13 Hudson Bay

Overview

The Hudson and James bays stretch across the northern reaches of Manitoba, Ontario and Quebec. The bays are fed by water from one third of all Canadian rivers, and form one of the world's largest seas. The catchment area covers 2.6 million km^2, from Labrador in the east to the Rockies in the west, and from the Arctic Circle in the north to almost the Great Lakes in the south.

In this report, the Hudson Bay is defined to include James Bay unless the text indicates otherwise.

Location

Basic information

Surface area : 760,000 km^2
Volume : 95,000 km^3
Average depth : 125 m
Maximum depth : 234 m

Nature

< Background >

Hudson Bay constitutes a large, shallow inland sea connected to the Atlantic Ocean by Hudson Strait and the Labrador Sea, and to the Arctic Ocean by the Foxe Basin and Fury and Hecla straits.

The Hudson Bay watershed extends west to the continental divide of the Rocky Mountains and the Mackenzie River watershed. It borders the St. Lawrence/Great Lakes watershed to the south. The annual discharge into Hudson Bay is twice that for either the St. Lawrence or the Mackenzie river systems. [1]

Hudson Bay forms the western maritime coast of Quebec, the northern maritime coasts of Ontario and Manitoba and the eastern maritime coast of the Nunavut mainland. It is bounded on the north by a line connecting Cape Fullerton (in Nunavut) to Ivujivik (in Quebec), via the southern Southampton, Coats, and Mansel islands. This boundary was constructed on the basis of physical and biological oceanography.[2]

▶Climate

Hudson Bay moderates the temperature of the lowlands during summer but the effect diminishes in winter when the Bay is covered in ice. Cold, dry arctic air typically lingers over the area throughout winter. The temperature and precipitation correlate closely with latitude.

Temperatures throughout the year tend to be colder near the coast and warmer inland. Summers are cool and brief. The average mean daily temperature in July ranges from 12 to 16 ° C, and in January it hovers around -25 to -23 ° C. Frost free periods are shortest (about 70 days) on the coast and longest (80 days) along the southern margin. Average annual precipitation is approximately 500 to 700 mm per year, and is lowest in the north. Rainfall peaks in July at about 100 mm. Of this precipitation, snow accounts for very little; snowfall may be in the 2,000 mm range, which is half that of the Great Lakes area. The mean maximum snow depth is less than 1,000 mm. The spring break-up on major rivers tends to occur in late April or early May, and ice jams can raise river levels by 7 to 10 m.

As an ice-covered region, Hudson Bay is readily impacted by short-term or long-term climatic changes. In the past two years, the ice has been melting earlier, which has in turn been affecting shipping and marine and aquatic species and their habitats.

< http://www.ccea.org/ecozones/hp/land.html >

▶Topography

The Bay can be characterized as shallow, with a mean depth of less than 150 m. Because of the shallowness, the entire Hudson Bay area can be characterized as a coastal region.

< http://www.mar.dfo-mpo.gc.ca/e/homepg.htm >

▶Hydrology

The water properties of Hudson Bay depend mainly on exchanges with Foxe Basin, Hudson Strait and the large freshwater input from rivers surrounding the bay and sea-ice melt in spring and summer.[3] Currents are strongly affected by influxes of fresh water from rivers and, during the open-water season, by wind stress. Cold saline water enters Hudson Bay from the northwest. Less saline surface water flows out along the eastern shores of James and Hudson bays and northward to Hudson Strait.

The formation and melting of sea ice has a strong influence on the climate of Hudson Bay. It is completely ice-covered for 8 to 9 months of the year, with the thickness reaching a Bay-averaged maximum of 1.6 m at the end of April. The range at that time is from 1 m in the south to 2 m in the north.

The effect of ice on the freshwater content is twofold. Ice is created mostly in the northern areas and is advected to the south where most of the melt occurs, leading to a net transport of freshwater to the southern parts of the Bay. Also, convective mixing and brine rejection, associated with ice formation, removes freshwater from deep within the water column and brings it to the surface, where it is immobilized as ice. The melt releases this freshwater at the surface, resulting in a net vertical transport of freshwater. The residence time of freshwater is 10.2 months in James Bay, and 6.6 years, or 8 times longer, in Hudson Bay as a whole.

Hudson Bay has a two-layer system, with old waters at lower depths and ventilated waters in the top 100 m, resulting from winter convection. The deep layer has origins in the Arctic Polar waters. Its nutrient concentrations are similar to Arctic waters, but are distinct from Atlantic waters.

The Bay is deeper than the sill that separates it from Hudson Strait, which limits the exchange and renewal of deep water. Ventilation times of 3 to 14 years have been calculated for deep water.

The Bay has a cyclonic surface circulation of 5 cm/s in summer, forced by fresh water input. High runoff in the summer causes a circulation of 19 cm/s in James Bay. On the western Hudson Bay coast, the semi-diurnal component height of the tides is maximal at about 1.25 m (measured from mean level to crest). Tides may be observed in excess of 5 m (measured crest to crest) in western Hudson Bay.[1]

< http://www.carc.org/pubs/v19no3/2.htm >

< Surrounding environment >

▶Wildlife

Ringed seals are found on all coasts of Hudson Bay, with the total populations estimated at 516,000. The main concentration of walruses are on the northeastern Coats Island and southeastern Southampton Island where they are found during all seasons, with an estimated summer population of 2,000. Polar bears, which depend on seals as their main food source, are found on the coasts during the summer and fall. Beluga whales are the main species of whale found in Hudson Bay. The most recent report estimates a population

of 8,000 to 9,000 belugas that summer in western Hudson Bay, while a small population summers on the east coast of Hudson Bay. A population of possibly less than 100 bowhead whales inhabits northern Hudson Bay and Hudson Strait, most probably on a year-round basis. The species is endangered and has been protected by international protocols. Approximately 60 species of fish are known to inhabit the estuarine communities of Hudson Bay.

The land around the coast of Hudson Bay is tundra, taiga and peatlands. The Hudson Bay coasts provide a major migration pathway and a breeding ground for many species of geese and ducks. Approximately 2.5 million lesser snow geese and 200, 000 Canadian geese use staging areas on the coastal marshes of the Hudson Bay lowlands during spring and fall migration. In an average year, 1.5 million lesser snow geese use the James Bay coastal areas. The high fertility and productivity of the coastal zone supports a wide range of food types, which enable reproduction, growth of juveniles and fattening of all ages prior to fall migration. A major breeding colony of lesser snow geese is located just west of Cape Henrietta Maria, with smaller breeding areas located on Akimiski Island, near Churchill, and in the vicinity of Arviat. Approximately 75 per cent of the global population of Atlantic brant geese is concentrated on the eel grass beds of the Quebec coast and parts of the Ontario coast of James Bay. Also, almost the entire North American population of up to 320,000 black scoters uses southern James Bay as a staging area.

< http://www.carc.org/pubs/v19no3/2.htm >

Marine Protected Area

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

History and Culture

< History >

Human activities have strong historical roots in the Hudson Bay. The ill-fated expedition of Henry Hudson, who was set adrift by his mutinous crew in 1611, left the legacy for most of the names on today's maps. Later, interest in fur drew other English and French explorers to the area. In the late 1600s, the Hudson's Bay Company erected a series of forts along the bay at the Albany, Rupert, Moose and Hayes rivers and, later in the early 1700s, on the Churchill River. These posts were the early gateways to the riches of central Ontario, Manitoba, Saskatchewan and the Northwest Territories.

The fur trade brought European and aboriginal cultures together and for years it was a prosperous venture. Unfortunately, fierce competition for furs between the North West Company, from lower Canada, and the Hudson's Bay Company eventually strained the native economy, affecting subsistence and commercial activities.

< http://www.ec.gc.ca/soer-ree/English/Vignettes/Terrestrial/hp/default.cfm >

< Culture >

The Hudson Bay bioregion has been occupied by Cree and Inuit people for thousands of years. The Cree occupy the southern part of the region in Manitoba, Ontario and northern Quebec, as far north as Whapmagoostui. Inuit communities are found along the eastern shores of Hudson Bay in Quebec, north from Kuujjuarapik to Ivujivik and Salluit. In the Northwest Territories, Inuit communities extend from Arviat, on the western shore of Hudson Bay, to Coral Harbour on Southampton Island. The Inuit community of Sanikiluaq is found on the Belcher Islands in southeastern Hudson Bay, about 100 km from the mouth of the Great Whale River.

Cree regard their part of the bioregion as a "garden" providing for all their needs. As part of their traditional subsistence economy, the Cree hunt migratory birds, particularly in the spring, as well as terrestrial mammals, such as moose. The Cree fish the rivers in the region and trap fur-bearing mammals, such as muskrat and beaver. Traditionally, Inuit have focused their harvesting efforts on fish and marine mammals, such as seals, walruses

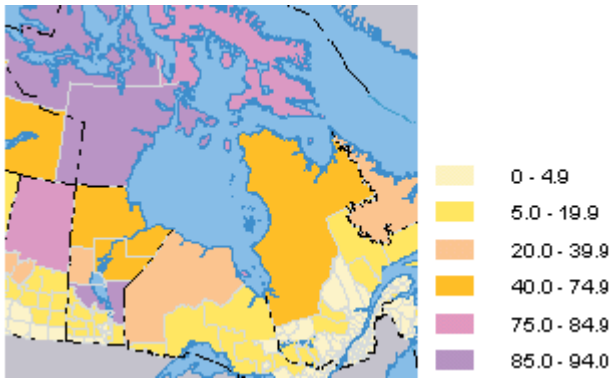
and whales. Some communities also depend heavily on caribou. A collective body of knowledge on the dynamic ecosystem and the complex relationships that govern the behavior of animals, fish and birds in the Hudson Bay area has been gathered from observation and experience that has been passed down through the generations by song, story and dance.

< http://www.carc.org/pubs/v19no3/2.htm >
< http://www.carc.org/pubs/v20no2/8.htm >

Social Environment

< Population >

Except for a few coastal villages, the area is almost unpopulated and home to only 32,000 residents. The populations of the ecoregions surrounding the Hudson Bay are approximately 10,000 in the Hudson Plains, 5,500 in the Eastern Taiga Shield, 9,000 in the Southern Arctic and 8,000 in the Northern Arctic. Population density ranges from 0 to 0.9 people per km^2. The percentage of the population that is aboriginal is relatively high in these regions.



Percentage of Aboriginal Population by Census Subdivision 1996 [Natural Resources Canada]

< http://atlas.gc.ca/site/english/maps/peopleandsociety/aboriginalpopulation/percentage >

< Land use >

Land uses include trapping, hunting, fishing, mineral exploration and hydroelectric development. Most of the human population and land use is along the coast. As the period without sea ice increases, during the warmer months, there is more frequent use of Hudson Bay for travel, distribution of goods and the harvesting of resources.

< Industry >

While the Hudson Bay area is ecologically diverse, it is not well endowed with timber and minerals. Instead, tourism, fishing, hunting and trapping provide the main economic base.

The importance of fish in the domestic economies of this region cannot be understated. Arctic char, whitefish, arctic cod and other species contribute directly to the domestic fishery, and indirectly to the food chain of marine and terrestrial mammals and birds.

Shipping is an important commercial activity in Hudson Bay, particularly near the coast of Manitoba at the Port of Churchill. Shipping is one of the main commercial activities in or near the Port of Churchill, although the port itself is not as busy as other Canadian ports. There is limited commercial fishing and tourism in or affecting the Bay. Commercial fishing occurs in or near the Nunavut Settlement Area and Hudson Strait.

Tourism activities on the Manitoba coast focus around Town of Churchill and Wapusk National Park. These activities include sport fishing and hunting, and ecotourism activities, such as polar bear and whale watching. In Ontario, the Polar Bear Provincial Park draws many tourists. The varied wildlife, contrasting landscapes, ocean coasts and scenic rivers of the area have become popular attractions.

Other activities such as mining, forestry and hydroelectricity generation occur on lands adjacent to Hudson Bay, in Manitoba, Ontario, Quebec and the Nunavut Territory. These activities are regulated provincially and federally, and are subject to Canadian commitments under international agreements. Aspects of these activities may affect the water quality and flow into the bay. This in turn may affect marine species and birds that are dependent on the Bay.[4]

< http://www.carc.org/pubs/v19no3/2.htm >
< http://www.ec.gc.ca/soer-ree/English/Vignettes/Terrestrial/hp/human.cfm >

Environmental Problems

< Current status >

The interest in chemical contaminants in the Hudson Bay is driven by several important observations. In the coastal communities of northern Quebec, human milk has high levels of PCBs, and high proportions of people in the region have a blood mercury level over the normal range. Increasing mercury levels have also been observed in some birds and mammals, and mercury is present in snow meltwater and air samples of the region.

Food is believed to be the predominant source of these contaminants to the people of Hudson Bay. Activities that are also potential causes of contamination include hydroelectricity developments, mining for metals including uranium, spills during transportation, and inactive municipal, industrial and military sites.

Increased mercury levels have been found in the muscle of Northwest Territory lake fish species, and in Hudson Bay beluga whales, ringed seals and benthic animals. Other contaminants have been found in beluga blubber (Toxaphene, PCBs, DDT, Chlordane) across the Northwest Territories and Hudson Bay. Elevated lead concentrations have been found in Hudson Bay sediments.[1]

< Other Environmental Problems >

Climate change is also an important environmental influence in the Hudson Bay region. It is believed that climate change will occur most dramatically at high latitudes, with increases in winter temperatures and snowfall and probable reductions in the extent and thickness of sea ice. The physical effects could include a gradual transformation of the arctic to the subarctic, with a northward movement of ice edges. At the very least, it will result in a shift in animal populations.

Apparently, Hudson and James bays are experiencing some impacts from climate change with earlier ice breakup. The ice-free shipping season has been extended, although annual variations still occur.[1]

< Environmental Protection Measures >

The waters of Hudson Bay fall within exclusive federal jurisdiction and thus are not part of the adjacent provinces or territories. There is a federal responsibility to protect the integrity of marine and freshwater ecosystems of the region and to account for the downstream cumulative impacts of provincial projects.

Canada's Oceans Act (1997) directs that the Minister of Fisheries and Oceans shall lead and facilitate the development and implementation of plans for the integrated management of all activities or measures in or affecting estuaries, coastal waters and marine waters that form part of Canada, or in which Canada has sovereign rights under international law. In the fall of 2000, Fisheries and Oceans Canada (DFO) initiated the Hudson Bay Integrated Management Project, with the following objectives.

- Adoption of a co-management governance model appropriate to the complex multi-jurisdictional legislative and regulatory context of Hudson Bay.
- Establishment of reasonable and open processes to facilitate development of an integrated plan for western Hudson Bay
- Establishment of objectives and guidelines that will protect, maintain or enhance the health of the Hudson Bay ecosystem.
- Development of effective communication processes for sharing information, including traditional and scientific knowledge.
- Promotion of stewardship of Western Hudson Bay by all interested parties.

Other environmental protection programs affecting Hudson Bay are as follows.

Arctic Marine Conservation Strategy (DFO)
National Programme of Action for the Protection of the Marine Environment from Land-based Pollution (national)
Northern Ecosystem Initiative (regional)
Northern Contaminants Program (regional)
Arctic Borderlands Ecological Knowledge Coop (local)

(Source:Newton S., Fisheries and Oceans Canada)
< http://www.carc.org/pubs/v19no3/2.htm >

▶Monitoring programs

The environment of Hudson Bay is monitored by various programs, such as the Arctic Monitoring and Assessment Program (global), Ecological Monitoring and Assessment Network (regional), Char and Beluga Monitoring Program (local) and Mackenzie Valley Cumulative Impact Monitoring Program (local).

▶Related organizations and NGOs

・Canadian Arctic Resources Committee < http://www.carc.org/ >

References

1. Hudson Bay Ocean Working Group, 2001, Examining the Health of the Hudson Bay Ecosystem. Proceeding of the western Hudson Bay workshop, Winnipeg, MB, October 25-26, 2000, Edited by D.G. Cobbs, S. Eddy and O. Banias, Oceans Programs Division, Fisheries and Oceans Canada.
2. D.B. Stewart, 2000, What Makes Hudson Bay Special, Fisheries and Oceans Canada Hudson Bay Workshop Reports.
3. R. Grant Ingram and Simon Prinsenberg, Coastal oceanography of Hudson Bay and surrounding eastern Canadian Arctic waters.
4. Magdalena A K Muir and Donn Pirie, 2000, Regulation of Marine Transportation and Implications for Ocean Management in Hudson Bay, Fisheries and Oceans Canada.