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Marine Conservation -- Keeping the Arctic Ocean on the Agenda

by Leslie Beckmann

" The Canada Oceans Act must acknowledge that there are limits to our management ability: it must mandate integrated, ecosystem-wide decision-making based on a precautionary approach. "

Summer fishing: fillets of arctic char.

The recent international dispute between Canada and Spain over turbot fishing has seen Brian Tobin, Minister of Fisheries and Oceans, win much domestic praise for vigorously promoting Canada's offshore fishing interests in negotiations with the Europeans. But Canada's oceans and their resources have captured othet national headlines recently: the collapse of the Atlantic cod stocks and the disappearance of millions of Pacific salmon. There is no doubt that Canada's efforts to manage the commercial fishery in its own waters have failed. By now, all Canadians are aware that, despite the government' s commitment to environmentally sustainable development, something is amiss with our oceans.

New approaches to marine management are urgently needed to deal with marine issues on the east and west coasts and to prevent similar crises in the North. Rather than simply managing the commercial fishery on a species-by-species basis, we must make conservation of both commercial and non-commercial species and their habitats the fundamental tenet of our national and northern marine policies. Fisheries politics must be replaced by ocean conservation.

The task before us is to deeply embed principles of conservation and sustainable development in marine decision-making.

A major initiative by Brian Tobin and the Department of Fisheries and Oceans (DFO) could go some distance towards this end. In November of last year, DFO released the federal government's "Vision for Ocean Management." This policy renewed a long-standing promise to promulgate a Canada Oceans Act to co-ordinate disparate marine programmes and to focus efforts strongly towards conservation. CARC believes that this legislation should serve as Canada' s Charter for the Oceans-a national vehicle to guarantee environmental conservation and sustainable development of Canada' s oceans and coasts. To do so, it must acknowledge that there are limits to our management ability and, accordingly, must require integrated, ecosystem-wide decision-making based on a precautionary approach. Only adoption of these principles in law will yield behaviour that preserves our marine "capital" so that we may always rely on the "interest" for our prosperity.

The next step will be to ensure that these principles are applied to all three coasts. While, in practice, the Arctic Ocean has been harvested chiefly to meet subsistence needs and thus seems insulated from the crises on the east and west coasts, it remains vulnerable. Long-range transport of toxic pollutants threatens marine mammals on which many Inuit depend. In- credibly, we still lack basic marine research facilities in the North that would help us determine how much can be harvested without damage to the marine ecosystem. And, many northerners eye Greenland's marine-based economy and foresee commercial development of living marine resources in Arctic Canada. For these reasons, among others, northern Canada must not come a distant third in the competition for legislative attention.

This issue of Northern Perspectives has been produced to underscore the need to address three of Canada's coasts in the policy arena. It begins with an article that provides a brief history of ocean management in the North, an overview of CARC's marine programme, and a review of several issues key to successful management of arctic marine ecosystems. The following article, prepared by Dr. Harold Welch of the Freshwater Institute in Winnipeg, presents, in detail, the problems confronting the northern marine environment and offers a suite of possible solutions to those problems. The final article, by Bruce Gillies of Nunavut Tungavik Incorporated (NTI), offers a review of the Nunavut Final Agreement and its implications for marine management in the North.

The Coldest Coast-Marine Issues in the North

by Leslie Beckmann

Though called different things, principles of conservation and sustainable development of the marine environment have been the basis for decision-making in Canada's North since aboriginal peoples settled there. The present discussion focuses on recent efforts to bring these principles into effect nationally and internationally.

The summer/fall 1994 edition of Northern Perspectives laid out the policy developments from the early 1970s in great detail. In brief, however, it is fair to say that a number of excellent policy statements, including the Canadian Arctic Marine Conservation Strategy, produced by DFO in 1987; DFO's promise to produce a discussion paper on a Canada Oceans Act by 1991; and the Department of Indian and Northern Affairs' Arctic Environmental Strategy produced in 1991, have failed to gain the public attention and political will necessary for full implementation. Two notable exceptions have been the conclusion of the Inuvialuit and Nunavut Land (and sea) Claims Agreements, which establish powerful and potentially effective co-operative structures for making decisions affecting land and sea areas within (and in the case of the Nunavut Final Agreement, adjacent to) the settlement areas.

Four key events occurred in 1994, however, to advance significantly the national debate on marine conservation.

- Firstly, The National Advisory Board on Science and Technology (NABST), which reports directly to the prime minister, released its report on Oceans and Coasts. Three years in the making, the report recom- mended a number of things, including a comprehen- sive marine environment protection system, to safeguard Canada's oceans for future generations' health, enjoyment, and economic welfare.
- Second, Parks Canada released its revised "Guiding Principles and Operational Policies," which includes a section on establishing Marine Conservation Areas.
- Third, the Canada Wildlife Act was amended to allow the establishment of wildlife areas out to 200 nautical miles (n.m.).
- Finally, DFO released "A Vision for Ocean Manage- ment," which outlines the essentials of a new ocean management strategy for Canada.

The revised guidelines from Parks Canada are particularly significant in that they recognize the need to design marine conservation areas to accommodate varying levels of human activity within them. This is particularly important in the North, where individuals rely heavily on fish and marine mammals for food. The result is that effective conservation measures can be set up to protect ecosystems without impinging on traditional rights.

Equally, the amendments to the Canada Wildlife Act are significant in that they allow much larger marine wildlife areas to be established. While primarily designed for the protection of seabird habitat, wildlife areas can be an effective means to protect marine mammals and the habitat upon which they depend for survival. This kind of protection is being sought by the community of Clyde River for the bowhead whale -- a protection which, it is hoped, will allow the bowhead population to reach levels that can again support a traditional hunt.

Perhaps most importantly, DFO, in releasing its "Vision," recommitted itself to the creation of a Canada Oceans Act, which will lay the groundwork for conservation and protection of Canada's marine environments.

Among other things, the new act will authorize the federal government to work with other governments and individuals to establish an "Integrated Management Regime." It will allow the government to monitor, preserve, restore, and enhance ocean quality and it will require the federal government to work with other governments and individuals to develop an integrated coastal and ocean management plan (or plans) to resolve use conflicts.

The last component is particularly important, given that many marine problems for which the federal government is responsible have their roots far inland, under provincial, municipal, and aboriginal government jurisdiction. In intent, therefore, the act, which could reach first reading by this summer, and the subsequent strategy development process which it enables hold a great deal of promise for marine conservation. CARC's goal is to see that the promise is kept (see box), both to the nation and to the North.

The CARC/CNF National Marine Conservation Strategy

In early 1994, in recognition of the then slow pace of the marine policy debate, CARC joined forces with the CNF to begin a national discussion on marine conservation in Canada. Called "the CARC/CNF National Marine Conservation Strategy Programme," its purpose is to develop a discussion document on a national marine conservation strategy and to advise government on the elements necessary for adequate marine conservation in Canada.

The first year of the two-year programme has been divided into three phases: research, workshops, and development of a draft discussion document on marine conservation.

Research

Three research consultants were hired to provide an overview of issues facing Canada's oceans. Evelyne Meltzer prepared the paper on the Atlantic; Richard Paisley, the paper on the Pacific; and Dr. Harold ("Buster") Welch, the Arctic Ocean paper, reprinted in this Northern Perspectives. Each author was asked to provide a biological overview of the coastal region, to outline the major

environmental and, where appropriate, economic issues facing it, and to review some of the regional efforts to address the problems facing the region. The papers then became the basis for discussion at the regional workshops occurring in Phase Two.

Workshops
February 7th, 1995, marked the first day of the first workshop to gather regional views on marine conservation. Five two-day workshops were held in total: one in each of St. John's, Newfoundland; Halifax, Nova Scotia; Inuvik and Iqaluit, Northwest Territories; and Vancouver, British Columbia. At the workshops the same two questions were asked of the 15 to 25 individuals representing a variety of interests: "what are the major stumbling blocks to adequate marine conservation of your oceans and coasts?"; and "what solutions can you suggest to solve the problems?" Interestingly, each region pointed to a suite of similar problems, yet each proposed slightly different solutions, a phenomenon that suggests the need for region-specific strategies for conservation.

A Discussion Document on Marine Conservation
The completion of the workshops on March 28th, 1995, also marked the beginning of the third phase of the programme's first year: preparation of the discussion paper on marine conservation. The paper, available shortly after Oceans Day (June 8), 1995, compiles the research work and integrates it with the results of the workshops. It contains a number of recommendations on the direction national marine policy should take to conserve Canada's oceans and their resources adequately for present and future generations.

Throughout our history, ocean policy has been created on an ad hoc basis, responding to issues rather than planning for them... Now is the time for Canada to break from the reactive approaches...of the past and take an innovatives proactive step. There is a need for a comprehensive policy strategy to manage and protect the marine environment.
- NABST Committee on Oceans and Coasts

Keeping the Promise in the North -- Arctic Ocean Issues

If federal efforts to revise the nation' s marine policy are to meet the needs of the most northerly ocean and the people who depend on it for survival, three major shortcomings must be addressed. These are

- a poor understanding of the marine management regimes set up under the Inuvialuit and Nunavut final agreements among policy-makers in the South;
- insufficient basic ecosystem research, the absence of which seriously hampers sustainable use decision- making; and

- insufficient federal attention to building international agreements to curb release of toxic pollutants that contaminate the arctic food web.

1. **Land-claims agreements**

   So as not to compromise the ability to meet future needs, the Inuvialuit and Nunavut agreements require that marine management decisions affecting Inuit lands and adjacent waters be made in consultation with the Inuit. As Bruce Gillies of NTI points out, however, simple ignorance of these requirements can mean that the Inuit are not involved in decision-making that affects them.

2. **Insufficient research**

   Basic ecosystem research can help to determine the kinds of harvesting and use the ecosystem can sustain without suffering irreversible damage. Very little of this kind of work is currently being done throughout the country, and almost none is being done in the North. This absence of information seriously hampers efforts to make decisions in support of sustainable use.

3. **International co-operation**

   Most immediate threats to the arctic marine environment are beyond Canada's control. Like foreign overfishing on the Grand Banks, pollution problems in the North stem largely from other couniries in which unregulated industrial activity releases toxic waste products that are carried by wind and water to the Canadian Arctic. Without co-ordinated international action and agreement to curtail pollution, the domestic problem will, at best, simply not improve.

   Insufficient international co-operation compromises the ability to conserve the arctic marine environment in a second way: it prevents the ecosystem from being managed as a whole. The cumulative effect of unco-ordinated decision-making could mean inadvertently exceeding sustainable harvest and development limits. The recent establishment by the eight circumpolar nations of the Arctic Environmental Protection Strategy has improved co-operation significantly.

   Participants at the northern workshops conducted as part of the CARC/CNF National Marine Conservation Strategy Programme (see box, above) suggested a number of ways to address these problems. Their suggestions included innovative ways to combine western science and traditional ecological knowledge, developing a northern research lab, and establishing an Arctic Council of heads of state from the eight circumpolar nations. Equally, the northern workshops revealed that northern co-operative decision-making may be a useful model for reducing conflicts in Canada' s more southerly oceans. The CARC/CNF National Marine Conservation Strategy Programme expects to have a discussion document ready shortly after

Oceans Day (June 8) 1995 that will expand upon each of these points and offer means to implement them.

Conclusion

The CARC/CNF National Marine Conservation Strategy Programme will, with the completion of the discussion document, have captured important regional views on marine conservation in Canada. CARC and CNF will then be well positioned to advise the government of the regional views on marine conservation and sustainable use as it builds and revises Canada's national marine policy. The second year of the programme will be dedicated to communicating the information gathered over the first year and working to assure its incorDoration in national policy.

Leslie Beckmann is CARC's Marine Conservation Advisor.

If you have comments or questions about the programme, or would like to suggest methods for marine conservation, please contact Leslie Beckmann at CARC at (613) 241-7379. Or you can fax or e-mail us: the fax number is (613) 241-2244 and the e-mail address is ay385@freenet.carleton.ca.

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Marine Conservation in the Canadian Arctic: A Regional Overview

by Harold E. "Buster" Welch

The following paper was prepared to facilitate discussion at the National Marine Conservation Strategy Programme workshops held in Iqaluit and Inuvik in March, 1995.

Aerial view: Resolute Marine Laboratory wet lab on jetty at Resolute Bay (currently not open due to lack of funding).
All photos by H.E. (Buster) Welch

Biophysical Characteristics

For the purposes of this paper, Canadian arctic marine waters include the Beaufort Sea eastward from the Yukon/Alaska border, all of the Arctic Archipelago, and Foxe Basin, Hudson Bay, Hudson Strait, and James Bay. These shallow seas are entirely within the Continental Shelf, except for parts of Baffin Bay and the Polar Basin (Arctic Ocean proper). This area includes about 173,000 km of coastline, twice that of the Canadian Pacific and Atlantic regions combined, and over 1 million km2 of continental shelf waters, equivalent to the combined extent of Atlantic and Pacific waters within Canada's 200-mile economic zone. These waters, which are generally as productive as or more productive than the adjacent arctic land surface, provide most of the food for Canadian Inuit. Except for the northwestern portion of the Archipelago and the Polar Basin itself, where multi-year ice exists year round, this is entirely an area of seasonal ice cover. Annual ice reaches 1-2 m thickness by May and is melted or exported almost entirely by September.

Because the ice is covered by a variable quantity of wind-blown snow that both reflects and absorbs solar radiation strongly, and because the sea ice absorbs some of the remaining radiation, on average only one to two percent of solar radiation penetrates to the water before snow melt in early June. Maximum sunlight typically enters the water column in July, after ice breakup, which means that, despite moderately high nutrient levels (inorganic nitrogen, phosphorus, and silica), phytoplankton production is limited to late summer. In shelf waters this phytoplankton bloom fixes 30-100 grams of carbon per square metre (30-100 g C-m2) of water surface (equivalent to 75-250 grams dry biomass); beneath multi-year ice in the Northwest Archipelago and Polar Basin, production is even lower. Ice algae growing on the underside of sea ice in spring addperhaps another 5 g Cm2 to this total. Thus, arctic waters produce only about one quarter of the organic biomass per unit area that is produced annually over the continental shelves of the Canadian east and west coasts.

Major currents include the clockwise gyre in the Beaufort; the flow of polar water southeast through the Archipelago; the West Baffin Current, which carries ice south along the east coast of Baffin Island in summer; the counterclockwise gyre in Hudson Bay; and the opposing eastward and westward tidal currents in Hudson Strait. Locally, the currents may maintain open water areas-so-called polynyas-for much or all of the year. The largest of these, the North Water in north Baffin Bay, is large enough to allow an early and persistent phytoplankton bloom. The North Water is therefore a biological "hotspot," and, like other smaller polynyas, serves as a winter refugium for air-breathing marine mammals and seabirds. Ice edges exist not only at polynyas, but along the floe edge between landfast and drifting ice. As the ice breaks off and recedes in spring, these ice edges become very important feeding and staging grounds for marine mammals and seabirds.

Unlike in the Antarctic, where herbivorous krill (~6 cm long) are a direct link between primary (plant) production and large consumers such as seals and whales, arctic primary production in the Arctic is grazed by relatively small herbivores such as copepods, pteropods, and invertebrate larvae, and thus another trophic level is necessary to link the herbivores and large carnivores. In the central and high Arctic, arctic cod-supplemented by amphipods, particularly the large pelagic Themist~provides this link. In southern Hudson Bay and James Bay, capelin and sand lance replace arctic cod as intermediate carnivores. The importance of arctic cod to the arctic marine food web can scarcely be overstated, and it has been estimated that 148,000 tonnes of these small fish are consumed annually by seabirds and marine mammals in the Lancaster Sound region alone.

Arctic cod, amphipods, and herbivorous copepods are in turn eaten by millions of seabirds concentrated in Jones and Lancaster sounds, on the east coast of Baffin Island, and in Hudson Strait/northern Hudson Bay, where thick-billed murres, northern fulmars, black-legged kittiwakes, black guillemots, gulls, dovekies, and loons feed. The majority of these birds are colonial nesters on island cliffs, requiring special protection from disturbance during the nesting season.

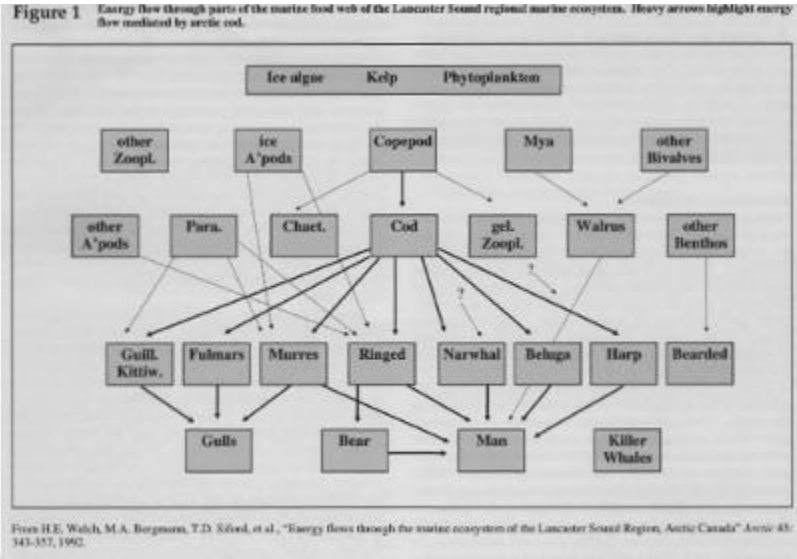
Arctic cod and other prey support several million resident ringed seals throughout the Arctic, along with migratory harp seals, beluga whales and narwhals in the eastern Arctic and beluga whales in the western Arctic. Bowhead whales filter-feed on zooplankton, probably large copepods,

chaetognaths, pteropods, and ctenophores. Since bowhead whale stocks were decimated by whalers, the western arctic stock has rebounded somewhat and supports a modest harvest by Alaskan and Canadian aboriginal peoples, whereas the eastern stock is still severely depleted, numbering only a few hundred animals. The central Arctic and the northwestern Archipelago, coinciding roughly with the distribution of permanent pack ice, is devoid of the major migratory seabirds and marine mammals, and the density of ringed seals is also low. Ringed seals are the primary food of polar bears, which, along with humans, occupy a clearly-defined fifth trophic level (Fig. 1). Although Figure 1 is a crude approximation of a very complex real-life food web, the trophic levels of the main predators have been verified by stable isotope analysis and the diagram can be used as a model for marine food webs elsewhere in the Canadian Arctic, although in the western Arctic and Hudson Bay some of the component species, such as fish, may be different.

Total energy flow is divided about evenly between the benthos and zooplankton, in contrast with energy flow in deeper seas, where most primary production is consumed in the water column. Arctic bottom organisms tend to be long-lived (e.g., the clam Mya truncata reaches 55 years of age) and to maintain very high biomass with relatively slow growth. The average composition of the benthos is similar to that in temperate oceans, but with different species. The benthic community supports a variety of small benthic fish (sculpins, zoarcids, blennies, and Greenland cod) in the low Arctic as well as the eastern arctic walrus, which feeds primarily on the bivalves M. truncata and Serripes groenlandicus and benthic-feeding old squaw and eider ducks. Walrus, like bowhead, thus feed low on the food chain, although they occasionally eat ringed seals.

Commercial fishery potentials in true polar Canadian waters are small. Anadromous arctic char derive most of their energy from the sea via amphipods, arctic cod, pteropods, and capelin, but are not important components of marine energy flow. The commercial fishery for arctic char is worth about $1.2 million annually; the domestic char fisheries have an approximate equivalent value. Most of the major char populations are harvested at or above maximum sustainable yield. Anadromous coregonids support subsistence fisheries in Hudson and James bays and in the Beaufort Sea and may have a small commercial potential.

Greenland halibut, commercially called turbot, are found in deep Baffin Bay and Arctic Ocean waters in commercial quantities and support a successful shore-based winter fishery worth $1 million annually out of Pangnirtung, south Baffin Island. Redfish, round-nosed grenadier, and Greenland sharks are also present in Baffin Bay in commercial quantities. Shrimp are found in south Baffin and Hudson Strait waters, and scallops have been found off south Baffin Island and in Hudson Bay, although the commercial potential is probably small. Shallow coastal waters probably have no invertebrate or fish populations capable of sustaining significant long-term fisheries, with the possible exception of the bivalves *M. truncata* and *S. groenlandicus*. These clams are present in shallow coastal waters in densities over 100/m2 and can be harvested by hydraulic dredge, although there has been no serious effort to do so. There is a large biomass of kelp in nearshore shallow waters throughout the eastern Arctic, but its commercial potential has not been assessed.



Marine mammals and seabirds are the main biological products of Canadian arctic seas. Seabird populations are generally stable or, in the case of thick-billed murres, declining because of mortality elsewhere in their range (incidental netting, oil fouling, and hunting). Marine mammal populations are generally stable, although population data are not adequate to detect any but the grossest population changes. The annual yield to humans is in the order of 130 beluga in the western Arctic and 300 beluga, 330 narwhal, and 390 walrus in the eastern Arctic. A large harvest of high arctic beluga and narwhal stocks by Greenlanders compounds the management/conservation problem. While there are no current harvest statistics for ringed seal, and populations appear to be stable, production to humans and polar bears is probably near maximum yield. With no large sources of marine production left to exploit, priority must be given to at least maintaining the level of current domestic consumption by the careful husbandry of existing populations.

The long food web in arctic marine systems contrasts with the web in arctic terrestrial systems, where herbivores (caribou, muskox, geese, rabbits, ptarmigan) are taken by humans occupying the third trophic level. The terrestrial system may produce as much or more consumable meat per unit area as does the sea; however, the shorter food chain suggests its primary production per unit area may be lower. The long marine food chain also encourages the biomagnification of pollutants, which are present in surprisingly high concentrations in top marine predators.

The arctic marine system has the following important attributes:

- very large size;
- low and intensely pulsed primary productivity, caused by seasonal ice and snow that covers the sea for most of the year;
- relatively low food web diversity but long food chains supporting top predators;
- long-lived species with low reproductive rates and multi-annual generation times;

- polynyas and ice edges, which are particularly important to spring and early summer concentrations of migratory mammals and seabirds;
- concentration mechanisms leading to unexpectedly high contaminant levels in top predators;
- susceptibility of seabirds to oil fouling;
- a diversity of marine mammal stocks, some of which are harvested by other countries besides Canada;
- a human population that is scattered and low density and that is dependent upon marine mammals for food and cultural continuity;
- heavy ice, which makes ship navigation difficult and requires special hulls and restrictions.

Threats to Ecosystem Integrity

We assume here that a complete, functioning ecosystem includes the higher trophic levels (marine mammals, sea birds, and polar bears). Top predators may have feed-back effects that help the ecosystem to be structured and to function as it does; in addition, top predators are the primary "ecosystem product" of interest to user groups. This is an important point, because most of the threats to arctic waters are directed towards higher trophic levels.

Hydroelectric development

Hudson Bay and James Bay, and possibly Hudson Strait and the Labrador Sea, have been and will continue to be affected by hydroelectric developments in Quebec, Ontario, and Manitoba. There have also been proposals to dam various headwaters of the Mackenzie River. The primary effect of damming is a change in flow regime, with an increase in winter flows and a decrease in summer flows. This in turn may change ocean currents, near-shore ice conditions, nutrient availability, the timing and magnitude of ice algal and phytoplankton production, the first feeding of larval fish, use of estuaries by marine mammals and anadromous fish, and patterns of sea and land use by residents and transients along the coasts. Increased mobilization of mercury is also a concern. While measurable changes occur to marine ecosystem structure and function as a result of hydroelectric development, such changes are probably concentrated near shore. More subtle offshore biological effects are almost certain, but current knowledge of the Hudson and James bays ecosystem is so poor that we can only guess at long-term changes. The Department of Fisheries and Oceans (DFO) has held workshops to hypothesize such effects and has designed a comprehensive research program to provide information on the structure and function of the Hudson Bay ecosystem and the results of river damming on downstream marine ecosystems.

It is probably not possible to put a dollar figure on ecosystem changes resulting from hydroelectric development in Hudson and James bays, partly because there are no commercial marine fisheries, partly because the changes affecting aboriginal lifestyles are difficult to quantify, and partly because the changes themselves have not been described. Once in place, hydroelectric

developments are irreversible, although some impacts. such as mercury methylation, may diminish with time.

Long-range transport of pollutants

A second threat to ecosystem integrity is the long-range transport of pollutants (LRTP) into the Canadian Arctic from agricultural and industrial activities elsewhere in the Northern Hemisphere. There are two important groups of LRTP contaminants: persistent organic pollutants (POP), usually halogenated compounds with chlorine, bromine, and/or fluorine; and heavy metals, particularly mercury and cadmium. These dangerous substances are all difficult to metabolize, so they bioaccumulate along the food chain, culminating in top predators such as marine mammals, seabirds, and humans. Compounds such as DDT and PCB are somewhat volatile and evaporate from cropland, dump sites, lands, and waters to the south. They may enter the Arctic via ocean currents (par- ticularly in Baffin Bay and Hudson Strait), but their main pathway is atmospheric transport. They preferentially ac- cumulate by condensation in the cold environment. Persistent winter air flows from Eurasia over the Pole into the central Canadian Arctic deposit thousands of tonnes of soil, fly ash particles, and associated pollutants on sea and land. These then enter the ocean during melt in June, are concentrated by ice algae and phytoplankton, and are passed down the food chain. At each trophic (feeding) level, about 90% of ingested energy is burned off metabolically, leaving about 10% as growth; however, POP and mercury are not efficiently ex- creted, resulting in a very approximate 10-fold concentration increase at each trophic level. Since arctic marine food chains are long, contaminants are often concentrated a million fold or more from water to top predators, at levels high enough to constitute potential health hazards for the animals and humans who eat them.

Mercury has always occurred in natural ecosystems and is naturally high in long-lived top predators such as seals, whales, and polar bears; however, global industrialization has mobilized additional mercury, particularly from the burning of coal and municipal wastes. Bottom cores taken in arctic lakes and in Hudson Bay reveal that mercury in sediments has increased about 3-fold in the past 75 years. This is corroborated by the concentration of mercury in the air over the North Atlantic Ocean, which has increased about 1.5% per year from 1977 to 1990, and by the increase of mercury in seabirds in the North Atlantic. Likewise, present-day mercury concentrations in the hair of Greenland humans and seals is 3-4 times higher than it was in the hair of pre-industrial humans and seals. The amount of specialized liver enzymes (metallothioneins and mixed function oxidases) correlates with concentrations of mercury and POP in marine mammals, but we have no knowledge of what the physiological and behavioral effects of this probable increase in mercury concentration in top marine predators might be. We can surmise that continued increases will place predators at risk (Weiner and Spry 1994). Unlike humans, bears and seals cannot switch to an alternative food source. Sublethal effects of pollutants on arctic aquatic predators need research.

Thus LRTP contaminants, via effects on top predators, may pose the most important threat to arctic marine ecosystem integrity. The economic and cultural costs of the loss of, say, polar bear are virtually incalculable. The difficulties of "clean up" are enormous, since it would require scrubbers

to remove mercury from combustion products and global action to reduce or eliminate the use of POP. We can regulate our own country, but it will be much more difficult to convince, for example, India that it should no longer use DDT.

Climate change

There is general agreement that the effects of climate change will occur most strongly at high latitudes, with increases in winter temperature and snowfall and probable reductions in the extent and thickness of sea ice. These physical effects will result in a gradual transformation of arctic into subarctic, with a general northward movement of ice edges and other boundaries. At the very least, there will be a shift in animal populations, although it is not possible to predict an entirely negative impact of climate warming on arctic marine waters; overall productivity might increase and some stocks of marine mammals and seabirds may flourish. At present we can only flag climate change as a concern for arctic seas, recognizing that little will probably be done to reverse the release of carbon dioxide and other compounds that increase the greenhouse effect.

Over-hunting

The harvest of marine mammals and birds is perhaps the most immediate and obvious threat to ecosystem integrity. Historic losses and reductions, mostly from commercial hunting, include the almost total extirpation of eastern arctic bowhead whales, the severe reduction of western arctic bowheads, the loss of Ungava Bay beluga, and the reduction of walrus stocks. Current low populations of beluga in eastern Hudson Bay and southern Baffin Island are a result, at least in part, of overhunting by aboriginal peoples.

Until the Inuvialuit and Nunavut land-claims settlements, marine mammal management was a responsibility of the Department of Fisheries and Oceans (DFO). Now comanagement mechanisms are in place and there are high expectations that stocks endangered by over-hunting will receive the protection they need to ensure conservation. Should over-hunting continue, however, there is a high probability that some whale stocks will be either eliminated or taken to such low levels that they will no longer be effective components of the ecosystem.

The implication of over-hunting is both economic and cultural, since aboriginal people depend upon marine mammals as a major source of food and as a mechanism for cultural inheritance. Control of over-hunting is relatively simple and straightforward compared with controlling other ecosystem threats such as LRTP pollutants and hydroelectric development. Ineffective management may cost the existence of the stock(s) in question, because once a stock decreases below a certain threshold it may not be able to recover readily. An example of slow recovery is the eastern arctic bowhead stock, which, despite 75 years of protection, still numbers only a few hundred animals.

Non-renewable resource extraction

Non-renewable resource extraction poses relatively minor threats to specific geographic areas, for example, the Polaris and Nanisivik base metal mines and the Bent Horn oil field in the high Arctic. Oil and gas exploration, especially in the Beaufort Sea, has been a source of hydrocarbon contamination, primarily from drilling muds and to a lesser extent from chronic fuel spills. The

potential for catastrophic oil spills from wells, tankers, and pipelines will be greater during the production phase, thought not to be likely for perhaps two decades. While we can be confident that stringent regulations governing production will be set in place, oil spills around the world show that some contamination is inevitable and massive disasters not unlikely. Massive oil spills threaten arctic marine ecosystem integrity primarily through effects on mammals, birds, and possibly coastal stocks of migratory fish. Depending upon location and time of year of a major oil spill, the damage could range from moderate to extremely severe.

There was a proposal to remove natural gas from the Sverdrup Basin (high arctic islands) eastward through the Northwest Passage, using two bulk liquified natural gas carriers that would transit the Passage 60 times per year. This activity would have negative impacts on the bird and mammal concentrations of Barrow Strait-Lancaster Sound and is unlikely to be approved. There has been no environmental assessment of a proposal to develop a port east of Coppermine for shipping base metal concentrate from Izok Lake to markets eastward, which would also result in heavy ship traffic through the eastern Northwest Passage, including through summer beluga whale concentrations in Peel Sound.

Other threats

Ozone depletion over the poles has resulted in increased ultraviolet radiation (UV) flux. The current consensus is that there may be minor damage to phytoplankton at high latitudes but probably not enough to affect ecosystem integrity. Likewise, radionuclide contamination, particularly from Russia, has received a lot of press, but indications are that increased radiation levels are currently undetectable even close to sunken reactors and are unlikely to pose an immediate threat to marine ecosystem integrity in the Canadian Arctic

Stakeholders

We can distinguish four classes of stakeholder in arctic marine systems. First, there are consumer groups who harvest the products of the system in some way, e.g., Inuit hunters. Second, there are non-consumptive groups who nevertheless depend on the integrity of arctic marine ecosystems, e.g., tourists. Third, there are groups that do not depend on the integrity or the products of the system, but are nonetheless dependent on regulation in so far as it may affect their activities, e.g., the shipping industry. Fourth, there are advisory and management groups that may have considerable influence on policy development but are not themselves users of the resource (e.g., the Canadian Polar Commission).

Class 1: Consumer groups dependent upon ecosystem integrity.

Foremost are aboriginal people and, to a much lesser extent, non-aboriginals who depend upon marine products for domestic and commercial use. Most Inuit are maritime people-Baker Lake is the only Inuit settlement not located on the sea-directly dependent on marine products for subsistence and economic development. It is difficult to overstate the importance of the sea to a people whose main traditional belief centres on a mythical half-woman, half-sea mammal creature that lived on the sea bottom and controlled the seals, whales, and walrus used by humans above.

Aboriginal user groups are represented at several levels of organization. Internationally, the Inuit Circumpolar Conference (ICC) represents all arctic aboriginals from Canada, United States, Russia, and Greenland, and is a powerful voice for arctic peoples as a whole. Regionally in the Canadian Arctic, marine consumer groups fall almost entirely under one of three land-claims agreements: the Inuvialuit Final Agreement, the Nunavut Land Claims Agreement, and the James Bay-Northern Quebec Agreement. A Makivik offshore claim for Hudson Bay is also currently being negotiated by Makivik and the federal government. Co-management boards established under these agreements integrate regional Inuit organizations and community-based Hunters and Trappers Organizations (HTOs). Beneficiaries of land-claims agreements have first priority for both domestic and commercial resource use.

Walrus near Resolute.

An existing Economic Development Agreement (EDA) between the federal government and the Government of the Northwest Territories (GNWT) provides funding for exploratory marine fisheries, but not in the context of a long-term land-use and sustainable fisheries plan. Economic considerations have prompted development of the Keewatin char fishery in the absence of initial comprehensive stock assessments, leading to probable over-capitalization and possible stock depletion.

Class 2: Non-consumers dependent upon ecosystem integrity.
All Canadians and the world population at large have a stake in the continued integrity of the arctic marine ecosystem, simply because "it's there" and because the "products" are the lure and stimulus of top predators. Ecotourism is a manifestation of this demand.

This national and international concern is focused through the various non-governmental organizations (NGOs) that serve as watchdogs over arctic affairs. Probably the best known and most effective within Canada is the Canadian Arctic Resources Committee (CARC). The World

Wildlife Fund (WWF) and the ICC are important players on the international arctic conservation scene. NGOs are generally sympathetic to aboriginal people and have emphasized the importance of traditional knowledge and the aboriginal holistic world view to the process of protection for arctic marine resources.

Ecotourism is potentially the largest economic engine based upon renewable resources in the Canadian Arctic, although I am not aware of any representative associations (GNWT's Dept. of Economic Development and Tourism is a contact point). Heritage Canada (previously Parks Canada) is another government agency with a large stake in arctic marine ecosystem integrity.

The world scientific community is also a stakeholder. The biophysical extremes exhibited by polar systems are important "anchor points" and test sites for many scientific theories and relationships; arctic data are important inputs in general circulation models to predict climate change; and glaciers, rocks, and ruins hold secrets of history. Even though much arctic science does not directly benefit northerners, the international science community needs access to the Canadian Arctic.

Class 3: Non-consumptive groups not dependent upon ecosystem integrity.
The non-consumptive groups include the federal departments of Natural Resources Canada (NRCan, previously Energy, Mines & Resources), Canadian Coast Guard (CCG, now part of Fisheries and Oceans), and Defence. Regulations and conservation measures established to protect the arctic marine ecosystem constrain the activities regulated by these departments, including shipping and the extraction of non-renewable resources.

Industrial organizations include the petroleum industry (Arctic Petroleum Operators' Association), Cominco Ltd. (Polaris Mine), and Nanisivik Mines Ltd. There are also potential mining ventures, such as the Kiggavik uranium mine near Baker Lake and the Izok Lake base metals mine, that would have an impact via shipping.

Class 4: Advisory and regulatory groups.
Class 4 includes all federal departments with regulations controlling various aspects of arctic marine activities. Within and between these departments are organizational units and advisory groups. There are also non-departmental advisory organizations at the national and international levels, such as the Canadian Polar Commission and the International Arctic Science Committee. A brief listing of federal departments and their primary responsibilities for regulation of arctic marine affairs follows.

- **Department of Fisheries and Oceans.** DFO has the legal responsibility to conserve habitat and stocks in Canada via the Fisheries Act and by so doing it discharges some of Canada's national and international obligations to maintain the integrity of arctic marine ecosystems. Under the current Program Review, DFO is expected to expand its role as lead agency for marine issues on all the coasts. DFO is also working on preparation of the Oceans Act.

- **Department of Environment.** DOE has legal responsibilities to look after various environmental aspects of the Canadian Arctic and is the home of the Canadian Wildlife Service (CWS), which manages polarbears and seabirds.
- **Heritage Canada.** This agency is responsible for national parks, including national marine parks.
- **Department of Indian Affairs and Northern Development.** DIAND has a direct interest in Canadian arctic marine affairs because of its legislated responsibilities to protect the Arctic and to co-ordinate government activities in the North. DIAND usually co-ordinates environmental review efforts on behalf of the other government agencies (DFO, DOE, TC, etc.), which do the bulk of the work. The Environmental Assessment Review Process (EARP) is expected to become more cohesive and streamlined with the recently promulgated Canada Environmental Assessment Act (CEAA).
- **Canadian Coast Guard.** The Department of Transport (DOT) has recently transferred CCG responsibilities to DFO, transferring with it responsibility for some legislation regulating shipping in arctic waters. The Canadian Coast Guard is an important player in arctic marine affairs.
- **Government of the Northwest Territories.** GNWT regulates various activities via ordinances and retains some authority over marine affairs via participation in co-management boards.
- **Co-management boards.** Set up under the authority of various land-claims agreements, these boards will have enormous influence on day-to-day decisions regarding arctic marine conservation.

The Role of Land-claims Agreements

The Inuvialuit Final Agreement was the most comprehensive land-claims settlement in Canada when it was signed in 1984. Its provisions for land-use planning, environmental review processes, and wildlife and fisheries management included the establishment of an Environmental Impact Screening Committee to assess the impacts of any development. If the committee considers any impacts to be serious, it refers the matter to the Environmental Impact Review Board, which advises the appropriate government agency whether the project should go ahead. The agency then decides if the project can proceed and under what conditions, if any. The government may also initiate an EARP. Both the screening comrnittee and the review board are composed of equal numbers of Inuvialuit and government appointees and a government-appointed chairman with a tie-breaking vote.

For the management of fisheries, including marine mammals, the agreement establishes the Fisheries Joint Management Committee (FJMC), with two Inuvialuit and two government members and a tie-breaking chairman selected by the committee itself. The FJMC advises the minister of Fisheries and Oceans as to quotas, regulations, and research and allocates subsistence quotas among communities. The minister can accept or reject the recommendations, with provision for

further consultation with the FJMC. At the community level, Hunters and Trappers Committees (HTC) suballocate quotas, set local by-laws, and serve as the liaison between the community and the FJMC. Prefacing all the legislation for fish and game management is a statement pledging conservation of stocks: 14 (1): "A basic goal of the Inuvialuit Land Rights Settlement is to protect and preserve the Arctic wildlife, environment and biological productivity through the application of conservation principles and practices." Thus, although management board decisions can be overridden by the minister on the basis of stock conservation, the boards are true co-management structures and are the legal authority over fish, game, and habitat.

The Inuvialuit Final Agreement also states that Inuvialuit are to have equal representation on any land-use planning boards that might be established, although no such planning boards were explicitly specified in the agreement.

The Nunavut Final Agreement (1993) for the central and eastern Arctic, exclusive of Quebec, is more comprehensive and specific than the Inuvialuit Final Agreement in its provisions for aboriginal control over marine habitat and stocks. It specifically provides for land-use planning by establishing the Nunavut Planning Commission, composed equally of government and Inuit representatives, and contains strong statements that habitat and wildlife will be managed according to the principles of conservation. Government retains the ultimate responsibility for wildlife conservation; however, beneficiaries have the right to take marine products up to the limit of their basic needs level (first priority), including intersettlement trade. Resident non-beneficiaries have next priority, then existing economic ventures, then beneficiaries have first refusal for the usage of further allowable catch. Inuit have preference in the development of economic structures based on harvesting, tourism, parks, and other marine products and the right of free access and harvesting up to the total allowable harvest for each stock in any national park, park reserve, and conservation area that may be set up, unless they decide voluntarily to limit their access or take.

Management of wildlife (including fish, sea birds, and marine mammals) is the responsibility of the Nunavut Wildlife Management Board (NWMB), composed of one member appointed by the GNWT, three members appointed by the federal government, four members from designated Inuit organizations, and a tie-breaking chairman selected by the NWMB itself. Thus the NWMB is a powerful body with a mandate to control all aspects of marine harvesting and conservation in the Nunavut Settlement Area. The minister of Fisheries and Oceans can interfere with this right only if it is demonstrated that NWMB actions threaten the conservation of stocks. The agreement further states that the Nunavut Impact Review Board, the Nunavut Water Board, the Nunavut Planning Commission, and the NWMB may jointly form a Marine Council, an advisory body only.

The NWMB effectively brings four levels of government together under one umbrella. Representing the GNWT, the federal government, and designated Inuit organizations, it is likely to delegate part of its responsibilities to regional wildlife organizations and community-based Hunters and Trappers Organizations (HTOs), which will have considerable input into decisions related to harvesting, catch allocation, economic development based on marine resources, and marine research programs. Procedures and practices are still evolving but an example of the exercise of

local control occurred in Resolute in April 1994, when the Resolute HTO requested a ban on scientific research activities in an area heavily used by ringed seals. Although the NWMB did not approve the request (the expected routing would be HTO -NWMB, then NWMB would make the request), research activities were immediately adjusted to meet local concerns. One hopes that the NWMB will not delegate too much power to HTOs, because many decisions require a more global viewpoint than is likely at the community level.

If the FJMC experience is any indication, the NWMB should evolve into a responsible mechanism for the wise use of marine resources. There is the inevitable learning curve, while aboriginal and non-aboriginal members develop trust in each others' motives and decisions, and this learning experience will help shape the way the board eventually works. Government must recognize that Inuit will act in their own best interest by conserving stocks at levels at least high enough to provide maximum sustainable yield; Inuit must realize that it is no longer a "them-us" dichotomy and that government efforts to conserve stocks represent the best policy in the long run. Such trust will preclude issues like the southeast Baffin beluga controversy, where DFO wanted a greatly reduced kill because it believed the stock to be depleted and the Inuit thought that scientific advice was just an obstacle to restrict their hunting. Both DFO and Inuit are now working together on the Southeast Baffin Beluga Committee to resolve the issue.

A parallel situation exists for some fish stocks, notably the arctic char run in the Sylvia Grinnell River at Iqaluit. Historically depleted by overfishing, this stock is being exhausted by the netting of small fish before they reach the size at which total biomass production is maximized. The run itself is in no danger of extinction since there is sufficient spawning escapement and smolt (juvenile) production, but continued disagreement between users and regulators keeps actual production well below its potential.

The Nunavut Agreement gives beneficiaries the right of free access and hunting, within the limits of stock conservation, on all land and territorial waters regardless of any other status, which means that parks and conservation areas are accessible to Inuit for harvest purposes, whereas they may be off-limits to non-Inuit. Indeed, Inuit see conservation areas as a mechanism for the protection of stocks from industrial and other influences, in effect creating large game preserves where production is maximal. This is part of the reasoning behind the proposed Isabella Bay bowhead sanctuary.

The Role of Science

Despite the enormity of Canadian arctic seas, the amount of scientific work performed there has been only a tiny fraction of that performed off the east and west coasts (see Fraser 1994). Most has been done on seabirds, marine mammals, stock assessments, and contaminants; very little research has been aimed at basic understanding of marine ecosystem structure and function. As a result, we remain largely ignorant of production mechanisms, food webs and rates of energy transfer, and the physical regimes that ultimately control these processes.

The reasons for this dearth of basic research are easy to find. First and foremost, there are no permanent facilities in the Arctic that provide ship and wet lab support, both absolutely essential for most kinds of basic marine biology. The absence of such facilities immediately eliminates university scientists, who lack the large-scale funding that would enable them to mount their own independent programs. Second, DFO, which has the mandate to conduct basic marine research, has not had an identifiable arctic marine research program (ARA 1991). Marine research in the Arctic has been heavily dependent upon B-base special project funding through programs such as the Northern Oil and Gas Activity Program (NOGAP), the Panel on Energy Development (PERD), the Environmental Studies Revolving Fund (ESRF), Green Plan, World Wildlife Fund (WWF), and land-claims agreements and has been oriented to specific issues such as stock assessments and contaminants. The "ecosystem" is never an issue, so research on it is poorly funded. This is particularly critical in the Arctic, where there are not decades of baseline data upon which to make decisions. "With most applied work it is like trying to build a house of cards on a wooden table; in the Arctic, there is not even a table" (G.B. Ayles, pers. comm., 1994).

The result of this imbalance of research efforts between the coasts is nowhere more apparent than in our lack of understanding of the Hudson Bay system and the potential cumulative effects of upstream hydroelectric development. Likewise, contaminants are an issue in the Arctic and, while Green Plan money is supporting a modest research program on contaminants levels in ecosystem components, the corresponding research on ecosystem structure and the effects of contaminants on non-human components, both necessary for interpretation of contaminant concentrations, is conspicuously absent.

The lack of basic ecosystem knowledge has become obvious during the process of establishing marine parks in the Arctic. Fairly specific knowledge of bird and marine mammal habitat exists, but there are so few data on ecosystems that selection of representative or valuable areas in some marine regions is no more precise than throwing darts at the map.

The importance of scientific knowledge to arctic marine conservation is explicitly stated in the DFO Arctic Marine Conservation Strategy, which lists science as the first of six implementation strategies. The reason is obvious: if the structure and function of a marine system are unknown, it is probably not possible to protect it from human-induced changes.

The Role of Traditional Knowledge

It is within the co-management regimes that traditional knowledge comes into play in the decision-making process. Aboriginal users of natural resources have built up a great storehouse of knowledge about their prey and the ecosystems that produce those prey. Aboriginal peoples have also developed a belief system that is still with them today -- the theme of which is the holistic nature of ecosystems: All creatures and the earth are interrelated, such that interference with one may have unpredictable effects elsewhere in the system. I have heard Cree from Hudson Bay state that the damming of rivers will have dire effects, even though aboriginal people and western

scientists alike do not know what all the effects might be. In a similar vein, Inuit object to ranking the importance of species both to ecosystems and to themselves, stating that all species might at one time be valuable as food and that all species have a function within the system, even if that function is unknown. Thus aboriginal people are Canada's original ecosystem ecologists. Their belief in the interrelatedness of things is accompanied by their respect for the creatures that must be killed so that humans might live. Hunting and fishing for sport is not always understandable and, even today, aboriginal people raised on the land do not appreciate catch-and-release fish conservation practices. Don't toy with your food -- if you catch it, you use it.

Until land-claims agreements installed meaningful co-management structures, traditional knowledge had little chance for expression in government policy. Now that aboriginal people have equal representation on management boards, traditional knowledge and beliefs are incorporated into management decisions, as described by Bell (1994) for the FJMC. We can assume that the NWMB will also incorporate traditional knowledge into its decisions. Since the overriding concern of northern aboriginals is the sustainability of resource harvesting, it is likely that co-management boards, including those for land-use planning, will incorporate a strong conservation and ecosystem integrity ethic into decisions. We can hope that the tools of western science will be combined with the knowledge and belief systems of Inuvialuit and Inuit to produce a strong amalgam of protective armour over northern marine ecosystems. As Bell (1994) puts it, "The magic of co-management is not that it brings aboriginal people to the science table, but rather that it makes science available to aboriginal people so that they can use it as a tool along with their indigenous knowledge...to make decisions consistent with their underlying philosophy of wise use."

A notable exception to the general lack of application of traditional knowledge to ecosystem problems is the Hudson Bay Programme (HBP), sponsored by CARC, the municipality of Sanikiluaq, and the Rawson Academy of Aquatic Sciences (of which CARC members will be aware). Using a combination of western science and traditional knowledge, the HBP seeks to assess cumulative impacts on the Hudson Bay bioregion. It sought input from elders and hunters from aboriginal communities encircling the bay, spearheaded by leaders from Sanikiluaq. This traditional ecological knowledge and management systems information was then compared and combined with a compilation of scientific data in a workshop in May 1994. Undoubtedly the largest formal compilation of traditional knowledge ever made outside the field of anthropology, it holds a wealth of information about Hudson Bay and the belief systems of the aboriginal people that depend upon the bay for subsistence and will become a guide for future interactive studies using traditional knowledge.

Current Efforts to Protect Arctic Marine Systems

There is an array of legislation designed in whole or in part to protect arctic marine ecosystems. Federal acts include the Arctic Waters Pollution Prevention Act, the Canada Shipping Act, the Fisheries Act, and the Canadian Environmental Protection Act. Provincial-type statutes include the Department of Indian Affairs and Northern Development Act and the Northwest Territories Act.

Relevant territorial ordinances include the Environmental Protection Ordinance, the Parks Ordinance, and the Wildlife Ordinance. It is obvious from reading the existing legislation that there are both duplications and gaps regarding the protection of arctic marine waters. An Oceans Act might serve as umbrella legislation, cover the gaps in existing regulations, and specify lead agencies with responsibilities for arctic marine protection. An important federal policy directive is the EARP. Another initiative to protect the arctic system is the Canadian Coast Guard effort to develop Arctic Environmental Sailing Directions that will assist shipping to reduce impacts on birds, mammals, and the environment.

The DFO is the logical agency to spearhead protection of the arctic ocean ecosystem, since it is already responsible for all stocks except polar bears, as well as for marine fish habitat, and has the mandate over oceans. One objective of current negotiations between DFO and DOE to clarify roles vis-a-vis fresh and marine waters is to strengthen the prime responsibility for all aspects of ocean management within DFO. DFO's procedure for protection of the marine ecosystem usually begins with management plans for individual stocks, the first step being stock assessment, followed by a fishing plan specifying total allowable catch. DFO has been working at these plans and presenting results to the joint management boards, which have not been able to conduct the research themselves. Plans for marine mammal stocks include the Canada / U.S. beluga plan; the Beaufort Sea beluga management plan; the Southeast Baffin beluga plan; the Eastern Hudson Bay beluga plan; and the western Arctic bowhead plan, which was precipitated in part by the political need to have some sort of management plan in place before taking bowheads in the Beaufort Sea.

Research vessel *Ogac*. The 25-tonnne, 43-foot vessel, operated out of Resolute Bay between 1988 and 1990, has been dry-docked at Nanisivik for the past four years due to lack of funding.

The 1984 Task Force Report on Northern Conservation "placed responsibility for developing Arctic marine environmental conservation policies at the feet of the Department of Fisheries and Oceans by recommending that the Department assume its legitimate responsibilities as the lead agency for Arctic Marine Conservation." In response, DFO published the Canadian Arctic Marine Conservation Strategy discussion paper in 1987, calling for a series of action plans based upon six implementation strategies.

The first strategy, science, requests science to provide biological advice to DFO managers on arctic fish and marine mammals stocks. Unfortunately, additional internal funding for arctic marine science was not forthcoming, which has resulted in issue-specific research funded by B-base sources, without a corresponding level of support for research on ecosystems.

The second strategy is shared management, which has come to pass with the land-claims settlements. DFO has been a willing and effective partner in the co-management process.

The third strategy is integrated resource planning and management. There have been some land-use planning initiatives (Lancaster Sound region, Mackenzie delta-Beaufort Sea region, the west Kitikmeot region, the Keewatin region), although there is a long way to go before reasonably complete integrated resources planning is established. The strategy also called for streamlining EARP guidelines, which has occurred with the proclamation of the CEAA.

The fourth strategy is protection of marine environmental quality. Hydroelectric impacts are mentioned specifically, but DFO itself has recognized that existing data for Hudson Bay are inadequate to assess impacts and has developed plans for a multi-disciplinary study of the Hudson Bay system. This strategy includes the establishment of a system of marine protected areas in the Arctic, on which some progress has been made by Heritage Canada.

The fifth strategy, public knowledge, calls for education of Inuit and the general public regarding the arctic marine system. Again, no new money was forthcoming to implement this strategy. It also advocated training northerners for responsible positions. There has been some progress on this matter, although Inuit technical staff have also been lost to attrition.

The sixth strategy, international considerations, is a mixed bag. On one hand, the department is participating in bilateral talks with the United States and Greenland on shared stocks but, on the other hand, individual scientists are hindered by a lack of funds and by a travel policy that discourages participation in international conferences and research efforts.

Finally, the conservation strategy calls for a steering committee and an annual audit of progress; this has not happened.

In summary, DFO developed an excellent Arctic Marine Conservation Strategy, but government departments, particularly DFO, were unable to follow through on many of the components because

resources for implementation dried up as industrial activity in the Arctic decreased and the federal government reduced spending.

Currently there is no marine protected area in the Canadian Arctic, aside from small areas around bird refuges such as Prince Leopold Island and Coburg Island, which protect only bird life (aboriginal hunters may carry on subsistence hunting there).

The Canadian Parks Service (now part of Heritage Canada) established a National Marine Parks Policy in 1986, in response to the Brundtland Commission' s call for 12% of land surface to be set aside as parks and an unspecified area of marine ecosystems to be set aside as parks or reserves. Article 194 of the Law of the Sea Treaty also imposes obligations on signatory states to protect marine ecosystems, and the Montreal Guidelines on Land-based Pollution require states to take appropriate measures to establish marine reserves to protect certain areas from harm. The Parks Service divided arctic marine waters into 10 regions, each with similar biology and oceanography as far as is known. Of these 10 regions, only the Northern Arctic (Arctic 3), by virtue of its inclusion in the Ellesmere Island National Park Reserve, has an identified area ready to be set aside.

One notable accomplishment in the designation of protected areas has been the proposed Igalirtuuq conservation area at Isabella Bay, 100 km south of Clyde River on east Baffin Island. Isabella Bay was originally brought to the attention of the federal government by the residents of Clyde River, who described concentrations of bowhead using the bay each fall. After a decade of research and consultation, the federal government' s Green Plan provided funds for workshops in Iqaluit and Clyde River, where a plan was developed for the conservation area. The plan was then approved by the people of Clyde River and the Baffin Region Hunters and Trappers Committee; the NWMB approved the boundaries. The objective of the plan is to protect and conserve bowhead stocks by setting aside Isabella Bay as a national wildlife area and possibly as a biosphere reserve under the Man and Biosphere Programme. While not perfect for the purpose intended, the designation as a national wildlife area under the Wildlife Act (administered by DOE) was seen as the best way to protect Isabella Bay from outside developments. Designation as a biosphere reserve carries considerable moral, but no legal, weight.

The Isabella Bay experience is instructive on several counts. First, it was based on sound biological data that documented the importance of the bay to bowheads, an endangered species in the eastern Arctic. Second, it involved local people right from the outset, and local people were eager to protect the bowheads. Third, it received support from the various government agencies involved because it was a real conservation issue. Fourth, an existing legislative mechanism, although not perfect, served to protect the area.

If we apply the lessons of the Igalirtuuq experience to current efforts by Heritage Canada to establish national marine parks in the Arctic, we find that there is little biological data for most of the marine areas. Without good data specifying the critical importance of a given marine area, other stakeholders may see little reason for setting it aside. Local residents must also see the value (for them as well as for stock and habitat preservation) if they are to support the establishment of a

marine reserve. While there are good reasons to set aside representative marine areas for preservation, there are also valid reasons not to set aside such areas unless they are shown to be in genuine need of protection.

In an area the size of the Canadian Arctic, designating several areas as being important to protect may not be a good approach, because the great diversity of habitat and stocks means that many places are important to various species and processes and because many species are migratory. Certainly the Lancaster Sound region ranks high on any list of critical marine areas, by virtue of its polynyas and ice edges, high density of resident seals and polar bear, seasonal bird and mammal migrants, and high biological production. But the area used by these species is vast, over 100,000 km2 of sea surface, and it is unlikely that a marine park encompassing the entire area could be established. And what about other arctic "hotspots" such as Hudson Strait, the Mackenzie delta, Cape Bathurst polynya, the Belcher Islands, and Foxe Basin?

Dividing the Arctic into 10 regions is a step towards recognizing and protecting the diversity of marine habitats. An alternative approach would be to develop and periodically update comprehensive land- and marine-use plans. Provision could be made for setting aside critical habitat, much as is being done for Isabella Bay. This might be more flexible and adaptive than arbitrarily setting aside a"representative" marine area, only to discover subsequently that other habitats and stocks also need special protection. In any reserve system, boundaries should follow ecosystem and oceanographic lines rather than political ones.

Coastal Zone Management

Coastal zone management is generally a lesser problem in arctic waters than it is on the east and west coasts, because coastal industrial and municipal development is relatively minor and existing legislation can be used to control its effects.

However, the lack of a coastal zone management scheme for Hudson and James bays is apparent. There, upstream development of hydroelectric power in particular has resulted in increased mercury flux to downstream areas and altered freshwater flows (including major diversions) to estuaries and coastal regions. Indeed, Manitoba Hydro's diversion of the Churchill River, which began in 1976, was not preceded by a study of the Churchill and Nelson river estuaries, which are known to harbour concentrations of anadromous fish and beluga whale. Only now are the downstream effects of proposed further damming on the Quebec shore being questioned, and Hydro Quebec has been informed that it must consider effects on coastal zone marine systems as part of its environmental impact statement. This is still a long way from effective coastal zone management.

DFO's approach to coastal zone management has been to develop and implement a classification scheme for all arctic waters based upon three priorities. The first priority is the conservation and management of fish and marine mammal resources and their habitats. The second is the sustained use of marine resources by northerners, followed by other users where appropriate, and the third is

to ensure that other activities such as mining proceed with minimal effect on fisheries and habitats. These three priorities are consistent with DFO' s Policy for the Management of Fish Habitat (DFO 1986), which states the overriding principle of no net loss of habitat.

The policy's classification scheme ranks all arctic waters under four designations, from one (greatest importance, maximum protection) to four (limited importance, basic protection). This classification was used in planning exercises by the Northern Land Use Planning Commission, a joint initiative of DIAND and GNWT. Present and future land-use planning exercises will occur under the various land-claims settlement mandates, and DFO will continue to apply its classification scheme to marine areas for the purpose of coastal zone management, land-use planning, and protection of marine resources. Whether this is sufficient to protect marine areas from upstream, onshore development -- particularly hydroelectric dams -- remains to be seen.

We can conclude that some sort of coastal zone management plan is necessary even for arctic waters. It will not eliminate all the threats to the arctic marine ecosystem, notably those originating from beyond Canada's borders, but it will prepare for further hydroelectric development, mining, road-building, port development, and shipping.

Responses to International Development

So far, Canada's actions for arctic marine conservation have largely been reactive instead of proactive. The transit of the Northwest Passage by the Exxon tanker Manhattan in 1969 touched off a flurry of activity that culminated in the Arctic Waters Pollution Prevention Act, promulgated in part to control foreign shipping in arctic waters. The Third United Nations Conference on the Law of the Sea (UNCLOS III) resulted in the 1982 United Nations Convention on the Law of the Sea. Although Canada has refused to ratify the convention because of the seabed mining article, it was a major designer of the convention and, as a result, has declared a 200-mile exclusive economic zone as well as a 12-mile territorial sea, thereby taking national jurisdiction over most of the Canadian continental margin.

UNCLOS III carried certain obligations to control pollution from shelf activities that must be no less effective than existing international rules based on the UN Environment Programme (UNEP) and the International Maritime Organization (IMO) guidelines. Articles 192-212 of UNCLOS III spell out various actions that member countries are obligated to take for the preservation of the marine environment. The 1987 World Commission on Environment and Development (Brundtland Commission) strengthened international pressure on coastal states to conserve biodiversity and to preserve marine habitats. Specific events such as the Arrow oil spill in Chedabucto Bay, the loss of the Ocean Ranger, and the 1985 transit through the Northwest Passage of the U.S. icebreaker Polar Sea have imparted a sense of urgency and specificity to calls for pollution control, safety standards, sovereignty over arctic waters, and marine conservation.

In the case of long-range transport of pollutants and chlorofluorocarbon (CFC) depletion of the ozone layer, Canada has been a leader, being the first country to ratify the 1985 Vienna Convention

for the Protection of the Ozone Layer and hosting the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

Canada's recent policy documents (Ocean Policy, Marine Parks Policy, Fish Habitat Policy, Arctic Marine Conservation Strategy) indicate that it is trying to put in place proactive preventive measures to preserve our ocean habitats. How much progress will be made remains to be seen.

A recent international development gaining momentum is the Arctic Environmental Protection Strategy (AEPS), the result of an eight-nation ministerial-level agreement in Rovaniemi, Finland, in 1991. The first program to be set up under AEPS was the Arctic Monitoring and Assessment Program (AMAP), which is documenting the distribution of chronic pollution in arctic waters. The second program was the Conservation of Arctic Flora and Fauna (CAFF), which includes aspects of habitat conservation and indigenous knowledge. The third program, just now getting under way, is the Protection of the Arctic Marine Environment (PAME). Finally, the Emergency Prevention, Preparedness and Response (EPPR) working group has been established.

The AEPS program has virtually no money in Canada. Existing funding avenues (e.g., Green Plan, scheduled to end in 1997 and significantly cut since its inception) are being used to fund research and monitoring that more or less fit into AEPS programs like AMAP. Without specific funding, the AEPS agreement may have limited effect on Canada's research programs, although PAME increases pressure for Canada to establish marine conservation areas. AEPS thus brings to bear considerable moral and political pressure for Canada to document and respond to threats to arctic waters. Since AEPS programs are still evolving, it is difficult to predict their results.

The Inuit Circumpolar Conference (ICC), representing the concerns of all arctic aboriginal people, has developed its own science and technology policy, expressed in the paper "Principles and Elements for a Comprehensive Arctic Policy." ICC calls for a holistic approach to sustainable development in the Arctic that recognizes the rights of indigenous people and that, among other things, requires that development be based on the principle of conservation of marine systems. ICC has observer status within the AEPS and contributes strongly to this and other arctic marine conservation policy developments.

The International Geosphere-Biosphere Programme (IGBP), sponsored by the International Council of Scientific Unions (ICSU), is another international influence on Canadian events. The Royal Society of Canada has been the chief agent for MBP in Canada. Under IGBP, the Land-Ocean Interaction Zone has considerable relevance to arctic marine conservation; it aims to compare a number of coastal zone systems with regard to pollution load, carbon flux, and other parameters, and IGBP is urging Canada to work at an arctic marine location, probably either the Beaufort or Hudson Bay.

International forces such as IGBP/LOICZ and AEPS/PAME/CAFF are collectively strong influences on the direction of Canada's arctic marine research and conservation efforts, particularly since DFO has no overall plan of action. This means that Canada's arctic marine research efforts

may be dictated by outside forces in a manner that rnay not result in the program that best suits Canada's needs.

Conclusion

There are unique biophysical attributes of arctic marine systems that require special conservation consideration. These include long food chains, specific prey needs, landfast and pack ice, polynyas and ice edges, areas of mammal and bird concentrations, long-lived species, and slow rebound from population reductions. The western scientific knowledge base is incomplete for fisheries stocks and extremely inadequate for ecosystems. The traditional knowledge base could be used to narrow the gap, but it has not been extensively tapped. Legislation and policy directives aimed at arctic marine ecosystem conservation have been largely reactive to specific events, and international developments are having considerable influence on arctic marine conservation. Existing legislation is confusing and scattered and might benefit from amalgamation into a single cohesive directive. Actual conservation efforts have been piecemeal and sector based, rather than comprehensive management plans that encompass economic development, ecosystems, and social institutions. Efforts have been made to establish a series of marine parks but progress has been slow. Aboriginal land-claims settlements have legislated a variety of co-management boards that are just now coming into their own and that are evolving into powerful forces for marine conservation and protection. These management boards could be used as simple models for the east and west coasts, where the diversity of interests and stocks makes a coherent conservation policy very difficult to achieve.

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The Nunavut Final Agreement and Marine Management in the North

by Bruce Gillies, Nunavut Tunngavik Inc.

Legislation ratifying the Nunavut Final Agreement (NFA) was passed by Parliament in 1993. Far from being a land-claims agreement, the NFA establishes bold new precedents for integrated land and sea management that have profound implications and lessons for marine management throughout the country. Indeed, it is sometimes referred to as a "sea-claims" agreement, reflecting the dependence of the Inuit on ocean ecosystems for their livelihood.

The following article reviews the little-known ocean management provisions of the NFA and underscores their implications for federal decision-making on marine matters both in, and adjacent to, Nunavut.

The Nunavut Final Agreement -- Marine Provisions: An Overview

The NFA provides for the establishment of a complete comanagement regime for Nunavut designed to produce land-use plans, regulate access to wildlife, regulate water use, review the potential impacts of development, and meaningfully advise government on the management of the Nunavut marine environment.

This last point is key: twenty-six of the twenty-seven communities in Nunavut are on the coast. Not surprisingly, therefore, a good portion of the NFA focuses on offshore rights, responsibilities, and jurisdiction. The agreement recognizes seven principles related to marine areas, and no fewer than 13 of its 42 articles -- or almost 45%-relate directly to marine matters.

The principles (section 15.1. 1), which establish the context for marine management in Nunavut, include recognition that

- in marine areas, the legal rights of the Inuit flowing from the agreement are based on traditional and current use;
- Inuit harvest wildlife that might migrate beyond the marine areas [identified in the agreement];
- there is a need for Inuit involvement in aspects of Arctic marine management, including research; and
- there is a need to develop and co-ordinate policies for marine areas.

Extending from these principles are a number of management provisions, set out principally through section 15, "Marine Areas." It is noteworthy, however, that 12 additional articles, ranging from conservation through land-use planning and development impact to employment matters, shall also apply to marine areas.This represents a significant step towards ecosystem management-a management system that does not stop at the shore but considers the land and sea as two connected parts of a whole. This integrated approach is also recognized in the powers of the Nunavut Wildlife Management Board (NWMB), which is to be the main instrument of wildlife (including marine wildlife) management within the Nunavut Settlement Area.

Timothy Idlout scanning for polar bear while son Andrew Atagotaaluk butchers bear meat.

Key among these provisions is the structure proposed for marine management in the Nunavut Settlement Area under section 15.4.1 of the agreement. "The Nunavut Impact Review Board (NIRB), the Nunavut Water Board (NWB), the Nunavut Planning Commission (NPC), and NWMB [each of which is a co-management body having equal government and Inuit representation] may jointly, as a Nunavut Marine Council, or severally advise and make recommendations to other

government agencies regarding marine areas and Government shall consider such advice and recommendations in making decisions which affect marine areas" [emphasis added]. In practice, the consensus-building approach of institutions like the marine council would mean that their recommendations should carry the day.

The Final Agreement, recognizing that Inuit are dependent on migratory marine species that leave the settlement area, also establishes two special zones ("Zone I" along the east coast of Baffin Island and "Zone II" in Hudson and James Bay) that are not part of the settlement area. Section 15.3.4 stipulates that "Government shall seek the advice of the NWMB with respect to any wildlife management decisions in Zones I and II which would affect the substance and value of Inuit harvesting rights and opportunities within the marine areas of the Nunavut Settlement Area." One obvious need for consultation would be in the establishment of quotas, such as for Greenland halibut (turbot) in Davis Strait.

And, under section 15.3.1, the Final Agreement obligates the government to maintain a structure or structures to promote co-ordinated management of migratory marine species in zones I and II.

Implications of NFA
Provisions for Management

The implications of the NFA for management are two-fold:

- the federal government is required to consult in a meaningful way with the Inuit of Nunavut when making decisions that affect them; and
- the federal government is obligated to approach management of the Nunavut marine environment in an integrated and co-ordinated way.

Consultation

In the past, consultation has been a code word for a number of things, many of which have not adequately addressed the need to gain the Inuit perspective and opinion on developments in the North. A case in point was the recent proposal to allow a third passage of the MV Arctic from Cameron Island to carry crude oil out of the Arctic. Although the Brander-Smith report on tanker traffic and oil spills response recommended an amendment to the Canadian Arctic Shipping Pollution Prevention Regulations that would require a full environmental assessment, including public consultation, the proponents considered an information session with the Resolute Hamlet Council to be sufficient. An information session is a good starting place, but neither local knowledge nor local views can come forth in this kind of session. The NFA obligates the government to engage in consultation that will allow both local knowledge and local views to be brought meaningfully into decision-making processes.

The Inuit of Nunavut put the protection and management of their land and offshore above a land and cash deal! We put the Inuit right to meaningfiully participate in the decision-making process concerning the management of our land and marine environment above all else. Why? Because the land and marine environments are the Inuit culture and anything that affects them, affects us. We will be involved in any decision affecting this environment and that, in a sentence, is what the Agreement guarantees.

Jose Kusugak
President Nunavut Tunngavik Inc.,
Presentation to the Standing
Committee on Environment and Sustainable
Development, May 9,1995

The Inuit of Nunavut have successfully negotiated a land claim settlement in order to meaningfully participate in decision-making processes that affect, or have the potential to affect, any aspect of their lives. We will not accept information or consultation processes where Inuit views are dismissed or assumed to be irrelevant.

James Eetoolook
1st Vice-President, Nunavut Tunngavik Inc.,
Presentation to the Canadian
Coast Guard, April 28, 1995

Co-ordinated Decision-making

In their response to the Department of Fisheries and Oceans' (DFO) "Vision for Ocean Management," Nunavut Tunngavik Inc. (NTI -- footnote 1) noted "[all] stakeholders can...agree that the management of Canada' s marine environment to date has been ad hoc, piecemeal and largely ineffective. No organization knew this better than [NTI's predecessor, the Tunngavik Federation of Nunavut] TFN, when negotiating the claim settlement of Nunavut." Given that a significant proportion of the negotiations included and involved the negotiation of provisions for the offshore, TFN found itself, at times, negotiating with government personnel from a multitude of branches within more than six departments.

Even when the list is narrowed to those two departments with the greatest stake in the marine environment (Fisheries and Oceans, which is responsible for marine fish and mammals; and Environment, which is responsible for preservation of the natural environment), a gap remains: no

co-ordinated jurisdiction exists for the preservation and enhancement of the natural marine or ocean environment.

For this reason, NTI agrees completely with the-federal government' s plan to use the proposed Canada Oceans Act to establish "a clearly identifiable lead federal agency accountable for ocean management." Such a regime would provide a focal point for advice from the Nunavut Marine Council and could take~the lead in establishing the body to oversee decisions in zones I and II of the settlement area. It is critical, however, that any agency established under the act, and the powers given it, be consistent with the provisions of the Nunavut Final Agreement. Failure to ensure consistency, to put it bluntly, will undermine the Canada Oceans Act because, constitutionally, the Final Agreement will take precedence.

Conclusion

A strong, co-ordinated and co-operative land-and-sea management regime is being built under the auspices of the Nunavut Final Agreement. It will provide for extensive integrated planning and management, offering tools for other parts of the country to emulate. The key to successful federal management adjacent to the Nunavut Settlement Area will be in developing a management structure and strategy, possibly through the Canada Oceans Act, that is consistent with the Nunavut Final Agreement and can accommodate community needs and views. NTI will continue to work to ensure that both conditions are met.

Footnote 1. The Tunngavik Federation of Nunavut (TFN) negotiated the land-claims agreement on behalf of the Inuit of Nunavut. Following the successful conclusion of the NFA, TFN incorporated, in part to handle settlement funds, and is now known as Nunavut Tunngavik Inc.

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