

# Lancaster Sound Regional Study: Coastal and Marine Resource Planning in the Canadian High Arctic

James A. Dobbin  
Michèle H. Lemay  
Nancy E. Dobbin

James Dobbin Associates Ltd.,  
Toronto, Ontario

*Abstract* The Lancaster Sound Regional Study serves as a pilot project for regional planning in the Arctic. Probably the most biologically productive area of all arctic regions, Lancaster Sound represents a unique Canadian heritage. And since it occupies the strategic eastern entrance to the Northwest Passage, the Sound has long been a summer shipping route. Now, proposals are under review that would permit year-round shipping of oil and gas from the Beaufort Sea by means of ice-breaking tankers. Also proposed are the exploration and development of possible hydrocarbon reservoirs within the Sound. Actual decisions for the area's use must respect the interests of the native Inuit who have lived there for centuries as well as the preservation of the environment. This paper describes the preliminary phase of the regional planning for the region: the preparation of a public discussion paper to elicit informed comment and opinion on future uses of the Sound. It is a first step toward recommending suitable management and use options for the region.

### **Lancaster Sound: A Case for Strategic Regional Planning**

Situated in the Canadian High Arctic, Lancaster Sound offers special challenges for integrated coastal and marine resource planning (Figures 1 and 2). This deep marine channel—the eastern entrance to the famous Northwest Passage—is estimated to be the most biologically productive area in the Canadian Arctic, and perhaps of all the world's arctic regions. The Sound and its associated inlets and bays serve as migratory, calving, and feeding habitats for a significant proportion of the world's population of marine mammals including narwhals, bowhead whales, and several species of seals. Some of the world's largest seabird colonies are located on the sheer rocky cliffs overlooking the Sound. For centuries, such abundant and diverse marine life, largely dependent on the undisturbed waters of the region, has supported the native Inuit who continue to live in harmony with this magnificent environment. These people are justifiably concerned about plans for the future uses of the Sound's resources.

A shipping route for more than 150 years, the Sound until now has been used only during the short open-water season from mid-July to late October. Because of the current world energy shortage and Canada's determination to be energy self-sufficient, this situation may change. Proposals are currently being reviewed to allow the year-round shipping of oil and gas from the Canadian High Arctic and Beaufort Sea region eastward through the Sound by means of powerful ice-breaking tankers.

Year-round shipping isn't the only new plan under consideration for the region: the Sound may itself contain hydrocarbon reservoirs. The exploration and development of these potential resources could profoundly affect both the environment and the Inuit way of life.

Such significant changes in such a complex environment demand very careful planning. Traditionally, planning for coastal areas has been limited to land-use planning along the coastal edge with little regard for the resources, physical processes, and socioeconomic activities offshore. Lancaster Sound demonstrates the special need for a planning approach that considers the intricate relationships between the coastal and marine zones.



Figure 1. Situated in the Canadian High Arctic, Lancaster Sound offers special challenges for strategic coastal and marine resource planning.

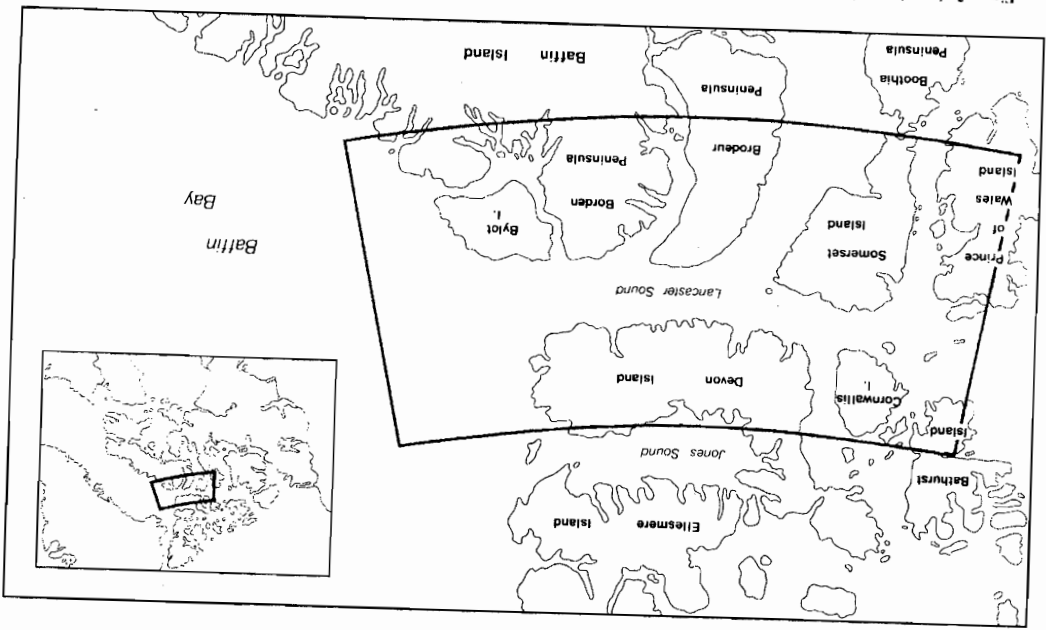


Figure 2. Location of Lancaster Sound Regional Study.

While land and sea should always be considered as interacting units when developing plans for coastal areas, the need is especially great in an arctic region such as this. During winter, for example, the solid ice covering much of the Sound becomes an extension of the land providing habitats and migration territory for animals. The Inuit then trap and hunt in these winter ranges. One can readily understand the potential impact of year-round ice-breaking tankers in the Sound and of other proposed new uses of the region.

Often planning approaches have to catch up with industrial activities that are in process or have been carried on for some time. In the Lancaster Sound Regional Study, we had the advantage of a relatively "clean slate." The intention was to consider options up to the year 2000 before many commitments were made for the development and conservation of the area's natural resources. As planning for the area progresses, there will be an excellent opportunity for strategic planning and the application of IUCN's World Conservation Strategy: sustainable development through adherence to conservation principles.

### How the Lancaster Sound Regional Study Evolved

In 1978 public hearings examined an application by Norlands Petroleum Ltd. requesting permission to drill an exploratory well in Lancaster Sound. The panel of officials set up under the Federal Environmental Assessment and Review Process (EARP) recommended a comprehensive review of the Sound's complex resource use problems before making decisions about a single use: exploratory drilling.

The panel further recommended that DIAND (The Department of Indian and Northern Affairs) conduct the overview. Our firm was contracted to help develop the approach by drawing on our experience in marine resource use studies in the Bering/Chukchi Seas, the Persian/Arabian Gulf, the Canadian Atlantic and Pacific coasts, the Caribbean, and the eastern U.S. coastal and ocean zones.

The project began with the formation of an interdisciplinary Steering Committee and Working Group representing six federal departments, the government of the Northwest Territories, and our

firm. This team included specialists in marine engineering, hydrocarbon engineering, cultural resources, terrestrial and marine ecology, marine biology, oceanography, economic planning, climatology, park planning, landscape architecture, and coastal and marine resource planning.

### An Overview of the Methodology and Planning Steps

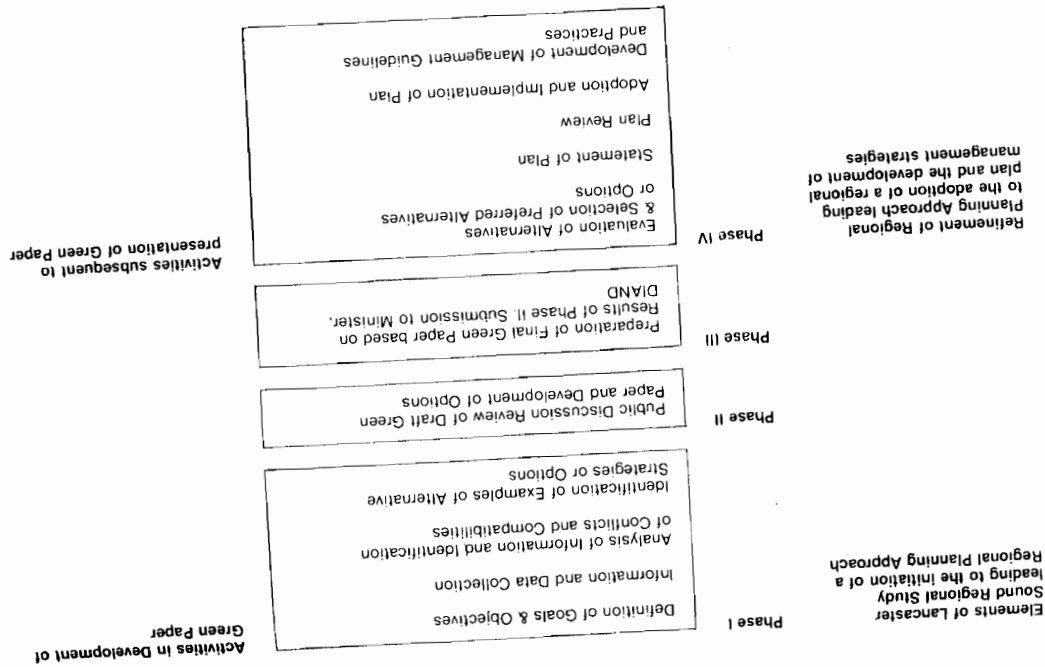
As coastal and marine resource planners, we were to provide the Working Group with a general approach and specific methods to fulfill the mandate of the study. While the project was experimental, we did have methods and tools that proved to be effective in other studies.

Among these was Systems Analysis Mapping or "SAM." Based on IMGRIID Computer Mapping (Harvard University) and other methods, SAM is a means of compiling, organizing, analyzing, and presenting a broad range of spatial/geographic information for the purpose of regional planning in large coastal and marine areas. It helps researchers sort out the interrelationships among physical and biological processes, living resources, and socioeconomic activities.

Perhaps one of the greatest advantages of the SAM system for this study was that it allowed us to present complex issues in a relatively clear, uncomplicated manner. This was of particular importance since a chief objective of the study was to achieve public participation in the formulation of management and use options.

The study progressed according to three main phases (Figure 3):

Phase 1 *The Preparation of a Draft Green Paper* (a government-sponsored public discussion paper). Rather than providing a final regional plan, the Draft Green Paper formed the foundation and framework for a planning process up to and including the public consultation phase. Seeking informed public comment on future uses of the Sound, it presented a summary of existing knowledge including the physical and biological environment, the current socioeconomic situation, and current and potential uses of the area. The audiences addressed included native people, local government and industry, environmental interest groups, and the scientific community across Canada.



Phase 2 *The Public Review Phase*. The purpose of the public review phase was to gather comments on the Draft Green Paper and background materials. There were three interrelated activities during this phase: a review by the four communities of the Lancaster Sound Region; a northern workshop held in Resolute, N.W.T., a major staging area in the region; and a southern workshop held in Ottawa. A detailed assessment of all comments received yielded several recommendations as to what might be preferred options and an acceptable regional planning process for the region (Jacobs, 1981).

Phase 3 *The Preparation of a Final Green Paper* (released July 30, 1982). After the first round of public consultations, the Green Paper was revised to outline six options for the management of Lancaster Sound, ranging from strict environmental protection to concerted economic development. In recognition of the consensus expressed during the review phase for the need for ongoing public involvement through planning, two distinct alternatives for a regional process were also incorporated into the Green Paper. Further public discussion following the release of the document is expected to gradually narrow the range of options, pointing to a preferred direction for the future of the region.

### Phase I: Preparation of the Draft Green Paper

This initial phase was intended to provide the materials that would encourage informed public discussions. The objective was to present a picture of the region as it exists today and to show how this picture might be affected in the future by the introduction of new uses. The presentation included an assessment of possible environmental impacts from future activities as well as possible influences on the traditional culture and way of life of the Inuit.

During the first few months of the study, Working Group members collected data from a variety of scattered sources that would be useful for this purpose. Field trips throughout the region by icebreaker and helicopter served to verify certain data and provide a better understanding of the region as it exists today. We then prepared a *Preliminary Data Atlas* of relevant information on the biological, ecological, and socioeconomic features of the area. Figure 4 provides a list of the 83 thematic maps that were drawn to a scale of 1:2 million.

### 1. Physical and Environmental Characteristics

- 1.1 Geology
- 1.2 Earthquake Epicentres
- 1.3 Physiography
- 1.4 Coastal Geology
- 1.5 Coastal Geomorphology
- 1.6 Coastal Slope
- 1.7 Marine Sediments
- 1.8 Rivers and Lakes
- 1.9 Mean Annual Rainfall
- 1.10 Mean Annual Snowfall
- 1.11 Mean Annual Precipitation
- 1.12 Mean Surface Wind Roses
- 1.13 Mean Surface Wind Roses
- 1.14 Surface Water Circulation: Summer
- 1.15 Mean Tidal Range: Spring
- 1.16 Consolidated Ice Edges: 1964-1979
- 1.17 Median Ice Cover: May 28
- 1.18 Median Ice Cover: June 25
- 1.19 Median Ice Cover: July 29
- 1.20 Median Ice Cover: August 20
- 1.21 Minimum Ice Cover: August 20
- 1.22 Maximum Ice Cover: August 20
- 1.23 Median Ice Cover: September 17
- 1.24 Median Ice Cover: October 29
- 1.25 Median Ice Cover: October 29
- 1.26 Minimum Ice Cover: October 29
- 1.27 Maximum Ice Cover: October 29
- 1.28 Ice Drift: Winter
- 1.29 Ice Drift: Summer
- 1.30 Icebergs

### 2. Biological Characteristics

- 2.1 Phytoplankton: Summer Standing Stock
- 2.2 Polar Bear: Spring and Summer
- 2.3 Polar Bear: Winter
- 2.4 Ringed Seal
- 2.5 Bearded Seal
- 2.6 Harp Seal
- 2.7 Walrus
- 2.8 White Whale (Beluga)
- 2.9 Narwhal
- 2.10 Bowhead Whale
- 2.11 Killer Whale
- 2.12 Colonial Seabirds
- 2.13 Fish
- 2.14 Vegetation
- 2.15 Arctic Fox
- 2.16 Muskoxen
- 2.17 Ptarmigan
- 2.18 Bumper-Ground Caribou
- 2.19 Snow Goose
- 2.20 Birds

### 3. Existing Human Activities

- 3.1 Communities
- 3.2 Tourism
- 3.3 Shipping: Combers
- 3.4 Air Transport
- 3.5 Scientific Research: 1979-1980
- 3.6 Archaeological/Historical Sites and Sanctuary
- 3.7 Polar Bear Hunting
- 3.8 Walrus Hunting
- 3.9 Seal Hunting
- 3.10 Whale Hunting
- 3.11 Muskoxen Hunting
- 3.12 Caribou Hunting
- 3.13 Willow Hunting
- 3.14 Fishing
- 3.15 Trap Lines
- 3.16 Mining
- 3.17 Oil and Gas: Permits

### 4. Potential Human Activities

- 4.1 Tourism: Potential
- 4.2 Shipping: Potential Combers
- 4.3 Shipping: Potential Pollution (Winter)
- 4.4 Shipping: Potential Pollution (Summer)
- 4.5 Air Transport: Potential
- 4.6 Parks Canada's Areas of Interest
- 4.7 Ecological Sites (I.B.P.)
- 4.8 Mining: Potential
- 4.9 Sand and Gravel: Potential
- 4.10 Oil and Gas: Potential
- 4.11 Oil and Gas: Exploration
- 4.12 Oil and Gas: Potential Development
- 4.13 Oil and Gas: Potential Pollution (Winter)
- 4.14 Oil and Gas: Potential Pollution (Summer)
- 4.15 Representative Oil Spill Trajectories: Summer A
- 4.16 Representative Oil Spill Trajectories: Summer B

Figure 4. List of 83 Thematic Maps drawn to a scale of 1:2 million.

This data base, characteristic of the SAM methodology, was to provide background for some of the most critical questions. For example, if hydrocarbon development should occur, which coastal and marine habitats would be most vulnerable to an oil spill from a blowout or a shipping accident? To address such issues, we mapped data on ocean currents, winds, tidal ranges, icebergs, ice drift, and the distribution of marine mammals and birds. Accompanying text supplemented the *Atlas*. To ensure that materials could be reviewed successfully by the public, we prepared all the maps and the text in three languages: English, French, and Inuktitut (the Inuit language).

The data collection phase included an assessment of data reliability. At times our work revealed discrepancies between the information provided by scientists and that provided by the Inuit. Data on the distribution of species such as caribou and walrus showed such variations. These observations eventually assisted in recommending directions for future verification and study.

With all the relevant information at hand, the Working Group then analyzed the data to gain the present-day picture that would be presented to the public.

#### *Analysis of the Region Today*

The characterization of present-day Lancaster Sound was achieved by looking at the physical makeup of the region and by reviewing biological and ecological features, hunting, fishing and trapping patterns, current commercial activities, and social and economic features. These regional characteristics were illustrated by colored "composite maps" derived from information in the *Preliminary Data Atlas*, and another feature of the SAM methodology. In the accompanying text, it was convenient to describe this complex region according to typical conditions encountered during winter and summer. However, this simplification did not affect later analysis that took into account the variability so characteristic of the region.

As mentioned earlier, there are important interrelationships among sea ice conditions, marine mammal life history, and native hunting patterns. Our analysis identified specific examples. For instance, at the western end of Lancaster Sound and in adjacent

inlets, the sea surface is covered by stationary (land-fast) ice. Here, ringed seal populations bear their pups in the early spring. Since polar bears are the major predators of seals, they also tend to concentrate in these areas while arctic fox scavenge on the seal carrion left behind by the bears. In turn, Inuit hunters use the fast ice areas intensively during the winter and early spring because of the abundance of wildlife.

Such information assists in evaluating seasonal activities for the region. Among these are the location of the ice edge (the boundary between land-fast and drifting ice), and the presence of leads (open water areas in the ice) that provide suitable feeding habitat for marine mammals and seabirds migrating in the early spring.

Similar considerations are necessary when evaluating suitable summer activities for the region. With the retreat of the fast ice in June and July the marine life of the Sound and the native people who depend upon it move inshore. For example, polar bears retreat to coastal areas; narwhal and white whales concentrate in fjords and inlets for calving; and the Inuit move to summer coastal camps for hunting marine mammals along the shore and fishing arctic char.

#### *Proposed Activities to the Year 2000*

With this understanding of the region as it is today, it was then more effective to present in detail the activities proposed by industry and government for the next twenty years. The seven categories of activities are year-round shipping, oil and gas exploration, oil and gas development, mining, preservation of natural areas, tourism and recreation, and hunting, fishing, and trapping (Figure 5). Experts on the seven categories of activities reviewed available industrial proposals, and made assumptions as to what feasibly could happen during the next twenty years given the currently available technology. They specified the facilities, services, and other requirements of each industrial venture.

The Working Group then prepared written profiles and mapped scenarios to reflect the changes Lancaster Sound might undergo as a result of these proposed activities. Changes, for example, in the environment, the economy, and harvesting patterns were deter-



sance), air transport, and the construction and maintenance of shore-based facilities (e.g., dock area, bulk storage area, airstrip).

These activities will determine whether oil and gas reserves actually exist in the Sound. Exploration could also increase employment in the region and other parts of the country, spur research and development, and possibly result in improved transportation services.

Detrimental effects could stem from nearshore pollution disrupting marine wildlife habitat. The noise of operations and the increased risk of an oil spill with consequent implications for hunting and trapping are other important considerations.

### 3. Oil and Gas Development and Production

At this time, technology is not available to ensure safe and reliable development and production of possible oil and gas discoveries in Lancaster Sound. However, were this technology to become available, activities would require the construction, installation, and operation of a variety of production facilities such as oil tanker terminals, fuel storage, jet airstrips, warehousing, an oil tank farm, and possibly a gas liquefaction plant.

Production systems would provide several economic benefits relating to more reliable national oil supplies, improved technology, increased national revenues, and additional employment. They could also bring chronic and accidental pollution with subsequent disruption of wildlife and its habitat. Development and production phases are considered to be more hazardous than exploration because of the probability of a major oil spill through a blowout from wells or from a tanker accident.

### 4. Mining

Lead and zinc deposits of economic importance are currently being mined on Little Cornwallis Island (Arvik) and in Strathcona Sound (Nanisivik). Nanisivik will phase out production in nine years. A third site on Little Cornwallis (Eclipse deposit) is a potential producer.

Exploration for lead and zinc and other base metals will continue

and possibly lead to new mining operations. These would require the construction of mining facilities as well as a town site and associated services. Major economic and social implications include increased job opportunities in the region, changes in the social system, increased transportation, and additional revenues through taxes and royalties. Environmental impacts could include the disruption of caribou and walrus habitat, particularly in areas of more intensive exploration on Little Cornwallis Island and Bathurst Island.

### 5. Preservation of Natural Areas

There are several existing programs for protecting outstanding natural areas within Lancaster Sound. These include Parks Canada's activities for identifying and selecting terrestrial and marine national parks. Several areas have already been identified and compared. Based on a recent recommendation by our firm, the agency is actively considering Bylot Island/Eclipse Sound as a possible combined terrestrial and marine national park. International Biophysical Program (IBP) sites are also located in the area and the Canadian Wildlife Service Sanctuary is situated on Bylot Island.

The creation of a national park within the Sound region would help to fulfill Canada's international obligation to protect unique areas. Changes for the area would include the control of sport fishing and hunting and of nonrenewable resource development. Tourism-related activities would increase.

### 6. Tourism and Recreation

The government of the Northwest Territories is studying ways to encourage community-based tourism in the Eastern Arctic. Attractions to visitors could include tours to view the scenery and wildlife, visits to historic sites and industrial operations, and excursions for a variety of recreational activities.

Greater tourism would increase local employment and encourage local small businesses. However, excessive visitor use could damage natural resources.

### 7. *Hunting, Fishing, and Trapping*

Hunting, fishing, and trapping are expected to continue as important features of the Inuit lifestyle. The disruption of wildlife habitat and the loss of access to hunting territories associated with increased industry could threaten the quantity of resources available for a growing resident population. Some species could become locally or seasonally scarce, eventually leading to the harvest of alternative native species such as arctic cod.

### Asking Questions and Seeking Opinions: The Future of Lancaster Sound

Having presented the implications of various uses for the Lancaster Sound region, the Draft Green Paper ended by asking readers to respond to the following four questions:

*Question 1:*

Should new major industrial development be deferred until safer technology and greater understanding of environmental, social, and economic relationships are available?

*Question 2:*

Should parks and reserves be formally designated before new industrial development is allowed?

*Question 3:*

Should shipping be expanded at this time to include year-round transportation of oil and gas?

*Question 4:*

Should there be a determined program to explore and develop the resources of the Lancaster Sound region?

These questions represent scenarios for the Sound's future. The discussion accompanying the questions pointed out that by the year 2000 significant changes will have taken place whether or not industrial development goes ahead. Changes will be brought about by the growth of the local population which is expected to increase substantially over the next twenty years. Of course, more profound effects on the communities may be expected if larger-scale develop-

ments occur. What the questions aimed to achieve was the thoughtful consideration of uses most appropriate for the region.

The questions were accompanied by a discussion acknowledging that there is no single public view, but rather a spectrum of different perspectives within Canadian society. To allow for more thorough consideration of the issues, each potential scenario or development strategy was discussed according to four main concerns:

- concern for the national interest centered on the notion that all Canadians should share the country's resources;
- concern for the protection of the environment based on the belief that all Canadians have an obligation to ensure the continued viability and beauty of our natural environment;
- concern that people of the region have the opportunity to select or maintain a satisfying and flexible lifestyle; and,
- concern that appropriate technology be used to prevent accidents or disasters, or to minimize the impact of development to an acceptable level.

The Draft Green Paper was then distributed to provide a regional perspective on alternative uses and an insight into cumulative impacts. It helped to stimulate informed discussion on the region's future.

### Phase 2: The Public Review Phase

In April 1981, meetings in the four communities of the Lancaster Sound Region (Resolute, Arctic Bay, Grise Fiord, and Pond Inlet) provided opportunities for comment on the Draft Green Paper at the local level. A northern workshop conducted in Resolute in May, 1981 and a southern workshop held in Ottawa provided involvement on the regional and national levels.

In a subsequent assessment of the public review phase, it was suggested that continued public involvement was essential at both the regional and national levels for the success of the planning study. It is only through this involvement that we can develop a

planning process tailored to the environment and people of the High Arctic, yet sensitive to the national interest. (Jacobs, 1981). There was also general public agreement that all options put forward in the final Green Paper must emphasize the long-term well-being of the region, and hence allow for sustained use of renewable resources.

Public participation facilitated a better review of the work completed to date and helped to move us closer to finding acceptable options for the future use of the region.

### Phase 3: The Preparation of a Final Green Paper

During the third phase of the Lancaster Sound Regional Study, the Draft Green Paper was refined and modified to take into account the contributions arising from the public review meetings and other comments received by the Working Group. New data and corrections were incorporated into the *Data Atlas* and amendments were made to the regional framework and the potential activities discussed in the Draft Green Paper. This led to the preparation of six detailed use and management options for the Lancaster Sound region. The Green Paper, in its final form, was scheduled to be submitted to the Minister of Indian and Northern Affairs by November 1982.

### Conclusions

Although the final use and management options are yet to be reviewed by the public and approved, the Lancaster Sound Regional Study has already been acclaimed as a possible prototype for regional planning north of 60°. Several attributes are responsible for this distinction. Public participation and community involvement, for example, were important achievements that few planning projects enjoy. Discussions were encouraged through the use of well organized and easy-to-understand analytic materials presented in three languages. Meetings and workshops ensured participation at national, regional, and local levels.

Although in draft form, the information presented showed the important interrelationships between land and sea that are impor-

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tant for regional planning in the area. It allowed an objective view of potential uses and the possible ramifications of these uses as to the environment, industry, and the Inuit way of life. The achievement of objectivity was largely the result of an interdisciplinary and interdepartmental approach. The long-term outlook of twenty years is another important feature of the study. This "crystal-balling" to the year 2000 is an important first step in strategic regional planning for the Lancaster Sound region.

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