CHAPTER 3 NATIONAL ISSUES

Introduction

The coastal zone has the highest marine resource-use conflicts, the greatest concentration and diversity of critical marine habitats, and the most serious threats from land-based activities to coastal human health and marine life. In geographical terms, the coastal zone is defined here as the landward area consisting of all coastal watersheds and the lower portions of large drainage basins; and the seaward area to the limit of the zone of influence of land-based activities. Population expansion in the coastal zone brings additional pressures. A number of estuaries and nearshore regions of Canada, particularly near urban centres and major industrial operations, are degraded by chemical contamination and physical or biological disruption. As a consequence, shellfisheries and public amenities are being impaired or lost; consumption of some species of fish and wildlife is being restricted for health reasons; some local populations of species are at risk; and biological diversity is threatened or at least seriously challenged.

The source of problems in the marine environment can also be quite distant. Contaminants that pose risks to human health and living marine resources are transported great distances by river water, by mass movement through global ocean currents and by atmospheric processes.

3.1 Identification and Assessment of Problems

3.1A Contaminants

Sewage

Sewage-related problems all over the world have a great deal in common. Consequently, domestic wastewater discharges are considered one of the most significant threats to coastal environments worldwide.

The key issue of sewage contamination (in this case human and animal waste) relates to effects on human health and the environment from bacterial and viral contamination of shellfish. Sewage is released to the marine environment from point sources (municipal discharges) and non-point sources (individual septic systems, stormwater and agricultural practices). Within urban areas and during periods of high runoff, combined sewer overflows allow sewage to be transferred from the sanitary sewer system to the stormwater system, resulting in significant contamination of nearshore waters.

Closures of shellfish harvesting and swimming areas are both common. Bacteria discharged with municipal wastewater are implicated in about half of the areas closed to shellfish harvesting along the Atlantic and Pacific coasts; the other half are closed because of non-point sources of bacteria (Environment Canada, 1996). This problem will escalate with the continued development of coastal regions, unless adequate wastewater treatment measures are adopted and non-point sources are reduced.

Data on available sewage treatment are presented below for urban coastal communities (greater than 1000 people) in 1996 — the year

of the most recent national census. These data were extracted for communities within 60 km of a marine shoreline from Environment Canada's Municipal Water Use Database, and may differ from other sources cited in this document that include communities of fewer than 1000 people.

Table 3-1 Extent in 1996 of Municipal Sewage Treatment Serving Urban Coastal Communities (Greater than 1000 People) in Canada

	Urban population served by:							
	Municipal sewage with no treatment (%)	On-site disposal systems (%)	Municipal ponds (%)	Municipal primary %	Municipal secondary %	Municipal tertiary %	Population reporting	No. of communities
Newfoundland	73	16	3	3	5	0	400 455	83
Nova Scotia	40	29	4	4	22	0.6	663 057	39
Prince Edward Island	0	7	13	68	12	0	63 528	9
New Brunswick	9	17	20	27	27	0	349 079	60
Quebec	11	20	63	0	6	0	210 357	37
Northwest Territories*	0	0	94	0	6	0	20 420	13
British Columbia**	2	14	3	67	14	0.2	2 780 808	76
Canada	15	17	8	46	15	0.2	4 487 704	317

(Source: Lacelle, 1998)

* 1996 data refer to the area that is now Northwest Territories and Nunavut.

** Greater Vancouver Regional District upgrades in 1999 have significantly reduced reliance on primary treatment in B.C. Current figures show "Municipal primary" at 24%, and "Municipal secondary" at 57%. (Source: Jenkins, 2000)

Persistent Organic Pollutants

On entering the environment, persistent organic pollutants (POPs) can alter the normal biochemical and physiological functions of plants and animals, including humans. Effects may include molecular changes (enzyme activity, DNA damage), cellular changes (tumour formations), tissue changes (eggshell thinning, organ functioning), individual changes (behaviour, deformities), population changes (mortality, abundance, distribution), and community changes (numbers of species and their interactions).

POPs include organochlorine pesticides and their metabolites, industrial chemicals, and anthropogenic and natural combustion products. Sources can be local, regional or distant.

Contamination by POPs found in harvested species of fish and wildlife can be a significant concern in certain marine environments. The long-range transport of POPs to the Arctic is considered one of the most significant threats to environmental quality in a region where there is a heavy reliance on traditional foods. Tributyltin (TBT) anti-fouling paint has been recognized as a toxic problem in Canadian harbours. In view of its high toxicity, international use and continued use on vessels exempt from restrictions, the continued assessment of potential impacts and consideration of further controls are justified.

Radionuclides

Radioactive materials can present hazards to human health and to the environment. Radiation can alter essential cellular components and genetic material (DNA), causing a range of problems including cancer.

In Canada, Point Lepreau in New Brunswick is the only nuclear generating plant located in the coastal zone. Releases to freshwater may or may not result in downstream effects in marine environments. Inputs of radionuclides to the marine environment from Canadian sources are monitored and are very low.

The majority of radionuclides that have entered Canada originate from atmospheric fallout of nuclear weapons testing that took place between 1952 and 1978, and the accident at the Chernobyl nuclear power plant in 1986. Although current radionuclide levels are low, the potential exists, through long-range transport, for impacts on the marine environment from accidental releases in other parts of the world.

Heavy Metals

Metals and metallic compounds entering the marine environment may pose a risk to human health through the consumption of seafood in areas of significant contaminant content and exposure. Like POPs, heavy metals may also alter the normal biochemical and physiological functions of plants and animals. Heavy metals may adversely affect specific tissues, reproduction and development. They may also cause anemia, nervous system disorders and depressed immune systems, resulting in mortality and effects on population levels.

Major local sources of heavy metals are mining, smelting, urban settlements and industrial complexes (such as pulp mills, chemical industries and shipyards). Mineralization of natural geological deposits can also contribute local inputs of heavy metals. Distant sources include smelters and coal-fired generating stations, which contribute to the atmospheric transport of heavy metals.

Mercury and cadmium have been found in fish, polar bears and other marine mammals. High concentrations of these metals in the tissues of some species pose a concern for human consumption. As with POPs, metals with origins in industrialized regions of Europe, Asia and North America are found in the Arctic and, to some degree, in other parts of the Canadian marine environment. Some heavy metals found in biota may also originate from naturally occurring geological sources.

Oils/Hydrocarbons

Oils may be toxic to aquatic life when ingested or absorbed through skin or gills and can interfere with respiratory systems. They can also foul fur and feathers, taint seafood, contaminate water supplies and smother aquatic communities, habitats and beaches.

Oil pollution from urban settlements and industrial complexes is primarily of local concern. Oil pollution in ports varies with the volume of ship traffic and the tonnage of oil handled at oil handling facilities. The risk from onshore oil and gas operations, including pipelines and refineries, is associated with the accidental release of oil or chronic discharges.

Non-point source discharges of oil/hydrocarbon products are common. In dense urban areas, the concentration of automotive hydrocarbons in stormwater may contribute significantly to the presence of these contaminants in the nearshore habitat. Other releases into the marine environment result from spills during the transfer and storage of fuel during coastal community resupply (a particular problem in the Arctic).

Nutrients

Eutrophication of coastal waters may result from natural processes or from the introduction of excessive nutrients caused by human activity.

The effects of enhanced biological productivity can result in excessive algal growth, decreased dissolved oxygen, anoxia and associated fish kills (especially during the summer months), loss of habitat and changes in species diversity. It is also suspected that enhanced biological productivity causes an increased prevalence or frequency of toxic algal blooms and eutrophication that may impair aesthetic and economic value.

On a national basis, nutrient inputs to the marine environment are not considered a significant problem. Exceptions include situations where localized eutrophication may result from nutrient inputs, as in the case of some point and non-point sewage sources, or non-point source agricultural runoff.

Contaminated Sediments

Sediments can be repositories for some contaminants that can accumulate over time. Once chemicals are in sediments, they are generally considered to be less of a threat to organisms. Moreover, they are not transported to other areas unless the sediments are disturbed and resuspended. However, bottom-feeding organisms can be subject to contamination and become a major pathway for contaminants to enter food chains.

Elevated concentrations of contaminants (heavy metals, POPs and polycyclic aromatic hydrocarbons) are associated with major seaports as a result of shipping and land-based activities. Dredging and inter-tidal disposal of contaminated sediments can lead to increased dispersion of these contaminants. The problem of contaminated harbour sediments will continue until land-based sources are better controlled.

Sediments can also have a physical impact on habitat. The section on habitat alteration provides an examination of the physical impact of sediments.

Litter

Litter or marine debris is any persistent, manufactured or processed solid material that is discarded, disposed of or abandoned in the marine and coastal environment.

Litter threatens marine life through entanglement, suffocation and ingestion. It degrades the visual amenities of marine and coastal areas, resulting in negative effects on tourism and general aesthetics. Litter in the marine environment can also damage coastal habitats, foul fishing and aquaculture gear, and create navigational hazards.

Sources include poorly managed or illegal waste dumps adjacent to rivers and coastal areas, windblown litter from coastal communities, resin pellets used as industrial feedstocks, and litter channelled to the marine and coastal environment through municipal stormwater systems and rivers. Marine litter is also caused by dumping of garbage into the marine and coastal environment by coastal communities and recreational and commercial vessels.

3.1B Physical Alteration and Destruction of Habitat

Shoreline Construction/Alteration

Most loss or degradation of shoreline habitat is from many small-scale activities by individuals, small industries or local utilities. Considered on their own, these activities may appear benign. The net consequence over many years, however, is a cumulative loss of these critical habitats. Areas where population growth is at its highest (e.g., the Lower Mainland of British Columbia) are of particular concern.

Large-scale alterations of shoreline habitats are infrequent but significant in their impact. They are generally related to port development, larger industrial expansion, or attempts to harden shorelines against natural erosion to protect existing shoreline communities, businesses and amenities. Such alterations, both large and small, occur mainly in the harbours, inlets and estuaries that are among the most productive and important marine habitats. The impacts are therefore related more to ecosystem integrity than to human health or the economy, although the fishing industry can experience losses. Affected areas also cease to provide sources of traditional foods, affecting local populations that have depended on these sources for part of their livelihood.

Inter-tidal and Sub-tidal Alteration

This category of habitat alteration includes effects related to fixed fishing gear, docks and piers and certain types of land-based aquaculture devices and facilities. Concerns involve the loss of key habitats for native fish species, including areas required for migration, spawning and nurseries. Log holding and transport on the West Coast causes loss of habitat in the holding areas, but it also results in degradation of benthic habitats because of the accumulation of bark.

Ice breaking of land-fast ice associated with shipping near Arctic ports and harbours creates unsafe conditions for over-ice travel and interferes with subsistence hunting. It also has an effect on seal pups and other sea mammals.

Human health and the economy are not generally affected to a significant extent by this category of activity, but some impacts on the safety of northern over-ice travel and traditional food sources may occur. The greatest concern with this type of activity is the preservation of ecosystem integrity.

The harvesting of marine plants from the inter-tidal and sub-tidal zone can result in alteration or loss of habitat for other species, decreased biodiversity, or unsustainable use of the resource.

Mineral and Sediment Extraction/Alteration

Harbour dredging and sediment disposal are common on all three Canadian coasts, but existing controls limit the severity of impacts. The National Programme of Action for the Protection of the Marine Environment from Land-based Activities (NPA) is concerned with cases where dredging and disposal occur in the inter-tidal or nearshore zone.

Sand and gravel extraction has not yet become a prevalent activity. Nevertheless, in the areas where it does occur, there can be localized habitat destruction.

Coastal mining (e.g., the extraction of minerals from coastal deposits) is not a widespread activity in Canada. However, land-based mines and mills have occasionally disposed of tailings and other wastes into the marine environment, resulting in significant alteration through burial of habitats.

These forms of habitat alteration do not generally result in impacts on human health, the economy or traditional foods, but they may cause some environmental impact (see also section on contaminated sediments).

Wetland and Saltmarsh Alteration

Since the earliest coastal settlement in Canada by Europeans, wetlands and marshlands have been altered or destroyed. Today, less than 70% of the original habitat remains. Losses are greatest in areas of intense urbanization and agriculture. Other forms of alteration continue, such as harvesting of marsh grasses and other vegetation, draining to control insect populations, and engineering works to create waterfowl habitat.

Wetlands are highly productive habitats that play an essential role in critical life stages of fish, amphibians, reptiles, birds and mammals. They serve as spawning grounds and nurseries for fish and as nesting grounds, staging areas and migration stop-overs for waterfowl and other birds. The effects of loss and degradation of such habitats are principally related to ecosystem integrity, biodiversity and marine resource productivity. Human health is not normally endangered, and economies, with the exception of those based upon the fishing sector, are generally unaffected. Local sources of traditional foods, however, can be severely limited, creating economic hardship for coastal communities. Other economic losses can result, such as those resulting from a decline in ecotourism.

Marine Waters and Coastal Watershed Alteration

Localized impacts can result from entrainment and entrapment of fish and other marine organisms in saltwater intakes at power plants or intakes for industrial use. For similar reasons, there are concerns over thermal, gas pressure and salinity alterations in coastal and estuarine habitats caused by impoundment, cooling water outflows, and major hydroelectric watershed diversions.

Although the state of scientific knowledge on the effects of such alterations is limited, the resulting impacts are viewed to be primarily of ecological concern.

Biological Alteration

Biological alterations in coastal waters are caused by the accidental transport of various exotic or non-indigenous species from large tankers and freighters on international routes. Much of this problem results from ballast water exchange offshore and does not fall within the purview of the NPA. However, the NPA addresses species introduced from possible ballast water discharges within and adjacent to ports.

Another form of biological alteration can result from accidental or deliberate movement of organisms in land-based or nearshore aquaculture operations. In most cases, the introductions are inadvertent (e.g., non-indigenous salmonids escape when nets are damaged by seals or climatic conditions, and parasites or pathogens from cage-reared fish transfer to wild fish populations).

Impacts on the availability of traditional foods are moderate, except in some temporary closures for shellfish harvesting because of toxic algal blooms (e.g., Domoic acid problem). Similarly, human health impacts have been restricted to the dangers posed by harmful algal blooms and are subject to stringent monitoring efforts.

3.2 Establishment of Priorities for Action

Based on the severity of risk to human health and the environment, and the adequacy of existing controls, various land-based activities affecting the marine environment are assigned priorities for action (see Chapter 2). An overview of national priorities is found in Table 3-2 (see section 3.2B below).

National priorities for each contaminant or habitat category may not necessarily be the same as regional priorities, as detailed in later regional chapters, since national priorities for action are those that are viewed as common, shared or global in nature.

Regional priorities for action focus on problems that can be addressed through regional and community-based actions.

3.2A Contaminants

Sewage

Sewage inputs to the marine environment are a common resource-use conflict and public health problem found in all regions of Canada. More effective point and non-point source control measures are required, supporting a need for **high priority** attention.

Persistent Organic Pollutants

POPs are a serious environmental and public health problem shared by all regions in Canada and the global community. In addition to severity of impact, there are immense difficulties and expenses in cleaning up contaminated sites. National point source control measures are considered effective; however, strengthened remedial measures and non-point source controls are needed. Controlling inputs from international sources would benefit from further regional and global agreements. POPs are in need of **high priority** attention.

Radionuclides

Radionuclides are a shared and global problem. However, radioactive contamination in Canada is low, and sources are well regulated. On a national basis, a **low priority** is assigned. The management of radioactive wastes is a major concern in the Russian Federation and is a priority for the circumpolar countries.

Heavy Metals

Heavy metals are also a shared and global problem. Metals such as mercury and cadmium are of particular concern because of their human health impacts. National controls on point sources are considered effective. International measures on long-range transport are improving and are supported. Additional national controls on non-point sources are necessary. A **medium priority** is assigned.

Oils/Hydrocarbons

Oils/hydrocarbons are viewed as a common problem resulting in resource-use conflicts such as degraded fish habitat, oiled beaches and tainted seafood. Fish kills, oiled seabirds and hydrocarbon contamination in harbours are also of concern. Improved measures are needed for urban runoff, spill response, and proper handling and storage. A **medium priority** is assigned.

Nutrients

Nutrients can cause eutrophication in all regions of Canada. Much of the concern related to nutrients can be addressed at the regional level through improved sewage treatment and good agricultural practices. On a national basis, a **low priority** is assigned.

Contaminated Sediments

Contaminated sediments are a common problem found in all regions with impacts mainly limited to sediments found in harbours and adjacent areas. The current regulatory controls on disposal of dredged sediments are considered effective. The long-term solution is to improve the control of discharges to water from which dredged material is taken, and thus a **medium priority** is assigned.

Litter

Input of litter from land-based sources is also common to all regions and results in reduced amenities, property damage, and entanglement and loss of marine life. Enhanced public awareness and adequate disposal facilities are effective measures to reduce litter. A **medium priority** is considered appropriate.

3.2B Physical Alteration and Destruction of Habitat

Shoreline Construction/Alteration

Shoreline construction and alteration activities are a common problem resulting in a cumulative, wide-scale loss of valuable foreshore habitat with losses measured in both environmental and economic terms. They are given a **high priority**.

Inter-tidal and Sub-tidal Alteration

Inter-tidal and sub-tidal alterations can be severe on a local scale. In most cases controls are available, although not always employed. The consequences of such impacts are largely environmental rather than economic. For these reasons, this category of habitat alteration is accorded a **medium priority**.

Mineral and Sediment Extraction/Alteration

Mineral and sediment extraction and alteration are fairly ubiquitous activities but generally well regulated. Impacts associated with these activities are usually of lesser environmental importance and often temporary. They are consequently considered a **low priority** for further action.

Wetland and Saltmarsh Alteration

Activities altering wetland and saltmarsh habitat are assigned a **high priority** because of the limited availability of these habitats and their high value for numerous species at various life stages. Losses of wetlands also have significant economic consequences, particularly for the fisheries sector.

Marine Waters and Coastal Watershed Alteration

Alterations to marine waters and coastal watersheds can be severe on a local scale. Impacts are primarily environmental rather than economic. Controls are available in most cases, although sometimes not employed. For these reasons, such alterations are given a **medium priority**.

Biological Alteration

Biological alterations are accorded a **medium priority** on a national basis. Biological introductions from aquaculture and hatchery operations are subject to stringent regulation. At this time, species introductions from ballast water exchange are not well controlled. However, from the perspective of the NPA, only a fraction of the potential impacts from this activity can be considered land-based.

3.3 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.

3.3A 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.

Table 3-2 National Priorities

CONTAMINANTS				
Sources	**Criteria**		**Priorities**	
	Common*	Shared*	Ranking	Rationale
Sewage	✔		high	• demonstrated effects on humans/animals • restrictions on shellfish harvesting • affects all regions • additional point and non-point source control measures required
POPs	✔	✔	high	• demonstrated effects on humans/animals • affects all regions • serious difficulties for clean-up • effective point source control; non-point source control measures need to be strengthened
Radionuclides		✔	low	• Canadian contamination low • sources well regulated
Heavy metals	✔	✔	medium	• demonstrated health impacts • national point source controls are effective • international measures on long-range transport are improving • additional non-point source controls are required
Oils/ hydrocarbons	✔		medium	• degradation of marine organisms and habitat • improved measures for urban runoff, spill response, and proper handling and storage are required
Nutrients	✔		low	• affects most regions (eutrophication) • impacts can be predominantly addressed by improved sewage treatment and good agricultural practices
Contaminated sediments	✔		medium	• impacts usually localized (contamination of harbour sediment) • regulatory controls on disposal of dredged sediment are effective • controls on discharge of source materials (i.e., POPs and heavy metals) from non-point sources are required
Litter	✔	✔	medium	• land-based sources are common to all regions • health hazard to humans/animals; environmental impacts • public awareness and increased disposal facilities can reduce litter

PHYSICAL ALTERATION AND DESTRUCTION OF HABITAT				
Sources	**Criteria**		**Priorities**	
	Common*	Shared*	Ranking	Rationale
Shoreline construction/ alteration	✔		high	• cumulative, wide-scale loss of habitat • environmental and economic losses
Inter-tidal and sub-tidal alteration	✔		medium	• locally severe • controls available but not always employed • primarily environmental impacts
Mineral and sediment extraction/ alteration	✔		low	• generally well regulated • impacts frequently temporary • impacts usually of lesser environmental importance
Wetland and saltmarsh alteration	✔		high	• limited habitat that is extremely valuable • significant economic losses, especially fisheries
Marine waters and coastal watershed alteration	✔		medium	• locally severe • controls available but not always employed • primarily environmental impacts
Biological alteration	✔	✔	medium	• high risk factor • generally stringent regulation

*See Chapter 2 on ranking priorities and description of "common" and "shared."

Specific management objectives for each of the contaminants of concern at the national level 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.

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.

3.3B 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 occur 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 exotic species to the marine environment from land-based activities.

Specific management objectives for each of the habitat categories of concern at the national level 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 — prevent all inadvertent or inappropriate introductions of alien species and pathogens and protect sensitive coastal ecosystems.

3.4 Identification, Evaluation and Selection of Strategies and Actions

Two key strategies employed in Canada for the protection of the marine environment from land-based activities are pollution prevention and control, and integrated management of the coastal zone. Both these strategies involve using sustainable and integrated environmental management, as well as other approaches such as the harmonization of integrated coastal management, river basin management and land-use planning.

Pollution prevention reduces the risk to human health and the environment by using processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste. It focuses on eliminating the cause of pollution, rather than treating the symptoms.

The purpose of integrated coastal zone management (ICZM) is to maximize the benefits provided by the coastal zone while minimizing the harmful effects of resource-use activities. Its goals are conservation, sustainable use and economic diversification in the coastal zone, and it focuses on collaborative planning and decision making.

For all land-based activities in Canada there are common national actions that are ongoing or emerging in support of the goals under the NPA. It is inherent in the NPA that the most cost-effective approach is to build on these existing or emerging programmes. National actions take the form of:

1. monitoring existing actions that are deemed adequate,
2. strengthening existing actions when they are deemed inadequate; and
3. proposing new actions for immediate preventive and remedial action based on existing knowledge, resources, plans and processes.

Using this approach, the following sections itemize specific national actions.

3.4A Contaminants

Sewage

- Ensure/promote compliance with existing regulations.
- Upgrade infrastructure (including stormwater infrastructure) (proposed).
- Maintain and restore shellfish growing areas (existing measures should be strengthened).
- Promote adequate installation and maintenance of septic systems and manure storage systems (existing measures should be strengthened).
- Employ economic instruments for upgrading infrastructure (proposed).
- Promote research and development of alternative technologies for small communities and those with special geographic/climatic features.
- Apply sound land-use planning practices (existing measures should be strengthened).
- Develop, promote and monitor implementation of best management practices (proposed).
- Use education to inform the public of their roles/potential contributions (existing measures should be strengthened).

Persistent Organic Pollutants

- Implement the Toxic Substances Management Policy.
- Ensure/promote compliance with existing regulations.
- Remediate "hot spots."
- Promote the ARET (Accelerated Reduction and Elimination of Toxics) Programme and other voluntary control measures.
- Promote sound pesticide use.
- Promote alternatives to harmful chemicals.
- Promote the use of appropriate environmental indicators.
- Implement the POPs Protocol under the UN-ECE LRTAP Convention (United Nations Economic Commission for Europe Convention on Long-Range Transboundary Air Pollution), upon its coming into effect (expected by the end of 2000).
- Continue to participate in the development of the UNEP (United Nations Environment Programme) Global Initiative on POPs.

Radionuclides

- Promote safe processing, storage, conditioning, transportation and disposal of radioactive substances.
- Assist the Russian Federation in treating and disposing of radioactive wastes (existing measures should be strengthened).

Heavy Metals

- Ensure/promote compliance with existing regulations.
- Promote clean technology for industries and utilities (e.g., metal mining/milling, metal plating, thermal generation) (proposed).
- Promote best management practices, such as International Standards Organization (ISO) 14000.
- Continue participation in international efforts to establish and implement regional agreements (e.g., UN-ECE LRTAP Convention).

Oils/Hydrocarbons

- Ensure reporting of oil spills.
- Ensure/promote compliance with existing regulations.
- Promote proper waste oil handling and disposal (existing measures should be strengthened).
- Increase public understanding and awareness of the problems associated with oils/hydrocarbons (existing measures should be strengthened).
- Establish adequate contingency plans (proposed).

Nutrients

- Apply sound land-use planning practices (existing measures should be strengthened).
- Promote sound application practices for fertilizer use.
- Promote adoption of best management practices to address the release of nutrients and contaminated sediments from agriculture.
- Promote the use of appropriate environmental indicators.
- Improve treatment of sewage (existing measures should be strengthened).
- Inform consumers of sound product uses through education/awareness (existing measures should be strengthened).

Contaminated Sediments

- Ensure/promote compliance with existing regulations (e.g., *Canadian Environmental Protection Act* [CEPA] provisions for ocean disposal).
- Increase the use of best management practices in agriculture and ports (proposed).
- Promote the use of appropriate environmental indicators.
- Upgrade municipal infrastructure for stormwater treatment (proposed).
- Apply sound land-use planning practices (existing measures should be strengthened).

Litter

- Ensure/promote compliance with local bylaws and provincial regulations for waste management.
- Establish proper waste management/disposal facilities (existing measures should be strengthened).
- Promote public education and awareness on disposal and recycling of litter (existing measures should be strengthened).

3.4B Physical Alteration and Destruction of Habitat

There are several actions that can assist in preventing impacts from all forms of habitat-disrupting activities. These include:

- Ensure/promote compliance with provincial regulations on land-use practices.
- Ensure/promote compliance with federal regulations on fish habitat protection under the *Fisheries Act*.
- Establish integrated planning and management mechanisms involving all Aboriginal peoples, public stakeholders and regulators (proposed).
- Institute a national framework and support mechanisms for locally implemented ICZM (proposed).
- Implement marine protected areas within local integrated management plans where appropriate (*Oceans Act*; other federal and provincial acts) (proposed).
- Improve scientific knowledge of distribution and sensitivity of resources and ecosystems.

There are also specific or unique actions that apply to individual categories of habitat disruption. These include:

Shoreline Construction/Alteration

- Ensure/promote compliance with local bylaws for residential and industrial construction along shorelines (existing measures should be strengthened).
- Promote public education and awareness.

Inter-tidal and Sub-tidal Alteration

- Ensure/promote compliance with federal and provincial laws governing fisheries, habitat and aquaculture (existing measures should be strengthened).
- Promote public education and awareness.

Mineral and Sediment Extraction/Alteration

- Ensure/promote compliance with federal laws on dredging and disposal (CEPA).
- Ensure/promote compliance with provincial and federal regulations on coastal mineral and aggregate mining, and mine waste disposal.

Wetland and Saltmarsh Alteration

- Promote public education and awareness.

Marine Waters and Coastal Watershed Alteration

- Ensure/promote compliance with federal and provincial regulations on water diversions, intakes and extraction

Biological Alteration

- Ensure/promote compliance with provincial regulations on aquaculture (existing measures should be strengthened).
- Ensure/promote compliance with federal regulations on introduction and movement of marine organisms (*Fisheries Act*) (existing measures should be strengthened).
- Continue work with the International Maritime Organization (IMO) toward international standards for the prevention of accidental introductions of alien species in ballast water.

3.5 Identification of Criteria for Evaluating Effectiveness

The following criteria and indicators will be considered for evaluating the effectiveness of actions.

3.5A Contaminants

Sewage — improved level of sewage treatment; compliance with standards; reduced shellfish closures and beach closures; and restoration or improvement of appropriate indicator species and/or biodiversity.

Persistent Organic Pollutants — reduced inputs; compliance with standards; level of remediation; results of environmental effects monitoring (EEM) programmes; restoration or improvement of appropriate indicator species and/or biodiversity; progress on the development of international agreements and compliance with national regulations.

Radionuclides — compliance with international standards and national regulations**.**

Heavy Metals — reduced inputs from anthropogenic sources into the marine environment; progress on the development of international agreements and compliance with standards and national regulations.

Oils/Hydrocarbons — adequate reception facilities in place; compliance with standards and national regulations; adequate contingency plans in place.

Nutrients — reduced shellfish closures; compliance with standards.

Contaminated Sediments — reduced harbour contamination; compliance with national and provincial regulations; maintenance of natural sediment loads.

Litter — reduced level of marine debris; adequate number of waste management/disposal facilities in place.

3.5B Physical Alteration and Destruction of Habitat

Most of the specific categories of physical alteration and destruction of habitat share a common criterion for evaluating effectiveness.

Shoreline Construction/Alteration, *Inter-tidal and Sub-tidal Alteration, Mineral and Sediment Extraction/Alteration*, *Wetland and Saltmarsh Alteration,* and *Marine Waters and Coastal Watershed Alteration* — productive capacity of habitats that are either lost or degraded, compared with the productive capacity that is restored or created in these habitats.

Biological Alteration — number of alien species introduced; species diversity in coastal ecosystems; productivity of native species.

3.6 Programme Support Elements

The principle support elements for Canada's NPA include:

- institutional support;
- clearing house mechanisms for pollution prevention and habitat protection; and
- monitoring (reports on implementation and effectiveness).

3.6A Institutional Support

At the initial stages of the NPA, the key programme support elements are the organizational and technical arrangements to implement and further develop the NPA as a co-operative management arrangement among federal, provincial and territorial governments in consultation with Aboriginal peoples and other relevant stakeholders. In particular, a number of NPA committees and consultation networks/mechanisms are in place to carry out this work at the national and regional levels. Secretariat support is also provided to the various committees. These committees include:

- The Federal/Provincial/Territorial Advisory Committee on Canada's National Programme of Action for the Protection of the Marine Environment from Land-based Activities (which agrees to meet annually). This committee is responsible for developing and implementing the NPA.
- The Federal Interdepartmental Committee on the Protection of the Marine Environment from Land-based Activities. This committee is responsible for federal activities under the NPA.
- Federal/provincial/territorial technical review committees for developing clearing house mechanisms, guidelines and codes of practice.

3.6B Clearing House Mechanisms for Pollution Prevention and Habitat Protection

Clearing house actions include:

- developing Canadian data directories, with components organized by source category, and containing information on current sources of information, practical experience and technical expertise;
- maintaining directory and delivery mechanisms and feedback functions to identify and respond to information gaps and training requirements for clearing house users; and

- recognizing the need for compatibility with other (international/national/provincial/ territorial) clearing house mechanisms.

3.6C Monitoring (Reports on Implementation and Effectiveness)

Recognizing the need for open and transparent reporting actions includes:

- providing annual reports on progress in implementing the NPA;
- developing additional indicators for monitoring the implementation and effectiveness of the NPA;
- providing periodic reports on land-based activities and their effects;
- promoting regular consultations with Aboriginal peoples and other key/relevant stakeholders; and
- providing periodic (approximately every three to five years) national reports to the international community (e.g., UNEP, Commission on Sustainable Development) on Canada's progress in implementing the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA).

3.7 International Considerations/ Linkages

Canada has also made significant progress toward international implementation of the GPA.

- The Arctic Council was established in 1996 as a high-level forum to promote co-operation and co-ordination among the eight Arctic states on issues of sustainable development and environmental protection. Part of the Council's mandate is to oversee and co-ordinate the Arctic Monitoring and Assessment Programme (AMAP), Conservation of Arctic Flora and Fauna (CAFF), Protection of the Arctic Marine Environment (PAME), and Emergency Prevention, Preparedness and Response (EPPR).
- The first Ministerial Meeting of the Arctic Council in Iqaluit, September 17-18, 1998, adopted a Regional Programme of Action for the Protection of the Arctic Marine Environment from Land-based Activities (RPA). The RPA will contribute substantially to meeting GPA commitments in the Arctic; it also has a particular focus on regional co-operation and capacity building to address the regional priority pollution sources found in the Russian Federation.
- At the April 1999 meeting of the Commission on Sustainable Development (CSD), Canada highlighted the importance of the protection of the marine environment from land-based activities and its commitment to develop a National Programme of Action.
- Under the North American Agreement on Environmental Cooperation (NAAEC) of the NAFTA Commission for Environmental Cooperation (CEC), two sub-regional coastal areas were selected for pilot projects to implement the GPA: the Gulf of Maine and the Bight of the Californias. Also under the NAAEC, North American Regional Action Plans (NARAPs) are being developed and implemented for specific substances such as mercury and DDT.
- Under Asia-Pacific Economic Cooperation (APEC), an Action Plan for Sustainability of the Marine Environment encourages member economies to implement the GPA at a domestic/regional level. Other related initiatives include protocols under the UN-ECE LRTAP to manage POPs and heavy metals, and the UN Convention on Biological Diversity.
- In the context of financial assistance for developing countries, official development assistance (ODA) should play a catalytic

role in the implementation of national programmes of action. The purpose of Canada's ODA is to support sustainable development in developing countries and to help them protect marine environments. In addition, multilateral funds can help support implementation of the GPA, and the Global Environment Facility can help cover the extra incremental costs involved in addressing regional and global concerns. Governments can also play a catalytic role in supporting the growth of environmental industries. Part of this commitment relates to providing opportunities for environmental industries in export and development assistance programmes.

3.8 Conclusions and Next Steps

3.8A Conclusions

- The goals for the NPA 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 NPA recognizes the cost-effectiveness of building on existing programmes that address many of the GPA-related commitments and the NPA priorities.
- The NPA also recognizes the benefit of a phased approach beginning with immediate priorities and moving toward addressing all priorities.
- The NPA is based on existing resources and an approach of increasing cost-effectiveness, efficiency and co-operation among existing policies, programmes, resources and legislation. This does not preclude the development of improved integrated planning and management processes where appropriate, nor the use of novel economic instruments and incentives to encourage beneficial action.
- Priorities for action have been developed based on the severity of risk and the adequacy of existing measures. High priority for action is assigned to sewage, POPs, shoreline construction/alteration, and wetland and saltmarsh alteration.
- Point source controls for contaminants originating within Canada appear to be adequately addressed with the exception of sewage. The associated pollution control and prevention programmes should continue to be monitored to ensure desired NPA goals are met. Non-point sources of contaminant input from within Canada are not considered to be adequately addressed.
- Contaminant sources from outside Canada, such as long-range transport of air pollutants, are nearly all addressed through ongoing international negotiations. The adequacy of these will need to be assessed as part of ongoing evaluation.
- To achieve the goals of the NPA, responsible authorities need to further develop common processes and decision-making strategies to integrate the management of activities that have an impact on the coastal zone. The development of a national approach to ICZM by Canada would be a major step toward achieving NPA objectives.
- The NPA addresses land-based activities and in the future will be integrated into a broader integrated management framework that will address both land-based and marine activities.
- The key programme support elements at the initial stages of the NPA are the organizational and technical support arrangements. These will help implement and further develop the NPA as a co-operative management arrangement among

federal, provincial and territorial governments, in consultation with Aboriginal peoples and other relevant stakeholders.

3.8B Next Steps

The NPA calls for a variety of actions.

As stated in the introduction to this document, the NPA aims to protect the marine environment through co-operative solutions. Such co-operation can be achieved through the participation and collaboration of federal, provincial and territorial governments. Reporting on the progress of actions identified in the NPA is a collective initiative that is co-ordinated at the national level. Such actions include:

- Monitor existing actions that are deemed adequate. Point source controls for contaminants originating within Canada appear to be adequately addressed with the exception of sewage. Regulations and controls on dredging and sediment disposal, water diversions and land-use practices also appear adequately addressed.
- Strengthen existing actions when they are deemed inadequate. Measures for public understanding, awareness and involvement need to be strengthened. One tool is an information clearing house for pollution prevention and habitat protection.
- Undertake proposed new actions for immediate preventative and remedial action. These include upgrading infrastructure for sewage treatment and stormwater runoff, and developing guidelines and codes of practice for reducing non-point sources of contaminants.
- Institute a national framework and support mechanisms for coastal zone management.
- Conduct applied research, assessment and monitoring activities to obtain knowledge needed for appropriate action.
- Develop reporting requirements and provide annual progress reports on NPA implementation.
- Keep priorities current and develop further concrete actions and capacities to achieve the goals of the NPA.
- Use regional ecosystem initiatives to pursue collaborative regional and community-based actions.
- Expand NPA coverage to address issues in Northern Quebec, Hudson Bay and James Bay.
- Promote regional and global controls on POPs and heavy metals.

Literature Cited

Environment Canada. 1996. **The State of Canada's Environment, 1996.** Ottawa: Public Works and Government Services Canada.

Jenkins, C. (British Columbia Ministry of Environment, Lands and Parks). 2000. Personal communication.

Lacelle, D. 1998. **1996 Municipal Water Use Database.** Ottawa: Environment Canada.