takes place along the region's coasts, and the impact on the marine environment is therefore negligible. These activities are governed by a number of

federal and provincial laws, regulations and policies, most notably the *Quebec Environmental Quality Act* concerning the issue of authorization certificates and the Environmental Impact Assessment and Review Procedure; the *Fisheries Act* and the Policy for the Management of Fish Habitat; and the provisions of Part 7 of the *Canadian Environmental Protection Act* (1999) concerning disposal at sea.

#### Wetland and Saltmarsh Alteration

Salt marshes and brackish marshes in the region have been significantly altered because of agriculture, residential construction and the development of roads and harbour facilities. The problem is particularly serious along the south shore of the St. Lawrence estuary, which has the highest concentration of marshes. Over 1000 ha of marshland have been altered over the course of the 20th century, primarily through the drainage of their upper portion with dikes for agriculture. These changes have reduced the productive capacity of the marine environment and eliminated critical habitats for aquatic wildlife and birds. The changes made to the natural environments of this area have had a major impact on many species associated with the upper marsh zones. Waterfowl and some endangered birds nest in these habitats.

From 1988 to 1996, close to 6500 ha of coastal environment located in the area covered by the NPA have received protection status. Despite all the important work that has protected thousands of hectares of habitat, including critical habitats for endangered species, there is still a great need for further protection.

### Marine Waters and Coastal Watershed Alteration

Flows on the St. Lawrence River and several other major rivers (Saguenay, Betsiamites, aux Outardes, Manicouagan and, since 1998, Sainte-Marguerite) are controlled by hydroelectric dams. Their cumulative impact has reduced seasonal variations in freshwater inflows into the estuary over the last 20 years by 50%. Less recognized is the reduction of surface nutrient salt caused by the reduced upward movement of deep water at river-mouths. The harnessing of rivers also alters the sediment regime and can cause delta erosion. Dams can also create obstacles to the migration of anadromous and catadromous species of fish, and may have contributed to declines observed in several populations since the 1950s. The dredging of the St. Lawrence ship channel between Montreal and Quebec City during the 1950s may also have had a negative impact on fish populations such as the striped bass, the Atlantic sturgeon, and the rainbow smelt.

Road and railway construction in coastal areas has reduced exchanges with the sea in several estuaries and lagoons in the region. This problem is particularly serious in the sandbars of the Gaspé Peninsula and the lagoons of the Magdalen Islands, where saltmarshes and eelgrass flats are found. This type of alteration has reduced the biological productivity and biodiversity of environments that provide critical habitats for fishery resources and migratory birds. In the territory covered by the NPA, two disrupted areas, the Bonaventure and the Paspébiac sandbars, have recently been restored. Many other areas are currently being studied for eventual restoration.

### Biological Alteration

There have been no documented cases of the introduction of exotic species that have had a significant impact on habitats and resources in the marine region of Quebec. However, in 1993, about 6.1 million tonnes of ballast water from foreign ships were discharged into the harbours of the estuary and the Gulf of St. Lawrence. Many planktonic algae and invertebrates known to have been introduced in coastal environments similar to those of the Gulf may have been introduced through ship deballasting in harbours. Voluntary guidelines now encourage foreign ships that enter the Gulf to exchange their ballast water offshore. It is not known, however, whether the guidelines are followed by ships headed to harbours in the St. Lawrence estuary, the Gulf of St. Lawrence or the Saguenay River. Transfers of molluscs between zones harbouring distinct populations of the same species are on the rise because of aquaculture development. These transfers from other zones can bring about the inadvertent introduction of toxic algae or diseases. This can alter the phenotypic composition of local populations and reduce their ability to adapt to the environment.

## **6.2 Establishment of Priorities**

Priorities for action were established using the following criteria:

- The severity of risk or the actual impact on human health or the health of the marine ecosystem.
- The nature of the activities at the source of the problem and the effectiveness of the existing control measures. The contaminant and habitat-alteration categories that have been given high priority are those that entail a significant



risk, or currently have major negative consequences on human health or on the productivity and biodiversity of the marine environment.

- When risk and impact are equal, a higher priority has been given to categories requiring additional or more effective measures.

Based on these criteria, each contaminant and habitat-alteration category was ranked as **high**, **medium** or **low priority**.

### 6.2A Contaminants

#### Sewage

The control measures implemented since the early 1990s (municipal sewage treatment plants) will not completely restore the quality of the coastal area or be sufficient for the restoration of many potential shellfish harvesting areas. Additional measures are required to restore shellfish areas that have been contaminated by inadequate septic tank systems and livestock waste storage facilities, as well as by overflows of sewer systems during heavy rains. A **high priority** is given to this category.

#### Persistent Organic Pollutants

Despite the major drop in POPs in the marine environment since the 1970s, these substances can still represent a major local threat to human health and the ecosystem. The elimination of land-based sources of POPs throughout the St. Lawrence watershed must continue. A **high priority** is given to this category.

#### Radionuclides

There are no significant local sources of radionuclides in Quebec. A **low priority** is given to this category.

#### Heavy Metals

The main industrial sources of heavy metals in the St. Lawrence watershed have been eliminated or considerably reduced. The main inputs now come from atmospheric transport. A **medium priority** is given to this category.

#### Oils/Hydrocarbons

Measures aimed at preventing and dealing with oil spills in harbours have improved considerably during the 1990s and are considered adequate. A **low priority** is given to this category.

#### Nutrients

The main potential problems linked to nutrients in the marine environment are not a major concern and are taken into consideration by the measures that target the sewage point sources. Inputs from non-point sources attributable mainly to agricultural activities are a cause of some concern and will be taken into consideration in the near future. A **low priority** is given to this category.

#### Contaminated Sediments

Inventoried contaminated sediment sites in the Gulf, river and the estuary harbours, as well as in the sediment basins of the St. Lawrence estuary and of the Saguenay fjord, are reservoirs of persistent bioaccumulative toxins (PCBs, PAHs, mercury). The risk that these areas pose to the marine environment, and the implementation of management plans aimed at reducing the impact, are priorities. However, owing to the contaminant loads above background levels, and the large areas involved, this category is given a **medium priority**.

### Litter

The measures aimed at reducing the quantity of land-based solid waste inputs to the marine environment are considered adequate. A **low priority** is given to this category.

## **6.2B Physical Alteration and Destruction of Habitat**

### Shoreline Construction/Alteration

Current legislation ensures an adequate level of shoreline protection. This issue is nevertheless considered a **high priority** because of the threat of erosion and the continuing development in numerous sectors. There is a lack of data on the habitat loss sustained during the past few decades.

### Inter-tidal and Sub-tidal Alteration

The activities that disrupt these habitats rarely take place in the region, and a **low priority** is accorded to this category.

### Mineral and Sediment Extraction/Alteration

Many measures control dredging and sediment disposal activities. However, several questions remain unanswered regarding the impact of these activities on resources (regeneration of benthos, recirculation of contaminants). Since dredging is often conducted in areas where sediments are likely to be contaminated (e.g., in some harbours), this issue is considered a **medium priority**.

### Wetland and Saltmarsh Alteration

The protection of wetlands and coastal seabeds remains a **high priority** even though the total area of protected environments has increased during the past few decades. The law does not yet protect most of these habitats, which are essential to the survival of many species.

### Marine Waters and Coastal Watershed Alteration

The protection, conservation and, when possible, the restoration of lagoons and sandbars is a **high priority**. Many protection, enhancement and restoration projects have been or will be initiated shortly by local groups. This shows there is a general interest in protecting riparian populations in these highly productive environments. Hydroelectric development projects are likely to have the greatest impact on the hydrodynamics of the coastal watersheds. The current regulatory framework should adequately control these projects. This issue is considered a **medium priority**.

### Biological Alteration

There is a risk of introducing exotic species into the marine environment through ship ballast water. The measures now in place to deal with this problem are considered inadequate. Since a large part of the problem stems from offshore activities, this kind of alteration is considered a **medium priority**.

## **6.3 Setting Goals and Management Objectives**

Under the NPA, Canada's goals are to:

- protect human health;
- reduce the degradation of the marine environment;
- remediate damaged areas;
- promote the conservation and sustainable use of marine resources; and
- maintain the productive capacity and biodiversity of the marine environment.

The following are specific management objectives for each source category.

### 6.3A Contaminants

The general management objective for most of the contaminants is to reduce their presence in the marine environment, primarily through pollution prevention. Where contaminants are released to or occur in the marine environment, the management objective is to apply life-cycle management or remediation to address the problems.

The management objectives for all categories of contaminants in southern Quebec are to:

- reduce, control or eliminate persistent, bioaccumulative toxic substances in liquid effluent in the entire St. Lawrence River drainage basin (as represented in Figure 6-1) and in atmospheric emissions that can affect the marine environment; and
- reduce, control or eliminate all categories of pollution from local, land-based sources.

Specific management objectives for each of the contaminants, consistent with the national plan, are as follows:

Sewage — reduce contamination from sewage; maintain and improve estuaries, coastal water and marine ecosystem quality for all users; maintain and restore shellfish growing areas.

Persistent Organic Pollutants — reduce/virtually eliminate anthropogenic inputs; apply life-cycle management to remaining inputs.

Radionuclides — reduce inputs where they are likely to cause pollution; apply radiological protection.

Heavy Metals — reduce inputs where they are likely to cause pollution; apply life-cycle management; avoid disturbing contaminated sediments so as not to resuspend contaminants.

Oils/ Hydrocarbons — prevent spills and establish contingency plans; apply life-cycle management.

Nutrients — reduce inputs where they are likely to cause pollution.

Contaminated Sediments — reduce sediment contamination at source.

Litter — reduce the incidence of litter/debris found in the marine environment.

### 6.3B Physical Alteration and Destruction of Habitat

The primary management objectives are to mitigate or avoid harmful alteration and destruction of habitats, and to restore those habitats already degraded. For some categories of harmful alteration (e.g., mineral and sediment extraction or alteration; alteration of marine waters and coastal watersheds), it is also necessary to identify critical habitats to ensure that such activities take place in areas of lesser environmental sensitivity or significance. Finally, there are some specific management objectives that apply to unique problems. For instance, the objective is to eliminate the accidental or deliberate introduction of undesirable or non-native (exotic) species to the marine environment from land-based activities.

The management objectives for all categories of physical alteration and destruction of habitat aimed at maintaining

the productivity and biodiversity of the marine environment, are to:

- prevent the destruction or alteration of the critical habitats of fish and species at risk;
- reduce the impact of land-based activities on habitat;
- increase the area of habitat that is given legally protected status; and
- restore the productivity and biodiversity of altered habitats, where possible.

Specific management objectives for each of the habitat categories, consistent with the NPA, are as follows:

*Shoreline Construction/Alteration* — minimize habitat loss and balance these losses by restoring or creating equivalent replacement habitat.

*Inter-tidal and Sub-tidal Alteration* — identify critical habitats and prevent loss or degradation of these areas while restoring those already degraded.

*Mineral and Sediment Extraction/Alteration* — identify and protect sensitive habitats and marine resources.

*Wetland and Saltmarsh Alteration* — prevent any further loss or destruction of critical habitats and, where feasible, restore valuable areas previously drained or altered.

*Marine Waters and Coastal Watershed Alteration* — protect key habitats for all life stages of marine resources.

*Biological Alteration* — reduce the risks of inadvertent or inappropriate introductions of undesirable (exotic) species and pathogens, and monitor sensitive coastal ecosystems.

## 6.4 Strategies and Actions

### 6.4A Contaminants

Many laws, regulations, policies and programmes are already in place, at both the provincial and federal levels, to meet NPA goals and the objectives of management to reduce or eliminate land-based sources of contamination. The existing international and federal strategies and measures are discussed in Chapter 3 of this document. The Government of Quebec's measures deal, in particular, with municipal, industrial and agricultural sewage, atmospheric emissions, pesticide use and the disposal of solid waste, snow and hazardous waste.

- The *Programme d'assainissement des eaux du Québec* (PAEQ) [Quebec water treatment programme] is of particular importance. The aim of this programme, implemented in 1978, is to clean waters so as to use them to their full capacity, and to preserve the ecological balance of ecosystems. The urban component of this programme was replaced by the *Programme d'assainissement des eaux municipales* (PADEM) [municipal water treatment programme] in 1995. In May 1998, another programme was added to existing measures for the treatment of municipal wastewater. Entitled *Les eaux vives du Québec* [Quebec's flowing water], the programme targets municipalities that do not have a wastewater treatment plant. With regard to the agricultural sector, in June 1997 Quebec promulgated the Regulations on the Reduction of Pollution from Agricultural Sources, the goal of which is to improve the storage of livestock waste and the spreading of fertilizers to minimize inputs into water. It is backed up by the *Programme d'aide à*

*l'investissement en agroenvironnement* (PAIA) [agri-environment investment support programme] to improve the management of livestock wastes.

- The *Programme de réduction des rejets industriels* (PRRI) [industrial discharges reduction programme] was established in 1988 to protect air, water and land by setting discharge standards determined by the characteristics of the receiving environment. As a result the standards may be more stringent than those required by regulation.
- The *Programme de gestion et de réhabilitation des lieux d'élimination des déchets dangereux* (GERLED) [hazardous waste disposal site management and rehabilitation programme] is designed to define hazardous waste disposal sites and, if necessary, to restore them according to the intervention priorities based on potential health and environmental risks.
- The *Plan d'action pour l'évaluation et la réhabilitation des lieux d'enfouissement sanitaire* (PAERLES) [sanitary landfill site evaluation and rehabilitation action plan] was introduced in 1991 to, among other goals, reduce the impact of sanitary landfill sites on the receiving environment.

The St. Lawrence Action Plan (SLAP), launched in 1988 and whose third five-year phase started in June 1998, is a joint programme of the Government of Quebec and the federal government. The St. Lawrence Action Plan — Vision 2000 (Phase III) contains many measures aimed at reducing the incidence of contaminants in Quebec. It has several components, including those focused on reducing industrial discharges, reducing pollution from agricultural sources, restoring disturbed environments and ensuring the

involvement of the coastal communities.

This last component comprises a programme geared specifically toward promoting public participation and action at the local level. Called the *Zones d'intervention prioritaire* (ZIP) [priority intervention zones] programme, it has already spearheaded the creation of many local committees whose mandate is to consult the public in order to define priorities for action in their sector, and to develop joint *Plans d'action et de réhabilitation écologique* (PARE) [ecological rehabilitation action plans] on the basis of identified priorities. Finally, the creation of the Saguenay-St. Lawrence Marine Park allows for the better management of activities that could cause a resuspension of sediment.

The Government of Quebec is participating in working groups with the federal and provincial governments to find solutions to specific problems regarding atmospheric emissions. For example, the Strategic Options Process (SOP) is aimed at reducing the quantity of certain kinds of contaminants such as fine particles that contain toxic substances (some metals: lead, arsenic, mercury; some organic substances: PAHs, benzene). A working group was also created within the framework of the Conference of New England Governors and Eastern Canadian Premiers in order to develop a mercury reduction strategy with a component on atmospheric emissions.

To recap, strategies and actions include:

- existing measures that are deemed adequate, and that it is proposed to maintain and to improve where required;
- existing measures deemed inadequate, and that it is proposed to strengthen (existing measures should be strengthened); and

- new actions deemed necessary that merit further consideration in the future (proposed).

When contaminants are discharged into the environment, an approach based on the management of substances during their life cycle and on the prevention of pollution at source is favoured. In addition, an approach based on integrated watershed and coastal area management is favoured to promote joint action by local, regional, provincial and federal stakeholders to optimize the protection of the marine environment and human health.

The following strategies and actions apply to all contaminant categories:

- Promote compliance with the laws and regulations in force.
- Maintain and improve the regulations and programmes related to the discharge of contaminants (pulp and paper, oil refineries, snow, air quality, hazardous waste, pesticides, agricultural pollution, SLAP, PRRI).
- Develop and encourage the use of economic instruments as an incentive to improve the existing infrastructures and to reduce the discharge of toxic substances in the environment (proposed).
- Pursue and promote research and acquisition of knowledge about toxic substances, their behaviour and long-term impacts on the environment.

The following strategies and actions apply specifically to individual contaminant categories:

#### Sewage

- Promote the installation and maintenance of functional, individual

septic tanks and systems for storing livestock wastes (existing measures should be strengthened).

- Give priority to the restoration of shellfish harvesting areas currently closed (existing measures should be strengthened).
- Promote public participation in the restoration of shellfish areas (proposed).
- Increase public awareness regarding the impact of inadequate sewage treatment on human health (proposed).
- Promote the use of economic instruments to improve existing infrastructures (proposed).

#### Persistent Organic Pollutants

- Identify land-based sources of chlorinated furans, dioxins and PAHs (and other POPs where appropriate) that are not currently regulated, and implement legislation and programmes that will eliminate, reduce or control them (proposed).
- Reduce and control PAH contamination from wharves made with creosote-treated wood (proposed).
- Remediate contaminated sites that pollute the marine environment (existing measures should be strengthened).
- Promote the use of substitutes for chemical products that lead to the production and discharge of POPs and the use of better environmental management practices in industry (existing measures should be strengthened).
- Promote the use of better environmental management practices for pesticides that are POPs (existing measures should be strengthened).
- Promote the use of appropriate environmental indicators (proposed).

Radionuclides

- Promote the use of safe production, storage, handling, transportation and disposal practices for radionuclides.
- Maintain contingency procedures in case of an accidental release.

Heavy Metals

- Identify the land-based sources of mercury and alkyl lead that are not currently under regulation and promote the implementation of legislation and programmes that will eliminate, reduce or control them (proposed).
- Identify problematic heavy metal land-based sources that are not currently under regulation and promote the implementation of legislation and programmes that will eliminate, reduce or control them (proposed).
- Promote the use of clean technologies for specific industrial sectors (e.g., metal mines) (existing measures should be strengthened).
- Reduce losses of metal ore during loading and unloading through good operating procedures (existing measures should be strengthened).
- Promote the use of better environmental management practices (existing measures should be strengthened).
- Promote the use of appropriate environmental indicators (proposed).

Oils/Hydrocarbons

- Promote the use of sound waste oil management practices throughout the Province of Quebec (existing measures should be strengthened).
- Maintain an effective accidental spill reporting system.
- Maintain effective planning and contingency intervention measures in

case of an accidental spill — i.e., contingency intervention plans.

- Develop intervention and rehabilitation technologies to deal with oiled shorelines (existing measures should be strengthened).
- Promote better environmental management practices (existing measures should be strengthened).
- Encourage public education and awareness (existing measures should be strengthened).

Nutrients

- Maintain the measures currently in place for municipal sewage and agricultural practices.

Contaminated Sediments

- Characterize contaminated sediment sites where there are insufficient data (proposed).
- Develop and implement plans for the management of contaminated sediments for each site at risk (proposed).
- Promote the development of rehabilitation technologies for contaminated sediment sites (existing measures should be strengthened).
- Develop and implement an integrated contaminated sediment management approach for the entire St. Lawrence basin (proposed).
- Promote the use of better environmental management practices in harbours and ports (existing measures should be strengthened).
- Promote the use of appropriate environmental indicators (existing measures should be strengthened).

Litter

- Promote sound solid waste management practices.

- Encourage public education and awareness of the problems caused by persistent solid waste (plastic) in the aquatic environment (proposed).

#### **6.4B *Physical Alteration and Destruction of Habitat***

Many laws, regulations, policies and programmes are already in place, at both the provincial and federal levels, to meet the general NPA objectives for the physical alteration and destruction of habitats. The existing international and federal strategies and measures are discussed in Chapter 3 of this document. The Government of Quebec measures deal, in particular, with the shores and coastal environments, the protection of endangered species (and their habitats) and the protection of unique and representative sensitive habitats (wildlife habitats, ecological reserves, conservation reserves, parks).

The St. Lawrence Action Plan includes many programmes geared toward the preservation, protection and rehabilitation of sensitive habitats, endangered species, and the restoration of altered habitats. The ZIP programme, mentioned in section 6.4A, is specifically geared toward public participation in the development of local rehabilitation measures.

Furthermore, an approach based on the integrated management of watersheds and/or coastal zones is recommended to encourage communication among local, regional, provincial and federal stakeholders. This would optimize the measures in place to protect the marine environment and human health.

The Saguenay-St. Lawrence Marine Park provides new regulatory and management

tools to ensure the conservation of marine and coastal habitats according to the principles of sustainable development. The zoning plan and conservation plan, which are currently under development, will define the strategies and actions that will be implemented to achieve this objective.

The strategies and actions that were identified to meet the goals and management objectives mentioned in the previous section on contaminants are presented below. This list includes:

- existing measures that are deemed adequate, and that it is proposed to maintain and to improve where required;
- existing measures deemed inadequate, and that it is proposed to strengthen (existing measures should be strengthened); and
- new actions deemed necessary that merit further consideration in the future (proposed).

The following strategies and actions apply to all physical alteration and destruction of habitat categories:

- Promote the purchase and protection of habitats.
- Create protected marine and coastal areas as stipulated in the *Oceans Act* (existing measures should be strengthened).
- Promote compliance with the laws and regulations in force (existing measures should be strengthened).
- Promote the updating of regulations regarding habitat protection (existing measures should be strengthened).
- Promote the restoration of altered habitats, and develop and improve restoration technologies (existing measures should be strengthened).



- Identify critical and sensitive habitats whose protection is a priority and ensure no further alteration or destruction occurs (existing measures should be strengthened).
- Identify under-represented habitats that should have legal protection (existing measures should be strengthened).
- Maintain and increase the channels of communication and partnerships with non-government organizations by means of SLAP (existing measures should be strengthened).
- Harmonize the various approaches for the conservation of land and marine habitats by means of SLAP and other programmes (existing measures should be strengthened).
- Educate people living in shoreline areas about habitat protection with the help of non-government organizations and ZIP committees (existing measures should be strengthened).
- Promote the use of an integrated management approach for the watersheds and coastal zones (proposed).
- Promote the acquisition and exchange of knowledge to help make better management decisions, and to pool the various databanks to maximize information exchange (existing measures should be strengthened).

The following strategies and measures apply specifically to individual categories regarding the physical alteration and destruction of habitat.

#### Shoreline Construction/Alteration

- Prevent erosion with environmentally friendly techniques (planting vegetation) and in accordance with regional plans (existing measures should be strengthened).

#### Inter-tidal and Sub-tidal Alteration

- Gather more information about these habitats and the impacts of human activity (existing measures should be strengthened).

#### Mineral and Sediment Extraction/Alteration

- Promote the updating of policies and regulations regarding this kind of activity (existing measures should be strengthened).
- Create a consultation committee on integrated management for dredging activities in the St. Lawrence by means of SLAP (proposed).
- Gather more information on habitats that need protection and on the impact of dredging and stockpiling (existing measures should be strengthened).
- Develop environmentally and economically viable and effective management approaches (proposed).

#### Wetland and Saltmarsh Alteration

- Maintain and increase investments in wetland restoration (existing measures should be strengthened).
- Gather more information and pool various databanks.
- Develop and improve restoration techniques for wetlands; test the grass wetland restoration guide (existing measures should be strengthened).

#### Marine Waters and Coastal Watershed Alteration

- Promote measures that ensure new project planning takes into consideration fish passage so as not to obstruct their movement (existing measures should be strengthened).
- Follow the evolution of restored habitats, using successes to promote potential

restoration projects (existing measures should be strengthened).

### Biological Alteration

In order to prevent the introduction of exotic species:

- Promote the updating of regulations regarding the introduction of exotic species (proposed).
- Maintain, improve and apply mechanisms currently in place regarding ship ballast water (existing measures should be strengthened).
- Improve knowledge of exotic species that could be established in the marine waters of the St. Lawrence (existing measures should be strengthened).

With regard to the conservation of endangered species, proposed approaches include:

- promoting the protection of all types of habitats in order to meet the needs of as many species as possible (existing measures should be strengthened);
- identifying endangered species and those that may become endangered (existing measures should be strengthened); and
- developing and implementing recovery plans for endangered species as well as those considered a priority (existing measures should be strengthened).

## 6.5 Next Steps

The following steps will be taken to complete the preparation of the Southern Quebec/St. Lawrence Region component of the NPA and to guide its implementation:

- Workshops are planned with interested government and non-government stakeholders to consult on management

objectives, goals and priorities presented here, and to develop and plan strategies and actions that may be implemented.

- Necessary steps will be taken to integrate the NPA with existing programmes and initiatives for the protection of Quebec's marine environment, such as the St. Lawrence Action Plan — Vision 2000 and its ZIP programme, as well as programmes under the *Oceans Act*.

Also, it is anticipated that the NPA will be completed with the addition of northern Quebec elements. To this end, the following actions should be undertaken.

- Consultations and workshops are planned with the Cree, the Inuit and other government and non-government stakeholders in northern Quebec in order to take stock of pollution sources, identify priorities, establish goals and management objectives, develop intervention strategies and plan possible actions.
- To complete the NPA, the results of the above-mentioned activities will be integrated with the NPA.
- At the same time, steps will be taken to link the NPA to existing programmes and initiatives to protect the northern marine environment such as the federal government's Northern Ecosystems Initiative (NEI) and programmes under the *Oceans Act*.

Parallel to these consultation and harmonization efforts, it is the intention of the NPA to promote and support:

- the implementation of PARE (ecological remedial action plans) developed under the ZIP programme;
- the development and implementation of ICZM (integrated coastal zone management) plans (*Oceans Act*);

- the establishment and management of marine protected areas (*Oceans Act*); and
- the implementation of the NEI.

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