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SEA

TO SEA

TO SEA

*Canada's National Marine
Conservation Areas System Plan*

SEA TO SEA TO SEA

Canada's National Marine Conservation Areas System Plan

1995

**Parks Canada
Department of Canadian Heritage**

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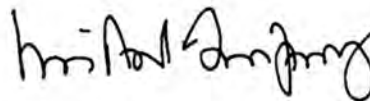
FOREWORD

It is not just coincidence that Canada's motto is *A Mari usque ad Mare* — "From Sea to Sea." For if there is any country that has been shaped by the sea, that country is Canada. We are bounded by three oceans — the Atlantic, the Pacific and the Arctic — and much of our southern border is demarcated by an inland freshwater sea — the Great Lakes. Since the earliest of times, the bountiful marine life of these waters has shaped Canadian culture and identity, whether it be the coastal villages of the First Nations, European whalers and fishermen navigating rough seas to harvest the wealth beneath the surface or early Old World settlers struggling to start a new life along the shores of a "new-found-land."

Until recently, there has been little effort given to conserving examples of our marine environment within a Canadian system of marine protected areas. With the approval of the *National Marine Parks Policy* in 1986 and the revised *National Marine Conservation Areas Policy* in 1994, Canada is co-operating on the national and international levels to set aside representative, vibrant, living marine systems for the benefit of present and future generations.

A first step in the process of creating a finite network of national marine conservation areas is to prepare a blueprint to guide its overall design. The *National Marine Conservation Areas System Plan* is an important step in this regard. It clearly sets out the approach that Parks Canada has adopted for the system's design — an approach whereby the country's three oceans and Great Lakes have been divided into 29 distinct marine regions. The long-term goal is to have a national marine conservation area within each region. As well, the steps that Parks Canada normally follows in establishing a new marine conservation area are briefly outlined. The *Plan* also attempts to portray each marine region with words and illustrations, and presents a statement of the status of each with respect to the creation of a national marine conservation area.

The *National Marine Conservation Areas System Plan* sets out a framework for protecting Canada's marine heritage, one which will ultimately put us in the forefront of marine conservation in the world. The vision which the *Plan* sets out and the pace at which it will be realized rest on our ability to develop new partnerships with all stakeholders and to involve others in creating and managing new national marine conservation areas. In the end, the *Plan's* success will depend upon the extent to which Canadians are willing to become stewards of their marine heritage.



Michel Dupuy
Minister of Canadian Heritage

ARCTIC OCEAN

- 1 Arctic Basin
- 2 Beaufort Sea
- 3 Arctic Archipelago
- 4 Queen Maud Gulf
- 5 Lancaster Sound
- 6 Baffin Island Shelf
- 7 Foxe Basin
- 8 Hudson Bay
- 9 James Bay

NATIONAL MARINE CONSERVATION AREA NATURAL REGIONS

ATLANTIC OCEAN

- 1 Hudson Strait
- 2 Labrador Shelf
- 3 Newfoundland Shelf
- 4 North Gulf Shelf
- 5 St. Lawrence River Estuary
- 6 Magdalen Shallows
- 7 Laurentian Channel
- 8 Grand Banks
- 9 Scotian Shelf
- 10 Bay of Fundy

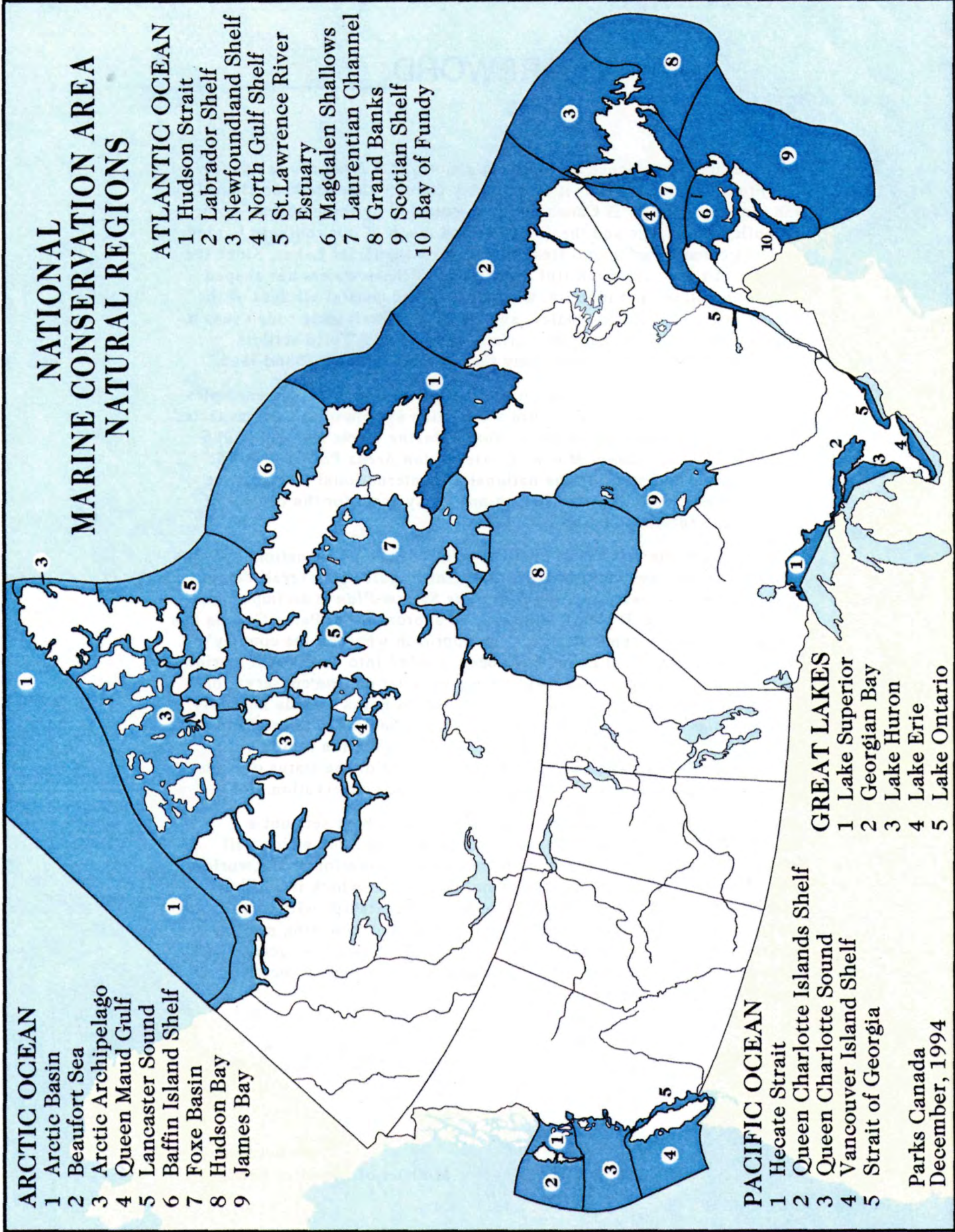
PACIFIC OCEAN

- 1 Hecate Strait
- 2 Queen Charlotte Islands Shelf
- 3 Queen Charlotte Sound
- 4 Vancouver Island Shelf
- 5 Strait of Georgia

GREAT LAKES

- 1 Lake Superior
- 2 Georgian Bay
- 3 Lake Huron
- 4 Lake Erie
- 5 Lake Ontario

Parks Canada
December, 1994



INTRODUCTION

To protect and conserve for all time national marine areas of Canadian significance that are representative of the country's ocean environments and the Great Lakes, and to encourage public understanding, appreciation and enjoyment of this marine heritage so as to leave it unimpaired for future generations.

National Marine Conservation Areas Policy (1994)

A Mari usque ad Mare — From Sea to Sea

Canada's motto is no idle boast. With 243 000 km of coastline along the Atlantic, Arctic and Pacific oceans, and an additional 9500 km along the Great Lakes, Canada has the longest coastline in the world. The vast marine* ecosystems off these coasts are varied, productive — and precious. We have a responsibility, both at the national and international level, to protect examples of this marine heritage for present and future generations.

Though Canada's system of National Parks is one of the oldest and largest in the world, with more than a third located in coastal areas, few of these terrestrial parks provide any direct measure of protection for the adjacent marine resources. Only three of these national park "marine components," as the protected waters are referred to, are more than a few square kilometres in area. In short, for a country with such marine wealth, Canada has until recently paid scant attention to protecting significant examples of the country's diverse marine ecosystems.

With the approval of the *National Marine Parks Policy* in 1986 and the revised *National Marine Conservation Areas Policy*

in 1994, Canada joined the growing list of coastal states that have committed themselves to developing a system of marine protected areas. Significant progress occurred in 1987 with the establishment of the country's first national marine conservation area — Fathom Five in Georgian Bay at the north end of Lake Huron. In 1988, the signing of a federal-provincial agreement committed both governments to work towards the creation of a national marine conservation area at Gwaii Haanas in the Queen Charlotte Islands of British Columbia. In 1990, Canada and the Province of Quebec agreed to work along a course leading to the establishment of a third marine conservation area, at the confluence of the Saguenay fjord and the St. Lawrence River estuary, and the 1990 federal government *Green Plan* called for the creation of an additional four marine conservation areas by the year 2000.

The national marine conservation areas program is quite new and studies to identify outstanding areas within each of the marine regions are just beginning. There is still much to be done to protect Canada's special marine places.

* Throughout this document, the word "marine" should be read as including the freshwater Great Lakes.

WHAT IS A NATIONAL MARINE CONSERVATION AREA?

National Marine Conservation Areas (NMCAs) are marine areas managed for sustainable use and containing smaller zones of high protection. They include the seabed, its subsoil and overlying water column and may encompass wetlands, river estuaries, islands and other coastal lands. They are owned and managed by the Government of Canada. While activities such as undersea mining, oil and gas exploration and extraction, and ocean dumping would not be permitted within the boundaries of NMCAs, most traditional fishing activities, managed on a sustainable basis, would continue.

National marine conservation areas will be managed on a partnership basis. The fundamental approach is to encourage Canadians to become stewards of their marine heritage and to work together towards the common goal of maintaining the area's ecological integrity and ensuring its long-term sustainability. Existing agencies will continue to manage renewable marine resources and regulate maritime navigation and shipping in co-operation with Parks Canada. All such activities will be subject to provisions limiting those uses which seriously impact on the natural and cultural resources which are the "raison d'être" for the

NMCAs. First Nations and local governments may also have roles in managing NMCAs. These elements would be included in the national marine conservation area's management plan.

Visitors will be encouraged to experience and enjoy the marine environment, and to develop an increased level of understanding of the natural values for which the marine conservation areas were established and protected, as well as the threats to their long-term viability. The sensitivity of marine ecosystems to human impacts and the need to separate potentially conflicting human activities would determine where and when various recreational activities would take place.

Treaty rights and rights recognized in native claim settlements with regard to traditional and subsistence hunting and fishing will be honoured within NMCAs.

National marine conservation areas are meant to:

- represent the diversity of our nation's marine ecosystems;
- maintain marine ecological processes and life support systems;
- preserve biodiversity;
- serve as "models" of sustainable utilization of species and ecosystems;
- facilitate and encourage marine research and ecological monitoring;

- protect depleted, vulnerable, threatened, or endangered species and populations (see Appendix) and preserve habitats considered critical to the survival of these species;
- protect and maintain areas critical to the lifecycles of economically important species; and
- provide interpretation of marine areas for the purposes of conservation, education and tourism.

Because marine ecosystems are dynamic, three-dimensional, ever changing and large, NMCAs will ideally encompass a broad area in order to attain the above goals and enhance the conservation of our marine environment. For example, Saguenay—St. Lawrence is 1138 km² in size and Gwaii Haanas 3050 km². However, these are small in extent compared to other marine protected areas of the world, such as the Florida Keys National Marine Sanctuary (Florida, USA — 9580 km²), Monterey Bay National Marine Sanctuary (California, USA — 13 800 km²) and the Great Barrier Reef Marine Park (Australia), which at 350 000 km², is the largest of them all.

National marine conservation areas cannot be managed in isolation from the surrounding region. Human activities, both on adjacent lands (pollution,

degradation of coastal habitats) and within the marine environment (over-exploitation of resources, pollution) have detrimental effects over wide areas. As a result, Parks Canada will work

closely with others to develop a better understanding of the relationship between these activities and their impact on NMCA ecosystems. Mutually satisfactory solutions will be sought to

mitigate the effects of such activities both within and beyond the boundaries of a NMCA which could threaten the long-term sustainability of its resources and ecosystems.

A SYSTEM PLAN FOR NATIONAL MARINE CONSERVATION AREAS IN CANADA

Parks Canada is committed to establishing a network of national marine conservation areas which will protect and conserve for all time marine areas that represent the full range of Canada's Atlantic, Arctic and Pacific oceans, and the Great Lakes. In order to achieve this nationally representative system, a regional sampling approach has been adopted. In brief, this method involves subdividing the marine environment into distinct geographic units or "marine regions" based on oceanographic and biological characteristics, and setting aside a representative sample of each region within the NMCA system. The resulting set of NMCAs therefore provide a representative cross section of the country's marine environments. The use of this approach for designing marine protected area networks was pioneered by Parks Canada and has since been adopted by other countries.

To guide the development of a finite

system of NMCAs, Parks Canada classified the Pacific, Arctic and Atlantic oceans, and the Great Lakes, into 29 marine regions. This framework was arrived at through consensus, following a series of workshops with scientists familiar with Canada's oceans and Great Lakes. This was no easy task. The marine environment tends to challenge our notion of easily identifiable boundaries. Terrestrial natural regions tend to be readily distinguishable — plains, mountains, lowlands and uplands are visually different features which are not likely to change in the foreseeable future. Because water is the primary element in a marine environment, the factors which separate one marine region from another are not immediately obvious from the surface and are based on characteristics such as temperature, salinity, currents, depth profiles and species distributions.

Though in a strict sense the Great Lakes are not "marine," they were

included in the NMCA system for several reasons. First, as the world's largest freshwater lake system they display many of the same attributes as marine environments. Secondly, there is little difference between the Great Lakes and ocean areas in terms of conservation potential, and commercial and recreational usage. And lastly, as one of Canada's first highways and shipping corridors, they have helped shape this country's history and economy.

This regional framework is not cast in stone. Better information and improved technology are stimulating the development of new classification systems which may provide a better basis for the design of the national marine conservation areas system. As well, new approaches to designing marine protected area systems may yet give us a more effective means of protecting our fragile and valued marine environments.

COMPLETING THE NATIONAL MARINE CONSERVATION AREAS SYSTEM

Parks Canada's long-term goal is to represent each of the 29 marine regions within the national marine conservation areas system. Although we're off to a good start with Fathom Five, Saguenay—St. Lawrence and Gwaii Haanas, the creation of new national marine conservation areas within each of the unrepresented marine regions will be increasingly complex and time-consuming.

The creation of a new national marine conservation area normally follows the establishment sequence outlined in the next section. However, deviations from

this standard process may occur because each situation is different. The final results reflect the individual circumstances and the involvement of all those parties which are directly affected. The section on page 14 summarizes the status of the system planning for all of the marine regions.

Filling the gaps in the system will not be achieved by the federal government acting alone. It will require a new consensus and determination on the part of local residents and resource users, as well as all Canadians and all levels of

government. Recognizing the important contribution that national marine conservation areas can make toward improving the quality of our environment and our lives is the first step.

The following pages present a brief description of each of the 29 marine regions, and a summary of where Parks Canada is with respect to the creation of a national marine conservation area in the region. We hope you'll agree that these environments are special, magnificent and well worth protecting.

ESTABLISHMENT PROCEDURES FOR

Step 1. Identifying Representative Marine Areas

Studies are carried out to identify preliminary areas which are representative of the marine region. Representativeness is based on: geological features (coastal landforms and submarine physiography); oceanographic features (tides, ice, water masses, currents, salinity, freshwater influence, etc.); marine and coastal habitats; biology (plants, plankton, fish, invertebrates, birds, marine mammals); and maritime prehistory and history. Just as important, these representative marine areas should be in a natural state, or be capable of being restored to a natural condition. Field studies of these preliminary areas are then conducted by Parks Canada to confirm their status as representative marine areas.

Step 2. Selecting Potential National Marine Conservation Areas

Once representative marine areas have been identified and confirmed in a region, further studies and consultations are undertaken to select one of these sites as a potential NMCA. In comparing representative marine areas at this stage, a wide range of factors is considered, including: quality of regional representation; importance of the area in maintaining biodiversity and protecting critical habitats for endangered species; occurrence of exceptional natural and cultural features; existing or planned marine protected areas; minimizing conflict with existing or probable marine resource uses; actual and potential threats to the sustainability of the area's marine ecosystems; the implications of aboriginal claims and treaties; potential for public understanding, education and enjoyment; and value of the area for ecological research and monitoring.

Step 3. Assessing National Marine Conservation Area Feasibility

When a potential marine conservation area has been selected for the marine region, a new NMCA proposal is prepared as the basis for a detailed feasibility assessment including public consultations. The factors listed above are now studied in greater detail, usually with the direct involvement of the provincial or territorial government and in consultation with representatives of local communities and, where appropriate, First Nations. Possible alternative uses are considered and compared, and where the seabed is under federal jurisdiction, a Mineral and Energy Resources Assessment is undertaken. Possible boundaries for the proposed NMCA are drawn at this stage. Discussions with the Department of Fisheries and Oceans (or the Ontario Ministry of Natural Resources in the case of the Great Lakes) on the management of fish and marine mammal resources, and with Transport Canada regarding navigation and shipping, are undertaken in consultation with the public. If the assessment shows that the proposed NMCA is feasible and there is public support for it, the governments may decide to proceed with the negotiation of a marine conservation area agreement. If a conservation area is not a feasible option, other representative marine areas within the region will be considered. The feasibility assessment is one of the most complex and time consuming steps of the entire establishment process.

NATIONAL MARINE CONSERVATION AREAS

Step 4. Negotiating a New National Marine Conservation Area Agreement

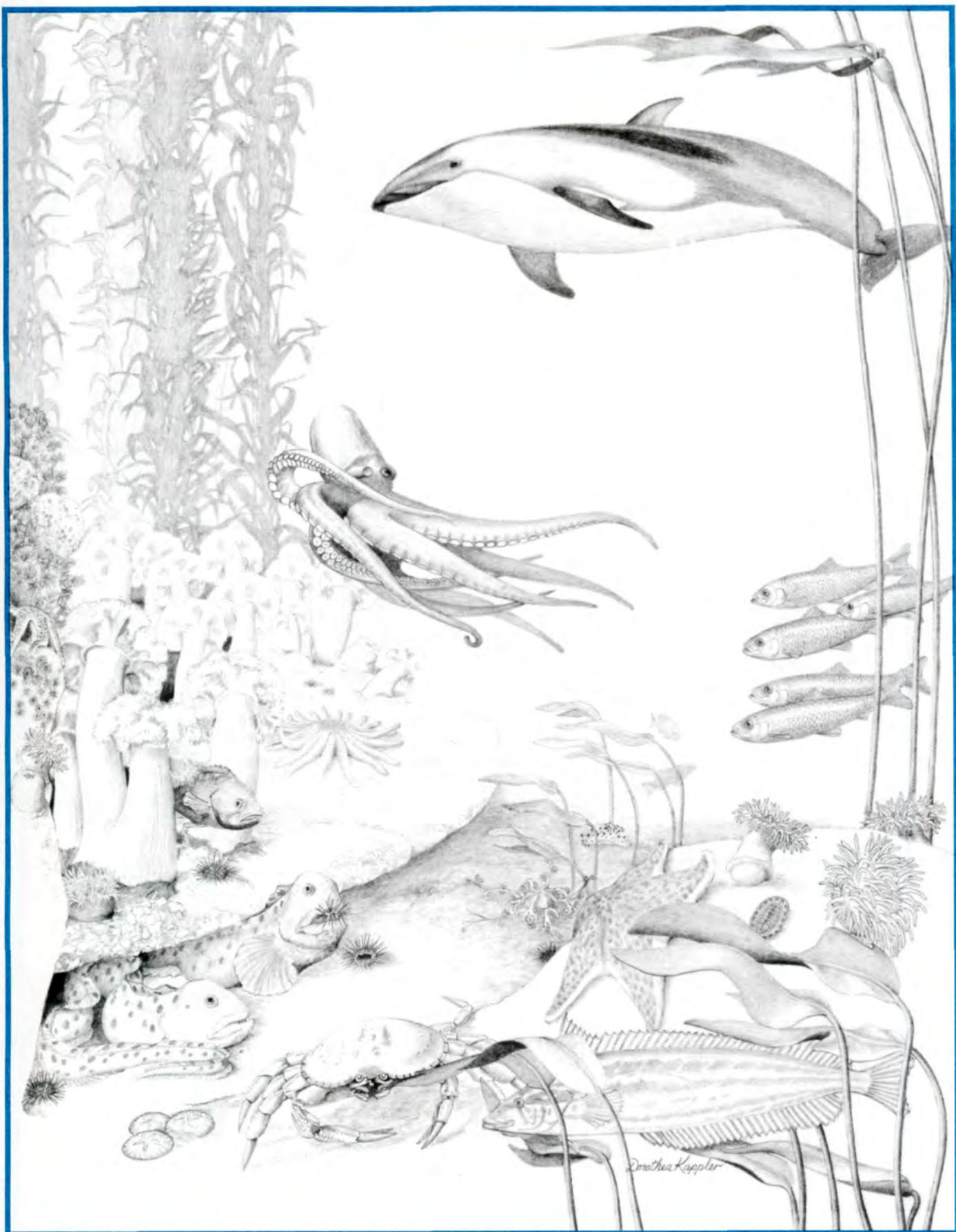
If the establishment of a national marine conservation area is determined to be feasible, a federal-provincial or federal-territorial agreement is formally negotiated setting out the terms and conditions under which the NMCA will be established and managed. These agreements cover many different topics depending on the circumstances, such as: final boundaries; management of fisheries and marine transportation; cost-sharing for land acquisition; timing of land transfer; continuation of traditional harvesting of renewable marine resources; co-operation in marine conservation area planning and management, regional integration and economic benefits. Where lands are subject to a comprehensive land claim by aboriginal people, a new marine conservation area can be established as part of, or subsequent to, a negotiated claim settlement, or a national marine conservation area **reserve** can be established pending the resolution of the claim.

Step 5. Establishing a New National Marine Conservation Area in Legislation

National marine conservation areas are currently established under the *National Parks Act*, although National Marine Conservation Area legislation is being developed. Once the responsible parties have agreed to create a new marine conservation area and the lands are administered by the federal government, the proposed new marine conservation area must be formally established by legislation of the Parliament of Canada so that the *Act* will apply. In the case of a national marine conservation area reserve, the *Act* would apply but the status of the area would be subject to the final resolution of the aboriginal claim.

STATUS OF NATIONAL MARINE CONSERVATION AREAS SYSTEM PLANNING

MARINE REGION	ESTABLISHMENT STEPS COMPLETED				
	Step 1	Step 2	Step 3	Step 4	Step 5
PACIFIC REGIONS					
1. Hecate Strait.....					■
2. Queen Charlotte Islands Shelf.....					■
3. Queen Charlotte Sound.....					
4. Vancouver Island Shelf.....					□
5. Strait of Georgia.....					■
ARCTIC REGIONS					
1. Arctic Basin.....					
2. Beaufort Sea.....					■
3. Arctic Archipelago.....					
4. Queen Maud Gulf.....					
5. Lancaster Sound.....					■
6. Baffin Island Shelf.....					□
7. Foxe Basin.....					
8. Hudson Bay.....					■
9. James Bay.....					■
ATLANTIC REGIONS					
1. Hudson Strait.....					
2. Labrador Shelf.....					■
3. Newfoundland Shelf.....					■
4. North Gulf Shelf.....					
5. St. Lawrence River Estuary.....					□
6. Magdalen Shallows.....					■
7. Laurentian Channel.....					
8. Grand Banks.....					
9. Scotian Shelf.....					■
10. Bay of Fundy.....					□
GREAT LAKES					
1. Lake Superior.....					■
2. Georgian Bay.....					□
3. Lake Huron.....					□
4. Lake Erie.....					
5. Lake Ontario.....					□
Step 1: Identifying representative marine areas Step 2: Selecting a potential national marine conservation area Step 3: Assessing national marine conservation area feasibility Step 4: Negotiating a new national marine conservation area agreement Step 5: Establishing a new national marine conservation area in legislation □ work ongoing ■ step completed					





1. Red Soft Coral
(*Gersemia rubiformis*)
2. Crumb of Bread Sponge
(*Halichondria panicea*)
3. Ochre Sea Star
(*Pisaster ochraceus*)
4. Club-tipped Anemone
(*Corynactis californica*)
5. Northern Red Anemone
(*Tealia crassicornis*)
6. Giant Green Anemone
(*Anthopleura xanthogrammica*)
7. Encrusting Coralline Algae
(*Lithothamnium pacificum*)
8. Red Sea Urchin
(*Strongylocentrotus franciscanus*)
9. Wolf-eel
(*Anarrhichthys ocellatus*)
a) male b) female
10. Eccentric Sand Dollar
(*Dendraster excentricus*)
11. Dungeness Crab
(*Cancer magister*)
12. Bull Kelp
(*Nereocystis luetkeana*)
13. Giant Kelpfish
(*Heterostichus rostratus*)
14. Leather Star
(*Dermasterias imbricata*)
15. Stomphia Anemone
(*Stomphia didemon*)
16. Lined Chiton
(*Tonicella lineata*)
17. Aggregating Anemone
(*Anthopleura elegantissima*)
18. Sea Clown Nudibranch
(*Triopha catalinae*)
19. Northern Basket Star
(*Gorgonocephalus arcticus*)
20. Black Rockfish
(*Sebastes melanops*)
21. Pacific Herring
(*Clupea harengus pallasii*)
22. Pacific White-sided Dolphin
(*Lagenorhynchus obliquidens*)
23. Giant Kelp
(*Macrocystis* sp.)
24. Giant Pacific Octopus
(*Octopus dofleini*)
25. Frilled Anemone
(*Metridium senile*)
26. Sunflower Star
(*Pycnopodia helianthoides*)

PACIFIC MARINE REGIONS

Biological productivity throughout these regions is high. The diversity of invertebrates along the Pacific coast is the richest in Canada — more than 3800 species representing 3.5% of the world's marine invertebrates. This is more than threefold the number of species on the Atlantic coast at similar latitudes. Impressive kelp forests and the medley of invertebrate species such as sea stars, sponges, sea anemones, sea cucumbers, nudibranchs (sea slugs), sea urchins and octopus are all part of the wonderful potpourri of colour and life found in the intertidal (between high and low tide) and subtidal (below low tide and always submerged) communities of these regions. The fish fauna — over 400 species are on record — of this coast is only slightly less diverse than in the Atlantic. The most abundant marine species are walleye pollock, Pacific cod, rockfishes, sole, Pacific halibut, arrowtooth flounder, lingcod, Pacific herring and Irish lords, as well as anadromous (living in salt water but spawning in fresh water) species such as steelhead trout and five species of Pacific salmon (coho, chinook, chum, pink and sockeye). Various shellfish, including assorted species of clam, crab, scallop, shrimp, prawn and squid are also common.

The Pacific regions are critically important to many species of breeding seabirds. They support a significant

proportion of the world population of rhinoceros auklet (25%), Cassin's auklet (70%) and ancient murrelet (40%), as well as some 75% of Canada's tufted puffins. They also provide feeding and resting areas for large masses of migrating and wintering ducks, geese, swans, loons and shorebirds. The abundant resources attract a seasonal variety of cetaceans. Grey, minke, humpback and killer whales, harbour and Dall's porpoises and Pacific white-sided dolphins are commonly seen. Sperm, blue and right whales occur farther offshore. Harbour seals and Stellar sea lions are common. Sea otters and California sea lions are found in a few locations and northern fur seals occur primarily offshore.

The cool Alaska Coastal Current strongly influences the Pacific regions as it flows northward over the continental shelf (i.e. that portion of the oceans which is less than 200 m below the surface and where most marine life is found). Tides are moderate, ranging in height from 2.5-4.0 m with strong tidal currents in inside waters, particularly in the numerous restricted passages. Water temperatures are fairly constant throughout the year, ranging from 8°-14°C overall, and reaching 20°C in sheltered areas during the warmest months. The year-round absence of sea ice, combined with the relatively uniform temperatures and the nutrient-rich waters flowing

through the system, result in the very diverse fauna found in these regions. The continental shelf is typically very narrow, rarely reaching 95 km and is generally less than 45 km wide.

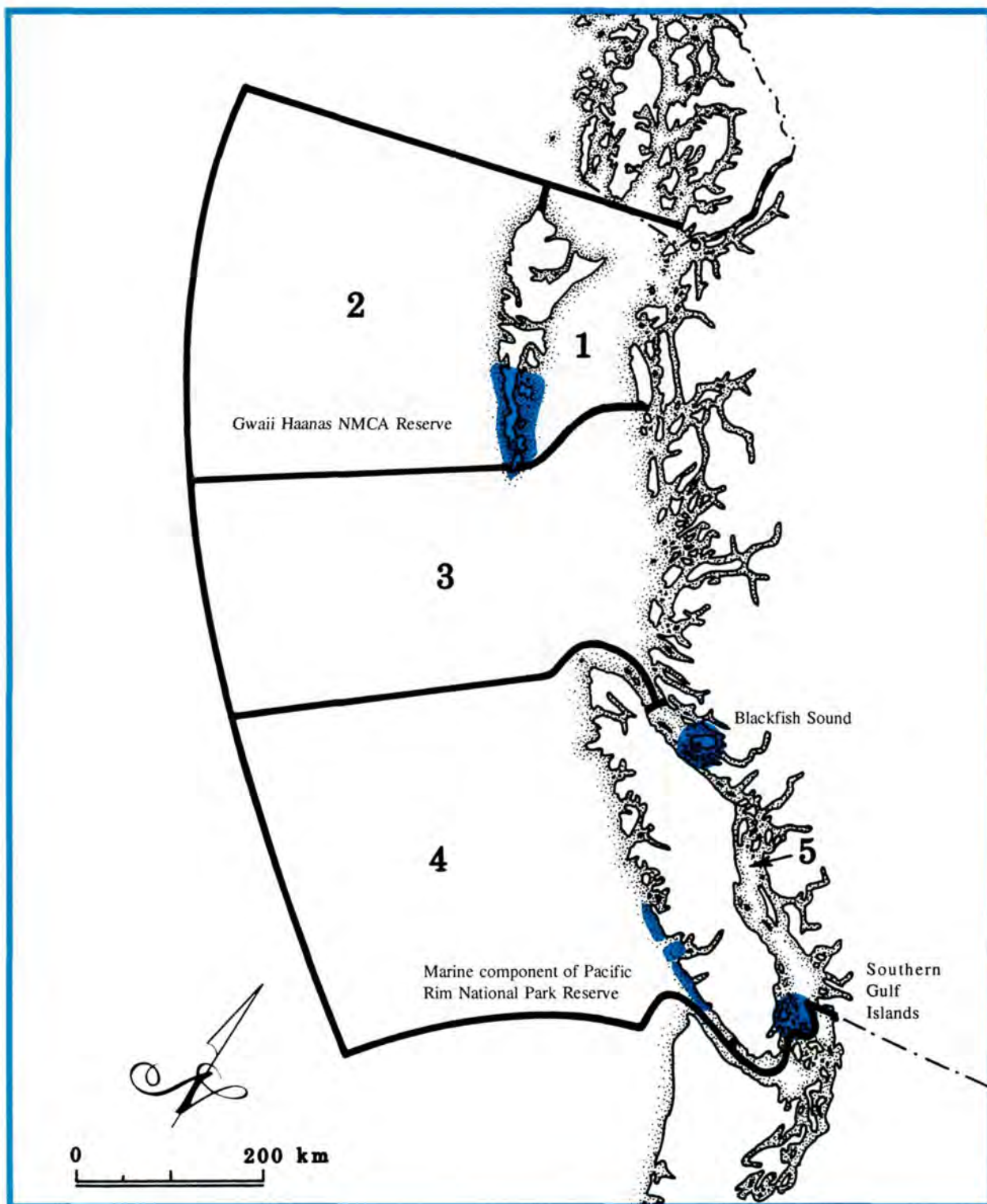
If you include islands, Canada's Pacific coastline stretches 27 300 km from the Washington state border to the Alaska Panhandle, representing 11% of Canada's ocean shoreline. The regions overlap four distinct continental plates — Pacific, North American, Explorer and Juan de Fuca. Several related fault zones make this area the most earthquake prone in Canada. Affected by extensive glaciation, the coastal areas "drowned" as the glaciers melted at the end of the last ice age. The outer coasts of resistant volcanic rocks resurfaced as an extremely rugged and complex shoreline. There are steep-sided fjords and inlets extending up to 110 km inland, low-lying rocky shores, island groups and wide intertidal platforms inundated with offshore shoals and isolated rocks. The east-facing coastlines are generally less rugged. Beaches are uncommon but occur locally in protected areas, as do mud flats, tidal marshes and deltas.

The Pacific marine regions are one of the most heavily populated coastal regions in the country. Water pollution problems are locally significant, with municipal sewage, heavy metals and toxic contaminants from various commercial and industrial sources being discharged into

marine waters. Heavy marine traffic has led to numerous accidental oil and chemical spills throughout these regions.

Development in major estuaries and deltas has altered and reduced critical habitats, while overfishing has seriously

impacted a variety of fish and shellfish populations and as a result, the other organisms which depend on them.



Map of the Pacific Marine Regions

HECATE STRAIT (PACIFIC REGION 1)

Wildlife

Intertidal and subtidal benthic (living on or near the bottom) communities are quite diverse and productive, dominated by kelp, mussels, barnacles, sponges, coralline algae, sea cucumbers and sea stars. Major salmon spawning areas occur throughout the area. The Nass and Skeena river systems support one of Canada's largest commercial salmon fisheries and are of primary importance to all five species of salmon and to steelhead trout as well. The region has important spawning areas for Pacific herring, rock sole and English sole plus rockfish, Pacific halibut and walleye pollock. Several juvenile rearing areas for a variety of fish species are also known, concentrated around the mainland outer islands and the shallow banks (submerged plateaus) offshore.

More than 50 seabird breeding colonies are found in the region, with ten colonies supporting more than 10 000 pairs of birds each. At least 240 000 pairs of Cassin's auklets, rhinoceros auklets and ancient murrelets breed here with lesser numbers of Leach's and fork-tailed storm-petrels, glaucous-winged gulls and pigeon guillemots. A strictly marine race of peregrine falcons also nests in the Queen Charlottes, feeding mostly on alcids. The shallow water banks and upwellings (where cold bottom water is forced upwards) are important



Stellar sea lion (*Eumetopias jubatus*)

The largest member of the Otariidae, or eared seals, male Stellers reach 3 m in length and weigh 450-1000 kg while the smaller females top out at 230 kg. In British Columbia, most of the population gathers on three rookeries during the summer to breed, then

disperses to numerous haul-outs along the coast for the rest of the year. They are largely non-migratory and tend to stay within a few kilometres of shore, feeding primarily on octopus and a variety of fish species.

feeding areas for breeding alcids, summering common murres, black-legged kittiwakes and sooty shearwaters, as well as for migrating loons, gulls, phalaropes and geese. Some 70 000 seabirds and waterfowl winter in the region. The coast

between Prince Rupert and Port Simpson is particularly important for several species of wintering shorebirds.

Killer whales, harbour porpoises and Dall's porpoises are regularly sighted throughout the year, while grey, fin, minke, humpback and

sperm whales are frequent summer visitors. Stellar sea lions and harbour seals stay year-round. Northern fur seals only winter in the area.

Marine Environment

The northern strait (Dixon Entrance) is a broad east-west depression in the continental shelf ranging in depth from 200-400 m. Hecate Strait is a shallow channel which runs north-south. It is bounded on the mainland side by a submarine valley and on the other by a wide, gently rising shelf with depths generally less than 100 m. Off northern Graham Island it is no more than 20 m deep as far as 6 km offshore. The waters in the inside passages between the coastal islands and the mainland coast are deep, especially in the fjords, the latter often exceeding 600 m. The tidal range is on the order of 3-5 m and helps to keep the waters well mixed. This increases biological

productivity and creates tidal rips and eddies (rough water caused by tidal currents) in various locations. The Skeena River has the second largest delta in British Columbia, while both the Nass and Skeena Rivers have large estuaries. Salt marshes are present in major inlets. Extensive mud flats only occur on northern Graham Island.

Coastal Environment

A broken shoreline of islands, isolated shoals and countless bays typify this coast. Receding glaciers left us with amazing fjords, narrow passages, coves, lagoons, sea caves, cliffs, sea arches and wave-cut terraces. In most of the region, a low rocky outer shoreline gives way to high relief mountains and uplands cut by numerous fjords and glacially cut channels. The low-lying northeast portion of the Queen Charlotte Islands is dominated by some of the most fascinating beach forms in

British Columbia. The north shore has 200 m wide sandy beaches and the east side has narrower coarse gravel beaches extending for 65 km, with 15-60 m high sea cliffs.

Status

This region is represented by Gwaii Haanas National Marine Conservation Area Reserve (3050 km²). A federal-provincial agreement was signed in 1988 to create Gwaii Haanas National Park Reserve and an adjacent marine protected area. A mineral and energy resources assessment has been completed and ministerial correspondence has confirmed the boundaries proposed in the 1988 agreement. Parks Canada is working with the Department of Fisheries and Oceans to develop a fisheries management plan for the marine conservation area and research programs are being developed.

QUEEN CHARLOTTE ISLANDS SHELF (PACIFIC REGION 2)

Wildlife

Intertidal and subtidal flora and fauna are dominated by kelp, limpets, barnacles, mussels, coralline algae, sea cucumbers, sea urchins, sponges and sea stars. Of particular interest in this region is its close proximity to the continental slope, with its component of truly oceanic waters and the associated benthic and deep pelagic (living in the open sea) faunas. Significant salmon spawning rivers as well as Pacific herring, Pacific halibut and sablefish spawning grounds are all found here. Shrimp, prawn and squid occur in the more protected embayments.

Again bird life is abundant. More than 390 000 pairs of rhinoceros auklets, tufted puffins, Cassin's auklets and ancient murrelets, 70 000 pairs of Leach's and fork-tailed storm-petrels, and lesser numbers of gulls, cormorants and pigeon guillemots breed in the region in some 30 colonies spread out along the coast.

Grey whales, killer whales, Dall's and harbour porpoises are frequently seen. Pacific white-sided dolphins, sei, minke and right whales are sighted on occasion. Northern fur seals migrate off the coast. Stellar sea lions are year-round residents, with more than 1000 breeding on the Kerouard Islands. Haul-outs — areas where the sea lions regularly "haul" themselves out on land — are found all along the coast. Harbour seals are rare.



Ancient murrelet (*Synthliboramphus antiquus*)

Named for the white feathers which resemble the white hair of an old man, this small quail-sized bird spends most of its life at sea. It nests on offshore islands with enough soil for a burrow, leaving the nest to feed only at twilight in order to avoid predators. A

few days after hatching, the young swarm down the hillsides to the sea in response to their parents call. The adults tend the young at sea until they can fend for themselves.

Marine Environment

The narrow continental shelf west of the Queen Charlottes closely parallels the shoreline. At its closest point, the shelf edge is barely 7 km from land and widens to only 30 km. The continental slope is unusually steep, dropping rapidly to over 2500 m. Bowie Seamount, an underwater volcanic peak 220 km west of the Queen Charlottes rises to within 37 m of the surface from depths of more than 3000 m. Its three shallow pinnacles cover approximately 4 ha, creating an oasis of life in a mid-ocean desert.

Coastal Environment

The coast is particularly rugged due to heavy glaciation and complex changes in sea level. This is predominantly a high relief fjord coast with numerous islands and low rocky shorelines on the outer fringe. Nearly vertical cliffs plunging more than 200 m into the sea are common, as are short gravel beaches and wide intertidal platforms. This region is also one of the windiest in Canada with persistent and intense local winds, frequent storms and long fetches (uninterrupted stretches of open water) of

more than 1000 km. The result is a coast constantly battered by large waves, creating a variety of erosional landforms such as sea stacks and sea caves.

Status

This region is also represented by Gwaii Haanas National Marine Conservation Area Reserve (3050 km²). See the

previous outline of the Hecate Strait marine region for details.

QUEEN CHARLOTTE SOUND (PACIFIC REGION 3)

Wildlife

Important spawning grounds for Pacific herring, rockfish, Pacific cod, sole, lingcod and sablefish occur throughout the continental shelf, but are concentrated around the shallow banks. Salmon spawning rivers dissect the mainland coast. Clams, shrimp and prawn are relatively abundant. Both intertidal and subtidal communities are quite diverse and productive.

Some 120 000 pairs of seabirds breed in several colonies, dominated by Cassin's and rhinoceros auklets. Though the number of breeding birds is far less than

most of the other Pacific regions, Queen Charlotte Sound is a vital feeding area for millions of breeding, summering and migrating seabirds and waterfowl.

Grey whales, killer whales, harbour and Dall's porpoises, Pacific white-sided dolphins and northern fur seals are common visitors, while harbour seals and Stellar sea lions make the region home. Sperm, sei, fin, minke, humpback and right whales occur primarily offshore. A small population of sea otters has recently established itself along the coast, a positive sign for the recovery of this endangered species.

Marine Environment

Queen Charlotte Sound has a complex bottom topography. Three broad troughs (essentially submerged valleys) 350-400 m in depth slice inland across the continental shelf. The troughs have low sills (submerged ridges) at the seaward entrance and are separated by wide shallow banks. The continental shelf is approximately 95 km wide with shoals throughout. Tidal rips and eddies occur in several areas along the mainland coast, a result of strong tidal currents which can reach speeds of 400-500 cm/s (14-18 km/hr). Upwelling concentrates the



Sea otter (*Enhydra lutris*)

The sea otter is truly a marine mammal — eating, sleeping, mating and giving birth at sea. Anchored in kelp to maintain its position

while sleeping or feeding, it eats abalone, sea urchins, crabs, mussels and fish (as much as 6 kg a day) using a rock placed on its chest to

break the shells. It thus uses tools more than any other mammal except primates such as chimpanzees and man.

nutrients and creates a giant biological fueling station.

Coastal Environment

Faulting, extensive glaciation and sea level changes have carved the resistant rocks into a shoreline broken up by islands and islets. The exposed

outer coastline is generally low-lying and flat, while the sheltered inner mainland coast is mountainous with many steep fjords and channels. Small sandy and pebble-cobble beaches, estuaries and salt marshes occur locally.

Status

This region is not yet represented in the national marine conservation area system. Studies to identify representative marine areas are the next step.

VANCOUVER ISLAND SHELF (PACIFIC REGION 4)

Wildlife

Productivity throughout this region is high and the intertidal and subtidal habitats are no exception. Benthic communities tend to vary with bottom type. Rocky habitats are dominated primarily by kelp, mussels, barnacles, coralline algae, sea stars, isopods, sponges and polychaetes. Sandy areas tend to have fewer species and are dominated by isopods, polychaetes, crabs and clams, with few marine plants. Important salmon and steelhead trout spawning rivers are present throughout the region. Pacific herring, rockfish, lingcod, Pacific hake and sablefish spawn off the coast. Shrimp, prawn, clams and crabs are common, abalone and oyster less so. Elusive six-gilled sharks, normally living at depths of over 1200 m, come into the shallow waters of Barkley Sound every year, to the delight of many a diver. The shallow offshore banks are important feeding areas for a wide diversity of fish species as well as a variety of seabirds.

The largest groupings of breeding seabirds in British Columbia are found in this area, mainly on Triangle and Sartine Islands. About 900 000 pairs of seabirds breed in the region, dominated overwhelmingly by Cassin's auklets. There are fewer numbers of rhinoceros auklets, tufted puffins, Leach's and fork-tailed storm-petrels, gulls

and cormorants. The inlets along the coast are used widely by tens of thousands of grebes, diving ducks and gulls.

In the spring, more than 21 000 grey whales migrate along the West Coast to summer feeding grounds in the North Pacific and Arctic oceans. Several dozen individuals remain in the region and spend the summer feeding along the coast. Killer whales, harbour porpoises, Pacific white-sided dolphins and fin whales can also be spotted along the coast. Stellar and California sea lions and harbour seals are common throughout the area, and northern fur seals migrate through the region. Sea otters, which vanished from Canadian waters in 1929, were successfully re-introduced here over 20 years ago and the resulting two small colonies are flourishing.

Marine Environment

The edge of the continental shelf which borders the island is only 20 km from the coast at its narrowest point in the north and widens to 80 km by the time it reaches the southern portion of the island and slopes gently offshore. Large portions of the shelf have been influenced by glaciation, leaving behind shallow banks, deep basins and troughs. Tidal streams create upwelling as they encounter these features. In spring and summer, the prevailing winds generate upwelling along the entire

coast. These upwellings create an environment ideal for plankton growth which supports dense concentrations of fish as well as marine birds and mammals.

Coastal Environment

A combination of uplift and erosion of both sedimentary and volcanic rocks has created a complex and rugged coast. Inlets, headlands, islands, reefs, surge channels, sea caves, vertical sea cliffs with flat sandstone benches, shallow embayments, rocky intertidal zones, small river deltas and extensive, though isolated, sand and gravel beaches are all important shoreline features of this wave-battered coast.

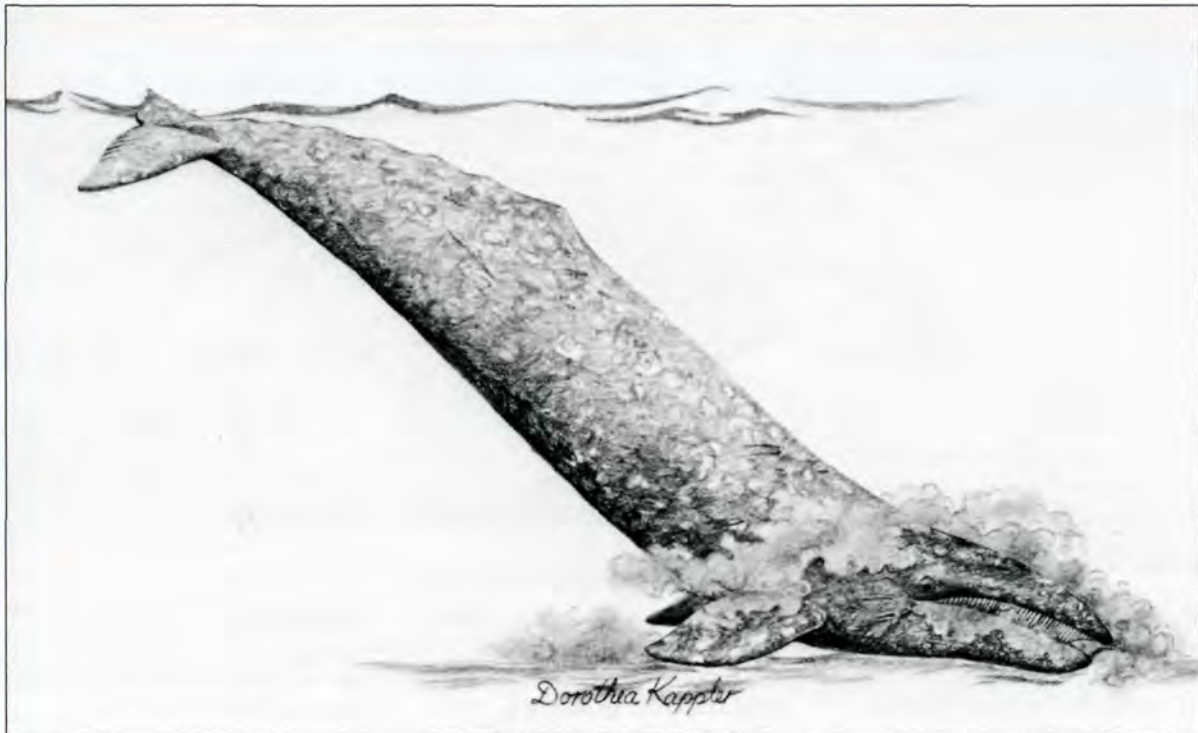
Status

This region is partly represented by the marine component of Pacific Rim National Park Reserve. The initial agreement between Canada and British Columbia providing for the creation of Pacific Rim National Park was signed in 1970. A final agreement was signed in 1987. The boundaries of Pacific Rim extend offshore to include a marine component of approximately 155 km². One portion extends to the 10-fathom line offshore the Long Beach and West Coast Trail units of the park, while another surrounds the Broken Islands Group. Studies have indicated that the park's marine

component could serve as the nucleus of an outstanding national marine conservation area at some future date, although boundary

modifications may be required to improve its overall representativeness and ecological integrity. The management plan for the Park

proposes that its marine resources be managed in accordance with the *National Marine Conservation Areas Policy*.



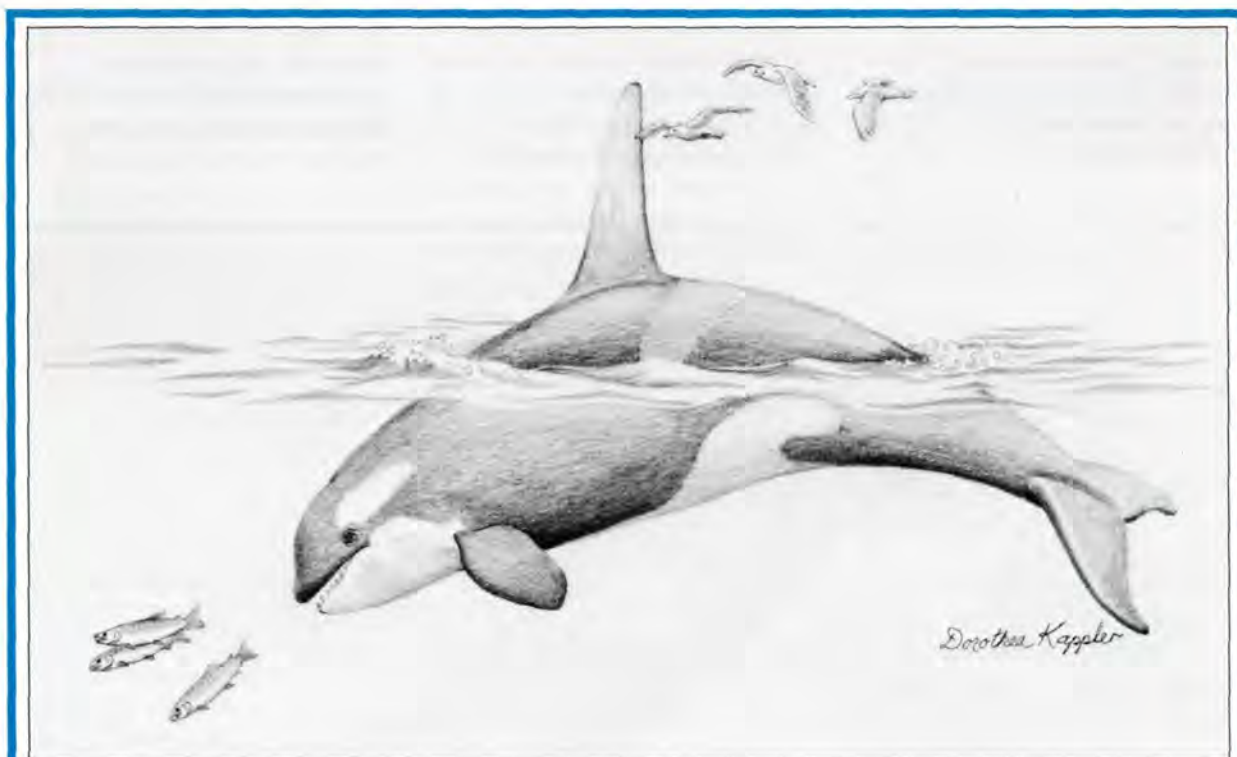
Grey whale (*Eschrichtius robustus*)

The aggressive way in which females defend their young from predators, including killer whales, sharks and man, earned them the name

“Devilfish” from early whalers. Grey whales feed mostly in shallow water, combing the bottom for various invertebrates which

they suck up, leaving a muddy cloud behind them which is often visible from the surface.

STRAIT OF GEORGIA (PACIFIC REGION 5)



Killer whale (*Orcinus orca*)

There are two distinct races of killer whale off the coast of British Columbia.

"Transients" occur offshore and feed mainly on other marine mammals, including dolphins, sea lions, seals

and other whales.

"Residents" are common near shore in summer and feed on fish, primarily salmon. Killer whales, also called orcas or "blackfish," live in tight

associations called pods which are matriarchal in nature — in other words, the whales remain with their mother for life.

Wildlife

The subtidal communities are particularly rich in this region and vary greatly from one location to another, depending on temperature and currents. The result makes for some of the most spectacular and breathtaking diving in Canada. The Fraser River is the most important salmon-producing river in North America, all five species making their way to

various streams in order to reproduce. A number of other major spawning rivers occur along the mainland coast. Pacific herring, lingcod, rockfish, sole, Pacific cod and dogfish shark are common, as are shrimp, prawn, oyster and various crabs and clams. Hornby Island is one of the rare places where the unaggressive six-gilled shark comes into shallow waters every year.

More than 230 000 pairs of seabirds breed in the area, most notably rhinoceros auklets, with lesser numbers of Cassin's auklets, storm-petrels, gulls and cormorants. More important are the more than two million shorebirds, grebes, loons, seabirds, diving and dabbling ducks, and geese which use the estuaries and coastal waters as summering, staging and wintering grounds.

About 280 killer whales cruise the waters of this region

throughout the summer, representing two distinct communities of “resident” orcas; a northern community of 190 whales in 16 pods (close-knit family groups) and a southern one of 90 whales in three pods. Easily observed, playful and quite demonstrative, they are one of the region’s star attractions. Harbour seals are also plentiful, with numerous haul-outs throughout the area. Stellar and California sea lions are primarily winter residents.

Marine Environment

Shallow banks, deep basins, shoals, sills and narrow channels are prevalent within the region. Depths reach 500 m in the north (Johnstone and Queen Charlotte Straits), average 155 m in the Strait of Georgia, and range from 55-250 m in Juan de Fuca

Strait which separates British Columbia from Washington state. Upwellings, tidal mixing, tidal rips, whirlpools, eddies, convergences and slow backwaters are common, resulting from highly variable currents and complex bottom and coastline features. The Fraser River drains about one-quarter of the land area of British Columbia and discharges so much fresh water in the spring that it essentially converts the Strait of Georgia into a huge estuarine ecosystem. All of these elements create one of the most productive marine environments on our Pacific coast.

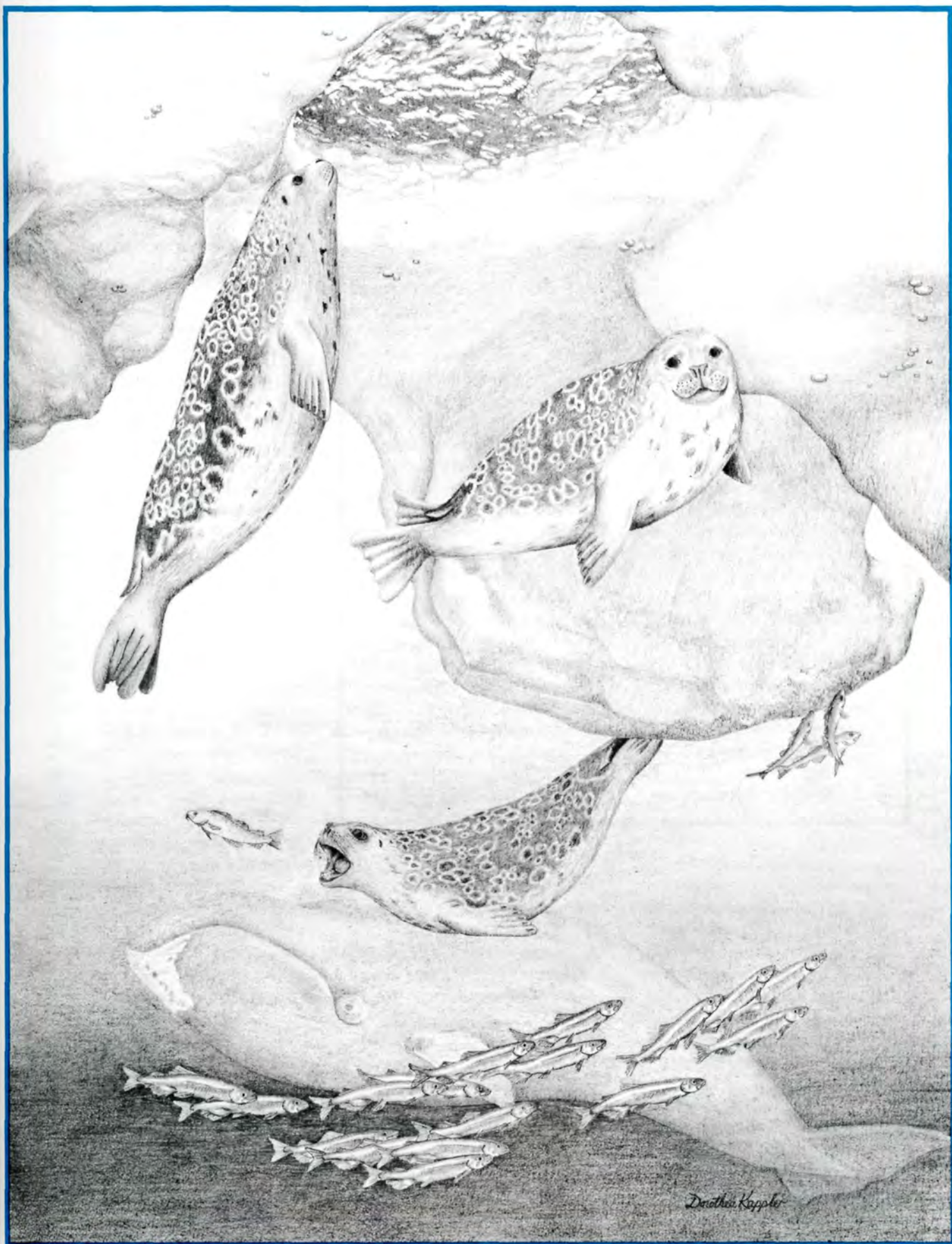
Coastal Environment

The mainland is marked by an indented coastline of long, steep-sided fjords, surging tidal channels, islands, sounds,

passages and steep channels resulting in some of the most spectacular scenery on the B.C. coast. In contrast, eastern Vancouver Island is characterized by a more regular, undulating coastline with extensive coastal bluffs, deeply incised river valleys and few inlets. Estuaries, deltas, salt marshes and eelgrass beds are particularly important coastal habitats.

Status

This region is not yet represented in the national marine conservation area system. Two representative marine areas have been confirmed: Blackfish Sound and Southern Gulf Islands. Preliminary discussions with the Province of British Columbia are the next step.





1. Polar Bear
(*Ursus maritimus*)
2. Ringed Seal
(*Phoca hispida*)
3. Ogac
(*Gadus ogac*)
4. Arctic Cod
(*Boreogadus saida*)
5. Ice algae
6. Bowhead Whale
(*Balaena mysticetus*)
7. Capelin
(*Mallotus villosus*)

ARCTIC MARINE REGIONS

Ice, the dominant feature of Arctic marine ecosystems, continuously sculpts the coastal landscape and acts as a major limiting factor to all biological activity. It separates the Arctic regions into two distinct zones. One is characterized by the year-round presence of sea ice and is comprised of the Arctic Basin marine region. The other eight marine regions are part of the seasonal ice zone, with ice-free periods ranging from less than a month to up to four months. However, even in the warmest months, the surface water temperature is barely above freezing.

Annual primary productivity (i.e. production by plants, mostly microscopic algae on which all other life in the oceans depend) ranges from barely 1% that of the Atlantic in areas of permanent ice, to a high of 17%. Yet certain Arctic areas are seasonally among the richest in the world, a result of longer ice-free periods and mixing of the various water masses by winds and currents. It is this seasonal abundance which attracts such tremendous numbers of seabirds and marine mammals to our Arctic waters.

Barely 130 fish species occur in the marine and brackish waters across the Canadian Arctic. This compares to the more than 500 species off the east coast and the more than 400 species off the west coast of southern Canada. Arctic cod and ogac, Arctic charr, sculpins, eelpouts and snailfish are the most

common, species diversity being greatest in the west and south. The intertidal invertebrate fauna is poor, primarily due to the action of ice along the shore, scouring to depths of several metres in many instances. Below this depth, a moderately diverse invertebrate community exists, composed mainly of species common throughout the world's Arctic waters. Walrus, ringed and bearded seals and polar bears are year-round residents, feeding on clams, fish — and seals for the polar bears. Significant portions of the world populations of various seabird, waterfowl and shorebird species, as well as narwhals, bowhead whales and belugas breed, feed and migrate throughout the Arctic. We are barely beginning to understand Arctic marine ecosystems and have tended to focus on what is easily visible, such as marine mammals and birds, or commercially important to man, such as Arctic charr. Yet we know almost nothing about other parts of the food web, such as the benthic plants and animals (i.e. clams, anemones, sea stars, polychaetes or sea worms), which make up more than 50% of the Arctic biomass.

Except during the brief summer season, the Arctic is covered in various combinations of landfast ice (sea ice growing close to shore) and pack ice (pieces of broken ice or ice floes). Polynyas and shoreleads play a crucial role in the Arctic during this period. Surrounded by sea

ice, these areas of open water, the most important found in the same site every year, are brought about by currents, tides, upwellings and winds. Some of these "recurrent" polynyas are open throughout the ice-bound winter, while others may freeze over during the coldest months but open up in the spring, well before the ice breaks up elsewhere. These ice-edge ecosystems are biological "hotspots," based on an intense bloom of microscopic plants and tiny shrimp-like crustaceans called amphipods, making them some of the richest sea areas on earth. They provide birds and marine mammals with a refuge in winter as well as feeding areas in spring and fall. When harsh winters prevent the opening of polynyas, the results are often severe; in 1964, the Bathurst Polynya failed to open and 100 000 ducks died on the ice.

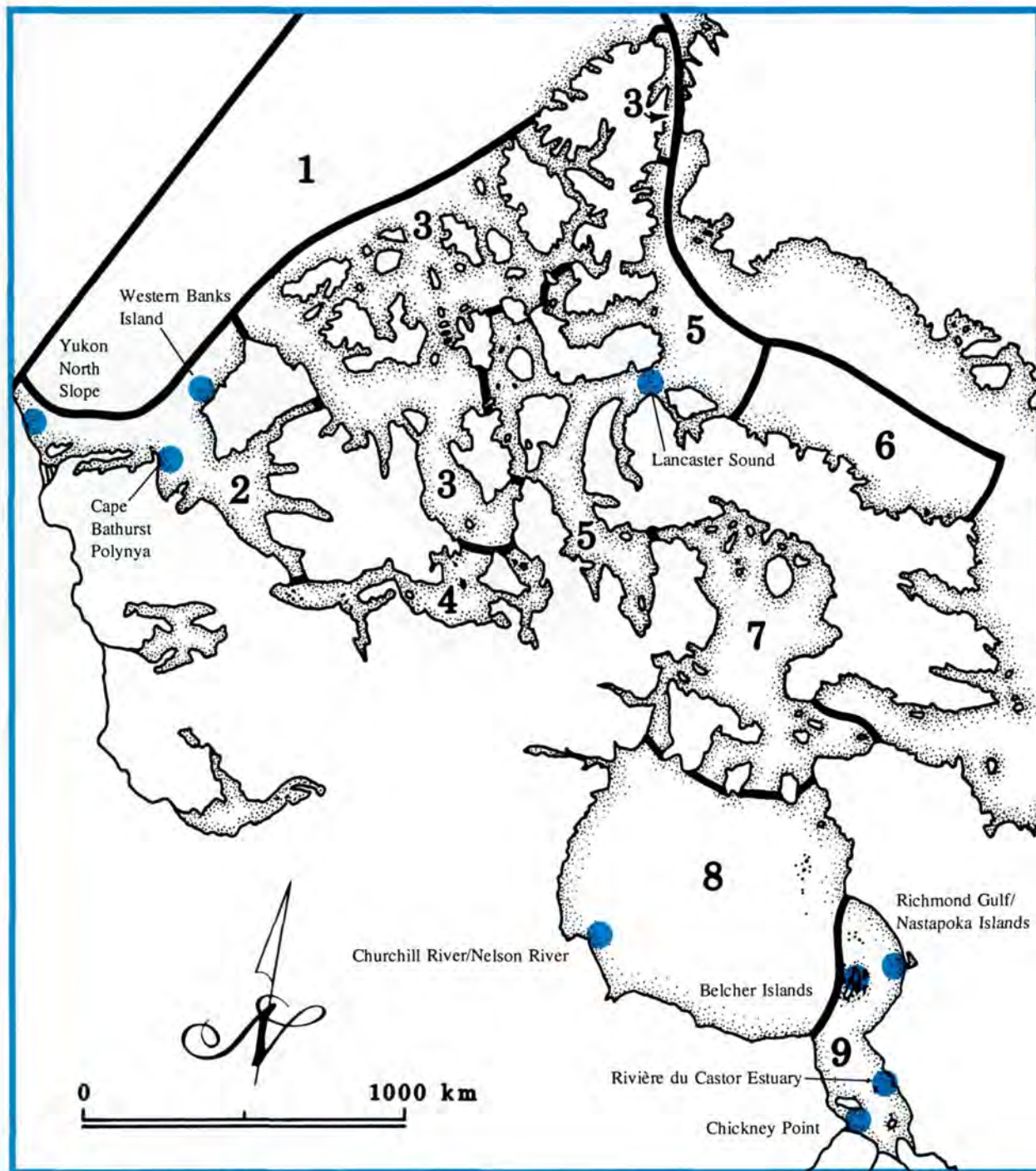
The Arctic coast (including islands) stretches 165 000 km from James Bay and Baffin Island to the Yukon, encompassing 68% of Canada's ocean coastline. The region has been shaped by volcanism, faulting, folding and glaciation, resulting in a wide range of coastal landforms and reliefs. These vary from steep fjord coastlines embedded in Canadian Shield rocks, to cliffs and headlands, gently rolling lowlands, wide tidal flats, estuaries, deltas and permanent ice fields. The tidal range is generally less than 0.5 m in the northern and western sectors of the region. Towards the east

and south, the tidal range increase from 1.0 m to 5.0 m.

Most of the Canadian Arctic is still a mystery except possibly to the small, dispersed human population which inhabits its coasts. Human uses are largely centred around hunting and fishing. Scientific studies have been concentrated

primarily in areas of potential oil and gas exploration, and even today, large parts of the Arctic remain virtually unknown. One of the major pollution concerns in recent years has been the detection of measurable amounts of toxic chemicals accumulating within the Arctic food chain. Produced

in distant industrial centres, these substances are transported to the Arctic by global atmospheric systems. There is also the potential for increased mining and oil and gas exploration activity, leading to concerns over greater marine traffic and the likely consequences.



Map of the Arctic Marine Regions

ARCTIC BASIN (ARCTIC REGION 1)



Ivory gull (*Pagophila eburnea*)

Greek for “ice loving,” its scientific name aptly describes this ghostly white bird, one of the hardiest gulls in the world. It lives

year-round amid the polar ice and snow and is rarely seen outside the Arctic. It is a bold and aggressive scavenger and feeds on

anything it can find — fish, crustaceans, dead whales and seals, including polar bear kills.

Wildlife

Only the hardy survive this far north and then only in small numbers. The occasional bearded seal, ringed seal, polar bear, bowhead whale and beluga are found along the ice margins. Birds are few and far between although the ivory gull,

“phantom of the polar ice,” can be found along the edges of the pack ice even in winter. Only beneath the ice is life slightly more prolific. There, a few fish species and various kinds of bottom dwelling invertebrates such as clams and polychaetes are known to occur.

Marine Environment

There is essentially no shallow water, except quite close to the coast. The Canada Basin, by far the largest of the Arctic Ocean sub-basins, dominates the marine region, with an average depth of 3600 m. It is bounded near the North Pole by the

Lomonosov Ridge, a submarine mountain chain rising to 1000 m below sea level. From this basin flows the water that reaches every corner of the Canadian Arctic. This region is constantly encumbered by sea ice which covers 90-100% of its surface area throughout the year. Caught in the Arctic Ocean Gyre, one of the main Arctic Ocean currents, the pack ice moves slowly in a vast circle and stays around for several years. This multi-year ice reaches a thickness of up to 2 m and is heavily ridged. Ice islands a few kilometres in length and width, and strong

enough for heavy aircraft to land on, are common. Tides are almost non-existent.

Permanently ice covered, the waters of the region remain unmixed and as a result are biologically poor.

Coastal Environment

There is very little coastline in this region and what is present is precipitous and deeply cut by fjords in the north and low-lying towards the south, constantly scoured by the ice to a depth of several metres. Ice shelves of the northern

Ellesmere Island coast, and particularly the 16-km-wide Ward Hunt Ice Shelf, are unique in the Northern Hemisphere and generate many of the ice islands which become part of the Arctic Ocean polar pack.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.

BEAUFORT SEA (ARCTIC REGION 2)

Wildlife

Many different types of fish do well in this region. There are more than 40 Pacific, Atlantic and Arctic marine species such as capelin, Pacific herring, ogac, Arctic cod and some freshwater/brackish ones, including cisco and whitefish species. In the Canadian Arctic, these last two groups occur only within this region. Some 4000-5000 bowhead whales, approximately 75% of the world's remaining population, and about 11 500 belugas summer and feed here, using

the shoreleads to reach their favourite feeding areas. This region has one of the highest densities of polar bears and ringed and bearded seals in the Arctic.

The Beaufort Sea is one of the Canadian Arctic's most important areas for waterfowl and shorebirds. In spring, migrating king and common eiders, oldsquaw, red-throated, Pacific and yellow-billed loons, and glaucous gulls occur throughout the open water leads and Cape Bathurst polynya. In summer, moulting ducks (largely scoters,

oldsquaw, mergansers and scaup) are found in most sheltered bays and channels throughout the region, while moulting geese are often found feeding in coastal salt marshes. Thousands of shorebirds nest throughout coastal wetlands and migrate along the coast. Red and red-necked phalaropes (shorebirds which swim and pluck marine invertebrates from the water's surface) are common fall migrants in nearshore waters. The only breeding populations of thick-billed murres and black guillemots in the Western



King eider (*Somateria spectabilis*)

King eiders are found by the tens of thousands along shoreleads in the spring as they wait for the snow to melt on their nesting grounds further north. They

winter at sea as far north as open water permits. Feeding to depths of more than 50 m, they are one of the deepest divers among the diving ducks. They feed mainly on

mussels and other molluscs, crabs, sea urchins, sea stars, sea cucumbers and sea anemones, as well as algae.

Arctic are also found here, many of the latter nesting among the historic buildings at Herschel Island. The lack of suitable rocky cliffs for nesting is probably the main reason there are so few of these seabirds compared to the Eastern Arctic.

Marine Environment

Along the Beaufort Sea, a broad but shallow continental shelf borders the coast and extends as much as 100 km offshore. Depths of 10 m or less are found up to 30 km from shore. Amundsen Gulf, a large embayment, is 600 m deep in the centre, with several large bays and relatively little shallow water. Tidal influence is minimal. The region is generally ice covered from October through June. Landfast ice extends 20-80 km from shore in shallow areas and pack ice dominates the rest of the region. During this period, the Bathurst polynya and shorelead system provide areas of open water that are critical to marine

mammals and spring staging birds. A small polynya in Lambert Channel, at the eastern end of Amundsen Gulf appears in spring and serves as a way-station for most of the Pacific population of common eiders and yellow-billed loons on their way to nesting sites further east. The MacKenzie River is the only large North American river emptying into the Arctic and the world's third largest. Its abundant freshwater output, combined with the generally shallow water depths, has a profound influence on the whole marine region, creating a freshwater plume which extends several kilometres from the coast. The area where this freshwater plume mixes with the truly marine waters further offshore is very productive and important for the entire ecosystem.

Coastal Environment

The coast ranges from mostly flat, wet and barely above sea level to sheer cliffs of 425 m. The Beaufort Sea proper is a

drowned coastline with low cliffs that are rapidly eroding. Pingos (mounds or hills with a core of ice) are characteristic of this area, both on land and below water. Amundsen Gulf to the east is also low-lying, with intermittent high backshore cliffs where Canadian Shield rocks outcrop. Barrier beaches, spits, extensive deltas, lagoons, estuaries, tidal flats, narrow sand and gravel beaches, and marshes are found throughout the region.

Status

This region is not yet represented in the national marine conservation areas system. Three representative marine areas have been confirmed: Cape Bathurst Polynya, Yukon North Slope and Western Banks Island. The selection of the preferred site for national marine conservation area purposes is the next step.

ARCTIC ARCHIPELAGO (ARCTIC REGION 3)

Wildlife

Polar bears and ringed seals are scattered throughout most of the region, while bearded and harp seals are observed mainly along the east coast of Ellesmere Island. Whales are rare and seabird numbers are low, due in large part to unpredictable open water conditions. Small numbers of brant and snow geese, ducks, loons, Arctic terns and glaucous, ivory and Iceland gulls breed and stage in the region.

Marine Environment

The region is characterized by deep channels and basins with almost no shallow water areas. Depths range from 200-500 m within most of the region, while several glacially scoured, steep-sided fjords and channels

in the Queen Elizabeth Islands group are 600-920 m deep. Ice cover, predominantly landfast ice, is complete in winter and extensive during the summer, particularly among the Queen Elizabeth Islands. Well into this century, the highly variable and unpredictable ice conditions common to the main channels of this region were the bane of all ships hoping to navigate the Northwest Passage. A shorelead associated with the Cape Bathurst polynya which extends across western M'Clure Strait is the only consistent area of open water.

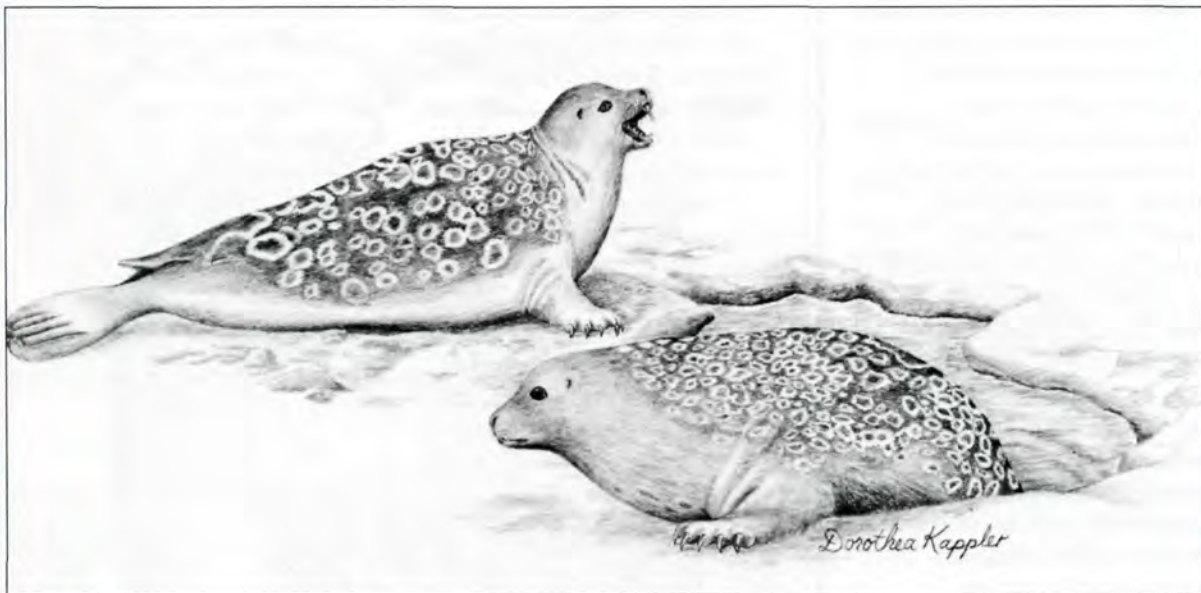
Coastal Environment

As the name implies, the region encompasses numerous islands with coastal features varying from place to place. High rocky coasts predominate in the northeast sector, while

moderate cliffs and bluffs are prominent along the southern sector. Lowland plains dominate the west central section. Large permanent ice fields and glaciers are present on the northernmost islands, with icebergs occasionally "calving" (splitting off) into the sea from the tidewater glaciers of eastern Ellesmere Island. The coast is a mixture of straight shorelines dominated by coarse sediment beaches and cliffs, and crenulated coastlines with numerous inlets, bays, fjords and estuaries.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.



Ringed seals (*Phoca hispida*)

The most common seal in the Arctic and found essentially everywhere north of 60° latitude, ranging the ice-bound coasts. Smallest of the seals, both sexes are only about 1.4 m long and

weigh up to 90 kg. As the sea freezes, the seals use their teeth and claws to make breathing holes in the ice, keeping a watchful eye out for polar bears as they come up to breathe. The

females dig a lair in the snow over landfast ice to bear their young and use a hole in the ice floor to come and go unseen.

QUEEN MAUD GULF (ARCTIC REGION 4)

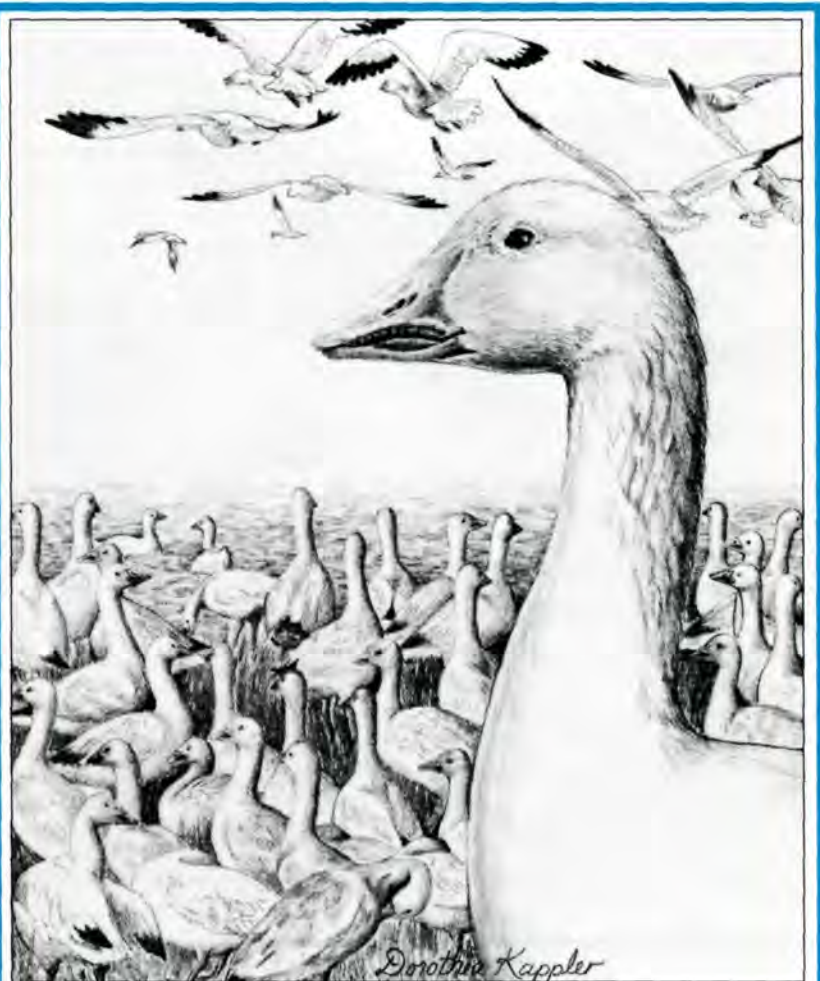
Wildlife

This is one of the relatively unknown regions of the Canadian Arctic. However, Arctic charr seem particularly abundant, numerous rivers supporting a commercial fishery. Ogac is the dominant type of cod. Whales are rare, except for the occasional narwhal in the northeastern corner of the region. Bearded seals, ringed seals and polar bears are the only marine mammal species known to regularly frequent these waters. The extent of landfast ice suggests that the region probably harbours a relatively high density of ringed seals.

Thousands of tundra swans, brant, white-fronted, Ross's, snow and Canada geese breed, moult and stage in the area. The largest concentrations are within the Queen Maud Gulf Migratory Bird Sanctuary, including most of the world population of Ross's geese. Common eiders, oldsquaw, yellow-billed loons and several shorebird species are also believed to be abundant in the region, though the lack of surveys makes this difficult to confirm.

Marine Environment

Both Queen Maud Gulf and Coronation Gulf are shallow basins averaging less than 100 m in depth and shoaling progressively towards the coast. Ice cover is complete from October to June. General ice break-up begins in July and



Snow geese (*Anser caerulescens*)

The most abundant of all the world's wild geese, the snow goose presents a perplexing array of names and colour phases. Though most "lesser" and "greater" snow geese are white with black wing tips, their scientific name actually means "blue goose," a confusing state of affairs as this refers only to the blue

form of the lesser snow goose, which is bluish-grey with a white head. To complicate matters even more, all forms often have a rust-coloured face, a result of grubbing in iron-rich mud for the roots of salt marsh grasses which they feed on along the coast.

open water predominates through August and September, though at times many of the

channels and straits are ice-choked throughout the summer, as Franklin discovered

in 1847. He and the rest of the crew of the *Erebus* and *Terror* perished on King William Island in Queen Maud Gulf that year. More than 50 years later, the quest for the Northwest Passage was finally realized when Amundsen sailed through these same waters on his way west.

Coastal Environment

The coastline is regular, with moderately high rolling

headlands present along the western mainland coast, and gently sloped mixed-sediment beaches and tidal sand flats occurring in the eastern and northern portions of the region. Numerous islands, islets, straits, inlets and bays are found throughout. Cliffs are common locally and reach 200-300 m in Coronation Gulf, and Bathurst and Chantrey inlets. Drumlins and eskers, reminders of the vast glaciers which have only recently

retreated, are typically found along the coast and inland.

Status

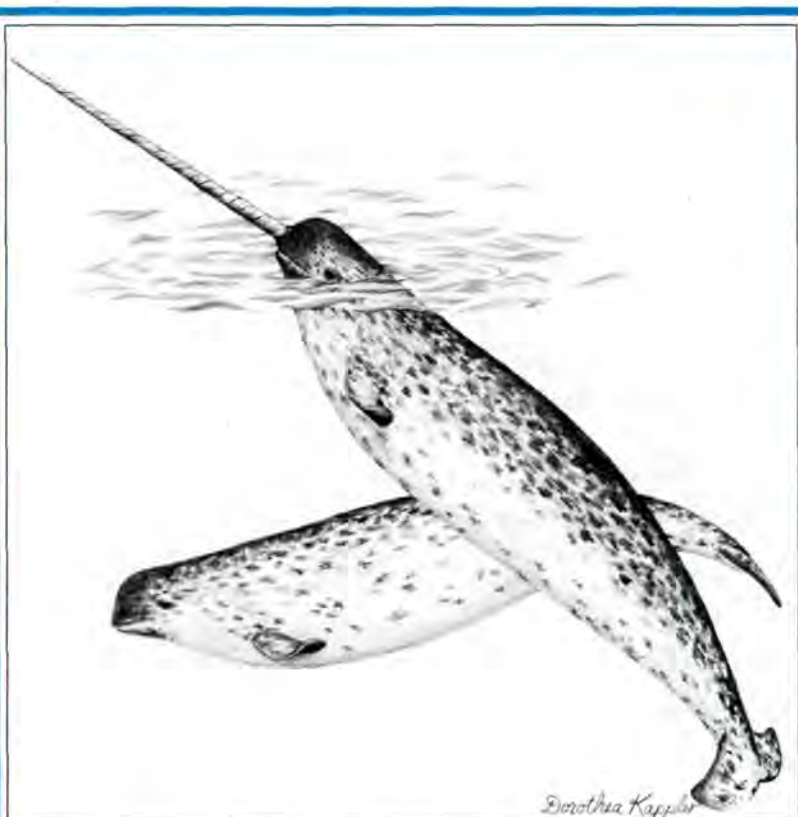
This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.

LANCASTER SOUND (ARCTIC REGION 5)

Wildlife

Although some 30 fish species have been reported for Lancaster Sound, one species — Arctic cod — makes up most of the diet of various seabird and marine mammal species. Large schools of Arctic cod, up to 20 000-30 000 tons worth, have been observed in throughout the region.

Lancaster Sound is critical importance to marine mammals. Most of the world's narwhal and a third of North America's belugas, as well as the endangered bowhead whale, spend the summer in these waters. The single largest summer concentration of narwhal, consisting of almost half the entire world population of some 20 000, is found in Prince Regent Inlet west of Baffin Island every year. In Peel Sound by Somerset Island, beluga have been found packed solid at the ice edge. Killer whales are regularly sighted in the region, pods of 5-20 animals following — and feeding on — narwhal and beluga. Large numbers of beluga, narwhal and bowhead winter in the North Water polynya in Baffin Bay. Ringed seals and walrus are ubiquitous residents of these waters, overwintering in all the major polynyas, while bearded seals are more common in the west. Some 20 000-50 000 harp seals arrive in these waters every summer. Lancaster Sound also has one of the highest densities of polar bears in the Canadian Arctic and is an important



Narwhal (*Monodon monoceros*)

Actually a tooth, the spiral tusk of narwhal pierces the upper lip and can be 3 m long at maturity. Normally only the male has a tusk, though there are a few instances of females having one as well. Narwhal like deep water and navigate through pack ice to

the edge of the ice cap. They have been seen within 5° of the North Pole. The Scandinavians gave the species their name, which means "corpse whale," referring to the drowned human appearance of their mottled skin.

denning site. All in all, this is one of the richest marine mammal areas in the world.

About one-third of Eastern Canada's colonial seabirds breed and feed in Lancaster Sound, including more than 700 000 pairs of thick-billed murres, black-legged kittiwakes and northern

fulmars. There are also several thousand pairs of black guillemots, Arctic terns and glaucous, ivory and Iceland gulls. Large colonies of greater snow geese are located on Bylot Island and in Bernier Bay. Some of the coast serves as primary moulting and staging areas for waterfowl and

shorebirds. Spring ice-edge staging areas are critical to all species prior to reaching their breeding sites.

Marine Environment

The inlets, sounds and straits are replete with troughs, ridges, basins, shoals and sills, creating a complex bottom topography. Depth increases along a general northwest-southeast line through the region, averaging from 100-600 m. Combined with tides in the 2 m range and strong currents, this results in cold, nutrient-rich water being upwelled to the surface, increasing primary production and resulting in a smorgasbord of life. Ice cover, comprised of both pack ice and landfast ice (the latter forming in the more

sheltered areas), is nearly complete from October to June. Nonetheless, the North Water polynya, largest in the Arctic, and several smaller ones such as Hell's Gate/Cardigan Strait, Coburg Island, Bellot Strait and Lancaster Sound, as well as the extensive shorelead system which develops between them, ensure the presence of open water throughout the year.

Coastal Environment

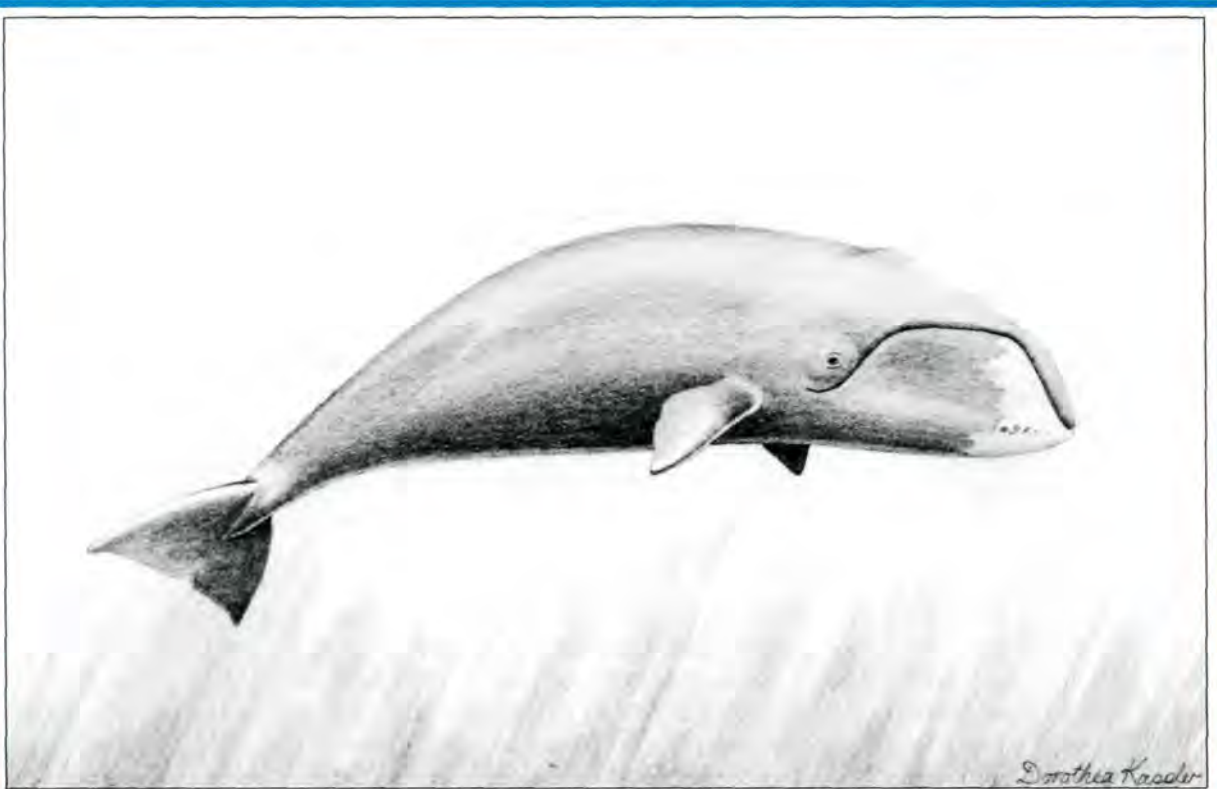
The coast is dominated by 300-400 m high cliffs, interspersed with coastal plains and lowlands and cut by numerous inlets, bays and spectacular fjords. Permanent ice fields are prominent on east Devon and Ellesmere Island, and icebergs occasionally calve

into the sea from the extensive tidewater glaciers. Small deltas, tidal flats, barrier islands and barrier beach-lagoon systems are scattered throughout.

Status

This region is not yet represented in the national marine conservation areas system. A national marine conservation area proposal for the Lancaster Sound area was prepared in 1987, the area having been recognized early for its importance within the marine region and the Arctic in general. The feasibility assessment for the proposed new marine conservation area was suspended at the request of the local Inuit.

BAFFIN ISLAND SHELF (ARCTIC REGION 6)



Bowhead whale (*Balaena mysticetus*)

Named for the shape of its strongly curved lower jaw which resembles an archer's bow, bowhead whales live at the edge of the Arctic pack ice. Slow moving and

unaggressive, the bowhead was hunted almost to extinction in the early part of this century for its oil and baleen, the latter being used to make corsets, umbrella

ribs, fishing rods and buggy whips. A few thousand bowheads remain in the Western Arctic, while less than 500 are found in the Eastern Arctic.

Wildlife

This is another region of critical importance — this time to the endangered bowhead whale. One-third of the Eastern Arctic population (down to 100-300 whales) concentrates in Isabella Bay during late summer and early fall. Killer whales, narwhal, belugas and harp seals use the area as a major migration route. Heavy concentrations of ringed seals

are found throughout the region, with lesser numbers of walrus and bearded, hooded and harp seals. Polar bears are common. Many of the High Arctic bowhead, beluga and narwhal winter in the open pack ice of Davis Strait.

Some 400 000 pairs of northern fulmars and thick-billed murres breed in several major colonies along the coast, as well as lesser numbers of eiders, black

guillemots, and glaucous and Iceland gulls.

Marine Environment

The continental shelf area is narrow and the slope drops rapidly to 2000 m in central Baffin Bay and Davis Strait. Most of the fjords and inlets are 200 m deep and often exceed 500 m. The region has a nearly complete ice cover from

October to June, with landfast ice in all the fjords and pack ice offshore which persists into late summer. Icebergs, most calved from the glaciers in Greenland, are frequent along the entire coast.

Coastal Environment

The shoreline is typically bold, with steep sculptured cliffs

rising abruptly from the sea to heights of 1000 m and skirted by an apron of talus (an accumulation of loose rock at the bottom of the cliff). The region is heavily indented with narrow fjords, inlets and bays. Some of the most incredible examples of glacial landforms in Canada are found here. Many icecaps, several reaching the sea, are scattered throughout this region. A few

tidal flats occur along mid-Baffin Island.

Status

This region is not yet represented in the national marine conservation areas system. Initial studies to identify representative marine areas are ongoing.

FOX E BASIN (ARCTIC REGION 7)

Wildlife

This is one of the most intriguing — and little known — areas of the Canadian Arctic. Tantalizing glimpses have revealed an area biologically rich and diverse. The numerous polynyas in northern Foxe Basin support high densities of bearded seals and the largest walrus herd in Canada (more than 6000 individuals) year-round. Another 2000 walrus use several haul-outs in northeastern Hudson Bay. Ringed seal and polar bear are common, with north Southampton Island being one of the highest density polar bear denning areas in Canada. This area is also an important summering area for some 40 Eastern Arctic bowheads, 1000 beluga and about 2000 narwhal. Fury and Hecla Strait provides an ice-free travel corridor for animals migrating east during the fall. Both bowhead whales and beluga winter in the waters of northeastern Hudson Bay.

The region is the main North American stronghold of the Sabine's gull, with some 10 000 pairs nesting on west Baffin Island. Black guillemots, Arctic terns, Iceland, glaucous and herring gulls also breed in moderate numbers. The Great Plain of the Koukdjuak on Baffin Island

is the world's largest goose nesting colony, with upwards of 1.5 million birds, 75% of which are lesser snow geese and the remainder Canada geese and brant. Large numbers of shorebirds and ducks nest in the region as well. In the southern part of the region, several hundred thousand thick-billed murres breed on the cliffs of Digges Sound and Coates Island.

Marine Environment

Foxe Basin is a broad, predominantly shallow depression, generally less than 100 m in depth, and particularly shoal along the northern and eastern shores where a submerged platform is present. Depths in excess of 200 m occur in Foxe Channel in the southern part of the region. Landfast ice dominates in the northern part of the region, while pack ice prevails towards the south. Foxe Basin itself is rarely ice-free until September, but the open pack ice which is common throughout the summer does not pose a problem to the myriad species which are found here. The sea ice of Foxe Basin is distinguishable from other ice in the Canadian Arctic by its dark colour, due to sediment content, and its rough texture. The latter is caused by the ice forming while under the

constant motion of the winds, tides and currents. Several small recurring polynyas are present in the region, most clustered around the head of the basin, near Fury and Hecla Strait. A large polynya opens up in Roes Welcome Sound, west of Southampton Island. The tidal range decreases from 5 m in the southeast to less than 1 m in the northwest.

Coastal Environment

Extensive glaciation, sea level changes and continuous scouring by ice has resulted in a shoreline indented with bays, inlets and islands. The terrain is rocky and rugged in the northwest, while low-lying bedrock shores dominate the northeast and western sectors. The only cliffs are found across the southern portion of the region, where most of the seabirds nest. Coastal marshes and tidal flats up to 6.5 km in width are found in the lowland section of eastern Foxe Basin, as well as in the bays of Southampton Island.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.



Atlantic Walrus (*Odobenus rosmarus rosmarus*)

Excellent swimmers, walrus can travel up to 20 km/hr, dive to 100 m and can remain submerged up to half an hour. The tusks are used in social displays, as

weapons against killer whales and polar bears, and even as grappling hooks to help them haul out onto the ice. They feed primarily on clams, using their sensitive

bristles to locate them on the sea bed and can eat several thousand a day. Their scientific name means "tooth walking sea-horse."

HUDSON BAY (ARCTIC REGION 8)

Wildlife

Some 40-50 freshwater, anadromous, Arctic and Subarctic marine fish species are found in the waters of the region, with Arctic charr, capelin, Arctic cod, ogac, sculpins and blennies being the most abundant.

Upwards of 20 000 beluga summer along the west coast of the bay, with the densest concentrations in the larger estuaries. Those of the Nelson River estuary are probably the largest in the world. Ringed and bearded seals frequent the region while small populations of harbour seals are found in isolated locations. The coastal areas near Churchill constitute one of the highest density polar bear denning areas in Canada. The bears' annual autumn gatherings along the Cape Churchill coast are quite exceptional as they come together to await the return of the ice and good feeding.

The Hudson Bay tidal flats and inland marsh areas harbour some of the world's largest concentrations of breeding, moulting and migrating shorebirds and waterfowl. Half the Eastern Arctic population of lesser snow geese breeds in the region, as well as considerable numbers of Canada geese, brant, oldsquaw, common eiders and loons. The region is one of the few known breeding sites for Hudsonian godwits and whimbrels. One of the



Polar bear (*Ursus maritimus*)

Though often considered a land animal, the polar bear is truly a marine mammal, as its Latin name implies. Bears spend most of their life on the sea ice stalking ringed seals, their main prey, and only come on land to give birth or when the melting ice leaves them no choice. They

are perfectly adapted to swimming in the freezing waters and use this ability to advantage to sneak up on the seals. Normally only found in the Arctic, polar bears have travelled as far south as Newfoundland, floating there on ice pans!

largest known concentrations of breeding peregrine falcons in the world is found along the northwest coast.

Marine Environment

Hudson Bay is a broad shallow basin, averaging 125 m in depth and less than 80 m deep for 20-100 km from the coast.

The bottom is predominantly smooth, although a few submarine valleys and banks are present. Ice cover lasts from October to June. Shoreleads along the entire inner edge of the bay are kept open through the winter by strong prevailing winds, separating the landfast ice along the coast from the pack ice which predominates in most of the bay. The waters of Hudson Bay are Arctic in nature, the strong outflow in the northeast part of the bay preventing any of the Atlantic water in Hudson Strait from entering. The annual freshwater discharge into Hudson Bay from the numerous rivers is more than twice that of either the Mackenzie or St. Lawrence River systems, resulting in significantly lower salinities throughout the region during the spring and summer seasons. The tidal range varies from less

than 1 m in eastern Hudson Bay to a little over 2 m along the western shore.

Coastal Environment

Hudson Bay is a vast Palaeozoic Era platform deposited in a pre-existing depression of the Canadian Shield. Shorelines in the north are typically low, rocky and indented with small islands, inlets and bays. In comparison, the west and southwest coasts and the southern portion of Southampton Island are a large expanse of drowned muskeg swampland, backed by marshes and fronted by extensive tidal mud flats reaching 9 km in width. Eskers and moraines, reminders of the presence of ancient glaciers, and raised beaches, indicative of the changes in sea level resulting from the land's continuing

rebound from the weight of those glaciers, are prominent features. Deltas and estuaries are important habitats.

Status

This region is not yet represented in the national marine conservation areas system. Two representative marine areas have been confirmed: Churchill River/Nelson River and Rankin Inlet/Marble Island. The Churchill River/Nelson River area was subsequently selected as the preferred choice for national marine conservation area purposes. Preliminary discussions with the Province of Manitoba, the Government of the Northwest Territories and local groups are the next step.

JAMES BAY (ARCTIC REGION 9)

Wildlife

Freshwater and anadromous fish species dominate the James Bay fish fauna, with less than 22 marine species found in the region. Brook trout, lake cisco, lake whitefish, capelin, Arctic charr and sculpins are some of the more common species. The Belcher Islands have a good diversity of invertebrates (six species of sea stars, sea urchins, blue mussels and sea cucumbers) and the islanders make greater use of this resource than anywhere else in the Arctic.

Ringed and bearded seals are common. Harbour seals are distributed along the coasts and isolated groups are present in nearby freshwater lakes. A small subpopulation of walrus is concentrated mostly around the Belcher Islands. The most southerly subpopulation of polar bears occurs in this region, with many summering on Akimiski Island and the Twin Islands in southern James Bay. The threatened eastern Hudson Bay beluga population concentrates around the many islands in the region, a few over-wintering in James Bay and around the Belcher Islands. Other whales are rare.

The Hudson Bay subspecies of the common eider breeds in the Belcher and Ottawa islands and winters in the shoreleads around the Belcher and Nastapoka islands. Snow geese, Canada geese and brant, and a variety of diving ducks (scoters, mergansers and oldsquaw) and dabbling ducks

(black duck and northern pintail) are found along the coasts of James Bay, especially during the migratory period. The west coast is critical to migrating shorebirds in general and to red knot and Hudsonian godwit in particular. A large portion of the Central Arctic population of red knots and the entire Central Arctic portion of Hudsonian godwits funnel through this area every year on their way south. Large numbers of Canada geese breed in the region, as well as smaller concentrations of glaucous and herring gulls, common and Arctic terns, and black guillemots.

Marine Environment

The region is very shallow, averaging less than 50 m, with depths of less than 6 m rimming the coasts for up to 15 km offshore. James Bay is ice-covered eight to nine months of the year, although extensive shoreleads develop throughout the region, kept open by the constantly blowing wind. The tidal range averages 1-2 m. The many rivers which empty into James Bay greatly decrease salinities in the bay and affect southeast Hudson Bay over a wide area. This has a strong impact on overall wildlife diversity.

Coastal Environment

The northeast coast of James Bay proper is mostly a skerry coast, rocky, rolling and

complex, fringed by shoals and with more than 500 flat and low-lying islands and islets. It is highly indented by bays and coves and interspersed with pebble-cobble beaches, small tidal flats and eelgrass beds. The west and south coasts, as well as the larger islands of the bay, are flat and low-lying, with extensive mud flats backed by salt marshes and muskeg further inland. Shorelines in southeast Hudson Bay are rocky, rugged and low-lying with some well-developed coastal cliffs and headlands reaching 500 m in height along portions of the Quebec shore and in the Belcher Islands. Long sandy beaches occur at intervals along much of the mainland coast. The Hopewell Is.-Nastapoka Is.-Long Island complex is the longest island chain in Canada, extending for approximately 600 km along the semi-circular coast. The majority of these islands are cuestas (i.e. a steep face on one side and a gentle slope on the other), with cliffs reaching 200 m in height. As the coast is still subject to rapid postglacial uplift (rise in height of the land as it rebounds from the weight of the glaciers which once covered it), emergent features such as raised beaches are quite prominent.

Status

This region is not yet represented in the national marine conservation areas system. Initial studies have

identified four areas that merit further consideration as representative marine areas: Belcher Islands, Richmond

Gulf/Nastapoka Islands, Rivière du Castor Estuary and Chickney Point. Confirmation studies and selection of the

preferred site for national marine conservation area purposes are the next steps.

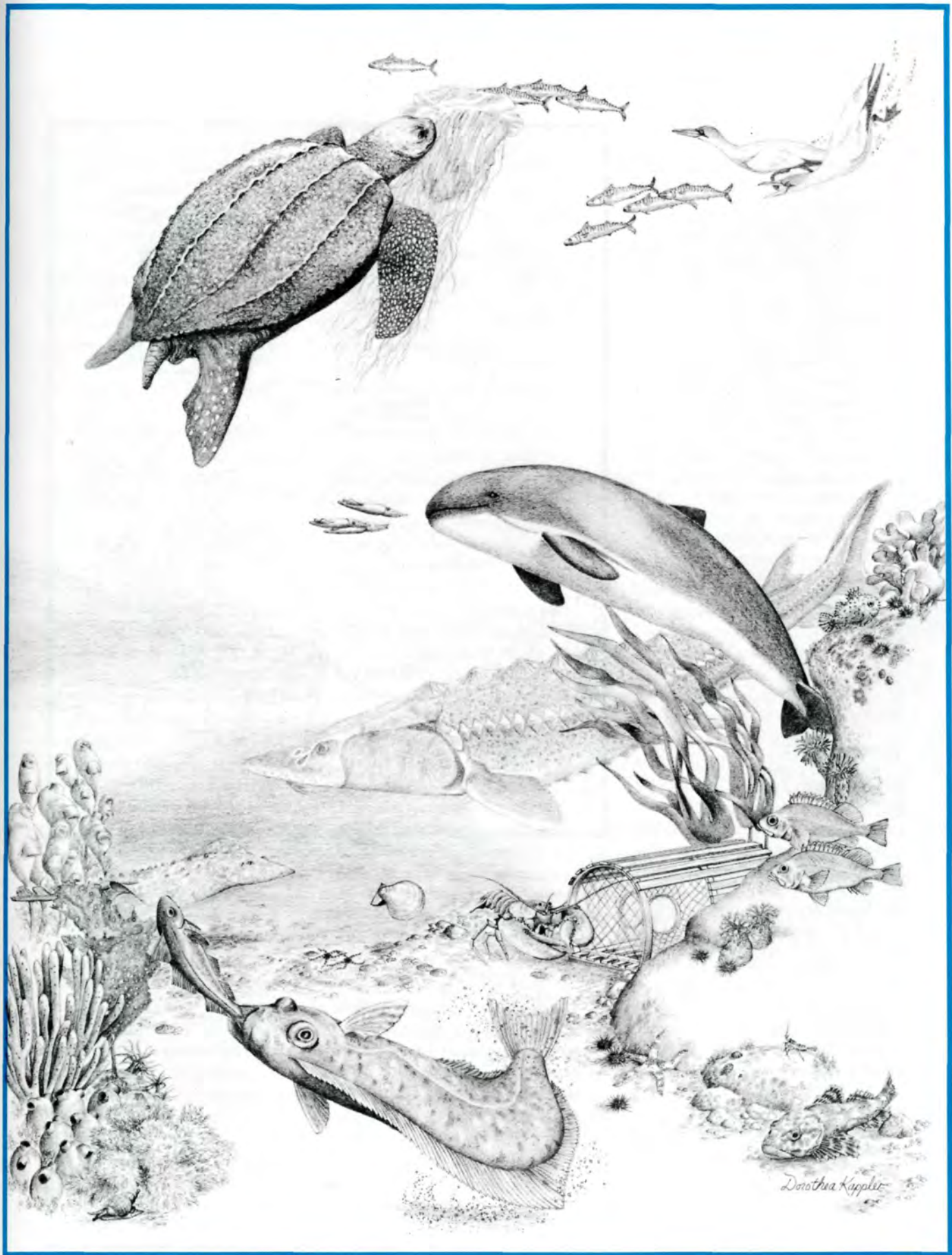


Shorebirds (large to small): Short-billed dowitcher (*Limnodromus griseus*), red knot (*Calidris canutus*) and sanderling (*Calidris alba*)

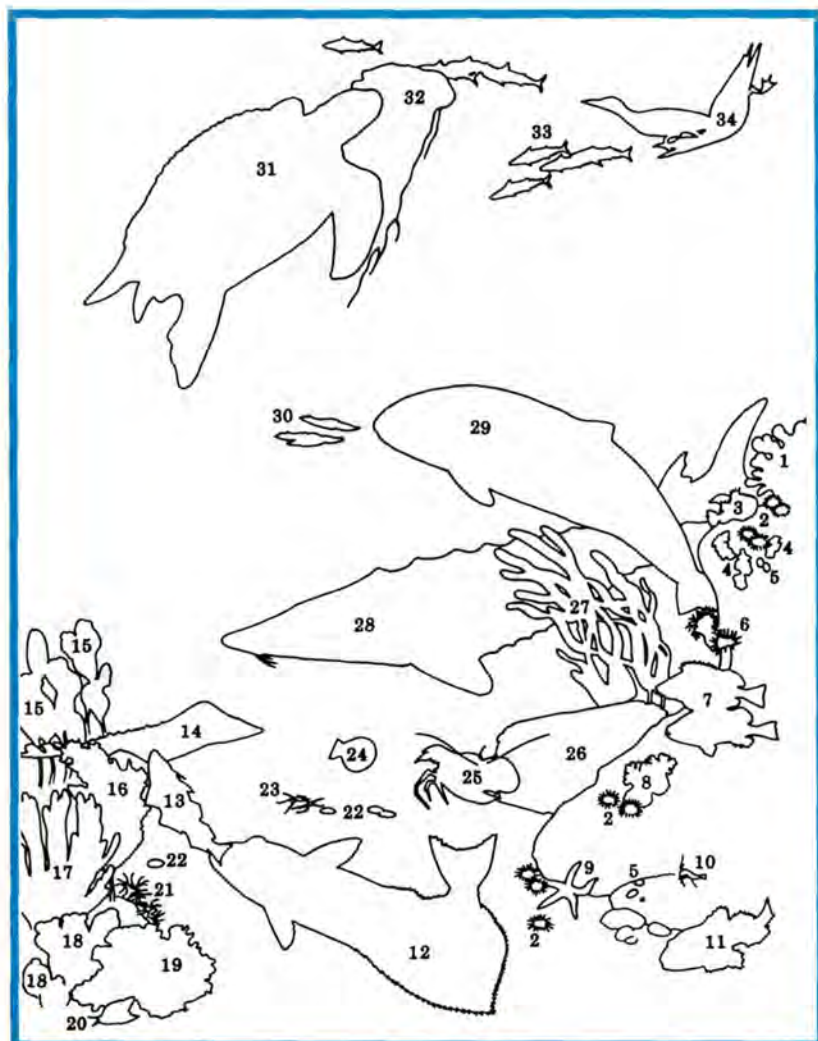
Weighing less than 60 g (about 2 ounces) and most less than half that, these small birds make some of the most spectacular migrations known. From their Arctic breeding grounds, they winter in Central and South

America, a return trip of 12 000 to 38 000 km depending on the species. This fantastic voyage is achieved with only a few stops along the way, the way between the two sites. At these critical stop-overs, the

birds turn themselves into small balls of lard putting on as much as 50% of their weight in fat as they feed on the abundant intertidal invertebrates.



1. Dulse
(*Rhodymenia palmata*)
2. Green Sea Urchin
(*Strongylocentrotus droebachiensis*)
3. Atlantic Spiny Lumpsucker
(*Eumicrotremus spinosus*)
4. Red Crust
(*Hildenbrandia rubra*)
5. Tortoise-shell Limpet
(*Acmaea testudinalis*)
6. Rugose Anemone
(*Hormathia nodosa*)
7. Acadian Redfish
(*Sebastes fasciatus*)
8. Scarlet Psolus
(*Psolus facricii*)
9. Polar Sea Star
(*Leptasterias polaris*)
10. Greenland Shrimp
(*Lebbeus groenlandicus*)
11. Shorthorn Sculpin
(*Myoxocephalus scorpius*)
12. Atlantic Halibut
(*Hippoglossus hippoglossus*)
13. Haddock
(*Melanogrammus aeglefinus*)
14. Thorny Skate
(*Raja radiata*)
15. Stalked Tunicate
(*Boltenia ovifera*)
16. Sea Colander
(*Agarum cribrosum*)
17. Eyed Finger Sponge
(*Haliclona oculata*)
18. Sea Peach
(*Halocynthia pyriformis*)
19. Spiral-tufted Bryozoa
(*Bugula territa*)
20. Waved Whelk
(*Buccinum undatum*)
21. Northern Cerianthid
(*Cerianthus borealis*)
22. Common Sand Dollar
(*Echinarachnius parma*)
23. Daisy Brittle Star
(*Ophiopholis aculeata*)
24. Sea Scallop
(*Placopecten magellanicus*)
25. Northern Lobster
(*Homarus americanus*)
26. Lobster Trap
27. Horsetail Kelp
(*Laminaria digitata*)



28. Atlantic Sturgeon
(*Acipenser oxyrinchus*)
29. Harbour Porpoise
(*Phocoena phocoena*)
30. Longfin Squid
(*Loligo pealei*)
31. Leatherback Turtle
(*Dermochelys coriacea*)
32. Lion's Mane Jellyfish
(*Cyanea capillata*)
33. Atlantic Mackerel
(*Scomber scombrus*)
34. Northern Gannet
(*Sula bassanus*)

ATLANTIC MARINE REGIONS

The Atlantic marine regions are divided into two main zones: the Subarctic and the Boreal, based mainly on ice and currents. The subarctic regions (1-7) have extensive ice cover in the winter and spring, and are primarily influenced by the Labrador and West Greenland currents. The former transports cold water from the Arctic, while the latter is an Atlantic water mass and has a moderating influence overall. The boreal regions, which include the Grand Banks, Scotian Shelf and Bay of Fundy, are essentially ice-free in winter. They are affected by the Slope Water Current and the Gulf Stream further offshore, both flowing from the south. August surface water temperatures are 4°-10°C in the subarctic zone and 10°-19°C in the boreal zone.

The continental shelf ranges in width from less than 150 km off Labrador to 480 km on the Grand Banks. Due in large part to the wide expanse of the continental shelf and mixing of the water column by tides, winds and currents, these wide, shallow banks are among the most productive in the world. The phytoplankton blooms turn the water green with life every spring and are the first link in the food chain. A wide spectrum of species depend on this annual bounty, starting with zooplankton (small animals) and ultimately fish, birds and marine mammals. The benthic, or bottom, communities are very diverse with a variety of marine plants, such as

seaweeds and kelp, and invertebrates (barnacles, sea stars, crabs, sponges, scallops, clams, jellyfish, to name just a few).

Though more than 500 species of marine fish have been recorded in the Canadian Atlantic, less than 300 species occur regularly. Important populations of groundfish (bottom fish such as Atlantic cod, redfish, haddock, pollock, Canadian plaice, witch and yellowtail flounder) and pelagic fish (fish which live in the water column such as silver hake, Atlantic herring, Atlantic mackerel, bluefin tuna, capelin and Atlantic salmon) are found in these waters.

The total population of marine mammals which makes its way to Canada's East Coast each year far exceeds the human population. Some 22 species of whales and dolphins, and six species of seals are attracted by the highly productive feeding grounds. The seals, harbour porpoises, minke whales and belugas breed in the region, while the other species are migrants.

On the whole, the Atlantic coast is heavily used by birds, although distributions are lopsided, the main factor being geology. Most of the seabird colonies are off Labrador, Newfoundland and the Quebec North Shore, where steep rocky cliffs and islands are found. All of the gannets and most of the razorbills and puffins in North America, as well as most of the eastern North American population of common murre, breed along the Canadian

Atlantic coast. Outside of the breeding season, waterfowl concentrate in the marsh habitats of the St. Lawrence estuary and the southern Gulf of St. Lawrence. Shorebirds prefer the mud flats of the Bay of Fundy. Large concentrations of seabirds winter on the open ocean off Newfoundland and Nova Scotia, including significant proportions of the North American or global populations of several species, such as the northern fulmar, greater shearwater, dovekie, common and thick-billed murre.

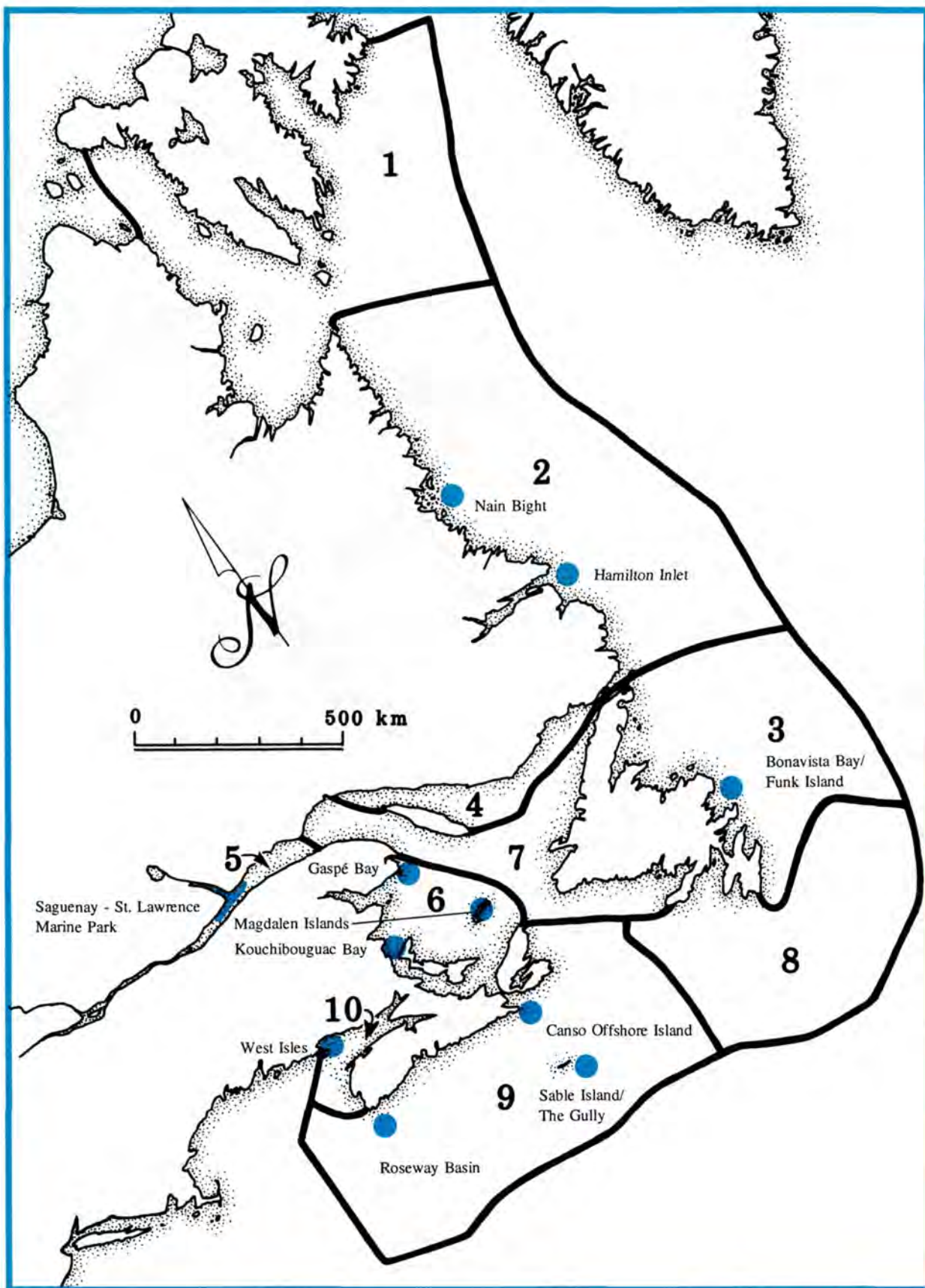
The Atlantic region stretches 52 000 km from mid-Baffin Island to the U.S. border, representing 21% of Canada's ocean coastline. The area was influenced by volcanic activity, glaciation, metamorphism, erosion and a series of mountain-building events resulting from the collision of continental plates. Resistant Canadian Shield rocks dominate in the north while deformed, younger sedimentary rocks underlie the southern portion. This results in a predominantly rocky shoreline with relatively few littoral sediments — less than 2% of the coastline is formed of beaches or sand/mud flats. Highlands and uplands surround a lowland plain that has been almost entirely drowned to form the Gulf of St. Lawrence. Coastal relief is high in the north and low to moderate in the south. More than 100 000 islands dot the coastline. Icebergs are another prominent feature, ranging in

size from a few thousand tons to over 10 million tons. In the past 50 years, an average of 380 icebergs have floated south of the 48th parallel every year, less than 10 of the largest of these making it onto the Grand Banks before melting. Only 5% of icebergs originate in the Canadian Arctic — the remainder come from Greenland and follow the currents. The tidal range varies considerably within the region. In the north, the range is about 9-12 m, but throughout the rest of the area it is typically on the order of 0.4-2 m. The tides at the head of the Bay of Fundy

are the exception: at 16 m, they are the highest in the world.

Almost 500 years ago, Europeans sent hundreds of ships to fish off our Atlantic coast — there is every indication that the fish, whale and seal resources of these waters could have been worth more than all the gold and silver of Mexico and the West Indies. Into this century, the fisheries of the Atlantic provinces accounted for about two-thirds of the marketed value of all Canadian fish. In recent years, however, overfishing, depletion of species important to the food chain and fluctuations in water

temperatures have resulted in severe declines in a number of fish stocks. Large parts of the Atlantic fishery have been virtually shut down as a result. Many seabirds and marine mammal species have equally been affected, as the fish species on which they depend become harder and harder to find. Other threats to the Atlantic marine regions include urban sewage, oil and gas development, heavy marine traffic and the general accumulation of toxic chemicals from a variety of industrial and agricultural sources.



Map of the Atlantic Marine Regions

HUDSON STRAIT (ATLANTIC REGION 1)

Wildlife

Some 60 Arctic, Subarctic and Atlantic marine, anadromous and freshwater fish species have been recorded here. Plentiful species include Arctic charr, capelin, sculpins, blennies and Arctic cod, while Aesop shrimp, Iceland scallop and Atlantic salmon have been recorded in specific areas. Greenland halibut forms the basis for a commercial fishery in Cumberland Sound.

One of the world's largest thick-billed murre colonies is found at Akpatok Island in Ungava Bay, with about 1.5 million birds nesting there. Black guillemots, black-legged kittiwakes, glaucous, Iceland and herring gulls, northern fulmars and common eiders are also abundant nesters throughout the region. The eastern end of Hudson Strait is a vital feeding area for seabirds in this region. Small numbers of birds, particularly common eiders and black guillemots, winter in these waters.

Two endangered beluga populations are found within the region. Some 1500 summer at the head of Cumberland Sound and a few in Frobisher Bay. Historically, thousands were sighted in Ungava Bay, but hunting has reduced their number to less than a hundred. Hudson Strait is the main migration route for beluga, bowhead and narwhal heading for Hudson Bay and Foxe Basin. Large numbers of these same species winter in the open waters of eastern Hudson Strait



Thick-billed murres (*Uria lomvia*)

One of the most abundant seabirds in the world, thick-billed murres nest in dense colonies, primarily in the Arctic. The young leave the colony before they can fly and so must launch themselves from cliffs up to 300 m in height, following

their parents and gliding on stubby wings to the sea below. The adults and flightless young then swim to the wintering areas off Newfoundland and West Greenland, a distance of more than 2000 km.

and the open pack ice of Davis Strait. Northern bottlenose whales are found in the deep waters offshore. Ringed seals are abundant in the region, while bearded and harp seals are common. A major hooded seal whelping patch is found off southeast Baffin Island in Davis Strait. Small numbers of

walrus have been observed during the fall on the outermost islands. Polar bears are particularly abundant in the eastern part of the region, and many important denning areas have been recorded along that coast.

Marine Environment

The region is predominantly deep, and undersea cliffs and canyons are common and generally quite abrupt, with depths of nearly 500 m attained very close to shore. Ungava Bay is typically less than 150 m in depth. The tidal range is quite impressive, generally 5-9 m and reaching a peak in the southwest sector of Ungava Bay where some of the world's highest tides are recorded (on the order of 12 m). The large tides and the narrow confines of most of the fjords, inlets and channels, combine to produce tidal mixing and upwelling in much of the region. These same currents and tides prevent Hudson Strait from having more than 60% ice cover in winter, leaving plenty of open water for wintering birds and marine mammals. Landfast ice dominates in the protected bays

and sounds. Pack ice is found in Davis Strait. The ice-free period lasts three to four months during the summer. Recurring polynyas are found at the entrance to both Frobisher Bay and Cumberland Sound. Icebergs are a familiar sight along east Baffin Island and in eastern Hudson Strait. Geographically, this region is part of the Arctic, but oceanographically it has more in common with the Atlantic marine regions. Atlantic water from the West Greenland Current, shunted across Davis Strait from Greenland, mixes in Hudson Strait with the Arctic waters coming out of Hudson Bay. The prominence of both Arctic and Atlantic water masses results in a greater diversity of plankton, invertebrate and fish species than in the Arctic marine regions.

Coastal Environment

This bedrock coast is highly indented with numerous inlets, islands, sounds, bays and a few fjords. Over much of the region, cliffs and headlands rise 200-300 m from the sea, though Ungava Bay is mainly low-lying with extensive tidal flats. Icecaps are a prominent feature in Frobisher Bay and Cumberland Sound. Estuaries and deltas are common throughout the region.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.

LABRADOR SHELF (ATLANTIC REGION 2)

Wildlife

Some 90 species of Arctic and Subarctic marine and anadromous fish occur in the region, with important Atlantic cod, Arctic cod, Atlantic salmon, Arctic charr and capelin spawning grounds. Ogac, Canadian plaice, Greenland halibut, redfish, sculpins, blennies and sea

snails are also abundant, as are shrimp and snow crab.

Several seabird colonies support more than 180 000 pairs of Atlantic puffins, common murres, thick-billed murres and 60% of the razorbill population of North America. Black guillemots, black-legged kittiwakes, glaucous, great black-backed and herring gulls, Leach's storm-petrels, Arctic and

common terns, and common eiders nest throughout the region.

Harbour seals reside here, while ringed and bearded seals winter in the area. Harp and hooded seals stage annual migrations along the coast and whelp in an offshore area known as "the Front" located along the ice-edge off southern Labrador and northern Newfoundland. About 60% of



Razorbills (*Alca torda*)

Great divers, razorbills have been caught in fishermen's nets 20 m below the surface. They nest in colonies on narrow open cliff ledges,

usually with murres, and are at sea the remainder of the year. About two weeks after hatching, young razorbills leap from their cliff ledges

into the sea where they are protected by their parents from predatory gulls until they can fly some two weeks later.

all harp seal pups in the Northwest Atlantic are born here. Atlantic white-sided dolphins, belugas, sperm, northern bottlenose, blue, fin, sei, minke, humpback, pilot and killer whales are present during the summer. Bowhead and narwhal winter off the northern coast. Polar bears are more common in the north, though the occasional one is seen further south.

Marine Environment

The continental shelf is relatively uniform in width, averaging 150 km, with depths of less than 70 m within 2 km of the shore. Several offshore banks extend to the edge of the steep continental slope that rapidly reaches depths of over 3000 m. The region is covered in ice seven to ten months of the year. The fjords, bays and a

narrow coastal zone are bound in landfast ice, while pack ice extends 150-225 km offshore. The Labrador Current flows south in two streams; a cold inshore branch and a slightly warmer offshore branch which keeps the pack ice moving. The tidal range varies from 3 m in the north to 1 m in the south. Icebergs are abundant and occur year-round.

Coastal Environment

As an old Newfoundland proverb puts it: "God created the earth in six days. On the seventh, He sat back, threw rocks at it and created Labrador." Although an accurate description of this barren and rocky 20 000 km coast, it does not do justice to its sheer beauty. Strongly influenced by glacial erosion, the shoreline is complex with

about 4000 coastal islands and many bays and inlets slashing inland for several kilometres. A precipitous coast ranging in height from 200-1000 m is broken by spectacular fjords and deeply incised valleys. Intertidal boulder flats and boulder barricades abound. Deltas, tidal mud flats, marshes and extensive sand beaches occur locally.

Status

This region is not yet represented in the national marine conservation areas system. Two representative marine areas have been confirmed: Nain Bight and Hamilton Inlet. Selection of the preferred site for national marine conservation area purposes is the next step.

NEWFOUNDLAND SHELF (ATLANTIC REGION 3)

Wildlife

Important stocks of Atlantic cod, capelin, Atlantic salmon, haddock, redfish, Canadian plaice, Greenland halibut, witch flounder, Atlantic herring, Atlantic mackerel and smooth skate occur throughout the region. Overall invertebrate diversity is high and includes such species as lobster, Iceland scallop, snow crab and shortfin squid. However, many other species are still completely unknown and several have not even been named! Most invertebrates in the region are Arctic in nature. Temperate species are found in embayments where the water temperature warms up sufficiently in the summer.

This region has the greatest concentrations of breeding seabirds in Atlantic Canada – close to six million pairs, over 90% in three main colonies: Witless Bay Islands, Baccalieu Island and Funk Island. Some 70% of the North American population of Atlantic puffins breeds in the Witless Bay colonies, along with black-legged kittiwakes, common murre and the world's second largest Leach's storm-petrel breeding population. Baccalieu Island has the world's largest Leach's storm-petrel colony (some 3.5 million pairs), in addition to impressive numbers of Northern gannets, Atlantic puffins, black-legged kittiwakes and common murre. Funk Island is the most remote of the seabird islands and was once home to tens of thousands of Great Auks,

extinct since the early 19th century due to overhunting. The island now has a large breeding population of Northern gannets and particularly of common murre (80% of the western Atlantic population). Millions of gulls, murre, dovekeys, fulmars and sea ducks winter offshore, while Southern Hemisphere shearwaters spend the austral winter here.

The region sees a great variety of migrating and summering cetaceans, particularly harbour porpoises, Atlantic white-sided dolphins, sei, humpback, fin, right, minke, sei, sperm and killer whales. Local populations of humpback whales are the largest in the world and continue to expand. World dominating populations of hooded and harp seals breed on the sea ice at "the Front" off northern Newfoundland. Harbour seals are resident, while grey seals are fairly common, migrating in from their breeding grounds further west.

Marine Environment

The continental shelf area is narrow, typically less than 50 km wide, but extends out to 200 km in places. The seafloor is uneven, with shallow banks towards the outer edge of the shelf and deep central basins and troughs down to 400 m. The numerous bays have a complex bathymetry, characterized by islands, reefs, troughs and shoals. Winds increase productivity by keeping the water column mixed. The tidal range rarely

exceeds 1 m. The region is ice covered for up to three months of the year, with close pack ice along the northern half of the Newfoundland coast and open pack ice predominating along the southern coast. Icebergs are common and are often very close to shore. This is the southernmost extent of Arctic water in the world and many of the seabird, marine mammal, fish and invertebrate species found in the region reflect that Arctic affinity.

Coastal Environment

A highly irregular, rugged and bold coastline dominated by bedrock cliffs up to 300 m in height, rock outcrops, pocket beaches and numerous islands, inlets and bays is one of the chief characteristics of this region. The coast is largely a storm-wave environment and the Atlantic Ocean batters all but the most sheltered areas.

Status

This region is not yet represented in the national marine conservation areas system. Three representative marine areas have been confirmed: Bonavista Bay/Funk Island, Trinity Bay and Hare Bay. Bonavista Bay/Funk Island was subsequently selected as the preferred choice for national marine conservation purposes in the region. Preliminary discussions with the Province of Newfoundland and local groups are the next step.



Atlantic puffins (*Fratercula arctica*)

Puffins nest in burrows that they dig in grassy islands or crevices among the rocks. They feed their young fish and euphausiids (small shrimp-like animals) caught

many kilometres offshore and brought back neatly lined up in their bill — as many as a dozen small fish at one time. Agile and fast swimmers, as are all alcids,

puffins catch their prey by diving from the air or from the surface of the water, using their wings to “fly” underwater and steering with their feet.

NORTH GULF SHELF (ATLANTIC REGION 4)

Wildlife

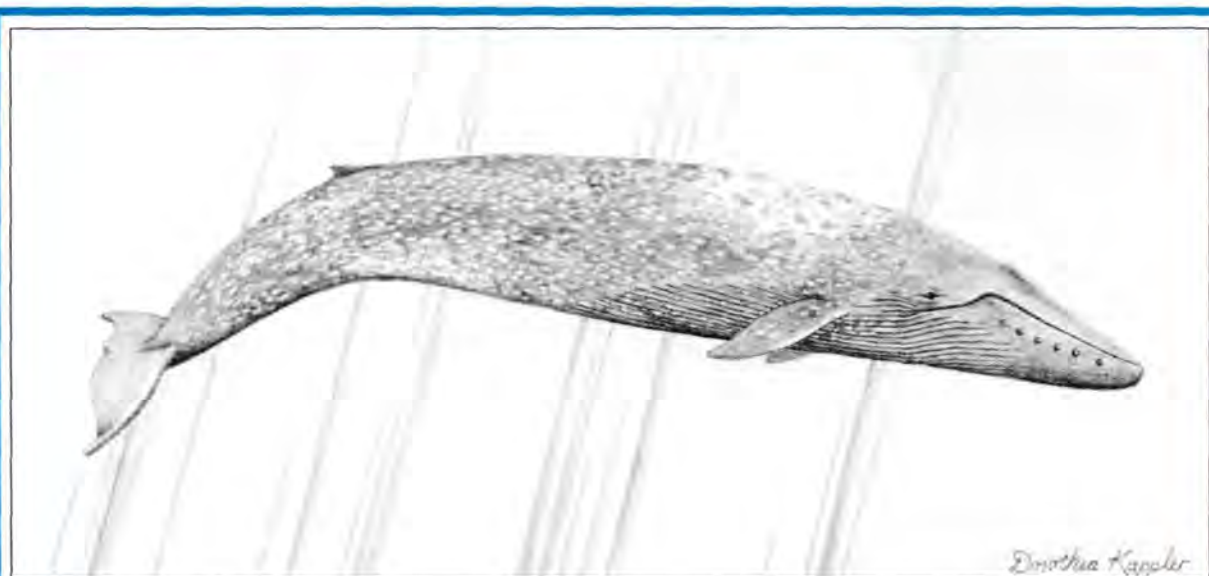
Some 55 marine, freshwater and anadromous fish species occur in the region, forming a generally cold-water fish fauna. Canadian plaice, Atlantic herring, capelin, Atlantic cod, Arctic cod, ogac, Greenland halibut, redfish and blennies are the most common marine fish species. Atlantic salmon, brook trout, rainbow smelt and sticklebacks are found along the coast and in the many rivers of the Quebec

North Shore. Northern shrimp, snow crabs and sea scallops are common.

About 70 000 seabirds nest in small colonies on the North Shore cliffs, including Leach's storm-petrels, great and double-crested cormorants, great black-backed and herring gulls, black-legged kittiwakes, common and Arctic terns, common eiders, razorbills, common murres, black guillemots and Atlantic puffins, as well as a small population of Caspian terns. The region is an

important staging and feeding area for waterfowl, seabirds and shorebirds.

At least 20 species of cetaceans have been noted in the region during the spring, summer and fall, including harbour porpoises, Atlantic white-sided dolphins, white-beaked dolphins, beluga, fin, minke, humpback, blue and pilot whales. Harbour seals are abundant throughout the region. Grey, hooded and harp seals are more numerous along the eastern portion of the coast.



Blue whale (*Balaenoptera musculus*)

The largest animal ever to inhabit the earth, blue whales are 20-30 m in length and can weigh up to 130 metric tons, though the average is about 73 tons — equal to 15-20 African elephants! Newborn calves are 7 m long and weigh

2500 kg, gaining about 90 kg a day. Blue whales also make the loudest noise of any animal, comparable to the roar of the rocket that launches the space shuttle and may be heard thousands of kilometres away. They feed primarily on copepods

and euphausiids (krill), small shrimp-like animals less than 3 cm long. Straining 20 tons of water at a time, blue whales will devour 5-7 tons of them a day!

Marine Environment

Subtidal platforms with depths of less than 100 m, and ranging in width from 6-35 km, run along the coasts of the region. The platforms have a rough and very complex topography characterized by depressions, banks, reefs and islets. Deeper troughs, offshoots of the Laurentian Channel, slice into the region with depths of 200 m to over 300 m. The cold Labrador Current is the main influence in this region, giving the waters a distinctly Arctic character which is strongly reflected in the flora and fauna of the area. Mean tidal range

increases from east to west, ranging from less than 1 m in the Strait of Belle Isle to 2.5 m in the east. The open water season typically lasts five to seven months, with an ice cover consisting of a belt of landfast ice along the coast and close pack ice elsewhere.

Coastal Environment

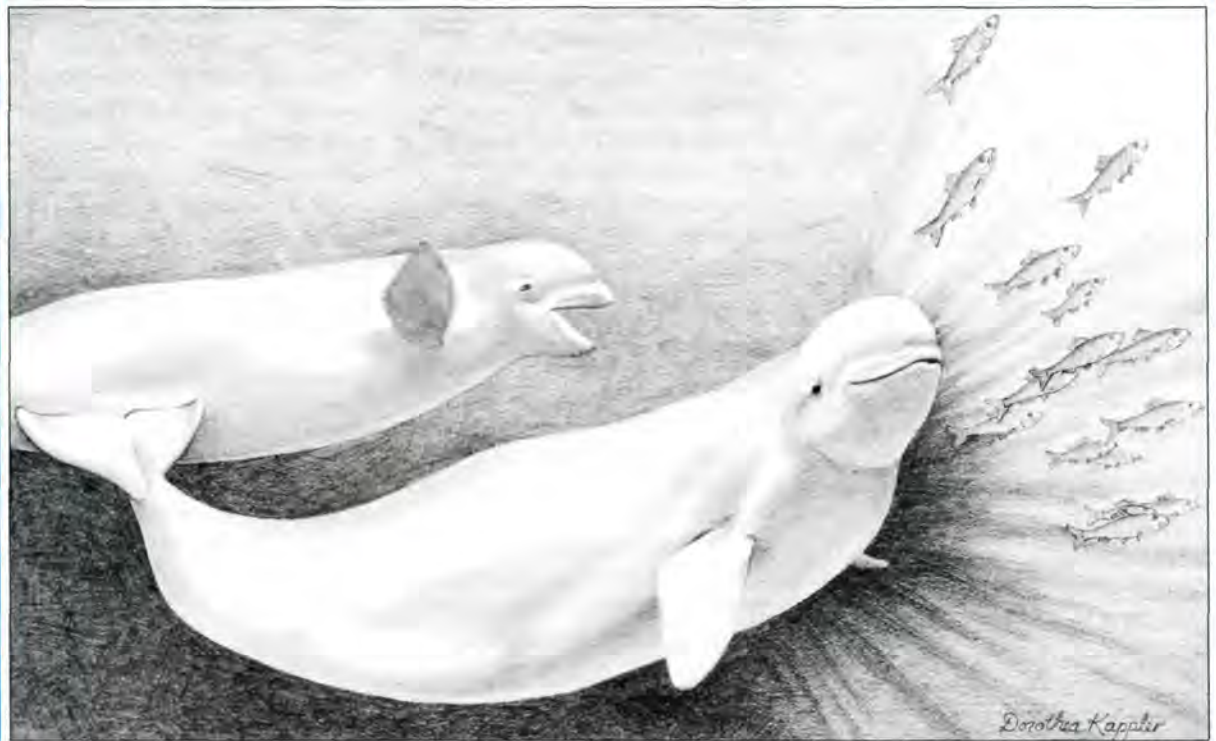
The coastline is bold and indented with numerous small bays, islands, reefs and inlets. Though predominantly low-lying, with low hills, estuaries and large deltas being the main features, cliffs up to 100 m occur along the north shore of

Anticosti Island and along the eastern shore of the region. Extensive sand beaches are found near the large rivers, particularly to the west. Erosional features such as wave-cut marine terraces and sea stacks occur locally, particularly in the Mingan Islands and Anticosti Island.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.

ST. LAWRENCE RIVER ESTUARY (ATLANTIC REGION 5)



Beluga or white whale (*Delphinapterus leucas*)

Highly social animals, belugas were dubbed “sea canaries” by the early whalers who heard their calls through the hull of their ships. They have one of the

most varied vocal repertoires of any whale and have been compared to such chatter-boxes as monkeys and humans. Beluga feed near the bottom in shallow waters,

eating various types of fish such as salmon, capelin, herring, cod and charr, as well as squid, octopus and crustaceans.

Wildlife

Some 65 freshwater, anadromous and marine fish species make up the fish fauna of the region. Atlantic cod, Greenland halibut, witch flounder, winter flounder, Atlantic herring, rainbow smelt, American shad, capelin, Atlantic salmon, brook charr, redfish, American eel, sculpins and snailfish are the most widespread. Northern shrimp and snow crab are also

abundant. The diversity and abundance of marine life found in this region and particularly along the underwater cliffs and shelves, make it one of the most interesting diving destinations in Eastern Canada.

Herring and great black-backed gulls and common eiders dominate the breeding birds, with small populations of double-crested cormorants, razorbills, black guillemots and common terns. The southern shore islands

harbour some of the greatest densities of nesting common eiders in North America, as well as some of the highest breeding concentrations of black-crowned night herons, great blue herons and double-crested cormorants in Eastern Canada. The region is of primary importance to migrating geese, sea ducks and shorebirds which stage in the marshes and mud flats, and to gulls and terns which concentrate in the upwelling

area at the mouth of the Saguenay River.

A fortuitous combination of geography and oceanography makes this one of the best whale watching areas in the country. Harbour seals and beluga are year-round residents. Harbour porpoises, minke, fin and blue whales, and harp and grey seals are regular summer visitors to the region, while humpback, sperm, pilot and sei whales, and hooded seals are sometimes observed. This is home to the only southern population of belugas. Less than 500 individuals feed, mate, calve and winter in the St. Lawrence Estuary. Despite strict protection, this endangered group has not yet recovered from overharvesting earlier this century. One of the probable reasons is the accumulation of heavy metals and toxic chemicals within their tissues. Originating from as far away as the Great Lakes, these chemicals affect reproduction and cause premature death through disease.

Marine Environment

East of Quebec City, the St. Lawrence is a 370-km-long, funnel-shaped, tidal river estuary, 48 km wide at its mouth, forming a major structural trough. Depths average more than 200 m, though the Laurentian Channel reaches depths in excess of 300 m as it extends down the

middle of the estuary. Steep submarine cliffs dominate the north shore. Wide subtidal platforms less than 10 m deep are common along the southern shore. The Saguenay fjord is an inland extension of the St. Lawrence Estuary, with strong tidal currents crossing over the shallow sill at its mouth. Depths range from 200-300 m for much of its 104 km length. A freshwater layer overlies a deeper layer that is distinctly marine and Arctic in nature. Opposite the mouth of the Saguenay River, the estuary floor shelves abruptly from 350 m to 25 m, bringing nutrient-rich waters to the surface and mixing them with the brackish waters of both the Saguenay and St. Lawrence rivers. This leads to high biological productivity, not only in this region, but far to the south as well. The tidal range within the estuary increases from 2.5 m in the east to 5 m in the west and as high as 6 m at the upstream end of the Saguenay fjord, with the tides discernable as far as Montréal. The open water season lasts seven to eight months. Open pack ice covers the estuary during the rest of the year, though currents keep the mouth of the Saguenay River open year-round.

Coastal Environment

Along the north shore of the region, Canadian Shield rocks form some spectacular scenery,

with bedrock bluffs indented by numerous deep valleys and gorges, as well as the steep-sided Saguenay fjord where the cliffs reach 450 m in height. A straight, low rocky shore, interspersed with a few small pebble-cobble beaches and strewn with offshore islands, dominates the south coast, with extensive mud flats and salt marshes in mid-estuary.

Status

This region is represented by the Saguenay—St. Lawrence Marine Park (1138 km²). In April 1990, the governments of Canada and Quebec signed a federal-provincial agreement providing for the establishment of the marine park at the confluence of the Saguenay River and St. Lawrence Estuary. The agreement stipulates that both levels of government will work towards its protection. Specific legislation at the federal and provincial levels is being prepared to officially establish the park and provide for its management. A management plan, now being finalized, confirms the stated objectives of both governments to involve the public in the management of this area through a co-ordinating committee. Park staff are on site, and research programs are being carried out.

MAGDALEN SHALLOWS (ATLANTIC REGION 6)

Wildlife

The relatively warm marine environments found in this region support several species of benthic marine plants which are either absent or extremely rare north of Massachusetts, as well as a relict population of the Eastern oyster. Irish moss, snow, rock and mud crabs, lobsters, sea scallops, surf, hardshell and softshell clams are common throughout the southern Gulf of St. Lawrence. Important stocks of Atlantic cod, Canadian plaice, winter flounder, white hake, windowpane, sand lance, Atlantic halibut, Atlantic mackerel, capelin, and Atlantic herring are also widespread. Several important spawning rivers for anadromous species such as Atlantic salmon, rainbow trout, alewife and American shad are found in the region, including the famous Miramichi River system.

Although the region has less than 2.5% of the breeding seabirds in Eastern Canada, many of the colonies are of national significance. The Bonaventure Island and Bird Rocks colonies support the bulk of the North American population of Northern gannets, more than 25 000 pairs. The region is critical for the endangered piping plover with more than 70% of Atlantic Canada's population breeding here. A variety of other species also nest in the region, including the razorbill, black-legged kittiwake, Atlantic puffin, black guillemot, double-crested



Northern gannet (*Sula bassanus*)

For the first three years of its life, gannets stay at sea year-round, thereafter returning to land only to breed in dense colonies. They feed by plunge diving from a height of 20 m or more into a school of fish such as

herring, mackerel or pollock near the surface. Once a fish is caught, it is brought to the surface and swallowed, and the gannet takes to the air again, soaring before making another dive.

cormorant, common murre, common tern, roseate tern, herring and great black-backed gulls, osprey and bald eagle. Tens of thousands of geese, sea ducks and shorebirds stage in coastal areas during spring and fall.

Tens of thousands of harp seals as well as some 1000 hooded seals whelp on the offshore ice around the Magdalen Islands in early spring. Both species then migrate north, following the retreating ice, with the harp seals swimming about 3200 km to reach their Arctic summering grounds. Grey seals are found throughout the region, but the largest group gives birth in early winter on the newly formed ice in eastern Northumberland Strait and along western Cape Breton Island. Following the breakup of the ice, the greys wander but generally remain in the Maritimes. Harbour seals are common residents of the region. Whale and dolphin sightings are sporadic and populations low.

Marine Environment

The region is an enclosed, shallow sea covering 79 350 km². The shelf is up to 150 km wide, with an irregular bottom topography characterized by several troughs, banks and shoals. Depths average less than 80 m, with the troughs reaching 200 m. The large freshwater input from the St. Lawrence River Estuary reaches the region via the Gaspé Current which rounds the Gaspé Peninsula. Combined with the shallow depth, this makes it the warmest oceanic area in Eastern Canada. Completely ice-covered in winter, surface waters reach 16°-20°C in summer, and as high as 25°C in shallow embayments — a marked contrast. Yet even then, the temperature just 20-30 m below the surface remains at 0° to 5°C.

Coastal Environment

The coast is indented with headlands and bays, and

dominated by gentle slopes and low cliffs less than 20 m in height. Cliffs up to 100 m are found only on Cape Breton Island and the Gaspé Peninsula. Wide sandy beaches, narrow mixed-sediment, and pocket sand and gravel beaches are plentiful. Erosion by wind, waves and currents is prevalent and has created barrier beaches, barrier islands, spits, coastal dunes, tombolos, cuestas, and sea caves, arches and stacks. Salt marshes, lagoons, estuaries and tidal flats occur locally.

Status

This region is not yet represented in the national marine conservation areas system. Three representative marine areas have been identified: the Magdalen Islands, Gaspé Bay and Kouchibouguac Bay. Selection of the preferred site for national marine conservation area purposes is the next step.

LAURENTIAN CHANNEL (ATLANTIC REGION 7)

Wildlife

Capelin, Atlantic cod and herring have important spawning grounds within the region, while Atlantic salmon spawn in several rivers along the coast. Atlantic and Greenland halibut, redfish, sand lance, witch flounder, Canadian plaice, silver hake, spiny dogfish, smooth skate and sculpins are also common. Because of its depth, the Laurentian Channel serves as a major break separating several stocks of shallow water fish species. Lobster and Iceland scallops are primarily found in the shallower coastal areas, while northern shrimp, and toad and northern stone crabs occur in deeper waters.

Moderate numbers of breeding birds are found in the region, dominated by great black-backed and herring gulls, while there are large black-legged kittiwake colonies on Anticosti Island. There are lesser numbers of great and double-crested cormorants, Leach's storm-petrels, common and Arctic terns, black guillemots, Atlantic puffins and razorbills. Small numbers of piping plovers and semipalmated plovers also nest in the region. Moderate pelagic concentrations of seabirds occur throughout the year and include various combinations

of fulmars, shearwaters, jaegers, gulls and sea ducks.

The region is a major summer feeding area for several species of marine mammals, mainly migratory cetaceans. Harbour porpoises, Atlantic white-sided dolphins, blue, humpback, right, fin, pilot, northern bottlenose and minke whales are often sighted. Harp and hooded seals breed in the region, while grey seals are particularly numerous around Anticosti Island. Harbour seals are resident and are found in all coastal areas.

Marine Environment

The dominant feature of the region is the Laurentian Channel, a submarine valley of glacial origin 1400 km in length, sending tentacles of itself around Anticosti Island and along the west and south coasts of Newfoundland, with depths ranging from 180-550 m. The Gaspé Peninsula and south coast of Anticosti Island are bordered by subtidal shelves under 100 m in depth less than 10 km wide, while these shelves vary in width from 10-55 km elsewhere. Nutrient-rich salty waters originating in the Atlantic are brought in at depth along this channel from the edge of the continental shelf, forming a deep water layer

which is generally warmer than the surface layer. These waters are brought to the surface and mixed with those of the St. Lawrence Estuary and then make their way to the southern Gulf via the Gaspé Current as it rounds the Gaspé coast. The region has a nine-month open water season, with an ice cover of open pack ice and landfast ice developing in shallow coastal areas, though much of southwestern Newfoundland remains relatively ice free.

Coastal Environment

Low rocky shores predominate in this region, although the southwest Newfoundland coast is an upland section with 800 m cliffs adjacent to the sea. The Newfoundland coastline is slightly indented with a few fjords in the west central portion and fairly regular along the remaining shores. Beaches are relatively scarce.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.



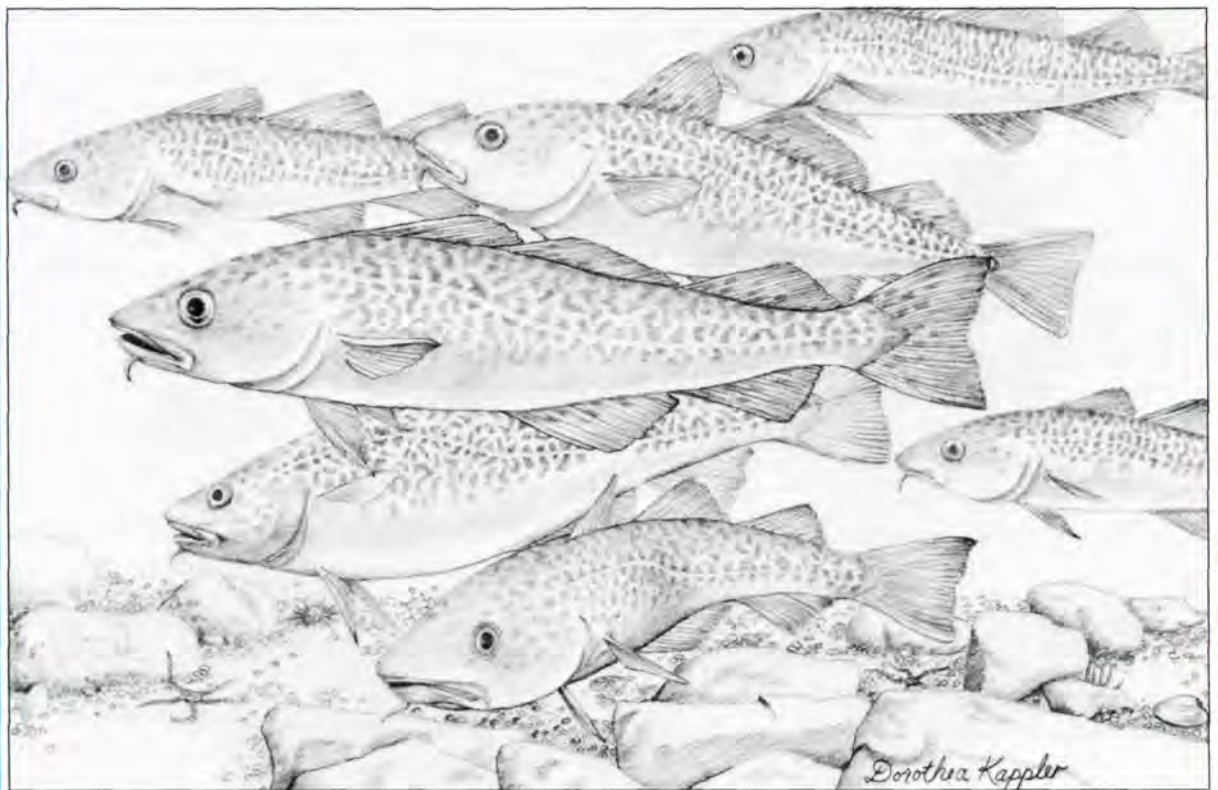
Harp seals (*Phoca groenlandica*)

Named for the horseshoe or harp-shaped band on the backs of the adults, harp seals spend the summer feeding among the ice floes

of the Eastern Arctic and off Greenland. In the fall, the majority drift south with the pack ice until they reach their large whelping

(birthing) areas in the Gulf of St. Lawrence and off southern Labrador, a swimming migration of some 3200 km.

GRAND BANKS (ATLANTIC REGION 8)



Atlantic cod (*Gadus morhua*)

Once so thick in the water that John Cabot reported they could be brought aboard by the bucket, Atlantic cod have been fished in Canada since the early 1480s and were justifiably known as

"Newfoundland currency." Cod spawn (breed) offshore in winter and spring at depths of 300-400 m where the water is warmer (3°C) than the 0° to -1°C temperatures found at lesser depths.

They then gradually migrate inshore to their feeding grounds. They eat mainly capelin, herring and other fish, but will feed on almost anything, including sea anemones!

Wildlife

The Grand Banks of Newfoundland have always been one of the richest fishing grounds in the world. Although overfishing has seriously reduced a number of stocks, the region is still of vital importance as a spawning and nursery ground, feeding and wintering area to a variety of fish and shellfish species.

Atlantic cod, haddock, sand lance, Atlantic herring, capelin, Atlantic halibut, Canadian plaice, yellowtail flounder, redfish, white hake, Atlantic argentine, spiny dogfish, smooth and thorny skate as well as lobster, sea scallop, Iceland scallop, shortfin squid, and various crabs and clams are the more familiar species. Benthic invertebrate diversity

is high and very productive overall.

Breeding birds are dominated by herring gulls, Leach's storm-petrels, kittiwakes, and common and Arctic terns. The second largest Northern gannet colony in North America is located at Cape St. Mary's. The area around the island provides critical wintering habitat for sea ducks and supports one of

the largest concentrations of eastern North American harlequin ducks, an endangered population. Middle Lawn Island is the only North American colony of Manx shearwaters, a species most commonly found breeding in Europe. Large numbers of bald eagles breed in the Placentia-Fortune bays area. Important offshore concentrations of seabirds occur throughout the year, consisting primarily of shearwaters, gulls and sea ducks, with lesser numbers of skuas, jaegers, fulmars, kittiwakes, alcids and phalaropes at various times of the year.

The region sees a high diversity of marine mammals, all migrants save for the harbour seal. Hooded, harp and grey seals, harbour porpoises, white-beaked dolphins, Atlantic white-sided dolphins, killer, sei, pilot, northern bottlenose, blue, humpback, right, fin and minke whales are commonly observed.

Marine Environment

The continental shelf is the widest in Canada and one of

the widest in the world, extending up to 480 km from shore, and is less than 150 m deep over broad areas. The shelf is dominated by the Grand Banks of Newfoundland, a series of shallow banks, ranging in depth from 25-100 m, which extend for some 730 km along the south coast of Newfoundland and cover 280 000 km². Several depressions and troughs occur locally, with depths in excess of 200 m. The coastal fjords are deep, generally over 250 m and some in excess of 700 m in depth. The Labrador Current floods the Grand Banks with cold water, which mixes with the warm water of the Gulf Stream in gyres and eddies around Flemish Cap. Located some 600 km off the southeast Newfoundland coast, Flemish Cap is a shallow bank rising to within 51 m of the surface from depths in excess of 1800 m. Upwelling is common, as nutrient-rich waters are forced up from the depths onto the shallows, resulting in high productivity over the banks. The region is generally ice free all winter, although ice will often form in sheltered bays

and inlets. Icebergs are fairly common, mainly far offshore. Intense storms are quite frequent, particularly during the winter months.

Coastal Environment

The coastline is bold and crenulated, with many islands, bays and several fjords. Rocky shores and bedrock cliffs rising 150 m and more from the sea dominate the area, with some sandy shores and estuaries. Raised marine terraces, hanging valleys and cirques are common locally, reminders of a period when the glaciers were dominant.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.

SCOTIAN SHELF (ATLANTIC REGION 9)

Wildlife

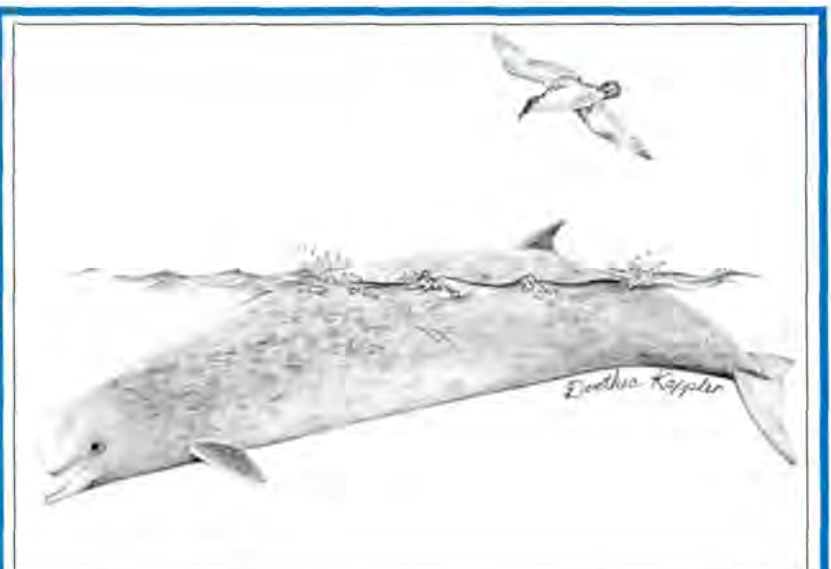
Along with the Grand Banks, the Scotian Shelf is one of the most heavily utilized fishing areas in the Atlantic region. Atlantic cod, haddock, pollock, redfish, Canadian plaice, witch, winter and yellowtail flounder, white, red and silver hake, sand lance, Atlantic herring, Atlantic mackerel, Atlantic salmon, bluefin tuna, Atlantic argentine, swordfish, Atlantic halibut, spiny dogfish, smooth skate, numerous sculpins, lobster, sea scallop, northern shrimp, various crabs and clams, and longfin and shortfin squid are just a few of the species found here.

Compared to other Atlantic marine regions, few birds breed in the area, though a large part of the Canadian population of the threatened roseate tern nests here. The coast is more valued as a migratory staging area for waterfowl and shorebirds, while offshore waters are important to wintering gulls, sea ducks, shearwaters, skuas, jaegers, terns and alcids. Although abundance is low, the diversity of bird species occurring in the region is high.

Right, humpback, sperm, sei, fin, blue, pilot, northern bottlenose and minke whales, harbour porpoises and Atlantic white-sided dolphins are common as they take advantage of the rich summer feeding. Roseway Basin off south-western Nova Scotia is a critical habitat for the right whale, mating groups of up to 30 individuals having been observed on a regular basis. At

least 70 to 100 individuals occupy the area over the course of a year representing 30% of the known population of this endangered species. The rarely seen northern bottlenose whales are found far offshore, preferring the deep waters along the edge of the continental shelf and particularly the area known as

"The Gully" east of Sable Island. A population of some 300 individuals is found in this area year-round. Sperm whales, particularly adult males, are also quite common in this area. Harbour seals are residents of the region and grey seals are observed year-round. Grey seals breed mostly in colonies, notably on Sable, Camp and the



Northern bottlenose whale (*Hyperoodon ampullatus*)
and **greater shearwater** (*Puffinus gravis*)

Northern bottlenose whales are rarely seen, preferring deep offshore waters. They are some of the greatest divers among whales and dolphins and can dive 1000 m straight down in two minutes and stay under for up to 70 minutes! They feed mainly on squid, but also eat sea cucumbers, sea stars and herring. They are quite curious and eagerly approach ships — a trait which made them popular with whalers.

Part of the "tubenose" family for their tube-shaped nostrils, greater shearwaters breed in the Southern Hemisphere and spend their winter in our waters, primarily offshore. Shearwaters get their name from skimming low over the ocean in their search for food, often only inches above the surface, seeming to shear the water with their wing tips.

Basque islands, invading and covering the beaches against a backdrop of stormy winter seas. Leatherback turtles, an endangered species worldwide, are seasonal visitors to the region, following the annual northward migration of jellyfish.

Marine Environment

That part of the continental shelf known as the Scotian Shelf varies in width from 125 km in the east to 230 km in the west and covers some 120 000 km², with an average depth of 90 m. The shelf is bordered by deep waters — the Laurentian Channel on the east side is over 400 m deep, while the steep continental slope to the south rapidly attains over 3000 m in depth, then descends more gently to the 5000 m of the Sohm Abyssal Plain. A series of shallow banks, 25-100 m below the surface, begins some 25 km from the coast and culminates at Sable Island, a sandy extension of the Sable Island Bank which protrudes 26 m above sea level.

These shallow banks are separated by basins and troughs ranging from 160-300 m in depth. A submarine canyon (The Gully), deeper than 1000 m, forms a notch at the edge of the continental shelf. Upwelling is prevalent, resulting in high productivity. Waters exiting the Gulf of St. Lawrence onto the Scotian Shelf have a lower salinity than those of the Grand Banks, a result of the tremendous freshwater input originating from the St. Lawrence River System. As it moves south, the Nova Scotia Current mixes with offshore waters, gaining in salinity, temperature and nutrients. This creates increased biological productivity seawards across the continental shelf — an unusual situation. Sea ice forms only in sheltered areas along the coast. The Gulf Stream has a strong influence on this region. A variety of species more commonly found further south appear at regular intervals, a result of the warm water cores that spin off from the Gulf Stream.

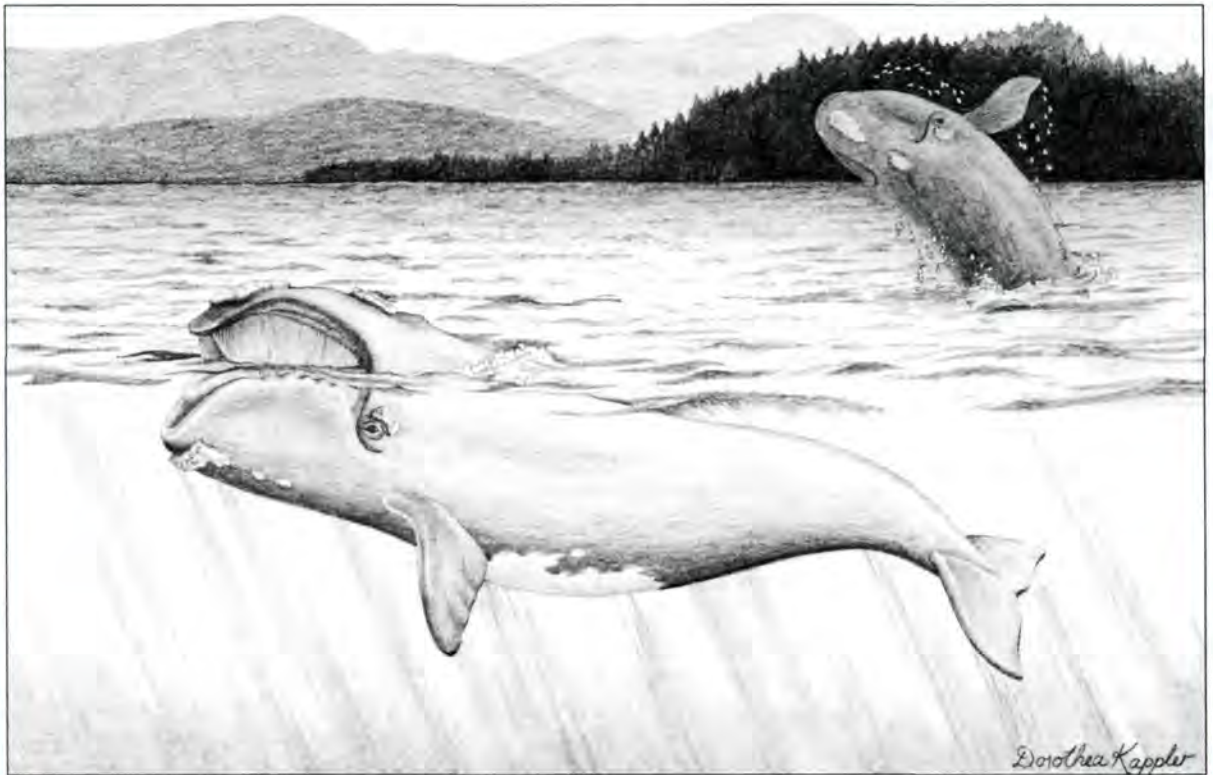
Coastal Environment

A low-lying, indented rocky coast with large embayments, headlands, low cliffs and numerous coastal islands is typical of this region. Lagoons, salt marshes and a few coarse sediment beaches have developed in sheltered sections. Sable Island, some 200 km off the mainland coast, is a 40-km-long sandy crescent. It is only 1 km wide at its widest point and is dominated by sand dunes.

Status

This region is not yet represented in the national marine conservation areas system. Three representative marine areas have been confirmed. Roseway Basin, Sable Island/The Gully and Canso Offshore Islands. Selection of the preferred site for national marine conservation area purposes is the next step.

BAY OF FUNDY (ATLANTIC REGION 10)



North Atlantic right whale (*Eubalaena glacialis*)

Rarest of the world's large whales, the right whale gets its name from the fact that it floats when dead, thus it was the "right" whale to hunt. Most of the remaining population of the North

Atlantic right whale is found in Canadian waters from July through October, particularly the Scotian Shelf and Bay of Fundy. Though now protected, this species has been very slow

to recover and studies suggest that one-third of all mortality is due to human activities, mainly collisions with ships and entanglements in fishing gear.

Wildlife

More than 800 species of benthic invertebrates have been reported in the marine region, dominated by molluscs, polychaetes, crustaceans and echinoderms. Lobster, rock crab, green crab, toad crab, sea scallop, shortfin squid and softshell clam are common. The fish fauna of the Bay of Fundy

is quite diverse. Some 100 species are generally found in the region, including migrants from southern waters (bluefin tuna, spiny dogfish, great white shark), from offshore (Atlantic salmon, alewife, American, shad) and from northern waters (Greenland shark). The more common species include Atlantic cod, Atlantic herring, winter, witch and smooth flounder, windowpane, sand

lance, red and silver hake, fourbeard rockling, pollock, redfish, Atlantic mackerel, haddock, Atlantic halibut, Atlantic sturgeon, and assorted sculpins, sticklebacks, skates and sharks. Productivity is exceptionally high, and is greatest at the mouth of the bay, the head of the bay being only one-quarter as productive as a result of the high sediment load.

The area is critically important as a migratory staging area for millions of birds, and is also an important summering and wintering area. Large feeding concentrations of red-necked and red phalaropes and greater shearwaters are common in the outer bay during the summer and fall. At various times of the year important inshore concentrations of great black-backed, herring and Bonaparte's gulls, common and Arctic terns, great and double-crested cormorants, dovekies, black guillemots, common murrelets, and sea ducks such as common eiders, scoters, common goldeneyes, oldsquaws and buffleheads, occur throughout the region. Up to 34 species of shorebirds are found here in the autumn, with the largest groups (as many as 1.5 million shorebirds) found on the mud flats at the head of the bay. The region is especially important to the semipalmated sandpiper, with 42-74% of the world population staging here in any given year.

The region is also very important to marine mammals, particularly during summer and fall when zooplankton and fish are most abundant. From June to October, important concentrations of harbour porpoises, fin, minke, sei, humpback and right whales are found in the bay, particularly at its entrance. The outer bay is used as a nursery area by the endangered right whale, mother-calf pairs and juveniles being the most commonly

sighted. Harbour seals are resident and widespread, while grey seals are found only near the mouth of the Bay.

Marine Environment

The Bay of Fundy is a 270-km-long, straight-sided, generally funnel-shaped embayment with an 80-km-wide mouth and two narrow extensions at its head (Chignecto Bay and Minas Basin). The bay is relatively shallow (less than 150 m in depth and generally less than 50 m), with a very irregular bottom topography. It is characterized by shoals, deep channels, reefs, islets, ledges, passages and islands. The length and shape of the Bay tends to accentuate the tides within the region, resulting in a difference between low and high tide that increases from 6 m at the mouth of the bay to as much as 16 m at its head. The combination of high tides, strong tidal currents (200-500 cm/s [7-18 km/hr] in some areas) and complex bottom topography results in tidal rips, surge channels, whirlpools, shear zones, strong upwellings and intense mixing throughout the region, as well as tidal bores in several rivers. Open water conditions prevail year-round because the large tidal range and intense mixing prevent sea ice formation.

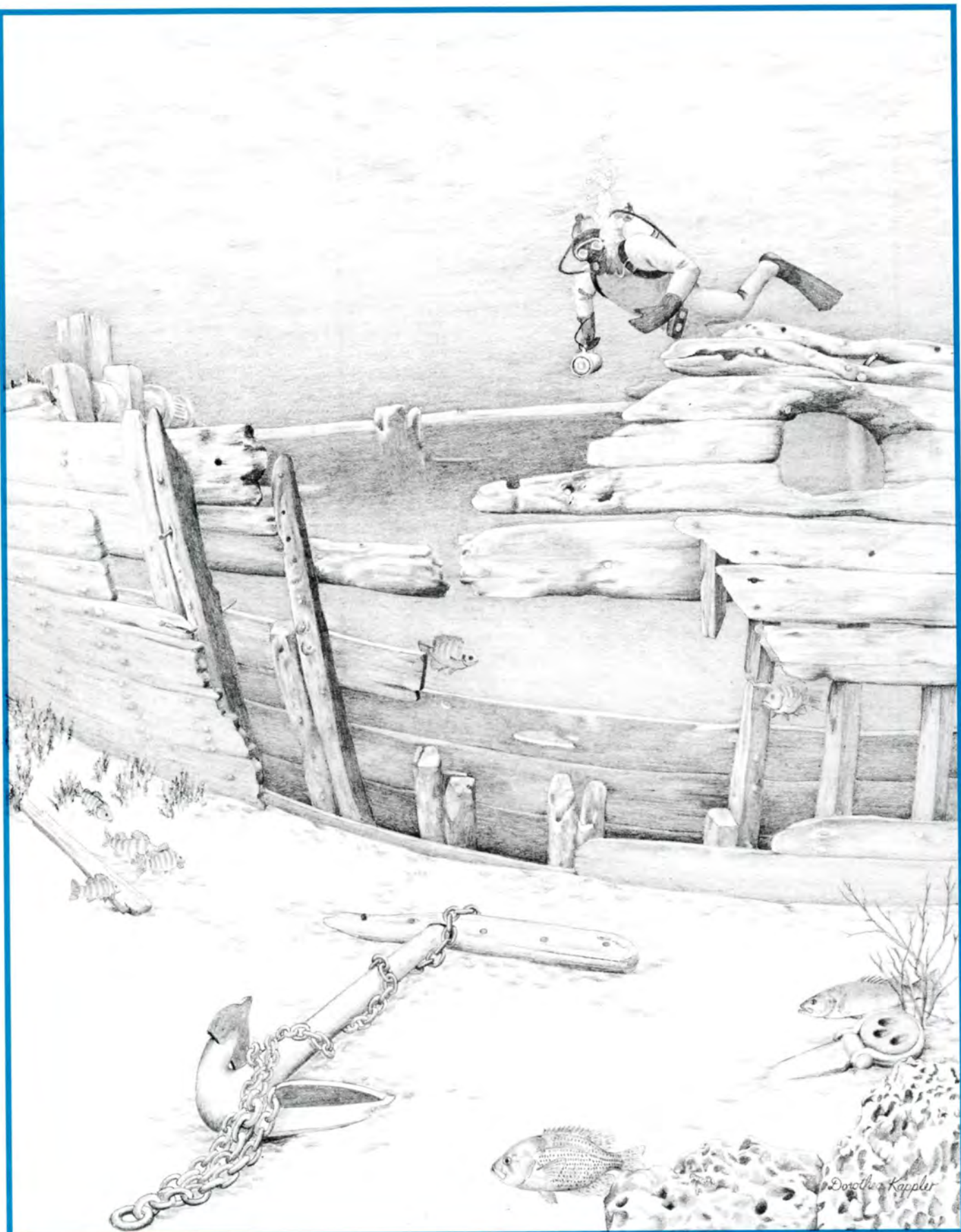
Coastal Environment

The Bay of Fundy is a major structural embayment, the

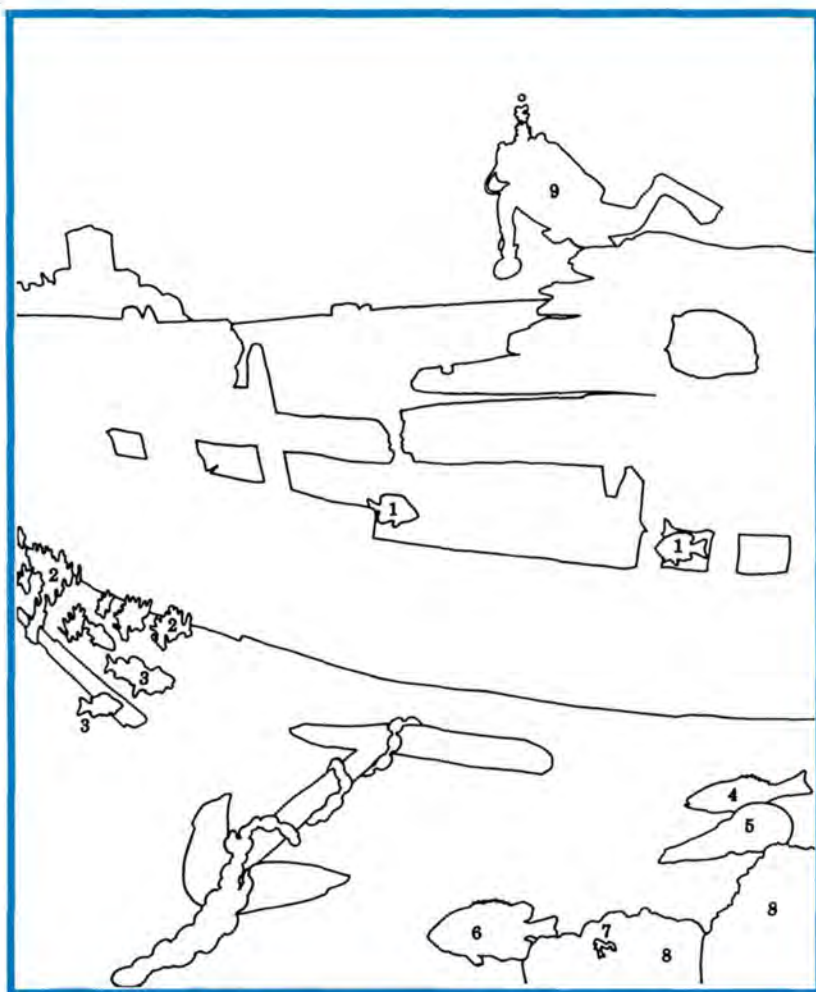
result of the subsidence of a rift valley during the opening of the Atlantic Ocean more than 160 million years ago, subsequently shaped by uplift, glaciation and erosion. Low-lying rocky shores prevail, interspersed with beaches and low eroding cliffs, though cliffs up to 200 m occur locally. Salt marshes and mud flats up to 5 km in width are common at the head of the bay. Undersea cliffs, caves and canyons, sea stacks and wave-cut platforms are found throughout the region.

Status

This region is not yet represented in the national marine conservation areas system. Three representative marine areas have been confirmed: West Isles, Grand Manan and Brier Island. West Isles was subsequently selected as the preferred choice for national marine conservation area purposes in the region. A study to assess the feasibility of creating an NMCA in this area was suspended in 1986. Though an NMCA was technically feasible, the prospect of a conservation area engendered significant local opposition. Since then, the West Isles area has become the focal point of salmonid aquaculture in Atlantic Canada. The New Brunswick and federal governments are currently considering reactivation of the West Isles project.



Dorothea Kappler



1. Bluegill
(*Lepomis macrochirus*)
2. Eurasian Water Milfoil
(*Myriophyllum spicatum*)
3. Yellow Perch
(*Perca flavescens*)
4. Smallmouth Bass
(*Micropterus dolomieu*)
5. Deadeye (used to haul sails)
6. Rock Bass
(*Ambloplites rupestris*)
7. Crayfish
(*Orconectes* sp.)
8. Limestone
9. Diver
(*Homo sapiens scubensis*)

GREAT LAKES MARINE REGIONS

At 245 000 km², the Great Lakes are the largest area of surface fresh water in the world, representing 18% of the planet's supply. Only the polar ice caps and Lake Baikal (Russia) contain more. The length of the Canadian coastline along Lakes Superior, Huron, Erie and Ontario is about 9500 km, including islands. The Great Lakes form a step-like sequence, with Lake Superior being at the highest elevation (183 m above sea level) and Lake Ontario the lowest (74 m asl). The most dramatic drop (100 m) occurs at Niagara Falls. The whole system drains into the Atlantic Ocean via the St. Lawrence River.

About three billion years ago, the foundation of the Great Lakes Basin was established with the formation of the Canadian Shield. During the Paleozoic Era (more than 500 million years ago), it was repeatedly flooded by saltwater seas inhabited by a variety of marine species, including corals, sea lilies and molluscs. Finally, with the Pleistocene Epoch, came the repeated advances and retreats of the glaciers, deepening the pre-existing river valleys in the Canadian Shield over a million-year period. Since the retreat of the last glacier, some 10 000 years ago, the land has been slowly rising, resulting in the present-day shorelines of the Great Lakes. These are primarily rocky shores or low bedrock cliffs, with hard

Canadian Shield rocks predominating in the west and less resistant sedimentary rocks in the east. Shorelines tend to be relatively straight except where there are resistant rock outcrops, then the coastlines become irregular with numerous bays, headlands and islands. Outcrops of the Niagara Escarpment and the Canadian Shield serve as natural dams and effectively separate the lakes from one another. Sandy and mixed-sediment beaches, deltas, marshes and lagoons are found locally.

The Great Lakes do not have true tides, but lake levels do vary as a result of seasonal factors, the weather and the influence of man. Seasonal variations on the order of 0.5 m occur, though long-term fluctuations of up to 2 m have been recorded. Frequent and severe storms are one of the main causes of these greater lake-level changes, often leading to rather dramatic seiche effects (oscillations in water levels). Thermal stratification (layers of water at different temperatures) is a common feature of the lakes as the surface waters, heated by the sun, form a warm water layer which does not mix with the deeper cold water layer. In the late fall and early winter, the surface waters cool, becoming heavier than the underlying layer, and thus sinking through it and causing a turnover of the entire lake. Ice forms over the whole

region, particularly along the shores, and lasts four to five months.

Before the advent of European settlement and industrialization, the Great Lakes, except in the shallow bays and shoreline marshes, were oligotrophic, meaning that they were cool and clear, not very productive, with an abundance of oxygen and little plant life. These conditions have changed in the last 150 years due to pollution. While the upper lakes are still primarily oligotrophic, Lake Ontario is now mesotrophic (has moderate plant life) and parts of Lake Erie are highly eutrophic (high concentration of nutrients leading to excessive plant growth and little oxygen at depth).

Some 180 species of fish were indigenous, or native, to the Great Lakes. Species composition varied from lake to lake due to the different characteristics of each. Muskellunge, northern pike, channel catfish and smallmouth and largemouth bass were found near shore, while open water species included lake cisco, lake sturgeon, blue walleye, lake whitefish, walleye, sauger, freshwater drum, lake trout and white bass. Overall species diversity has decreased over the past 200 years, a result of human activities. Several species have been introduced, either intentionally (such as coho, chinook and Atlantic salmon, sockeye salmon [kokanee],

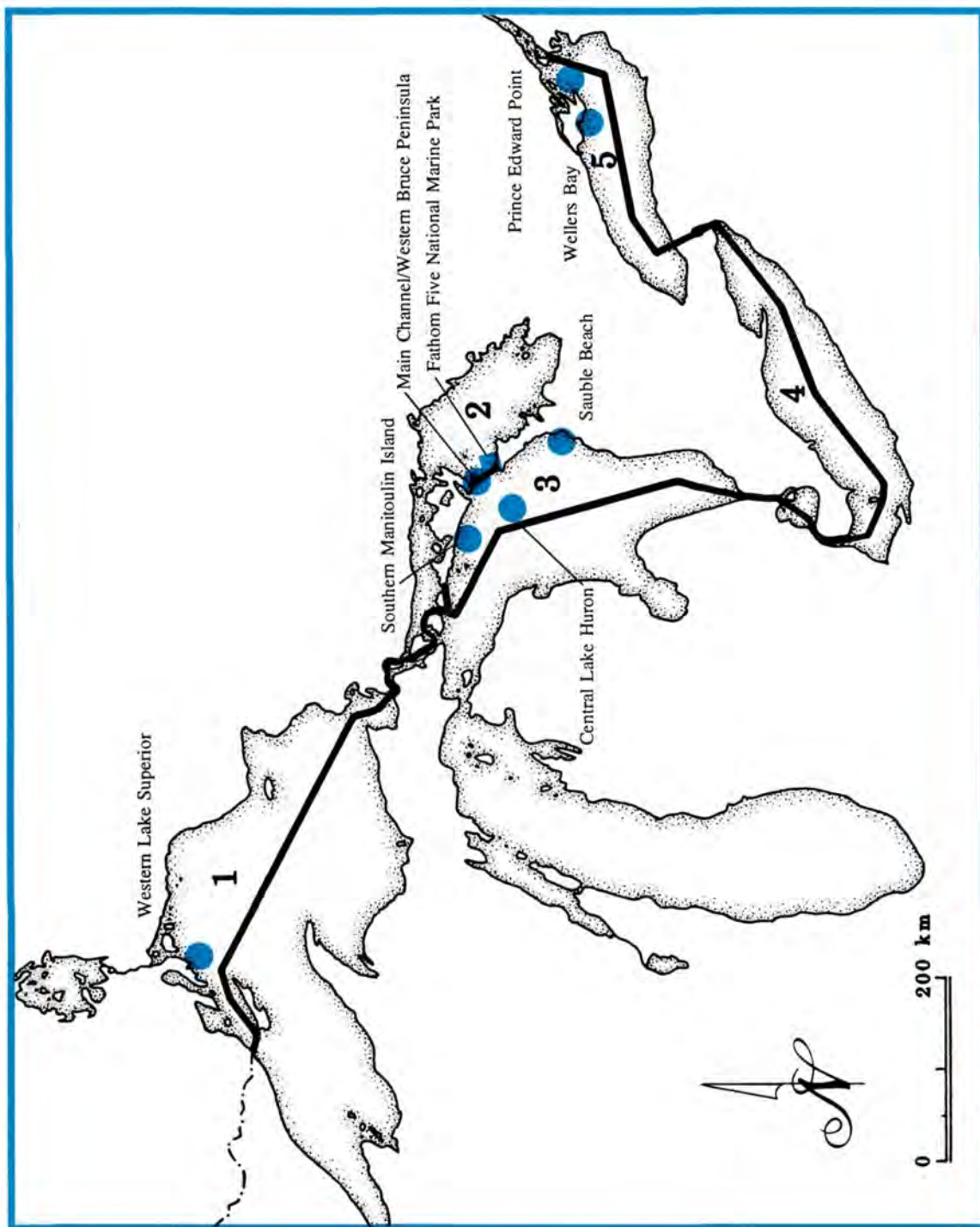
rainbow trout, brown trout) or accidentally (sea lamprey, American eel, pink salmon, rainbow smelt, goldfish, carp, alewife, zebra mussel), often to the detriment of the native species. Overfishing, destruction of spawning grounds and declining water quality have also been major factors. As a result, a number of fish species which were found in the Great Lakes have either disappeared or are on the endangered species list (see Appendix).

The region is used heavily by a few species of seabirds, notably herring and ring-billed gulls, which have adapted to the large-scale presence of humans. Use by waterfowl and

shorebirds is generally low. Only a few mammal species such as the otter and mink make occasional use of the Great Lakes aquatic environment, as well as a few amphibians (frogs, salamanders) and reptiles (turtles, water snakes).

Since the early 19th century, the Great Lakes have played a major role in the settlement and development of Canada. Now, more than 36 million people live within the Great Lakes Basin, including one-fourth of the population of Canada and one-tenth of the population of the United States. These marine regions are therefore the most densely populated coastal areas in the

country. A closed system with a slow outflow, the Great Lakes are especially vulnerable to pollution resulting from municipal sewage, industrial discharges, accidental oil and chemical spills, agricultural runoff, etc., and are subject to major, potentially long-lasting damage. The International Joint Commission has identified more than 40 areas which are so heavily contaminated that they require immediate action. Shipping, harbour activities, overfishing, recreational activities and coastal logging also add to the problems shouldered by the Great Lakes aquatic environment.



Map of the Great Lakes Marine Regions

LAKE SUPERIOR (GREAT LAKES REGION 1)

Wildlife

The Lake Superior fish fauna consists of about 70 species, including a number of introduced ones. The predominantly cold-water fauna is characterized by lake trout, lake whitefish, lake cisco, round whitefish, brook trout, bloater, kiyi, lake chub, emerald shiner, longnose sucker, burbot, logperch, and slimy and spoonhead sculpins. Populations of pink, chinook and coho salmon, as well as rainbow trout and rainbow smelt, all introduced species, are well established in the region. Lake Superior is also one of the last strongholds of the shortjaw cisco, a threatened species once abundant in several of the Great Lakes.

Double-crested cormorants, herring and ringed-billed gulls, great blue herons, common loons, spotted sandpipers, common and red-breasted mergansers, common goldeneyes, black ducks and mallards are the region's most common breeding bird species. A few duck species (particularly mergansers) and glaucous, ring-billed, herring and Bonaparte's gulls winter in the area. Low numbers of migrating waterfowl and shorebirds stage in the region. Bald eagles and ospreys breed in small numbers along the shore. Peregrine falcons are beginning to re-establish themselves in the region and several pairs now nest on the cliffs.



Peregrine falcons (*Falco peregrinus anatum*)

Known for their spectacular dives when in pursuit of their prey, peregrines have been clocked at speeds of 125-250 km/hr. They feed primarily on other birds, including ducks, shorebirds, pigeons, songbirds, seabirds, herons and even other birds

of prey. After being decimated by pesticides in the 1970s and 1980s, which affected the thickness of eggshells and prevented incubation, this endangered subspecies of peregrines is slowly making a comeback.

Marine Environment

Lake Superior is 563 km long, 257 km wide and covers an area of 82 000 km², which makes it the largest freshwater lake in the world. It is also the coldest and deepest of the Great Lakes, with a maximum depth of 405 m and an average depth of 147 m. Containing 10% of the world's freshwater supply, Lake Superior could easily hold all of the other Great Lakes, with three more Lake Eries thrown in for good measure. The eastern portion of the lake is characterized by a series of long parallel troughs 200-400 m in depth, while the rest of the lake is primarily comprised of large, deep basins. Water depths of less than 100 m are only found in a 5-35 km band paralleling the shoreline with a rapid fall-off, often with steep underwater cliffs. Deep channels separate numerous islands on the west side of the lake. Shoals are common along the eastern shore and the central portion of the lake. Upwelling occurs along the northwest shore, adjacent to Pukaskwa National Park and in the central portion of the lake, caused by a

combination of winds, currents and complex bottom topography. Lake Superior is always cold, the mean lake temperature not rising above 6°C. Surface water temperatures range from 0°-4°C in winter and 6°-14°C in summer. The lake is generally well mixed, with an abundance of oxygen and is the most oligotrophic of the Great Lakes. Productivity is low as a result. The waters are quite pure and low in dissolved solids as the watershed is composed primarily of hard, impervious and chemically resistant rocks. In normal winters, 60% of the lake area is ice covered. Due to its size, Lake Superior has a retention time of 173 years, which means it takes about that long for anything coming into the lake to flow out of it again. This is especially important where pollutants are concerned.

Coastal Environment

Cliffs reaching 100-300 m in height, interspersed with low rocky shores and deep bays characterize this coast. The western and southeastern sections of the lake have a

complex shoreline with large sheltered embayments, striking promontories and extensive archipelagos. The remaining coastline is relatively straight with open bays, headlands and a few island groups. Barrier beaches, spits, sea caves, sea arches, sea stacks, raised beaches and tombolos are found locally. The region is the most exposed of the Great Lakes, with wind fetches of up to 500 km, resulting in high wave action. Lake Superior is the least populated of any of the Great Lakes and thus retains much of its wilderness qualities.

Status

This region is not yet represented in the national marine conservation areas system. Two representative marine areas have been confirmed: Western Lake Superior and Cape Gargantua. Western Lake Superior was subsequently selected as the preferred choice for national marine conservation purposes in the region. Preliminary discussions with the Province of Ontario and local groups are the next step.

GEORGIAN BAY (GREAT LAKES REGION 2)

Wildlife

The fish fauna is dominated by warm-water species, such as walleye, yellow perch, northern pike, smallmouth and largemouth bass, muskellunge, white sucker, rainbow smelt and rock bass. The most common cold-water species are lake whitefish, lake cisco, lake trout and burbot. Several important concentrations of introduced species, including rainbow trout, brook trout and coho and pink salmon, spawn in the streams and rivers of the region. Georgian Bay is also the last Great Lakes refuge of the shortnose cisco, a threatened species once common throughout these lakes. The southern part of the region also has a particularly rich amphibian and reptile fauna, including several salamanders, frogs, turtles and one water snake which occasionally make use of the lake's aquatic environment.

Some 10 000 pairs of ring-billed and herring gulls, and lesser numbers of great blue herons, double-crested cormorants, black-crowned night herons, and common and Caspian terns nest in the region, most on the small islands in the southeastern portion of the bay. The spotted sandpiper and several species of ducks also breed along the shore. Their total population is small. Migrating waterfowl use the east shore of Georgian Bay as a stop-over site, but few overwinter.



Common tern (*Sterna hirundo*)

Any small bird with a forked tail found over the water and calling stridently is usually a tern and commons terns are the most widely distributed of this group in Canada. When feeding, terns hover with

rapid wingbeats. When they spot a school of fish near the surface, they make a swift, shallow dive, snatching their prey in passing and emerging from the water to swallow it.

Marine Environment

Georgian Bay is a shallow, westerly sloping basin with the deepest sections adjacent to the Bruce Peninsula, where depths in excess of 60 m occur within 100 m of the shoreline. The maximum depth is 92 m. Most of the region is characterized by extensive areas of shallow water, rarely exceeding 25 m and mostly less than 10 m. Reefs and shoals form a complex bottom topography. The Main Channel area is known for its fierce currents which, along with the frequent storms, have brought more than one ship to grief. Upwelling occurs off eastern Manitoulin Island and along the northeast coast of Georgian Bay as prevailing winds drive surface water away from the shore and replace it with colder water from below. These areas tend to be more productive than the rest of the bay, which is well stratified during the summer months. The shallow eastern shore of the bay is also quite productive as a result of the

warmer, sheltered waters. Surface water temperatures range from 0°C in January to 16°-19°C in August. The waters of Georgian Bay are among the clearest in the Great Lakes and visibility easily reaches 20-25 m. Ice covers most of the region between January and April.

Coastal Environment

The coastline is predominantly low-lying, rocky and generally complex, with long narrow inlets, numerous bays and thousands of islands and reefs. Pebble-cobble beaches, boulder beaches, sand beaches, cliffs, sand dunes, raised beaches, wide shallow bedrock platforms, marshes, lagoons, sea caves and sea stacks occur locally. The Niagara Escarpment, which runs along the Bruce Peninsula and the eastern shore of Manitoulin Island, effectively separates Georgian Bay from the rest of Lake Huron. It is also the only upland section in the region,

with cliffs up to 100 m in height along the shore. Elsewhere, coastal relief is low, generally less than 5 m.

Status

This region is partly represented by Fathom Five National Marine Park which was agreed to in 1987 by the governments of Canada and Ontario. This 130 km² area was formerly managed by the province as an underwater park. Authority to proclaim Fathom Five was contained in the 1989 amendments to the *National Parks Act*. However, as the park lake bed and waters have not as yet been transferred to the federal government, the park itself has not been fully established. Studies have indicated that Fathom Five is not fully representative of the marine region and boundary modifications may be required to increase its overall representation and ecological integrity.

LAKE HURON

(GREAT LAKES REGION 3)

Wildlife

Some 90 fish species are resident in Lakes Huron, including more than a dozen introduced species. Common warm-water species are walleye, lake sturgeon, yellow perch, smallmouth bass, northern pike, longnose sucker, white sucker, spottail shiner, pumpkinseed and rock bass. Lake trout, lake cisco, lake whitefish, round whitefish and bloater are the most abundant cold-water species. The other cisco species, abundant in Lake Huron at the turn of the century, are now either uncommon or extinct. Lake Huron has substantial populations of several introduced species, particularly sea lamprey, carp, rainbow and brown trout, kokanee, and coho and chinook salmon. The region is also recognized as being especially important for several amphibian and aquatic reptile species.

Lake Huron has one of the largest population of colonial water birds in the Great Lakes. There are more than 170 000 pairs, 75% of which are ring-billed gulls, 20% herring gulls, 4% common and Caspian terns, and the remaining 1% great blue herons, double-

crested cormorants and black-crowned night herons. A few duck species nest in the marshy areas of the southeast sector. Important staging areas for fall migrating ducks, gulls and shorebirds are found along the Bruce Peninsula and southern shores.

Marine Environment

The lake is relatively shallow, with an average depth of 59 m and a maximum depth in excess of 200 m. The lake bottom is fairly regular, with several basins more than 100 m in depth. The depth gradually increases from shore towards these basins. Six Fathom Scarp and Ipperwash Scarp, steep-sloped banks lying less than 40 m beneath the surface, separate the main basins. Upwelling occurs along southern Manitoulin Island and western Bruce Peninsula which increases biological productivity along these shores. Surface water temperatures range from 0°-4°C in January to 12°-16°C in July. Except for the deeper waters in the centre of the lake which typically remain ice-free through the winter, the region is usually completely ice

covered. The lake's average retention time is 22 years.

Coastal Environment

South of the Bruce Peninsula, Lake Huron has a straight shoreline dominated by low eroding bluffs 10-20 m in height, dunes, wave-cut terraces and extensive sandy beaches. The Bruce Peninsula and Manitoulin Island shores are more indented, with low rocky shelves, and many offshore reefs and islands. Pocket sand or sand-cobble beaches and marshes are common.

Status

This region is not yet represented in the national marine conservation areas system. Initial studies have identified four areas that merit further consideration as representative marine areas: Main Channel/Western Bruce Peninsula, Southern Manitoulin Island, Central Lake Huron and Sauble Beach. Confirmation studies and selection of the preferred site for national marine conservation area purposes are the next steps.



Great blue heron (*Ardea herodias*)

The great blue heron is a familiar sight along most shores, either in fresh or salt water. A solitary hunter, it

stands motionless in shallow water waiting for prey to come within reach. It feeds primarily on fish which it

spears with a lightning-like strike of its bill, but will also take frogs, salamanders, crabs, crayfish and insects.

LAKE ERIE (GREAT LAKES REGION 4)



Canvasback (*Aythya valisineria*) and **Redhead** (*Aythya americana*)

Both species of diving ducks are found in the Great Lakes on migration, sometimes gathering in large rafts. They feed mainly on vegetation,

usually in shallow water. Despite their similar requirements, the two species happily co-exist, canvasbacks preferring roots and tubers,

while redheads favour the submerged leaves and stems.

Wildlife

Lake Erie had one of the most diverse fish faunas in the Great Lakes, essentially a warm-water one with more than 110

native species. Bowfin, northern pike, yellow bullhead, golden and pugnose shiner, largemouth bass, black crappie, bluegill, pumpkinseed, alewife, gizzard shad and carp are

common in the marsh habitats. The open lake species include freshwater drum, rainbow smelt, white bass, yellow perch, smallmouth bass, walleye, muskellunge and lake

sturgeon. The lake chubsucker, restricted in Canada to Lake Erie and Lake St. Clair, occurs locally. Pollution and encroachment by introduced species, particularly carp, have resulted in an appreciable reduction in the number of native species. Important populations of amphibian and reptile species inhabit the coastal marshes and waters.

Among the Great Lakes regions, Lake Erie sees the greatest diversity of bird species, mostly migrants. Colonial water birds are limited to only a few colonies located in the middle of the lake at the western end, and in the Port Colbourne area. Some 50 000 pairs breed in the region, dominated overwhelmingly by ring-billed gulls, followed by herring gulls, double-crested cormorants, common terns and a few great blue herons. Common loons and several duck species (black duck, blue-winged teal, mallard, wood duck) also nest in the region. Moderate numbers of migrating waterfowl and shorebirds frequent the marshes. Important concentrations of canvasbacks, redheads, common and red-breasted mergansers, and Bonaparte's gulls often congregate along the shore

during the autumn migration. Various gull and waterfowl species winter where open water permits.

Marine Environment

Lake Erie, the shallowest of the Great Lakes, has a maximum depth of 64 m and an average depth of only 19 m. The lake has a surface area of 25 700 m² and is divided into three basins, with the west and central basins being very shallow (less than 20 m) and the eastern basin being the deepest (over 64 m). Bottom topography is relatively smooth. Productivity is the highest in the Great Lakes, increasing from east to west as the basins become shallower. On average, Lake Erie is about 4-7 times more productive than Lake Superior. Coastal upwelling occurs along the western shore and keeps the western basin well mixed. The shallow central basin, largest of the three basins, tends to be eutrophic in summer, with very little oxygen. This condition can be quickly aggravated by increased nutrients resulting from pollution. The waters are generally turbid and visibility is poor. Surface water temperatures range from 0°C in January to 20°-22°C in July. Ice is present for three to four

months and as a result of the shallow depths, the region is completely covered for part of the winter. Because of its small volume, the retention time in Lake Erie is only 2.6 years.

Coastal Environment

The shoreline is generally quite regular and low-lying, dominated by low eroding bluffs. An outcrop of bedrock in the extreme northeast has given rise to a series of headlands separated by sandy beaches that interrupt the straight trend of the coast. Material eroded from the unresistant bluffs has been moved by wind, waves and currents to form a few long sandy spits, complete with sand dunes and marshes: Long Point, Rondeau Point and Point Pelee. Beaches are rare elsewhere, mainly limited to narrow sand-pebble and pebble-cobble versions.

Status

This region is not yet represented in the national marine conservation areas system. Studies to identify representative marine areas are the next step.

LAKE ONTARIO (GREAT LAKES REGION 5)

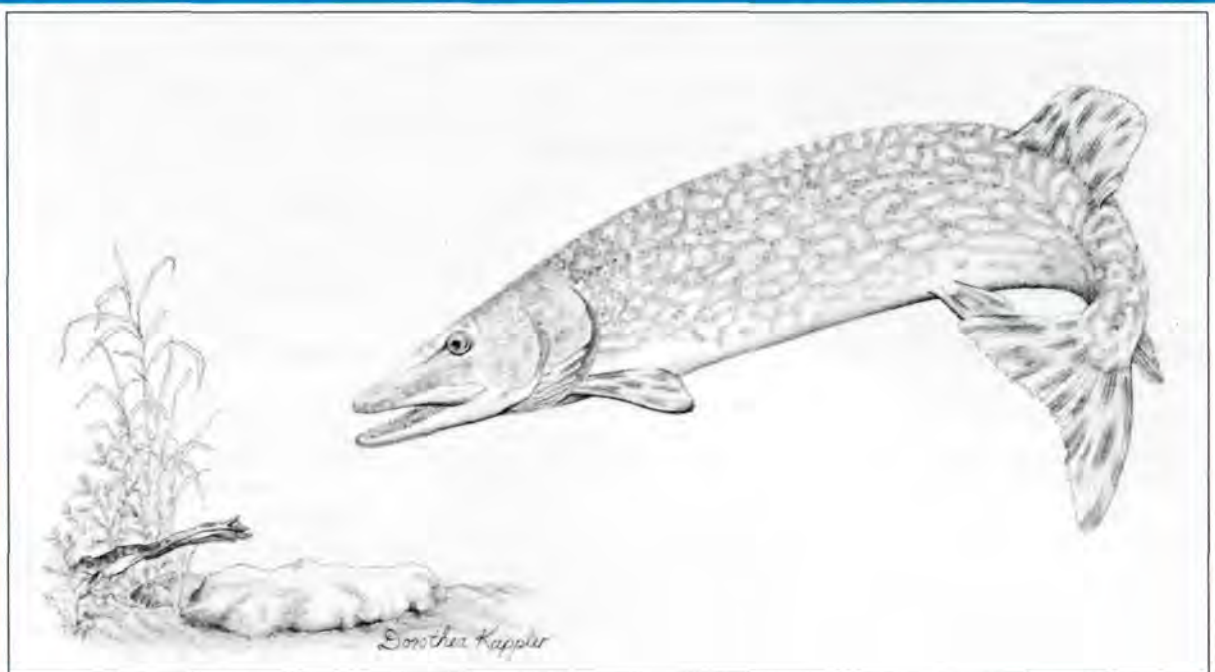
Wildlife

Some 85 fish species have been recorded in Lake Ontario. The pre-European fish community was one dominated by cold-water species. A number of once common species are no longer found in the lake, including deepwater sculpin (once so numerous they were a nuisance), blue walleye, bridge shiner, kiyi, blackfin cisco and Atlantic salmon. Though still present, lake trout and lake whitefish are no longer very common. At present, the most abundant native species include

yellow and brown bullhead, American eel, northern pike, yellow perch, walleye, sauger, smallmouth and largemouth bass. Introduced species such as brown trout, brook trout, coho and chinook salmon and sea lamprey are also doing well — for good or ill. Various species of amphibians and reptiles are common in wetland areas.

Although ring-billed gulls dominate the colonial waterbird fauna of this region by a wide margin, there are also small colonies of herring gulls, double-crested cormorants, Caspian and

common terns, great blue herons and black-crowned night herons. In addition, there is limited breeding by common loons and a few duck species. Significant numbers of waterfowl — Canada geese, black ducks, mallards, canvasbacks, redheads, and the greater and lesser scaups — stage in the region both in spring and autumn. They often gather along the eastern and western shores, and around Wolfe Island. Numerous birds winter in the region where open water permits, consisting mainly of ring-billed gulls, with fair numbers of herring,



Northern pike (*Esox lucius*)

Reaching up to a metre in length at maturity, pike are marked as predators by their large mouth and big, sharp teeth. They are opportunists

and will eat whatever is available. Though their main prey is fish, they feed heavily on frogs and crayfish at times. Mice,

muskrats and ducklings which stray into their path often become dinner as well.

glaucous, Bonaparte's and great black-backed gulls, as well as various ducks.

Marine Environment

Lake Ontario is the smallest of the Great Lakes with a surface area of only 18 960 km², although it has a greater volume than Lake Erie. Maximum depth is 244 m with an average depth of 86 m. The main portion of the lake is a smooth east-west trough divided into three basins. Water depths gradually descend towards these basins and water depths of less than 20 m occur in a 3-7 m wide band along the coast, representing only 10% of the lake. The eastern part of the lake, between Prince Edward Point and the St. Lawrence River (Kingston Basin) is less than 50 m deep throughout. It has a complex bottom topography comprised of submerged ridges, small

basins, islands and shoals. Upwelling occurs along the western edge of the lake and prevents stratification in this part of the lake. Surface water temperatures range from 0°-4°C in January and 12°-20°C in July. Primary productivity is moderate, about half that of Lake Erie. Water clarity is usually in the 5-10 m range while the lake's retention time is about six years. Lake Ontario has the least amount of ice cover of any of the Great Lakes, with over 85% of the lake surface normally ice free during the winter.

Coastal Environment

Along the eastern half of the lake, an outcrop of relatively resistant limestone was eroded by glaciers to form an irregular low-lying rocky shore. Wide flat-rock platforms, bays, coves and channels are common. The western half is dominated by a

relatively straight shoreline of low eroding bluffs subject to high rates of erosion, ranging from 0.3-3 m/yr. These bluffs are generally 3-10 m in height, but are up to 100 m high in the area of the Scarborough Bluffs. Wind-blown shore sediment has created several barrier beaches, sand dunes, sandspits and sand bars in the east, and a few sandy spits and bars at the western end of the lake. Small wetlands and marshes occur locally.

Status

This region is not yet represented in the national marine conservation areas system. Two representative marine areas have been confirmed: Wellers Bay and Prince Edward Point. Selection of the preferred site for national marine conservation area purposes ongoing.

APPENDIX

Marine-associated¹ species assigned a status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as of 1994.*

REPTILES

Leatherback Turtle (<i>Dermochelys coriacea</i>)	Endangered
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FISH

Deepwater Cisco ² (<i>Coregonus johanna</i>)	Extinct
Longjaw Cisco ² (<i>Coregonus alpenae</i>)	Extinct
Blue Walleye ² (<i>Stizostedion vitreum glaucum</i>)	Extinct
Paddlefish ² (<i>Polyodon Spathula</i>)	Extirpated
Acadian Whitefish (<i>Coregonus canadensis</i>)	Endangered
Blackfin Cisco ² (<i>Coregonus nigripinnis</i>)	Threatened
Shortnose Cisco ² (<i>Coregonus reighardi</i>)	Threatened
Shortjaw Cisco ² (<i>Coregonus zenithicus</i>)	Threatened
Channel Darter ² (<i>Percina copelandi</i>)	Threatened
Great Lakes Deepwater Sculpin ² (<i>Myoxocephalus thompsoni</i>)	Threatened
Bering Wolffish (<i>Anarhichas orientalis</i>)	Vulnerable
Pacific Sardine (<i>Sardinops sagax</i>)	Vulnerable
Blackline Prickleback (<i>Acantholumpenus mackayi</i>)	Vulnerable
Green Sturgeon (<i>Acipenser medirostris</i>)	Vulnerable
Pugnose Shiner ² (<i>Notropis anogenus</i>)	Vulnerable
Spotted Gar ² (<i>Lepisosteus oculatus</i>)	Vulnerable
Bigmouth Buffalo ² (<i>Ictiobus cyprinellus</i>)	Vulnerable
Black Buffalo ² (<i>Ictiobus niger</i>)	Vulnerable
Kiyi ² (<i>Coregonus kiyi</i>)	Vulnerable
Lake Chubsucker ² (<i>Erimyzon sucetta</i>)	Vulnerable
Silver Chub ² (<i>Hybopsis storeriana</i>)	Vulnerable

BIRDS

Great Auk (<i>Pinguinus impennis</i>)	Extinct
Labrador Duck (<i>Camptorhynchus labradorius</i>)	Extinct
Eskimo Curlew (<i>Numenius borealis</i>)	Endangered
Harlequin Duck (<i>Histrionicus histrionicus</i>)	
- Eastern population	Endangered
Piping plover (<i>Charadrius melodus</i>)	Endangered
Peregrine falcon (<i>Falco peregrinus</i>)	
- <i>anatum</i>	Endangered
- <i>tundrius</i>	Vulnerable
- <i>pealei</i>	Vulnerable
Marbled Murrelet (<i>Brachyramphus marmoratus</i>)	Threatened
Roseate Tern (<i>Sterna dougallii</i>)	Threatened
Ancient Murrelet (<i>Synthliboramphus antiquus</i>)	Vulnerable
Long-billed Curlew (<i>Numenius americanus</i>)	Vulnerable
Caspian Tern (<i>Sterna caspia</i>)	Vulnerable
Ivory Gull (<i>Pagophila eburnea</i>)	Vulnerable
Ross's Gull (<i>Rhodostethia rosea</i>)	Vulnerable
Trumpeter Swan (<i>Cygnus buccinator</i>)	Vulnerable

MARINE MAMMALS

Grey Whale (<i>Eschrichtius robustus</i>)	
- Atlantic population	Extirpated
Walrus (<i>Odobenus rosmarus</i>)	
- Northwest Atlantic population	Extirpated
Beluga (<i>Delphinapterus leucas</i>)	
- St. Lawrence population	Endangered
- Ungava Bay population	Endangered
- Cumberland Sound population	Endangered
- Eastern Hudson Bay population	Threatened
- Eastern High Arctic population	Vulnerable
Bowhead Whale (<i>Balaena mysticetus</i>)	Endangered
Northern Right Whale (<i>Eubalaena glacialis</i>)	Endangered
Sea Otter (<i>Enhydra lutris</i>)	Endangered
Harbour Porpoise (<i>Phocoena phocoena</i>)	
- West Atlantic population	Threatened
Humpback Whale (<i>Megaptera novaengliae</i>)	
- North Pacific population	Threatened
- Atlantic population	Vulnerable
Blue Whale (<i>Balaenoptera musculus</i>)	Vulnerable
Fin Whale (<i>Balaenoptera physalus</i>)	Vulnerable
Sowerby's Beaked Whale (<i>Mesoplodon bidens</i>)	Vulnerable
Polar Bear (<i>Ursus maritimus</i>)	Vulnerable

1) Marine also refers to the freshwater Great Lakes.

2) Great Lake species.

*NOTE:

COSEWIC is composed of representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Museum of Nature, Parks Canada, Canadian Wildlife Service and Department of Fisheries and Oceans, and three national conservation organizations (Canadian Nature Federation, Canadian Wildlife Federation and World Wildlife Fund Canada).

COSEWIC determines national status of wild species, subspecies and separate populations in Canada. All native fish, amphibians, reptiles, birds, mammals and vascular plants are included; invertebrate animals and non-vascular plants are not. (Invertebrates constitute the great majority of marine species.)

Definition of categories:

Extinct:	A species formerly indigenous to Canada that no longer exists anywhere.
Extirpated:	A species no longer existing in the wild in Canada but occurring elsewhere.
Endangered:	A species threatened with imminent extinction or extirpation throughout all or a significant part of its Canadian range.
Threatened:	A species likely to become endangered in Canada if the factors affecting its vulnerability are not reversed.
Vulnerable:	A species particularly at risk because of low or declining numbers, small range or for some other reason, but not a threatened species.

(from *Canadian Species at Risk* - April 1994, Committee on the Status of Endangered Wildlife in Canada, Ottawa).

GLOSSARY

Abyssal plain: The flat, essentially level area which occupies the deepest portion of many ocean basins; usually at depths greater than 3000 m.

Alcid: Refers to a family of marine birds (Alcidae). They are expert swimmers and divers which prefer open waters. All species are short-necked, stout-bodied and resemble small penguins. Includes the puffins, murres, guillemots, murrelets, auklets, razorbill and dovekie.

Algae: The simplest plants, having no true stems, roots or leaves; may be singled-celled (such as diatoms) or quite large (such as the seaweeds). Live in salt or fresh water.

Amphipod: Refers to a group of species within the crustaceans whose main feature is a laterally compressed body (the width of the body is small in comparison to its depth) giving them a shrimp-like appearance. Mostly marine, with some freshwater and terrestrial forms.

Anadromous: Those fish species which breed in fresh water and spend most of their lives in salt water, such as Atlantic and Pacific salmon, Arctic charr, smelt.

Archipelago: A group of islands.

Baleen: A strong and light material growing from the roof of the mouth in baleen whales, which include most of the larger whales (fin, blue, gray, bowhead, sei, minke, humpback and right whales). These comb-like plates allow the whales to feed by straining small organisms from the water. Also called whalebone.

Bank: An elevation of the seafloor covering a large area above which water depth is relatively shallow, but safe for navigation (i.e. Grand Bank).

Barrier beach: A sand or gravel bar which is exposed even at high tide and is separated from the coast by a lagoon.

Barrier island: Similar to a barrier beach but commonly has dunes, vegetated zones and swampy areas extending toward the lagoon; also a detached portion of a barrier beach between two inlets.

Basin: 1) A generally circular seafloor or lake-bottom depression of variable extent. 2) A more or less circular body of water connected to a larger body of water by one or more passages.

Bathymetry: The measurement of depth in oceans, seas and lakes.

Bay: Water area in an indentation of the shoreline of seas, lakes, or large rivers. Usually smaller than a gulf and larger than a cove.

Beach: The gently sloping shore of a body of water which is washed by waves or tides, especially the parts covered by sand or pebbles.

Benthic: Organisms, both plant and animal, which live on or near the bottom of a body of water; those which live on the surface of the ocean floor are the epifauna, while those beneath the floor surface are the infauna.

Bight: A rounded open bay formed by a bend in a coast.

Biomass: The quantity (weight) of living organisms in a given area or volume.

Bluff: Headland, cliff or river bank with a steep face.

Brackish: Mixture of salt water and fresh water — usually associated with estuaries.

Breakup: The rupture of the ice cover into various sized pieces which are then carried away by currents; usually associated with the onset of warmer weather.

Cape: A projection of land extending into a sea or lake; usually a prominent feature.

Catadromous: Those fish species which breed in salt water, yet spend most of their lives in fresh water, such as the eels.

Cetacean: (from the latin *cetus* for "large marine fish"). Refers to the order of mammals, primarily marine (a few freshwater species exist) with nostrils on top of their heads. They spend their entire lives in a water environment and cannot long survive outside of it. Includes whales, dolphins and porpoises.

Channel: Narrow stretch of water, either an inlet or a connection between two bodies of water.

Cirque: Deep, steep-walled, bowl-shaped indentation in a mountain side, formed and shaped by movement of snow and ice.

Cliff: A high, steep face of rock and/or unconsolidated material; above or below the surface. Used for sea cliffs (on the coast), mountain cliffs and river banks.

Colony: An area where many individuals of the same species assemble to breed. Most seabirds breed in colonies (cliff faces, islands) often with several other species. Sea lions are also colonial (breeding in "rookeries"), as are walrus and most species of seals (colonies or whelping patches).

Community: An association of plants and animals living in equilibrium in a given biological environment (i.e. a group of species adapted to a specific type of habitat, such as rocky bottom, sand, deep waters, etc.).

Continental shelf: That part of the submerged coast which gradually slopes seaward, with depths to 200 m. Widths vary considerably around the world. Most of the productivity in the oceans occurs here.

Continental slope: That part of the submerged coast which is beyond the edge of the continental shelf and slopes steeply to depths of 3000 m or more.

Cove: Water area in small indentation of the shoreline of seas, lakes or rivers; smaller than a bay.

Crustacean: Refers to a class of invertebrates, mostly aquatic, with two pairs of antennae. Includes shrimp, lobster, amphipods, isopods, barnacles, copepods, crabs, etc.

Cuesta: A hill or ridge with a steep face on one side and a gentle slope on the other.

Dabbling duck: Refers to a group of ducks which ordinarily feed in shallow water by submerging most of the body, leaving the tail sticking straight up above the water. They also feed on land. Unlike diving ducks, they don't patter along the surface when taking flight but spring directly up from the water. Includes species such as the mallard, teals, widgeons and pintails.

Delta: The usually triangular-shaped deposit of clay, silt, sand, gravel or other such material transported by a river and dropped at its mouth.

Diving duck: Refers to a group of ducks which are excellent swimmers and feed by diving. Compared to dabbling ducks, the legs of diving ducks are set farther back on their body and they need a running start along the surface of the water before rising into the air. Includes species such as the canvasback, redhead, mergansers and scaups, as well as the sea ducks.

Drumlin: A low, smoothly rounded, elongated oval hill, mound, or ridge built under the margin of an active glacier and shaped by its flow.

Dune: A mound, ridge or hill of wind-blown sand which can be several metres in height, either bare or covered with vegetation. Are found adjacent to the coast (coastal dunes) or inland (continental dunes).

Echinoderm: ("spiny skin"). Refers to a class of exclusively marine invertebrates possessing tube feet, whose body can usually be divided into five parts around a central point (radially symmetrical). Includes sea stars, sea urchins, sand dollars, sea cucumbers, etc.

Eddy: Small whirlpool in a watercourse or in the sea, running contrary to the direction of current or tide.

Embayment: An indentation in a shoreline forming an open bay or a conformation resembling a bay.

Erosion: The gradual wearing away of soil, rocks, etc., by glaciers, running water, waves or wind.

Escarpment: Long, continuous, steep slope, often cliff-like. Also called a scarp.

Esker: A long, narrow, sinuous ridge of sand and gravel which was once the bed of a stream flowing beneath or in the ice of a glacier and was left behind when the ice melted.

Estuary: The mouth of a river where tidal effects are evident and where fresh water and salt water mix.

Eutrophic: A lake or river having high productivity and biomass. It is rich in dissolved nutrients, often shallow and seasonally deficient in oxygen. This fertilization can be a natural process or one brought on by human activity, the latter often having a negative impact on the ecosystem.

Fault: A fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other. The movement producing this displacement is termed faulting.

Fauna: Animal life; the animal species of a particular area.

Fetch: A stretch of open water, unbroken by islands or land masses, which the wind blows across; long fetches cause water to pile up, resulting in large waves when these masses of water finally hit land.

Fjord: A deep, long, narrow inlet into the coast, with more or less steep sides and a shallow sill at the mouth which inhibits full water exchange with the sea. In effect it is a glacially eroded valley inundated by the sea.

Flatfish: Those fish species whose body is strongly compressed and have both eyes on one side of the head, such as halibut, flounder, sole and plaice.

Flora: Plant life; the plant species of a particular area.

Folding: Movement of the earth's crust which results in a bend (fold) in layers of rock.

Glaciation: The formation, movement and retreat of glaciers or ice sheets.

Groundfish: Those fish species which live near or on the bottom, such as cod, haddock and flatfish.

Gulf: A large inlet penetrating far inland.

Gyre: A large oceanic region of surface current circulation moving in a circle.

Haul-out: A rock, island, or beach where pinnipeds (seals, sea lions, walrus) gather out of the water; usually a resting area. Most are used regularly.

Headland: A projection of usually high land jutting out into a body of water, such as a cape or promontory.

Ice edge: The demarcation at any given time between the open sea and sea ice of any kind, whether landfast or pack.

Ice sheet: A thick glacier more than 50 000 km² in area, forming a continuous cover and moving outward in all directions.

Ice shelf: A thick and extensive floating sheet of glacier ice attached to the coast.

Indigenous: Which grows or lives naturally in a particular region or environment (native), as opposed to an introduced (exotic) species brought in from elsewhere either accidentally or intentionally.

Inlet: Elongated body of water extending from a sea or lake.

Intertidal or littoral zone: That part of the coast which is affected by the rise and fall of the tide; the region above is the supratidal (supralittoral) zone and that below is the subtidal (sublittoral) zone.

Invertebrate: Animal without a backbone — about 95% of all animals on earth. Includes everything from one-cell organisms such as amoebas to sponges, corals, anemones, worms, crustaceans, molluscs and echinoderms.

Isopod: Refers to a group of species within the crustaceans whose main feature is a dorsoventrally flattened body (when viewed from the side are very thin — body depth is small — while the width of the body is quite large in comparison). Mostly marine, with some freshwater and terrestrial forms.

Kelp: Any of various species of large brown seaweeds of the family Laminariaceae.

Lagoon: A shallow body of water which is partly or completely separated from the sea by a narrow strip of land.

Landfast ice: Sea ice which forms and remains attached to the coast; may be formed from sea water or by freezing of pack ice and it may extend a few metres or several hundred kilometres from the coast. Also called fast ice.

Landform: A natural feature of the earth's surface (i.e. hill, mountain, plain, valley, cliff, etc.)

Ledge: Flat rock area either projecting from land into the water or rising from the sea floor; may be partly exposed at low tide.

Marine arch: A sea cave which has broken through a narrow section to form an arch.

Marine mammal: Any mammal which spends most of its life in the sea. Includes the whales, dolphins, porpoises, seals, sea lions, walrus and polar bear.

Marine terrace: Relatively flat, horizontal, or gently inclined surfaces which are bounded by a steeper ascending slope on one side and by a steeper descending slope on the opposite side, giving it a step-like appearance. Usually long and narrow, it can be completely submerged or coastal and is the result of erosion, either by waves or sediments.

Marine: Of or relating to the ocean or sea; implies a saltwater environment.

Mesotrophic: A lake or river with moderate productivity.

Migration: (to go from one place to another). Migration is applied to any type of regular movement. It covers large-scale annual movements such as those of birds between nesting and wintering grounds; of whales between summering and wintering areas; of fish between feeding and spawning grounds. Migration also applies to the daily vertical movements of some of the larger zooplankton as they move from deep to shallow water and back again.

Mixing: Process which breaks down the stratification of a body of water, ensuring the homogeneity of part or all of the water column in terms of temperature, salinity and nutrients. Mixing can be brought about by currents, wind and wave action, upwelling, etc.

Mollusc: Refers to the phylum of invertebrates which includes clams, oysters, squid, octopus, snails, chitons, nudibranchs and their relatives.

Moraine: The debris or fragments of rock material brought down with the movement of a glacier and forming a mound, ridge, or other distinct accumulation.

Moult: The periodic shedding and replacement of feathers. Most adult birds of Canadian species moult twice a year. Birds generally undergo a moult of body feathers before the breeding season (into their colourful breeding plumage) and a full moult after the breeding season (into their duller winter plumage).

Mud flat: See tidal flat.

Nudibranch: A sea slug, a snail without a shell. These species are some of the most beautiful and spectacular of the molluscs.

Nursery area: In fisheries biology, an area where young fish are known to concentrate.

Oligotrophic: A lake or river with low productivity, deficient in plant nutrients and rich in oxygen throughout its depth. The water tends to be quite clear.

Outcrop: A portion of bedrock or rock strata projecting above the earth's surface and thus exposed to view.

Pack ice: Term used in a broad sense to include any area of sea ice other than landfast ice. Normally applies to broken and separate blocks of ice (floes) which tend to make navigation very difficult. Occurs in various concentrations from open pack where the floes are generally not in contact with each other to close pack ice where the ice blocks tend to be in contact.

Pelagic: Of, or relating to, the open sea, particularly that area beyond the continental slope (pelagic region). However, also generally applies to any offshore environment, rather than coastal or inshore, as in seabirds with a pelagic distribution. Also used to indicate species which range through the water column (pelagic fauna: pelagic fish, whales, jellyfish, plankton) as opposed to benthic species (bottom fish, sea stars, clams, kelp).

Phytoplankton: Refers to the plankton which are plant organisms, mainly unicellular diatoms and other microscopic algae, which form the base of the food chain in marine systems.

Pingo: Isolated, conical, ice-cored mound occurring in areas of permafrost (area of permanently frozen ground) and persisting for more than one season.

Plankton: Drifting marine and freshwater organisms with limited swimming capabilities. Generally microscopic but can also include large organisms (jellyfish). Divided into phytoplankton and zooplankton.

Polychaete: Refers to a class of exclusively marine invertebrates made up of the marine worms. Usually have a well-defined head. Includes clam worms, lugworms, fan worms and their relatives.

Polynya: Any non-linear shaped opening enclosed in ice. Polynyas are areas which contain very little ice or only young thin ice. Sometimes the polynya is limited on one side by the coast (shore polynya) or by landfast ice (flaw polynya). If it occurs in the same position every year, it is called a recurring polynya. Formed by various combinations of tides, winds, currents and upwellings.

Productivity: Production of plant and animal matter. Primary productivity refers exclusively to plant production, by both phytoplankton and larger plants such as seaweeds, and forms the base of the food chain in marine systems. Secondary productivity is animal production (zooplankton, fish, birds, mammals), which generally depends on the amount of primary production.

Promontory: A headland; a cliff or crag projecting into a sea or lake.

Raised beach: An ancient beach raised to a level above the present shoreline by uplift or by lowering of the sea level.

Reef: Rocks rising to or near the surface of a body of water, posing a hazard to navigation.

Relict population: An isolated population of a species once found over a wider area, but now reduced to pockets of suitable habitat over much or part of its former range due to large-scale climatic changes or changes in sea level which have geographically separated it from the rest of its species.

Relief: The difference in elevation between the high and low points of a region (i.e. the relief of an area with a bank at a depth of 100 m and an adjacent basin which is 1200 m deep, is 1100 m).

Resident: Species which lives in an area year-round; does not migrate.

Ridge: 1) A long narrow elevation of the sea floor, generally prominent due to the steep angle at which it rises. 2) A line or wall of broken ice forced up by pressure. 3) Elongated stretch of elevated ground.

Rift valley: An elongated valley formed by the depression of a block of the earth's crust between two parallel faults.

Salt marsh: A coastal marsh periodically flooded by salt water.

Sand flat: See tidal flat.

Scour: 1) Action of a powerful current or ice in hollowing out or digging into the seabed or shore. 2) Action of moving glaciers as they scrape, hollow out or smooth the surface rocks over which they pass; glacial scouring.

Seabird: General term applied to any bird that spends much of its life on or over salt water. Includes the gannets, loons, cormorants, gulls, terns, shearwaters, alcids, kittiwakes, fulmars, petrels, albatrosses, etc., as well as certain ducks.

Sea cave: A cave formed by wave action; generally at sea level and affected by tides.

Sea duck: Refers to a group of diving ducks which spend the winter on salt or brackish waters. Includes the eiders, scoters, harlequin duck, oldsquaw and red-breasted merganser.

Seamount: Undersea volcanic peak having a height of more than 1 km.

Sea stack: A rocky islet or pillar, near a coastline, which has been separated from the mainland by wave erosion; also called a flower pot.

Seiche: An oscillation in water level from one end of a lake to another due to rapid changes in winds and atmospheric pressure. Most dramatic after an intense but local weather disturbance passes over one end of a lake.

Shoal: Elevation of the bed of a body of water which reaches just below the surface and is therefore dangerous to navigation.

Shorebird: Any of a suborder of birds (Charadrii) that frequent the seashore. Includes the plovers, surfbirds, sandpipers, turnstones, curlews, willet, whimbrel, dowitchers, knot, yellowlegs, oystercatchers, sanderling, godwits, dunlin, avocet, stilt and phalaropes.

Shore lead: A fracture in sea ice which forms between pack ice and the shore.

Sill: A submarine ridge or rise separating partially closed basins from one another or from the adjacent ocean; as between the mouth of a fjord and the ocean.

Sound: 1) Large body of water from which two or more inlets, arms or channels branch off. 2) Arm of the sea or of a lake; inlet.

Spawning ground: Area where fish are known to breed (spawn).

Spit: Long, low, narrow projection extending into a body of water from the shore.

Staging area: Place where migrating birds always stop and feed for short periods, putting on fat before continuing on their migration. Also called a stop-over.

Strait: Passage connecting two larger bodies of water.

Stratification: The tendency for distinct layers of water to form as a result of vertical changes in temperature (thermocline) and/or salinity (halocline), and therefore in the density of the water.

Upwelling, currents, winds and changes in surface water temperatures destroy this layering, mixing the waters, thus permitting the exchange of nutrients and enhancing productivity.

Subtidal: Below the low tide mark; always under water.

Tidal bore: A wave with an abrupt front occurring in a narrow river or estuary on an incoming (flooding) tide advancing upstream like a wall of water which is noticeably higher than the water level of the river or estuary (several centimetres to more than a metre in height depending on location). Produced when the tide reaches shallow water and meets an outgoing river current, causing the water to pile up across the river and move along like a large broken wave.

Tidal current: Horizontal movements of water associated with the tide. Where these waters are channelled through narrow passages, the currents can become quite strong, first in one direction as the tide comes in (floods) and then reversing as the tide falls (ebbs).

Tidal flat: An area of marshy, muddy, sandy or mixed sediment land which is exposed as the tide falls.

Tidal range: The difference between the height of water at high tide and that at low tide in any given place.

Tidal rip: Turbulent water where tidal currents meet. Also called a rip.

Tide: The alternate rise and fall of the surface of the sea, twice a day in most regions, caused by the gravitational pull of the moon, and the sun to a lesser degree. High tide is the culmination of the rise of the ocean surface (flood tide) and on land corresponds to the highest point reached by the sea, while low tide is represented by how far out the water goes as the sea surface falls (ebb tide).

Tidewater glacier: A glacier that terminates in the sea, where it usually ends in an ice cliff from which icebergs are discharged ("calved").

Tombolo: A sand or gravel bar connecting an island with the mainland or another island.

Topography: The physical features of an area or region, especially its relief and contours.

Trench: A long narrow depression in the ocean floor, usually steep-sided.

Trough: 1) Long depression of the ocean floor or lake bottom characteristically flat-bottomed and steep-sided. 2) Depression between successive waves on the surface.

Uplift: Elevation of any extensive part of the earth's surface relative to some other part, as in mountain building or the rebound of the earth's crust following the retreat of the glaciers.

Upwelling: To move upward; is the process by which subsurface water moves towards the surface; either replacing surface water transported away by winds, or as a result of deep currents brought to the surface by marked changes in depth. Upwelling areas tend to be very productive.

Water bird: General term applied to any bird that lives part of its life in or around water, especially the swimming and diving birds (seabirds, waterfowl) and wading birds (herons, egrets, bitterns, shorebirds).

Water mass: Sea water with characteristic temperature and salinity properties which can be recognized at different depths and at great distances from its point of origin, such as Arctic water, Atlantic water, Pacific water, West Greenland water, etc.

Waterfowl: General term applied to ducks, geese and swans.

Wetland: Habitat containing much soil moisture, as in tidal flats, swamps, marshes, etc.

Whalebone: See baleen.

Whelping patch: Area where certain species of seals congregate to bear their young.

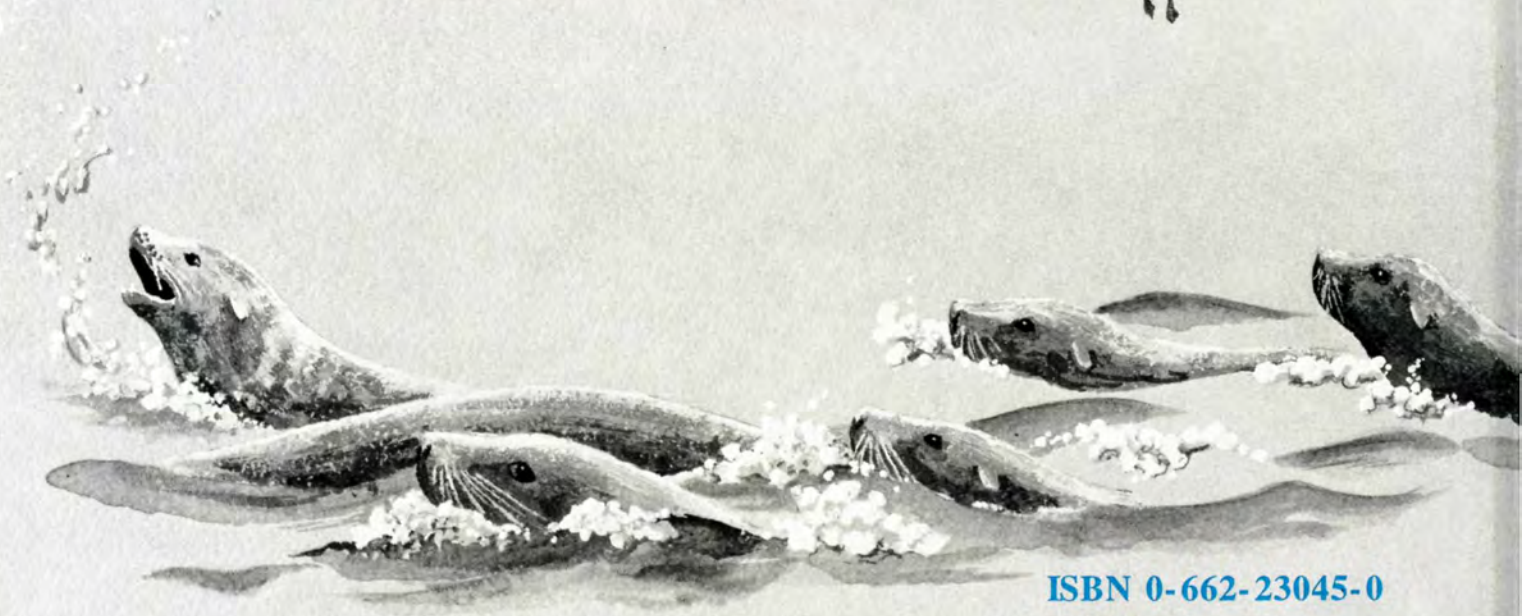
Whirlpool: Water moving rapidly in a circle, producing a depression in the centre into which objects are drawn.

Zooplankton: Refers to animal plankton, i.e. copepods, egg and larval stages of most fish and invertebrate species, jellyfish.

Canada

The world's longest coastline.
The second largest continental shelf.
Some of the world's richest fishing grounds.
Marine mammal and marine bird populations of
global importance.
Diverse and colourful underwater communities.
Gorgeous seascapes of wave-battered coasts,
island-strewn bays, quiet sandy coves.
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Of course!

At its 1994 General Assembly in Buenos Aires,
the World Conservation Union (IUCN)
recommended that "...coastal nations establish
under national legislation representative systems
of marine protected areas." The National
Marine Conservation Areas program meets this
challenge. When completed, it will protect for all
times an outstanding sampling of the
Arctic, Atlantic and Pacific oceans,
as well as the Great Lakes,
for our benefit and generations as yet unborn.



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