



Fisheries and Environment
Canada

Pêches et Environnement
Canada



annual report

1976 / 1977

The cover design symbolizes the outstanding event of the year for the department: extension of Canada's fisheries jurisdiction to 200 miles on January 1, 1977. See Highlights, page 8.

Annual Report for the fiscal year
ending March 31, 1977

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Canada





Minister
Fisheries and Environment Canada

Ministre
Pêches et Environnement Canada

Ottawa, Ontario
K1A 0H3

His Excellency
The Right Honorable Jules Léger
Governor General and
Commander-in-Chief of Canada

May it Please Your Excellency:

I have the honor herewith, for the information
of Your Excellency and the Parliament of Canada, to present
the Annual Report of the Department of the Environment for
the fiscal year ended March 31, 1977.

Respectfully submitted,

Roméo LeBlanc



Ottawa, Ontario
K1A 0H3

The Honorable Roméo LeBlanc
Minister of Fisheries and
the Environment
Ottawa, Canada

Dear Mr. Minister:

I have the honor to submit the Annual Report of
the Department of the Environment for the fiscal year ended
March 31, 1977.

Respectfully submitted,



J.B. Seaborn

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History and responsibilities

Canada's Department of the Environment came into being in 1971, following the Government Organization Act of 1970. Its creation brought together in one department the responsibility for environmental quality and for protection, enhancement and promotion of the wise use of renewable resources.

The elements of this new department, which were combined with what was then the Department of Fisheries and Forestry, included the Canadian Meteorological Service of the Ministry of Transport; the Air Pollution Control Division and the Public Health Engineering Division from the Department of National Health and Welfare; the Water Sector from the Department of Energy, Mines, and Resources; the Canada Land Inventory from the Department of Regional Economic Expansion; and the Canadian Wildlife Service from the Department of Indian Affairs and Northern Development.

The department's initial response to the challenge of protecting the environment was to establish standards to curb, control and abate pollution. With better understanding of the complex relationship between resources, energy, technology and population, emphasis was placed on anticipating problems stemming from the impact of human activi-

ties on the environment, and on integrating resource and environmental management with Canada's development.

To carry out these responsibilities the department undertakes three major programs: the Fisheries and Marine Program, carried out by the Fisheries and Marine Service under a senior assistant deputy minister; the Environmental Services Program carried out by the Environmental Management Service, the Environmental Protection Service, and the Atmospheric Environment Service, also under the direction of a senior assistant deputy minister; and the Administration Program carried out by Planning and Finance Service, directed by an assistant deputy minister, and by the Information Services Directorate under a director-general reporting to the deputy minister.

To control the potential threat to the environment of new large-scale projects, the Environmental Assessment and Review Process was established in 1973. The process is mandatory for all projects in which the federal government is involved, and is administered by the Federal Environmental Assessment Review Office, which advises the minister.

The Canadian Forestry Advisory Council provides the minister with independent advice on

forestry priorities, and the effectiveness of departmental programs in meeting those priorities. The council was set up with the view that the federal government's forestry programs would benefit from broad policy guidance in a systematic way from outside government service.

The Canadian Environmental Advisory Council was established in 1972 to advise the minister on the state of the environment and on threats to it; on priorities for environmental action by the federal government or by the provinces; and on the effectiveness of departmental activities in restoring, preserving and enhancing the quality of the environment. The council is composed of up to 16 members, including the chairmen of the resource councils which advise the minister, and members-at-large drawn from a wide cross-section of Canadian life and from across Canada. To carry out its functions, the council undertakes studies and reviews of environmental matters, holds regular meetings to consider progress and developments on these matters, and prepares statements and reports as appropriate, including an annual review summarizing the state of the environment in Canada.

In 1974, a minister of state (fisheries) was assigned to help carry out the particular responsibilities which the minister of the environment has in relation to the fisheries of Canada. In 1976, the minister of state (fisheries) became minister of fisheries and the environment, and the department became known as the Department of Fisheries and the Environment (DFE).

Fisheries and Marine Program

Fisheries and Marine Service

The mandate of the Fisheries and Marine Service includes a broad range of responsibilities related to the aquatic environment and the living resources of ocean and inland waters.

Included in these activities are management and development of Canada's fisheries and their associated environmental considerations; hydrographic surveying and the charting of navigable coastal and inland waters; administration of small craft harbors; fisheries and oceanographic research contributing to the

understanding, management and optimum use of aquatic renewable resources and their environment; environmental impact studies affecting coastal and inland waters; and research in support of international agreements relating to fisheries management and to the quality of marine and freshwater environments.

Operations of the Fisheries and Marine Service (FMS) are grouped under three major divisions -- Fisheries Management, Ocean and Aquatic Sciences, and Small Craft Harbors -- which operate in conjunction with the International Directorate and other policy and liaison groups at headquarters in Ottawa.

Day-to-day operations of Fisheries Management are supervised from regional headquarters at St. John's, Halifax, Quebec City, Burlington, Winnipeg and Vancouver, and at the following research establishments: St. John's Biological Station, Newfoundland; Marine Ecology Laboratory, Dartmouth, Nova Scotia; Halifax Laboratory; St. Andrews Biological Station, New Brunswick; Arctic Biological Station, Ste. Anne de Bellevue, Quebec; Freshwater Institute, Winnipeg; Vancouver Laboratory; Pacific Environment Institute, West Vancouver; Pacific Biological Station, Nanaimo; and the Great Lakes Biolimnology Labora-

tory, Burlington. The Sea Lamprey Control Centre is located at Sault Ste. Marie.

Fisheries Management programs include the conservation and restoration of fish stocks, protection and management of fish habitats, allocation and control of access to fishery resources, and programs of research in support of these activities. Responsibilities also include a national program of fish inspection and provision of support services to commercial fishermen and to the fish processing and distributing industry.

Ocean and Aquatic Sciences (OAS) is concerned with scientific activities related to preserving and enhancing the quality of fresh and marine waters and contributing to the effective use of these resources. OAS conducts research in physical, chemical and biological oceanography and limnology, and is responsible for hydrographic surveys, charting and various publications. Regional offices and laboratories are located at the Bedford Institute of Oceanography, Dartmouth; the Institute of Ocean Sciences, Victoria; the Canada Centre for Inland Waters, Burlington; and in Quebec City.

The various management and scientific programs of FMS are supported by a fleet of more than 600 vessels, serving

oceanographic and fisheries research programs, hydrographic surveys and fisheries management operations.

The Small Craft Harbors Branch administers harbors and marine facilities at some 2,300 locations across Canada, through six regional offices. Close liaison is maintained with the Department of Public Works, which provides design, construction, maintenance and property services.

Environmental Services Program

The Environmental Services Program is carried out by the Atmospheric Environment Service, the Environmental Management Service and the Environmental Protection Service, each under an assistant deputy minister. These services deal respectively with matters relating to meteorology; resource management of water, forests, wildlife and lands; and pollution control.

Atmospheric Environment Service

The Atmospheric Environment Service (AES) provides data and information on past, present and

future atmospheric, ice and sea-state conditions, and advice and consultation on the utilization and application of this data and information. The service operates a national weather and ice-forecasting system 24 hours a day, seven days a week, in support of the safety of life and property and the day-to-day planning and operating activities of Canadians. In addition, meteorological, ice and sea-state information and services are provided on a priority basis in support of the transportation and military requirements of the Ministry of Transport and the Department of National Defence.

AES conducts research and development in the general areas of atmospheric processes, weather forecasting and observing systems, air quality, other inter-environmental problems, and instrument design and evaluation.

Extensive specialized professional and technical training are provided for AES staff and various personnel of other government departments.

Environmental Management Service

The Environmental Management Service (EMS) provides support and leadership for the conservation and continued productivity of Canada's forests, inland waters,

wildlife and lands. The service also takes part in environmental assessments which are concerned with the protection of the quality of the environment.

EMS was formed in 1973 by the amalgamation of the Inland Waters Directorate, the Canadian Wildlife Service, the Canadian Forestry Service and the newly created Lands Directorate. The Policy and Program Development Directorate was established at the same time.

There are five regional directors general. These directors general in turn supervise directors of establishments. Each of these establishments is concerned with programs in one of the four natural resource fields for which EMS is responsible. In addition the service operates five national forestry institutes, two forest products laboratories and the Canada Centre for Inland Waters.

The Canadian Forestry Service conducts research to provide a scientific basis for federal policies affecting forestry and to assist the provinces and industry with information on improved forest management practices. It also conducts research to determine the environmental effects of forestry practices and to assess the effects of human activities on the forests. The service is responsible for the

co-ordination of programs to help the provinces and industry protect forests from fire, disease and insects; for conducting forest products research and for providing advice and co-operation in forest resource development and policy, both in Canada and abroad.

The Canadian Wildlife Service is responsible for the protection and management of migratory birds through research, surveys, development of regulations and habitat management. With the provinces and other agencies the service undertakes co-operative wildlife programs of research, management and interpretation. It also provides advice to other federal agencies and to territorial and provincial agencies.

The Inland Waters Directorate plans and participates in national and international water management programs and policies, and conducts research on inland waters quantity and quality. Major concerns of the directorate include a flood damage reduction program, development of federal policy on inland waters, co-ordination of Canada's responses to boundary water problems, river basin planning with the provinces and the research programs of the Canada Centre for Inland Waters.

The Lands Directorate provides information on the ecology, capability and use of land. It

operates mapping programs in support of federal and provincial programs of resource management and environmental quality objectives, and conducts land classification and land use research.

Environmental Protection Service

The Environmental Protection Service (EPS) was formed to ensure that the federal government's responsibilities for protection of the environment are carried out in a manner consistent with national policy and, where necessary, enforced under appropriate legislation. EPS is concerned with air pollution, water pollution, solid waste management, resource and energy conservation and environmental emergencies, and contributes to environmental impact monitoring and control.

As the control arm of the Department of the Environment, EPS is the focal point for contact on environmental protection matters with industry, corresponding agencies of the provincial governments, departments and agencies of the federal government and the public.

Administration Program

Planning and Finance Service

The Planning and Finance Service is comprised of two major elements, directorates dedicated to policy support and those providing common services.

The two policy support directorates (Policy, Planning and Evaluation, and Liaison and Coordination) assist in the development of departmental policy, and provide the minister and the deputy minister with an overview that gives coherence to the department's activities.

The common services (Finance, Internal Financial Audit, Departmental Management Services, Personnel and Organization, Computing and Applied Statistics, and Emergency Planning) develop guidelines, procedures and systems to support all elements of the department and provide liaison with central agencies such as Treasury Board and the Public Service Commission.

Information Services Directorate

Information Services Directorate (ISD) co-ordinates the information function of the department, which it carries out jointly with

service information groups at headquarters and in regional offices.

These information groups have the responsibility to communicate with the public on the policies, legislation, services and regulations of the department and its component services and to foster communication among the department's own employees, so that all elements of the department understand how their efforts contribute to a co-ordinated approach to environmental problems.

Federal Environmental Assessment Review Office

The Federal Environmental Assessment Review Office, created in April, 1974, reviews the potential environmental impact of proposed major developments which include a substantial federal involvement as sponsor, landowner, financial contributor or user. These reports and recommendations are used in the planning and implementation of such projects, in order to prevent or minimize any adverse effects on the environment.

Highlights of the Year

The most significant event of the year for the department was the introduction by Canada on January 1, 1977, of extended fisheries jurisdiction to 200 miles. This decision by the Canadian government was prompted by the critical state of fish stocks, particularly in the Atlantic region, and the need to impose a rational scheme of conservation and management to counter over-fishing by foreign fleets. The first three months of 1977 demonstrated the effectiveness of the new management regime and was an encouraging initial step in achieving the goal of restoring fish stocks to former levels of abundance.

Other Fisheries and Marine Service initiatives during the year saw the introduction of lobster fishing licensing schemes in Newfoundland and the Maritimes, intensified efforts to upgrade fish quality and a number of experimental fishing projects on both coasts. The year-end also saw the completion of the planning phase of the multi-million dollar salmonid enhancement program in British Columbia. FMS continued to play a key role in Canada's involvement in the Law of the Sea Conference and was active on many fronts in work relating to preservation of the aquatic environment, marine scientific research and develop-

ment, and transfer of marine technology.

At a time when Canada is confronted with the prospect of energy shortages, it is noteworthy that the Environmental Management Service commissioned a study to investigate the potential for large-scale production of methanol from forest biomass. This study indicated sufficient economic potential to justify a more detailed investigation which is now proceeding. If successfully developed, this industry could make an appreciable contribution to our automotive fuel requirements. Within CFS, there was a reallocation of resources to expand research into derivation of fuels from wood and forest harvest wastes.

The spruce budworm continued to be the most damaging forest insect pest in Canada. Moderate to severe defoliation occurred over some 90 million acres (36 million hectares) in eastern Canada. About 19 million acres (8 million hectares) of this area were sprayed in 1976. In view of the magnitude of the spruce budworm problem and of the possible side effects of chemical insecticides, the Canadian Forestry Service (CFS) increased its research program in an effort to find alternatives to chemical controls. Monitoring of the

large-scale control operations was also expanded.

The Inland Waters Directorate made major contributions to important work conducted by the International Joint Commission (IJC), including studies of the proposed Garrison diversion in North Dakota and investigations by the Upper Lakes Reference Group on the pollution of Lakes Superior and Huron.

The Canadian Wildlife Service (CWS) made a breakthrough in its research on the effects of marine oil on seabirds. This was the discovery in 1976 that small amounts of ingested oil gravely reduce the birds' ability to absorb nutrients from food.

Working with provincial governments, the CWS identified unprotected wetlands -- vital habitat for many birds -- and reviewed ways to secure the most critical ones.

The Lands Directorate chaired the Interdepartmental Task Force on Federal Land Use Policy, which prepared a review of major land uses of national concern. The directorate also co-operated with the James Bay Development Corporation in the presentation of the James Bay Environment Symposium in May, 1976, in Montreal.

At the Environmental Protection Service, highlights of the air pollution control program included initiation of legal

proceedings against a company that imported leaded gasoline containing more than the allowable maximum content of lead, and completion of a study on emissions and control technology in the vinyl chloride and polyvinyl chloride manufacturing industries.

The first of a series of aviation weather reporting stations was established by the Atmospheric Environment Service (AES) at Eskimo Point, Northwest Territories, through the co-operation of the Departments of Fisheries and the Environment, Transport, Indian and Northern Affairs and the territorial government. The new stations are designed to improve the safety and regularity of air operations in the Arctic.

With Ocean and Aquatic Sciences, AES helped to plan the First GARP Global Experiment of the Global Atmospheric Research Program, to be held from December 1977, to November, 1979. As the largest single contributor to this program, Canada will take on a lead-nation role.

An intensive study in support of the LRTAP (Long-Range Transport of Air Pollutants) Program, with AES as lead agency and involving EPS, EMS and FMS as well, gave insight into the distribution of sulphates in the air and precipitation in Eastern

Canada, and provided evidence that air pollution is a serious regional problem as well as a local one. A 50-station Canadian network was established to sample precipitation and investigate regional differences in the wet deposition of pollutants.

The first winter navigation by Canadian vessels in the upper Great Lakes was undertaken in February, during one of the coldest winters in 30 years. Special reconnaissance and ice forecasting support by the Atmospheric Environment Service assisted in three passages through the lakes during the winter.

Fisheries and Marine Program

Fisheries and Marine Service

The Fisheries and Marine Service (FMS) is responsible for the management of Canada's ocean and inland fisheries (the latter in co-operation with the provinces); fisheries and oceanographic research contributing to the management, understanding and optimum use of aquatic renewable resources and their environment; hydrographic surveying and charting of navigable coastal and inland waters; and research in support of international agreements relating to fisheries management and marine environmental quality. The service is also responsible for the planning and administration of more than 2,300 harbors for small craft, and contributes to environmental impact studies affecting coastal and inland waters.

Fisheries Management

Fisheries Management is concerned with the conservation of fish and protection of fish habitats as well as programs of research in support of these activities, allocation of control of access to fishery resources, fish inspection, and the provision of support services to commercial fishermen and the fish processing

and distributing industry. Activities are organized under Fishing Services, Resource Services and Industry Services, and are summarized in the following paragraphs.

Fishing Services

Highlighting one of the most eventful years in the history of commercial fishing in Canada was the implementation on January 1, 1977, of extended coastal fisheries jurisdiction to 200 miles on both east and west coasts. The overall objective is to provide increased opportunities to Canadian fishermen and open the way to a new era of prosperity in the fishing industry.

The unilateral decision to create the 200-mile fishing zone was dictated by the seriously depleted state of fish stocks, particularly in the east coast groundfisheries, and the need for effective conservation and management measures to allow the stocks to rebuild to their former levels of abundance. By the end of the year under review, bilateral agreements had been concluded with several foreign countries, permitting them to continue to fish within Canada's extended jurisdiction for stocks surplus to Canada's harvesting capacity and allowing a smooth transition to the new scheme of

fisheries management.

Introduced with the 200-mile zone on January 1 was a foreign fishing vessel licensing scheme, a significant result of which was to reduce the number of foreign vessels fishing off Canada's coast to fewer than 500 from the 1975 total of approximately 1,500. In addition, the catch quotas of foreign fleets were drastically curtailed. Under the new management plan it is anticipated that Atlantic groundfish stocks will be restored to nearly their full potential within 10 years, permitting an annual harvest of 1.6 million metric tons -- more than double the 1977 total allowable catch.

A vital component of the 200-mile zone management plan is a computerized data-base system known as FLASH (the Foreign Fishing Vessels Licensing and Surveillance Hierarchical Information System), devised and constructed by a staff team at FMS headquarters with the support of the Marine Environmental Data Service.

Fed with information from regional terminals at St. John's, Halifax and Vancouver, the Ottawa-based FLASH computer provides headquarters and regional managers with up-to-the-minute data on foreign fishing operations on east and west coasts. In addition to keeping track of

where all foreign fishing and support vessels are located within Canada's 200-mile zone, what they are fishing for and with what gear, FLASH allows for almost instantaneous estimates of catches for specific stocks, areas, fleets and vessels.

To assist in the job of patrolling and managing the extended zone, which represents an additional 600,000 square miles of high seas, FMS patrol vessels received support from ships and aircraft of the Departments of Transport and National Defence. During the first three months of 1977, boardings and inspections of foreign fishing vessels averaged 80 a month and the entire operation proceeded smoothly and effectively.

On the domestic side, staff were actively engaged in developing and monitoring the 1977 Fishing Plan for the Atlantic groundfish fleet. Main objectives of the plan are: (a) to avoid conflicts between local and distant-water fleets over scarce fishery resources; (b) to allow fish stocks to rebuild for bigger catches in the future; and (c) to stretch out available resources in order to keep the groundfish industry working year-round. The groundfish fleet consists of more than 10,000 intermediate and small boats and some 160 large trawlers.

Distribution des navires
au large de la côte est

East Coast -
Ship Distribution



A typical printout from the Fisheries and Marine Service's FLASH computer, showing foreign fishing vessels off the Atlantic coast. Concentrations of #s represent land masses; figures in the "water" indicate the number and location of foreign vessels; vertical and horizontal scales show latitude and longitude. The FLASH system is a valuable aid in the management of Canada's new 200-mile fishing zone.

Entry control was introduced to the Newfoundland lobster fishery during the year, based on recommendations of a comprehensive task force report, and a new lobster licensing policy was developed for the Maritime Region. Registration of all fishing vessels was completed and restricted entry policies were extended to all fisheries.

Illegal fishing for salmon, lobster and groundfish continued to occupy the attention of fishery officers, resulting in some 552 prosecutions in the Maritime Region alone. Concerted efforts were undertaken on both east and west coasts to reduce the level of poaching. An extensive study was prepared on the status of Atlantic salmon.

During the year the Fishermen's Community Services Program, aimed at improving the exchange of information between fishermen and the government, was introduced as a pilot project in Nova Scotia and New Brunswick. Initial results of the project were encouraging.

Acquisition of the first Canadian aluminum patrol vessel, the 120-foot Cape Harrison, greatly enhanced the service's ability to carry out its additional offshore surveillance responsibilities. A second aluminum patrol vessel was under construction, also for use on the

Atlantic coast.

The harp seal hunt, conducted off the east coast, was again a centre of controversy and resulted in a number of charges being laid under the Seal Protection Regulations. Canada's seal quota, as set by the International Commission for the Northwest Atlantic Fisheries, was 62,000 for the "front" (icefields north-east of Newfoundland and Labrador) and 63,000 for the Gulf of St. Lawrence and landsmen.

In August, 1976, the scope of the Fishing Vessel Subsidy Program was extended to include modification and conversion of vessels to increase their catching capability, improve the quality of the catch or allow operation in fisheries based on under-exploited species. In addition, the minimum length requirement was reduced. A total of \$4 million was disbursed under this program in 1976-1977.

A number of special projects were undertaken during the year in response to the needs of the fishing industry. These included a safety education program and co-ordinated air-sea rescue plan for the B.C. herring roe fishery, involving Fisheries, Coast Guard and National Defence vessels and aircraft. In contrast to previous years, no lives were lost during the current year's herring roe fishing operations.

Another highly successful project involved the Bay of Fundy herring purse-seine fishermen, who, with active FMS support and encouragement, formed their own marketing co-operative. By regulating the fishery through self-imposed vessel quotas and by diverting a larger proportion of the catch into food production rather than fish meal, the fishermen were able to increase the 1976 value of their catch by more than \$1 million. In addition, a lengthened fishing season provided an extra two months' employment for processing plant workers.

Among other projects undertaken during the year was the implementation of an assistance program to Irish moss fishermen in the Maritimes.

The number of policies under the Fishing Vessel Insurance Plan declined to 6,715 from the previous year's total of 7,363, with the plan showing a surplus of \$957,714 on the year's operations. Total value of insurance in force is \$122 million.

The total fish catch in Canada in 1976 amounted to 1.1 million metric tons, representing a landed value of \$390 million and marketed value of \$972 million. The catch was a slight increase over the two previous years, with the commercial value up by more than \$275 million over 1975.

Catches in the Atlantic provinces totalled 880,000 metric tons, with a marketed value of \$625 million, while the Pacific catch amounted to 180,000 metric tons, valued at \$297 million.

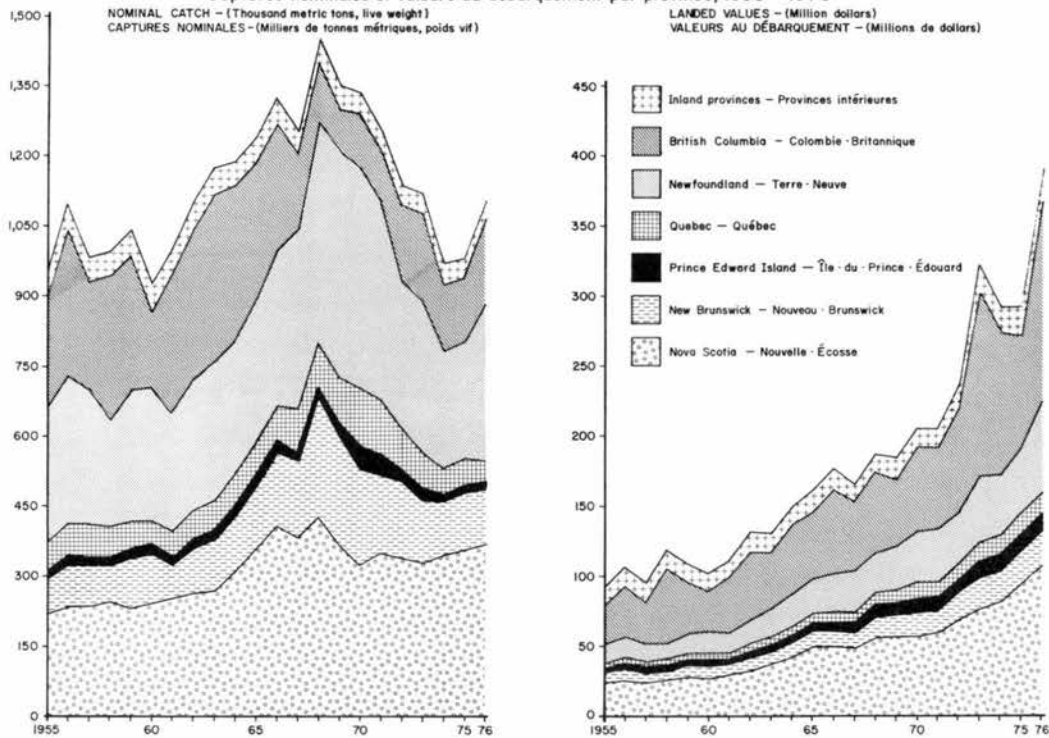
The value of fish products exported by Canada in 1976 amounted to \$600 million, compared with \$461 million the previous year.

Resource Services

The activities of Resource Services are directed towards improving the management and sustained economic use of Canada's marine and freshwater fisheries resources, and towards protection of the aquatic base supporting those fisheries. During the year this work involved resource and stock assessment and associated biological research, with particular emphasis on the fish stocks within Canada's new 200-mile fishing zones; fisheries resource enhancement and control of fish diseases in natural or hatchery stocks; fish habitat protection; contaminant control, environmental assessment and related research; aquaculture (fishfarming) development and the operation of vessels and other platforms for biological research.

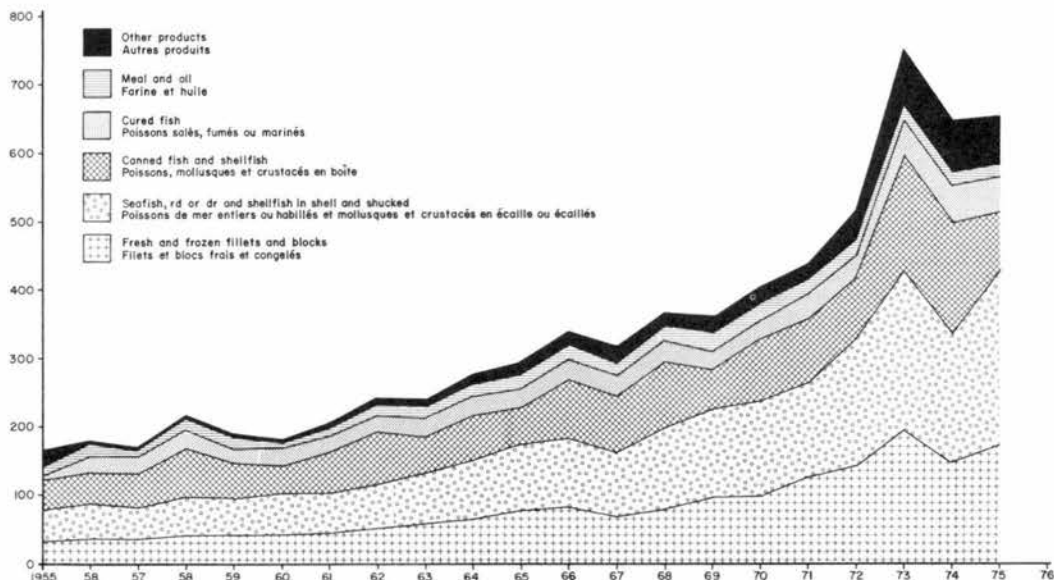
Staff contributed to the development and implementation of

Nominal catch and landed values by province, 1955 - 1976
Captures nominales et valeurs au débarquement par province, 1955 - 1976



After reaching a peak in 1968, Canada's commercial fish catch suffered a severe decline in the mid-1970s. Worst hit were the east coast ground-fisheries. Scientifically-based fisheries management policies are now bringing about a recovery of the stocks.

Marketed value by main product groups, Canadian sea fisheries, 1955 - 1976
Valeur marchande par principaux groupes de produits, pêches maritimes Canadiennes, 1955 - 1976
(Values in million dollars - Valeurs en millions de dollars)



Except for a decline in 1974 and 1975, the market value of Canada's fishery products has shown a steady upward trend over the past 20 years. Product value in 1976 (not indicated on chart) reached a record \$923 million.

new federal legislation and policies to protect the aquatic resource base. This included involvement in implementation of the Environmental Contaminants Act, amendments to the Environmental Assessment and Review Process and development of habitat protection amendments to the Fisheries Act.

In the Newfoundland Region, the main emphasis during the year was centred on increasing the data required to improve the reliability of stock estimates. As a result of these studies, total allowable catch levels for the major groundfish stocks were determined. Herring research in eastern Newfoundland revealed strong fluctuations in recruitment (increases in stock), with corresponding fluctuating catches.

Studies of the distribution and abundance of capelin in the coastal and offshore areas were expanded, using acoustic equipment to locate and estimate abundance. Lobster and snow crab studies concentrated on determining exploitation rates, annual abundance and catchability with respect to environmental conditions, and resource waste in the fishery. Monitoring of the squid fishery and studies on squid biology were continued, while giant scallop research was directed to problems related to scal-

lop culture, in co-operation with the provincial fisheries authorities. Stocks of Iceland scallops on St. Pierre Bank and in the northwestern Gulf of St. Lawrence were also studied.

Research in support of the management of freshwater and anadromous fish was continued in and around Newfoundland, as well as in the Labrador Sea and the West Greenland area. Laboratory experiments on the nature and effects of petroleum and petroleum dispersants upon marine organisms were also conducted.

Other research projects in Newfoundland included studies of the biochemical population genetics of commercially important fish stocks to help refine the distinction between stocks, and intensified research on species interactions and their resultant effects on growth and survival of stocks.

Laboratory studies continued on the chemistry of the bacterial components which result in antibody production in fish and act as a defence mechanism against possible disease. This knowledge will be applied to the problem of fish disease in hatcheries and aquaculture.

In the Maritimes, priority was given to studies to evaluate research requirements relating to Canada's new responsibilities under extended jurisdiction. In

addition to continuing research on fish stocks in the extended zone, staff provided scientific support for foreign fleet licensing and bilateral negotiations, and to such groups as the Atlantic Herring Management Committee. Research data was also provided in support of Canadian negotiations at meetings of international fishery commissions.

Investigations were accelerated on the inshore-offshore lobster stocks in the area southeast of Nova Scotia and in Northumberland Strait, while extensive field studies were conducted on the potential environmental impact on fisheries of the Wreck Cove hydroelectric development.

Other activities included the continued evaluation of the three major Atlantic salmon stocks currently under a commercial fishing ban; hatchery production and distribution of 2.26 million salmonids; and completion of the first phase of construction of the Liscomb River fishway in Nova Scotia. The framework for formation of the Canadian Atlantic Fisheries Scientific Advisory Committee was developed in conjunction with other regions and headquarters staff. The objective of the committee is to advise managers on the full range of conservation measures for all

Atlantic coast fish stocks.

Another highlight of the year was consolidation of regional fisheries environmental responsibilities under one co-ordinating unit, facilitating the involvement of FMS in protecting the aquatic resource base from the effects of major development proposals, such as deep-sea ports for oil tankers and nuclear generating stations.

The main thrust of Quebec-based research involved the study of several commercially-important marine mammal species on the east and west coasts of Canada, especially the harp and hooded seals and the North Pacific fur seal. Data obtained from tagging programs and from collections of biological samples were used to provide advice to management and to the International Commission for the Northwest Atlantic Fisheries (ICNAF), the International Whaling Commission and the North Pacific Fur Seal Commission.

Biological investigations were also carried out in Canada's North, with emphasis on the distribution and abundance of marine mammals of importance to the Inuit economy, particularly the white whale (beluga), narwhal, walrus and ringed seal. Further studies of marine fisheries were made in the Mackenzie Delta area and new data were gathered on the

ecological factors that control production in the sea, and the reaction of marine plants and animals to environmental stress. Much of this work was concerned with assessing the environmental impact of oil and gas developments, particularly offshore drilling in the Beaufort Sea and the construction of a gas pipeline from the Arctic Islands to Southern Canada.

The staffing of additional scientific positions in the Quebec Region accelerated efforts to establish a new research unit in the province, as well as advancing plans for a full-scale laboratory. During the year, staff participated with Pacific Region scientists in the Controlled Ecosystem Pollution Experiment in British Columbia and contracted for a study of eel populations in Quebec.

Research programs on the Great Lakes, which resulted primarily from the Canada -- United States Great Lakes Water Quality Agreement and international fisheries habitat protection problems, included studies of the effects that heated effluents, increased nutrients and toxic substances have on the well-being of plant and animal life in the lakes. Research was also carried out on behalf of the IJC on the effects of land use activities on the aquatic environment.

Investigations continued into the life history, behavior and migrations of sea lamprey, aimed at controlling the ravages of this predator in the Great Lakes. Work included surveys on 304 streams and Lake areas to detect the presence or delineate the distribution of sea lamprey larvae. Lampricide treatments were carried out on 28 tributary streams of Lakes Superior, Huron and Ontario, while several lake areas and estuaries on Lakes Superior and Huron were treated with granular toxicant to destroy lamprey larvae.

Research on freshwater fish populations in support of federal fisheries management responsibilities in the Northwest Territories included studies of commercial walleye exploitation, selective harvesting experiments on unexploited populations in small lakes, development of walleye rearing ponds to enhance survival in lake stocking practices, and continued study of the life cycle of the arctic char in Kent Peninsula. A new management scheme for the commercial fishery on Great Slave Lake was implemented as a result of whitefish population studies in preceding years.

Other research was aimed at assessing the ecological importance of the contamination of natural freshwater systems by

heavy metals, radionuclides and acid precipitation. A series of bioassays and protocols were developed for screening chemical pollutants in fresh water, to be used in developing effluent regulations to protect water quality and aquatic life forms. Studies of the English-Wabigoon river system and areas of Lakes Huron and Superior were undertaken to assess metal and pesticide pollution.

Various impact assessment studies were conducted, including the Arctic Islands pipeline project, the Mackenzie Highway, the Snare River and the Nanisivik and Arvik mines. Impact research studies involved experimental fish passage facilities, and basic and applied limnological research at Stanwell-Fletcher lakes. In addition, several studies were conducted within the AOSERP (Alberta Oil Sands Environmental Research Program) and major involvement with the Garrison diversion study continued.

Wide-ranging research projects in the Pacific Region included hydroacoustic biomass estimates of hake and pollock stocks in the Strait of Georgia and of other species in Queen Charlotte Sound and off Vancouver Island; development of more accurate methods to predict herring abundance; and an investigation of salmon kills

by lampreys.

Oyster spatfall forecasting, essential for successful seeding of oyster beds, was provided to the B.C. oyster industry. Mussel raft culture methods were perfected and scientific information was provided for a new abalone fishing permit system.

A new chemical tagging method for identification of salmon stocks was developed to the field trials stage and an efficient vaccine immersion method for protecting cultured salmon against vibriosis, a common marine bacterial disease, was tested and improved.

In a fish-farming experiment, 75 per cent of growth-accelerated coho and chinook salmon fry survived in seapens to a marketable size of 12 ounces in just over 14 months from hatching. Significant strides have been made in developing a hatchery diet for Pacific salmon which could be manufactured in British Columbia, thus replacing imported products. Enrichment of a sockeye salmon lake by air dropping chemical fertilizers to boost fish food organisms was successfully tested at Henderson Lake. Previous tests of the technique dramatically increased sockeye production.

Other enhancement studies included the release of two groups of 500,000 chum salmon fry

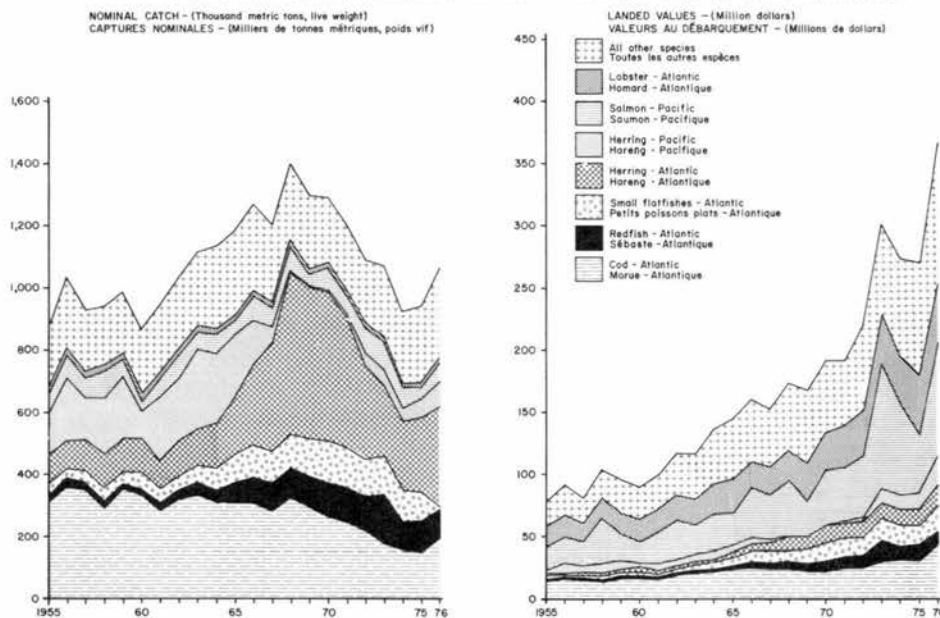
to compare fry-to-adult survival rates of the Japanese chum hatchery and gravel box incubation techniques, and the successful raising of 250,000 coho smolts in an experimental rearing channel.

The close of the fiscal year saw conclusion of a two-year planning phase prior to implementation of the multi-million dollar salmonid enhancement program in British Columbia, designed to double the annual production of Pacific salmonid species. Development projects

planned for the next few years cover the entire B.C. coast and extend to spawning and rearing waters in the interior of the province. Projects will include rearing ponds, incubation boxes, hatcheries, fishways, spawning channels and lake enrichment programs.

The second year of a major study of the impact of the forest industry on salmon-rearing streams has been completed and new information on avoidance of pulp mill effluents by young

Sea fisheries: Nominal catch and landed values by main species, 1955 - 1976
Pêches maritimes: Captures nominales et valeurs au débarquement par principales espèces, 1955 - 1976



Pacific salmon is traditionally the most valuable species in Canada's commercial fish catch, followed by Atlantic lobster and cod.

salmon in the sea was obtained in field and laboratory investigations. Significant progress was also made in identifying chemicals responsible for fish poisoning as a result of pulp mill discharges.

Various environmental impact assessment studies were undertaken, including those relating to the Kitimat oil port proposal, Alaska Highway gas pipeline proposal and the Hat Creek and McGregor River power development projects. Biological resource documentation was provided for the West Coast Oil Ports Enquiry and the Fraser River Canyon spruce budworm spray program.

Industry Services

The Industry Services Directorate is responsible for the development and implementation of industrial and commercial policies and programs for the rational growth, development and economic stability of the primary and secondary fishing industries.

As a result of the continuing decline in resource availability, steps were taken to assist the Canadian groundfisheries and other distressed segments of the industry during 1976-1977. Payments made to fishermen and processors of frozen groundfish fillets and fillet blocks kept the industry operating during

this difficult period. Funds were also utilized for initial programs to rehabilitate the fisheries. Vessel owners were given assistance to investigate the development of commercial fisheries in nontraditional areas, resulting in the discovery of new fishing grounds where the catch of flounder was sufficient to cover the costs of the program.

Two other rehabilitation programs involved studies relating to export marketing consolidation and restructuring of the groundfish processing industry. Both programs produced extensive policy advice to the minister on these problems.

Following the extension of jurisdiction to 200 miles, several marketing initiatives were undertaken to assist industry and government to better understand the changes resulting from this new economic reality.

Market outlook services involved the monitoring of major markets, including the supply and demand for traditional and underutilized species; periodic assessments of trends in the international supply situation; and projections and forecasts of supply and demand in the short and long term. Staff also participated in the development of a Canadian fisheries position for multilateral trade negotiations,

and the work of the Canadian Tariff and Trade Committee. Regular monthly outlook bulletins, the annual groundfish outlook and a shellfish outlook were published. Special market reports prepared, and other studies and projects examining appropriate programs and policies for orderly marketing and trade were completed.

Marketing development and product promotion activities carried out by the Fisheries Food Centre (formerly Consumer Services Division) included the planning and implementation of several major promotional events in Canada, the United States and Western Europe. Associated with these activities were radio interviews and television appearances by staff. The centre was also a major participant in the promotional activities of the North Atlantic Seafood Association, comprising the Scandinavian and Canadian fishing industries. Numerous fish recipes were researched, prepared and evaluated by test panels, and some 400,000 pamphlets and recipes were distributed during the year.

The declaration of the 200-mile fishing zone substantially increased the demand for statistical information which the Intelligence Services Division routinely provides to governments, industry and the general

public, as well as to such international organizations as the United Nations Food and Agricultural Organization (FAO) and Organization for Economic Co-operation and Development (OECD). Other activities included the provision of detailed information on landings, production, markets, costs, prices and earnings on an ad hoc and regular basis in the form of published bulletins and the Annual Statistical Review. Computer and statistical advice were also provided to data users.

Activities in the area of industrial policy centred on extensive interdepartmental liaison with the Foreign Investment Review Agency and the Department of Regional Economic Expansion. Staff also participated actively in the provision of advice to DREE respecting the administration of the Regional Development Incentives Act. There was, in addition, a substantial contribution to the work of the Canadian Saltfish Corporation.

Efforts were continued to improve the national inspection program covering vessels, processing plants and domestic and imported products in accordance with the service's statutory obligations to ensure the safety, good quality and proper identification of fish products. This

program is co-ordinated with the activities of other Canadian food inspection agencies and with international standards organizations.

Regional laboratories staff trained in various disciplines of fisheries science and technology were made available for industrial research and development aimed at improving the harvesting, processing and marketing of fishery resources.

On the Atlantic coast, programs included successful trials with insulated containers for transporting and holding fish and the use of net bags for unloading fish. In a continuing effort to expand and diversify the catching capabilities of longliners on the east coast of Newfoundland, two 52-foot longliners were chartered to test the feasibility of catching herring using the pair mid-water trawling technique. Demonstration fishing showed how redfish by-catch can be reduced during shrimp trawling.

Six exploratory trips were made to East Greenland to study northern waters for stocks of groundfish. The results were sufficiently encouraging to warrant further commercial exploration by Newfoundland-based vessels. Further exploratory trips, in co-operation with industry, indicated a potential for new fisheries for redfish,

cod and grenadiers in northern waters. Another experimental fishing project involved efforts to catch food-quality offshore mackerel during the winter months using conventional midwater trawls. More efficient methods for preparing salted minced fish were developed, and acceptability studies were conducted in several countries.

At the northern limit of Canadian waters on the Pacific coast, a demonstration project to fish for Dover sole using three 100-foot stern trawlers was notably successful. In other areas, research scientists assisted the B.C. herring roe industry in minimizing a costly spoilage problem affecting roe under refrigeration, and used the residual salted carcasses for production of a commercially and nutritionally valuable fish silage as animal feed. Staff also developed a more efficient technique for chilled seawater storage aboard vessels.

In the inland fisheries, new and improved freshwater fish products and processing techniques were developed for lake trout, mullet, alewife and freshwater roe. Research projects included the use of electronics and ultrasonics to assess fish quality and the design of a portable fresh and frozen fish processing plant. A major trans-

portation study of the flow of freshwater commercial fisheries from lake to market was carried out to provide a management tool to minimize costs of transporting, handling, processing and marketing of fish products. A survey assessed the possible impact on the Ontario aquaculture industry of the new Fish Health Regulations which came into effect January 1, 1977.

In the area of inspection, more than 1,100 fish processing plants, producing for interprovincial and international trade, were subjected to frequent inspection as well as periodic in-depth examinations for compliance with construction and equipment requirements. Domestic fishery products valued at \$973 million in 1976, of which nearly two-thirds were for export, were routinely inspected for quality during the year. Imported products valued at \$183 million from more than 80 countries were inspected at ports of entry. In addition to quality examination, fishery products were routinely monitored for potentially hazardous substances such as mercury, polychlorinated biphenyls (PCBs) and pesticide residues. Staff conducted a survey of commercial fish species in the Great Lakes to determine and develop a data base of PCB levels in commercially-harvested

fish.

Staff continued their work with the International Codex Alimentarius Commission to develop international fish product standards and codes of technological and hygienic practice. Other international activities included provision of an extensive inspection and developmental training program to Peru under the sponsorship of the Canadian International Development Agency (CIDA), and participation in international contaminant monitoring programs.

Ocean and Aquatic Sciences

At headquarters, the major divisions of Ocean and Aquatic Sciences are the Marine Sciences and Information Directorate (MSID) and the Canadian Hydrographic Service (CHS). MSID, located in Ottawa, is composed of three branches: the Ocean and Aquatic Science Affairs Branch, the Marine Environmental Data Services Branch and the Scientific Information and Publications Branch. CHS is responsible for hydrographic surveys and the publication of nautical charts and other material to ensure the safety of navigation on Canada's

coasts, major inland water routes and adjacent oceans. Co-ordinated in Ottawa, the work is carried out from regional centres at Dartmouth, Burlington, and Victoria.

Marine Sciences and Information Directorate

The Ocean and Aquatic Science Affairs Branch was active during the year in its primary role of providing advice and co-ordination on matters having an impact on the national interest in ocean and aquatic sciences. The branch assisted in completion of the TERMPOL Code, a voluntary program aimed at preventing pollution at marine terminals. Related activities were concerned with a TERMPOL review of the Kitimat Ltd. oil port proposal, the Thompson enquiry into the evaluation of west coast oil traffic and a departmental study on alternative west coast oil port sites and routes.

A staff member was chairman of a working group which reported on an environment risk index for the siting of deep-water oil ports on the east coast. This report has been used as the environmental basis for the Canadian opposition to oil tanker traffic in Head Harbor Passage, New Brunswick. A major study involving deep-sea tide gauging and mathematical

modelling was completed under contract with the Bay of Fundy Tidal Power Review Board. Staff members also provided scientific input to the departmental Long-Range Transport of Air Pollutants Committee, advised on Canadian policy regarding weather modification and considered the environmental impact of oil and gas exploration programs on ocean systems.

The Ocean and Aquatic Science Affairs Branch, which oversees the national administration of the Ocean Dumping Control Act, prepared the first national report on ocean dumping activities for the year 1976, and also played a role in intergovernmental meetings aimed at placing global controls on dumping of wastes at sea.

During the year the branch assumed responsibility for administration of the Fisheries and Marine Service Science Subventions Program. This program brings the Canadian university community into closer association with federal scientists, helping to achieve the service's objectives.

A substantial contribution was made to the departmental study on aquatic environmental quality. The study made recommendations which are having a significant effect on the conduct of work in this field.

In the area of ocean technology, Ocean and Aquatic Science Affairs Branch continued to act as a clearing house for unsolicited proposals with ocean and aquatic science implications. Staff was involved with surveillance satellite experiments, as well as with the second phase of the Canadian Ocean Data Buoy System. Planning for future studies in weather prediction to meet the requirements of DFE and other departments was begun. In addition to providing the secretariat for the Panel on Ocean Management, the Branch was assigned a wide variety of tasks, ranging from organization of funding for a new research institute in Newfoundland to the definition of federal involvement in the evaluation of tug-barge operations in the Arctic islands. Advice was also provided to the department on questions related to ocean engineering, particularly those associated with operations in ice-covered waters.

Staff assisted the Intergovernmental Oceanographic Commission (IOC) of UNESCO through involvement in its subsidiary bodies, development of financial and scientific management alternatives and formulation of its new policy initiatives. In concert with the FMS International Directorate, marine policy positions were developed for

input to the NATO Committee on Challenges of Modern Society (NATO-CCMS), the Marine Environmental Protection Committee of the Intergovernmental Maritime Consultative Organization (IMCO) and the International Council for the Exploration of the Seas. Considerable effort continued to be devoted to bilateral science and technology agreements with Germany, France, Belgium, Russia and Japan, with significant progress being achieved in the past year. Demands also increased for international transfer of technology and co-operative arctic marine studies.

The Scientific Information and Publications Branch, as the major information service in aquatic sciences and fisheries in Canada, handled more than 6,000 requests for scientific information during the year. Fifteen bilingual reports identifying scientific requirements for the management of fisheries and aquatic resources in Canada were completed, as were several French editions of major books. For the fifth time in eight years a branch publication won the Wildlife Society of America award for fisheries publications. Three special issues of the Journal of the Fisheries Research Board of Canada were published, on Lake Erie, the Pacific Science Congress and Canadian physical

oceanography. More than 100 items, amounting to 12,000 printed pages, were published or were in process in 1976-1977 and 500 other reports and scientific translations were co-ordinated and indexed.

The scientific and technical information program co-ordinated Canada's input to the FAO-IOC Aquatic Sciences and Fisheries Information System and advised on the development of this system internationally. The major benefit to Canadians will be improved information products -- especially a computerized data base, Aquatic Sciences and Fisheries Abstracts -- allowing direct access to the world's journal and report literature in these areas.

The Marine Environmental Data Services Branch (MEDS) continued to acquire, store and disseminate physical-chemical oceanographic data in fulfillment of national and international commitments. A total of 626 sets of observations from 30 different cruises were received and added to data files, in addition to the 3,935 bathythermograph records processed during 1976.

The branch shared experiences in oceanographic data base management with the National Oceanographic Data Center, Federal Republic of Germany. An experimental pollution data base was

jointly developed with the Bedford Institute of Oceanography, using data gathered through the Working Committee for the Integrated Global Ocean Station System. MEDS also became the focal point for the Canadian distribution of manuals and guides published by the IOC.

Hourly data from more than 140 tidal and water level gauges were processed. As part of an ongoing program, wave data were collected at three permanent stations off Halifax, Nova Scotia; St. John's, Newfoundland and Tofino, British Columbia. In addition, 19 temporary stations were in operation during the year at various locations around Canada in connection with marine construction projects and petroleum exploration. Work on the tsunami (seismic sea wave) warning project continued to progress well.

As regional data centre for oceanographic data for ICNAF, the branch was active incorporating data submitted by member countries and providing information on request. A total of 436 requests for information and data were received and answered, an increase of 20 per cent over the previous year.

MEDS also played a major role in the development of the FLASH computer-based information system in support of surveillance and enforcement operations for

Canada's 200-mile extended fishing zone.

Regional Activities

In the Atlantic Region, research into the processes of marine biological productivity continued in order to improve the management of Canadian commercial fisheries by providing a predictive capability. Although most of the work is long-term, significant advances have been made in studies of the structure, measurement and prediction of plankton availability; understanding and predicting the influences of climatic and oceanographic factors on fish stocks and production; and determining the effect of artificially induced environmental changes, such as pollutants, on marine ecosystems and their biological productivity.

Progress has been made in the development of sampling equipment and procedures for the real-time collection of biological data in the ocean, specifically relating to the distribution of phytoplankton, zooplankton and juvenile fish, and including the collection of associated physical oceanographic data. The equipment involved includes high-frequency sonar, electronically controlled nets, fluorometers and conductivity cells. This work

has resulted in the development of an advanced biological and environmental sampling system that is in the forefront of this area of instrumentation.

Investigations conducted during the year provided some measure of the current velocities at the edge of the Labrador Current and of the current's low-frequency variations.

A study of the wave "climate" of the North Atlantic including the Canadian Atlantic coast, showing the distribution of wave energy with season and location, was completed during the year. Such information is much in demand for designing engineering projects, such as oil drilling platforms and deep-water harbors.

An instrument tower, designed to withstand waves up to 18 metres high, was constructed and moored in 58 metres of water near the approaches to Halifax Harbor, where the fetch of southerly or easterly winds across the North Atlantic reaches a maximum. This unique facility is being used by the region and other groups for studies of air-sea interaction processes, which are important in the generation of wind-driven currents and the formation of air and water masses.

Regional scientists monitored and predicted the movement of the oil slick from the tanker Argo Merchant, grounded on December

15, 1976, off Nantucket, Massachusetts, and advised on potential impact. An associated investigation of oiled seabirds in Canadian Atlantic waters demonstrated that while some of the birds had been contaminated by oil spilled by this tanker, the majority of those studied were the victims of oil from other, unidentified, sources, probably of local origin.

The levels of Bunker C fuel oil in the tanks of the sunken oil barge Irving Whale, resting since September, 1970, in 67 metres of water in the Gulf of St. Lawrence, were determined. The system used, devised and developed by regional staff, employs a non-destructive acoustic technique with the sensing package carried to the barge aboard a remotely-controlled sub-surface vehicle.

The behavior of dissolved and particulate trace metals in coastal waters was studied, as well as their removal by natural means. In other chemical studies, the background levels of organohalogen compounds (DDTs, PCBs, etc.) were measured in marine sediments in the Atlantic Region. It was found that the majority of sediments examined had extremely low levels of these compounds.

A major tidal measurement program in the Bay of Fundy and

Gulf of Maine was completed for the Atlantic Tidal Power Review Board as part of a study to determine how the tidal regime in this area would be altered by the presence of barrages in the Bay of Fundy.

In the Pacific Region, Ocean Chemistry Division conducted a crash program to analyze sea water, plankton, fish and surface sediment samples in the southern Beaufort Sea to determine mercury levels. Other trace metal studies were related to the Ocean Dumping Control Act. To increase the reliability of detection of extremely low levels of trace metals, hydrocarbons and PCBs in environmental samples, development work was devoted to samplers and ultra-clean room techniques of analysis.

A major effort was devoted to the Ocean Weather Station P time-series study to document the increase in background carbon dioxide in marine air and to assess the oceanic capacity to absorb atmospheric carbon dioxide.

Experiments were conducted to observe the behavior of liquid chlorine and the relationship between gasification and water depth, in order to assess the environmental effects of chlorine if leaked from sunken tank cars in Malaspina Strait, British Columbia.

Ocean Physics Division work continued in southern British Columbia waters, with emphasis on the dynamics of the Strait of Georgia and the mechanisms of exchange between it and the open ocean. Plans call for shifting emphasis in the coming year to the northern coastal waters, including studies of the dynamics of fjord systems and the oceanography of the Kitimat -- Prince Rupert area.

Although the Beaufort Sea Project ended officially in 1975, work continued in both Ocean Physics and Ocean Chemistry divisions on analysis of data and the preparation of reports. Field work continued with high priority across the Arctic, with particular emphasis on the Beaufort Sea, the Sverdrup Basin area and southern approaches, and Lancaster Sound. Other work in progress included studies of the physics and possible consequences of underwater blowouts of gas and oil in shallow and deep water, with and without ice cover. These programs have been designed to acquire the information necessary to assess possible environmental consequences of offshore drilling, pipeline construction, and mining and transportation developments, and to establish procedures and controls over such activities in order that environmental hazards may be minimized.

The Hydraulic Research Unit further improved its numerical models of the Fraser River estuary and the approaches to Vancouver Harbor. Further development of oil spill tracking methods was carried out.

The Ocean Ecology Laboratory was established early in 1976, with a mandate to carry out bio-oceanographic studies in support of departmental and regional objectives, and to act as a catalyst between staff scientists and those of other government agencies and academic institutions.

Work on the new Institute of Ocean Sciences complex at Patricia Bay progressed satisfactorily, with staff occupying the workshop-warehouse building in June, 1976. Staff will move into the main building in stages during 1977 as major portions of the building are completed.

In the Ontario Region, work in physical oceanography, shore properties studies and environmental assessment saw completion of a comprehensive analysis of the freshwater budget of Hudson and James bays, an in-depth study of Point Pelee erosion and a one-dimensional model of tidal effects in Chesterfield Inlet. Of considerable significance was the release in July, 1976, of the Canada-Ontario Great Lakes Shore Damage Technical Report and the

first Coastal Zone Atlas of the Canadian erodible shoreline of the Great Lakes, based on the findings of the technical report. A memorandum of understanding signed by the ministers of the Department of Fisheries and the Environment and the Ontario Ministry of Natural Resources authorized a number of follow-up programs which include shoreline erosion monitoring; definition of hazard land (land likely to flood or erode); a site-specific study the development of a coastal zone management modelling system; and a public awareness series of workshops, seminars and other events. Action was initiated in all these programs.

Canadian Hydrographic Service

Another major step in the evolution of CHS was taken in 1976 with the decision to decentralize a large part of the Chart Production Branch to regional offices at Dartmouth, Burlington and Victoria. A fourth regional office has been established in the FMS regional headquarters at Quebec City. These moves, to be completed by 1979, will provide an opportunity to improve communication between hydrographers and cartographers, and bring another component of the federal public service closer to the public it serves.

Headquarters hosted the Fifteenth Annual Canadian Hydrographic Conference at the Conference Centre, Ottawa. There were more than 230 registrations from seven countries.

Agreement was reached with the U.S. National Ocean Survey (NOS) to establish the United States -- Canada Charting Commission to co-ordinate the work of the two agencies in Canada -- United States boundary areas. Through the co-operative effort of this group, two international general charts were published during the year using a common metric format. NOS produced a chart of Lake Erie, and CHS a chart of Lake Ontario. This program offers significant economies to both agencies, and will be gradually extended to cover all charts of the Great Lakes and connecting rivers of common interest to both agencies.

Work was completed on an international standard for definitions of undersea features for use on the fifth edition of the General Bathymetric Chart of the Oceans. This assignment was carried out by a sub-committee of the Joint Guiding Committee of the International Hydrographic Organization (IHO) and the IOC. Work was also completed on International Standards for the Education and Training of Hydrographers through a joint committee

of the IHO and the Fédération Internationale des Géomètres, chaired by the dominion hydrographer.

The first four charts in the new bilingual, metric contour format were published. These charts, covering Vancouver Harbor, were prepared through the use of CHS's newly-developed automated drawing system. A special chart of Kingston was published for the yachting Olympics. Four new editions of charts were issued to show the 200-mile fishing zone off the Atlantic and Pacific coasts. Some 65 new editions and 79 reprints were issued. The completion of the development of the first phase of the Graphical Outline Manipulation and Display System (GOMADS) marked a major step forward in cartography. The software for this interactive graphics system was developed in-house as no commercially available system met the data manipulation requirements. The GOMADS command structure is easy for cartographers to use and should reduce to a minimum the need for manual touch-up of automated plots.

A new Saint John River Small Craft Guide published in both languages was so well received by the public that a reprint was required within a few months. Three new editions of Sailing

Directions were published in English; two volumes were issued in French.

Of the 1,000 notices to mariners issued by the Department of Transport during the year, 300 were originated by the CHS. One thousand and sixty-five chart correction tracings were prepared, affecting 883 charts, and 1,536,000 hand amendments were made to stock. The number is down from last year, but numerous Light List corrections are not numbered under the new notices format adopted on January 1, 1976. Some 2,154 chart correction lists were issued.

Four hundred and thirty reports of potential chart corrections were received from Canadian Power Squadron members across the country, indicating that the Marine Reporting Program deserves continued support.

The Scientific Cartography Section produced 52 maps in the 1:250,000 series of natural resource maps including 16 bathymetric editions, 16 working editions, five free air gravity editions, five total field magnetic editions, five Bouguer gravity editions and five magnetic anomaly editions.

The General Bathymetric Chart of the Oceans (GEBCO) Section completed an intensive evaluation, begun in 1975, of the bathymetric data held by the

unit. The accepted data were contoured and incorporated into the GEBCO 1:1,000,000 series of master collection sheets. Following this evaluation, new format specifications were drawn up for the Canadian GEBCO 1:1,000,000 plotting and source sheets. Four sheets have already been revised according to the new specifications. Also, a 1:250,000 series was initiated for areas where bathymetric data are too dense to incorporate onto the 1:1,000,000 sheets.

In the Atlantic Region, the main hydrographic charting work during the year was concentrated in the St. Lawrence estuary, the north shore of the Gulf of St. Lawrence, the Labrador coast and Labrador sea, and the Eastern Arctic. For the second straight year CCGS Labrador sustained ice damage and was forced to operate a restricted program, while the chart revisory program experienced a temporary setback when the MV Christmas Seal was lost by fire. Despite this, a large number of projects were successfully completed.

Four hydrographic field parties moored arrays of current meters in the Gulf of St. Lawrence, the Arctic, and along the Labrador coast. The joint effort with Water Survey of Canada towards a permanent gauging network continued, with the

installation of additional submersible gauges in the Arctic and recovery of gauges moored in 1975. The adaptation of the Aanderaa tide gauge to an acoustic telemetry system was completed and field trials conducted.

Work started during the year on a mid-life refit of CSS Baffin at an estimated total cost of \$4 million. The refit, to be carried out in stages over a three-year period, will upgrade Baffin to a modern hydrographic survey and oceanographic research vessel at a cost considerably less than that of a new ship.

The lay-up of the CSS Wm. J. Stewart, the ice damage suffered by CSS Parizeau and the increasing decentralization of chart production were major factors influencing the 1976 hydrography program in the Pacific Region. The lack of major ship time forced an increase in shore party activities which had to be restricted to southern British Columbia waters. The disabling of the Parizeau led to cancellation of the Amundsen Gulf program, but hydrographic and geophysical surveys were continued along the continental shelf off Vancouver Island. Regionalization of chart production increased staff through man-year transfers from Ottawa, while creating severe production and training pressures.

Surveys continued along the Athabasca-Mackenzie waterway, with a major effort mounted in the Eskimo Lakes. Revisory surveys continued and for the first time a contract was let to undertake chart revisions on the British Columbia coast. Considerable effort went into preparations for 1977 Loran-C calibration and Vancouver Harbor surveys.

Three major tidal and current surveys were carried out in Haro Strait, Johnstone Strait and the approaches to the Fraser River, as well as operations in the Mackenzie River and Western Arctic.

The highlight of activities in Central Region during the year was management of a multi-agency offshore survey of the continental shelf off Senegal and The Gambia. The project, involving a three-month cruise by CSS Baffin, was funded by CIDA.

Projects in the North included evaluation of a tracked vehicle for depth-sounding through ice, and a survey of possible shipping routes and pipeline crossings in Penny Strait and Belcher Channel. The over-ice survey of bathymetry and gravity in James Bay was completed and the multi-parameter survey of Hudson Bay using CCGS Narwhal continued.

Completion of the final block of the lower St. Lawrence River

survey will enable a major re-charting of this region in metric units. A survey was made of the area in Lake Superior where the lake carried Edmund Fitzgerald was lost. Revisory surveys included small craft routes on the Richelieu and Ottawa rivers, the Rideau Canal and the Trent-Severn waterway.

Another major activity during the year was the development of the Tidal Acquisition and Telemetry System, which will lead to a fully-automated permanent tidal gauging network.

Development of the recently-established Quebec regional office continued during the year, with the objective of establishing a fully-operational Quebec-based unit with responsibility for hydrographic surveys and marine science programs.

Small Craft Harbors

Small Craft Harbors Branch administers and is responsible for development of approximately 2,300 commercial fishing and recreational harbors across Canada. Its objective is to provide suitable facilities to meet both present and future needs of small craft harbor

users.

Staff were actively involved in the development of Bill C-7, the Fishing and Recreational Harbors Act, which was tabled in the House of Commons during the year and was given second reading. In anticipation of the new measure, efforts were directed towards improving general on-site management and supervision at wharves. To this end, 50 additional wharfingers were appointed during the year. As a result of this action and increased support and supervision by regional staffs, revenue derived from leases, licenses, permits of occupation, wharfage and berthage increased significantly.

Funds allocated to the Small Craft Harbors Program in the fiscal year amounted to approximately \$47 million, comprising the regular Harbor Development Program of \$30 million, a special Canada-Quebec Program of \$5 million, a Federal Labor Intensive Program of \$5 million and a Local Initiatives Program totaling \$7 million, of which about \$5.5 million was provided by the Department of Manpower and Immigration.

The regular program included 600 projects in excess of \$10,000 each. Major harbor developments included the purchase of land for a new commercial fishing harbor at Steveston, British Columbia,

which is planned to accommodate up to 1,000 vessels on completion. Other major fishing harbor projects were undertaken at Cloridorme, Quebec; Lamèque, New Brunswick; Meteghan, Nova Scotia; and Fortune, Newfoundland. Some 13 projects for the development of recreational harbors were assisted by the branch under the Marina Policy Assistance Program and the Tourist Wharf Policy.

The branch participated in two special job creation programs during the past year, namely the Federal Labor Intensive Program and the Local Initiatives Program. A total of 159 projects were implemented under the FLIP program. The LIP program proved highly successful with some 156 projects undertaken, 113 in Newfoundland. Small Craft Harbors provided supervisors to help local groups prepare submissions, engineering assistance during construction and the cost of materials not covered by the LIP allotment. As a result, a number of the development goals of the branch were attained and a great deal of employment and satisfaction were generated at the local level due to community involvement.

The branch's computerized information retrieval system was further refined by the addition of a five-year forecast file which will allow for more accu-

rate planning of future years' programs and expenditures.

International Directorate

Directorate staff continued to play a key role in Canada's involvement in the Law of the Sea Conference, actively participating in work on fisheries, preservation of the marine environment, marine scientific research, and the development and transfer of marine technology. Attention was also directed to examining means of implementing requirements which may arise from a new Law of the Sea agreement, calling for the establishment of guidelines, rules and standards for the prevention of marine pollution from land-based sources, from the atmosphere, from the continental shelf and from seabed mining activities.

The directorate has undertaken the major task of assessing the implications of the draft Law of the Sea articles. This work, which may result in a restructuring of some United Nations organizations, is designed in such a way that these organizations will be made aware of their increased responsibilities and the need for structural change,

regardless of whether the Law of the Sea Conference results in a ratified convention or not.

There was continuing involvement in the work of the 11 international fisheries commissions of which Canada is a member as well as the many bilateral fisheries agreements to which Canada is a party, directed at improving fisheries management, securing advantages for Canada under existing agreements and deriving increasing benefits from the Canadian extension of fisheries jurisdiction to 200 miles on January 1, 1977. To aid in this process, the directorate has been instrumental in the development of regulations and quotas applied to the new regime and in the conclusion of bilateral fisheries agreements with Norway, Poland, the USSR, Spain, Portugal and Cuba. Under these agreements, countries have agreed to abide by Canadian laws and regulations within Canada's 200-mile fishing zone with respect to any fisheries Canada may authorize them to conduct for stocks that may be surplus to Canadian requirements.

An agreement signed with Cuba during the year is the first of what is expected to be a new series of agreements which recognize Canada's special interest in the area beyond and immediately adjacent to its 200-mile limit on

the Atlantic coast. In addition, the directorate has primary responsibility for the renegotiation, under way, of various international fisheries conventions to which Canada is a party to take into account extensions of fisheries jurisdictions to 200 miles. These include ICNAF, the International North Pacific Fisheries Commission, the Inter-American Tropical Tuna Commission and the International Whaling Commission.

Discussions continued with the United States over problems of Pacific salmon interception with a view to developing a new Canada -- United States Pacific salmon convention. Negotiations were also under way with the United States on reciprocal fishing arrangements to apply in the extended areas now under the jurisdiction of each country. Establishment of new maritime boundaries was also a subject of negotiations with the United States and similar negotiations were proceeding with France (with regard to St. Pierre and Miquelon) and with Denmark (with regard to Greenland).

Activities related to the complex issue of energy, environment and maritime oil transportation off Canada's coasts have occupied a considerable amount of staff time. Vessel traffic management, liability and compensa-

tion for damage from spills, and location of pipeline terminals and ports are all issues which have a significant impact on Canada's international marine policy, particularly insofar as they involve the marine environment and transportation policies of Canada and the United States.

The directorate plays a central role in connection with the work of the Marine Environment Protection Committee of IMCO and has had a substantial advisory role on the international policy aspects of the implementation of the London Dumping Convention. In addition, staff were active in advancing Canadian positions on marine environmental matters and related technology transfer in such organizations as the United Nations Environment Program, the IOC (particularly the work of the Training, Education and Mutual Assistance Committee), and other United Nations agencies, as well as the OECD.

During recent years, the directorate has significantly improved and expanded its working relationship with CIDA through the secondment of a fisheries expert to the agency. Requests for Canadian fisheries experts have increased markedly during the past year and, in an attempt to cope with this demand, the directorate has undertaken the creation of a human resource

inventory. Projects of major importance this year are the FAO-CIDA regional fisheries project in West Africa, as well as several long- and short-term bilateral programs in the West Indies, South and East Asia and South America, involving both fisheries and marine technology.

Ships

The fleet of ships currently operated by the Fisheries and Marine Service consists of 25 major vessels of over 100 feet in length, 239 vessels between 20 and 100 feet, and more than 500 small craft under 20 feet. Canada's second largest civilian-manned fleet, its present-day replacement cost is estimated at more than \$300 million.

Ships Branch responsibilities include advising senior management at headquarters and in the regions on the legal and safe operation of the fleet, as well as providing input to the national plan for search and rescue. Considerable effort was devoted during the year to a major assessment of the national requirements in search and rescue operations. The branch also provided departmental contribu-

tions to major studies concerning the overall concept of operation and control of ships and aircraft for the federal government.

During the year the Cape Harrison, the service's first 120-foot high-speed fisheries patrol vessel, went into service on the east coast. This marked the first time that aluminum had been used in the construction of a vessel of this size in Canada. A second vessel of similar type, as well as a 205-foot fisheries patrol vessel and a 65-foot fisheries research vessel, continued under construction. The first phase of the long-range vessel acquisition strategy plan has seen the addition of 21 ships to the FMS fleet during the period 1972-1977. Plans have been completed for the service's second-phase vessel acquisition requirements for the period 1978-1983.

A new system for the operation and manning of the Maritimes patrol vessels Cygnus and Chebucto was developed in co-operation with regional staff. The new system is expected to significantly increase the operational productivity of the two ships, reduce operating costs and man-years and provide regular time off for operating crews.

The branch continued to co-ordinate helicopter support for FMS programs with the Department

of Transport. Five "Jet Ranger" helicopters are now assigned by DOT primarily in support of Ocean and Aquatic Science programs.

Provincial and Federal Affairs

The Provincial and Federal Affairs Branch, which serves as the focal point for enquiries with federal-provincial implications, is primarily an advisory and co-ordinating group in support of headquarters and regional managers. It also deals with interdepartmental matters and is assigned special projects.

Close relationships between the provinces and the Fisheries and Marine Service on policies, programs and matters of mutual concern are made possible through four federal-provincial fisheries committees (Atlantic, Ontario, Freshwater and British Columbia) whose memberships comprise the deputy ministers of the respective provincial government departments responsible for fisheries and their federal counterparts.

During the year the branch was assigned lead responsibility for co-ordination work in connection with Bill C-38 (amendments to the Fisheries Act).

Recreational Fisheries

Progress was made in several areas toward the Recreational Fisheries Branch goal to optimize the contribution of recreational fisheries to human welfare and national well-being in Canada.

The nationally-co-ordinated survey of angling, organized in co-operation with all provincial, territorial and federal sport fisheries licensing and management agencies, developed into the most comprehensive study of its kind ever carried out. It was also the first study exclusively devoted to sport fishing.

Anglers returned 60 per cent of the 50,000 questionnaires issued in the first six months of 1976. The branch completed the processing and analysis of all questionnaires by the end of the year, with a view to providing each co-operating agency with its own survey results and the preparation of a nationwide report on sportfishing in Canada for the year 1975.

The branch convened the fourth Canadian Sport Fisheries Conference in Toronto in July. Sport fisheries managers from the provinces and from all FMS regional offices participated, as did representatives from the United States, other federal departments and several international agen-

cies and organizations. National and regional representatives of organized anglers also participated for the first time. A framework for appraising the net benefits of sport fisheries as opposed to commercial fisheries was outlined and examined. Conference support was given to plans for holding the first international symposium on inland fisheries resources allocation.

A report of an angling survey in Newfoundland, conducted in co-operation with the province and the Newfoundland Region of FMS, was published. Market and industry studies were completed in co-operation with provincial and regional agencies on the feasibility of a catch and release fishery for bluefin tuna in Prince Edward Island and on the commercial and economic aspects of fly-in sport fish camps in Labrador. An extensive socio-economic policy, planning and advisory input was made into the proposed salmonid enhancement program in British Columbia. Internationally, the branch served on the planning committee for a 1979 international symposium on inland fisheries resources allocation, which is to be oriented towards recreational fisheries. In keeping with Canada's interests in these respects, the branch was also asked to extend its present

management information clearing house service to more than 20 other countries.

Environmental Services Program

Atmospheric Environment Service

The primary responsibilities of the Atmospheric Environment Service are to provide data and information on past, present and future atmospheric, ice and sea-state conditions, and advice on the application of this data.

In addition, AES conducts research and development in the areas of atmospheric processes, weather forecasting and observing systems, air quality, other inter-environmental problems, and instrument design and evaluation.

Weather Services

Public Weather Services

The distribution of weather information to the general public received special attention during the year. Of particular importance was the establishment in January of the Weatheradio Canada facility in Vancouver, a pilot project offering continuous 24-hour broadcast of weather information.

Progress was made in the use of automated translation to provide forecasts in French. Public forecasts in both languages are now available for Quebec, the Maritime provinces and most of Ontario.

The 1976 Summer Olympics were strongly supported by weather offices set up in Montreal and Kingston.

In the fall, representatives of the media and AES met in Toronto at an informal gathering called Weathercasting One. The purpose of the meeting was to develop closer liaison with the media to provide better weather service to the public.

Weather Service Standards

The major component of AES' weather service system consists of 61 weather offices, staffed by 273 presentation technicians.

The number of requests for weather service in the public, economic and transportation sectors increased by 22 per cent. A large portion of this increase was met by the use of automatic telephone recording systems installed at 17 weather offices.

Weather offices at Toronto Island and La Grande were closed, while a new weather office was opened at Charlottetown to serve Prince Edward Island.

Transportation Weather Services

An aviation weather reporting station was established at Eskimo Point, Northwest Territories. This is the first of a series of stations to be established

through the co-operation of the Departments of Fisheries and the Environment, Transport, Indian and Northern Affairs and the territorial governments. The new stations are designed to improve the safety and regularity of air operations in the Arctic.

An English-French lexicon of terms used to describe weather phenomena in airport control services was developed in co-operation with Transport Canada.

A new edition of Aviation Weather Services was issued in English and French. This publication outlines aviation weather services available in Canada and incorporates the latest code changes.

AES has developed a policy to encourage the establishment and growth of private meteorology in Canada. This policy recognizes the need for private Canadian meteorological firms to provide specialized services to business, industry and municipalities. Specific plans, including an index of companies with meteorological research and development capacities, were being developed to implement the policy.

Forecast Services

To increase the efficiency of weather forecasting, several improvements were made to the communication system during the

year. Notably, the speed of transmission of the national facsimile circuit was doubled. This halved the time required for map transmission, permitting time to transmit satellite pictures.

Computer facilities were upgraded by adding processors at Winnipeg and Edmonton. At the Canadian Meteorological Centre (CMC), the Cyber 76 was upgraded to a Cyber 71. This, with the addition of a Nova 3/D computer to the facsimile system, brought the AES-CMC computer facility up to the level of a major linked multi-computer facility.

AES provided a variety of environmental ice, wind and weather services in support of Canadian Marine Drilling Ltd. (CANMAR) and Imperial Oil drilling operations in the Beaufort Sea basin. These services were provided at the users' expense. Special weather, ice and sea-state forecasts were issued in support of the operation during the summer.

Observational Systems

The routine data acquisition system of the AES consists of three major networks for acquiring data from land, sea and air.

The largest of these networks measures meteorological data on land. While the total number of sites in this network showed a

slight decrease by year's end, the number of "real-time" (principal) sites showed a slight increase. This increase was primarily due to the installation of nine second-generation Meteorological Automatic Reporting Stations, bringing the total number of these units to 15.

A prototype automatic station was installed in the Beaufort Sea in June. However, although the station continued to transmit during the summer forecast period, position tracking of the station was unsuccessful due to the failure of the Geostationary Observational Environmental Satellite (GOES) to "power-up" after daily solar eclipses near the end of August.

The system of capturing surface observations at the time of transmission for quality control and archiving purposes, initiated last year, continued. This method not only eliminates 80 to 90 per cent of the necessary key-punching of data, but permits evaluation of the quality of transmitted data in both content and teletype procedures. A similar system was being developed for upper air data.

Foundations were laid for establishing the next generation of automatic stations for the 1980s. Surveys were made of operational and headquarters units to determine data require-

ments, network configuration, sitings and other considerations for new stations.

A field evaluation of a commercially available, eye-safe laser ceilometer (an instrument to measure cloud height) was set up at two major airports. Results of this test over the next year should help to determine whether this instrument can be used to replace the present rotating beam ceilometer.

The marine data acquisition network had more than 200 ships participating in 1976-1977 in the voluntary marine weather observing program sponsored by AES. In addition to these permanent ships, 146 ships were recruited on a trip-to-trip basis, providing reports mainly on the more sparsely covered Pacific Ocean.

In addition to the land and marine observing networks, a third network, consisting of 34 land-based sites and one ocean weather station, measures temperature, humidity, wind direction and speed to altitudes of 30 kilometres, as well as observing data on the surface of the earth.

Final specifications for a system designed to automate computation of upper air data were completed during the year. This device, known as ADRES (Aerological Data Reduction System), is an on-site computer

system designed to significantly reduce the workload of observers, improve the quality of observations and make upper air data available more quickly.

The air data acquisition network lent support to the Strato-probe III balloon launchings and also, at selected sites, performed measurements of the total ozone in the atmosphere. An upper air observation program in support of the Alberta Hail Studies Project was conducted at Rocky Mountain House, Alberta, from mid-June to mid-September.

By the end of the year, the first of a new generation of weather surveillance radars was installed at Carp, Ontario. Final acceptance tests have been completed and the system is now undergoing extensive operational evaluation and maintenance tests. By the summer of 1978, four additional weather surveillance radars will have been installed, at Trepassey, Newfoundland; Villeroy, Quebec; Exeter, Ontario; and Abbotsford, British Columbia. A Radar Remote Output Monitoring System was connected with the Curtiss-Wright radar at Toronto International Airport for test purposes. This device will allow the transmission of radar signals to a distant office.

In January, the metric manual of surface weather observations and associated recording proce-

dures and practices came into effect.

A computerized system was developed to inventory weather observation facilities that could be quickly deployed during an emergency, and a starting inventory was produced.

Meteorological Applications

A broad range of environmental concerns with economic and social implications were addressed during 1976-1977. Climatic change and variability, energy and related environmental concerns, alternative energy sources, support to developing countries, responses to widespread drought and assistance for regional development were highlighted during the year.

Climatic impact was profound throughout North America during the year. Development was begun of a system to monitor climatic variability and to provide information on its nature and effects.

Climatic data and information was much in demand for the development and installation of solar and wind energy systems as alternatives to traditional energy sources. Systems were

developed to estimate energy needs, and to transmit climatic indices of energy use to organizations planning energy allocation and conservation. A major contribution was made by AES to the brief submitted by the department to the Ontario Royal Commission on Electric Power Planning. Oil and gas exploration and transportation programs were supported by preparation of comprehensive climatological information during the year.

Activities in support of other resource development included evaluation on behalf of the Department of Indian and Northern Affairs of the suitability for agriculture of 50 million hectares in the Yukon Territory and Northwest Territories. Other activities included national climatic zonation for maize production, and climatic assessment of opportunities for recreation and tourism for the Prairies, the Atlantic provinces, and four national parks.

Publications included general climatic information for 2,300 locations in Canada, more detailed information for large cities and handbooks on airport climates.

The main activity in many regional centres was the application of meteorology to the Environmental Assessment and Review Process. Among major

concerns were the proposal for a deep-water oil port at Kitimat, British Columbia; drilling in the Beaufort Sea and High Arctic; the planning of a marine environmental study in the Eastern Arctic; and oil shipping and drilling off the east coast.

Hydrometeorological activity included participation in flood forecasting projects for the Saint John River in support of a World Meteorological Organization (WMO) program, and for the Ottawa River as part of a federal-provincial undertaking. In response to a request by CIDA, AES became the executing agency for a three-year flood forecasting program in Colombia.

AES continued its extensive studies in support of the joint Canada -- United States International Field Year on the Great Lakes. The service maintained its program of observing Great Lakes temperatures, and took part in development work to obtain water temperature estimates from satellite observations.

Applications and climatological programs depend on the National Climatic Archive and on computing services for creation and use of the archive. During the year this facility served the needs of internal research, other government departments and universities in Canada and abroad.

Ice Services

Although 1976-1977 was an outstanding year for the Ice Branch, all the events of the year were not favorable.

The first offshore drilling season in the Beaufort Sea required special ice forecasting support. An advance base established at Tuktoyaktuk provided special weather, wave and ice forecasts to the drilling vessels from July until October. Staff for the base were drawn from Ice Branch and from the Arctic Weather Centre in Edmonton.

The first winter navigation by Canadian vessels in the upper Great Lakes was undertaken in February, during one of the coldest winters in 30 years. Special reconnaissance and ice forecasting support helped CCG Griffon and two bulk carriers to reach Thunder Bay. Two other passages were made before regular spring navigation began.

The highlight of the year occurred in March. Early in the month an international group of specialists gathered in Gander, Newfoundland, to attempt to establish a system of international symbols for use on ice charts. Canada has taken the initiative in arranging this experiment, an objective of the

WMO for several years. Good progress was made, and it appears likely that the new symbols will be approved and introduced in January, 1979.

A second noteworthy event in March was a successful sortie into the Arctic using a Department of National Defence (DND) aircraft equipped with Sideways Looking Airborne Radar. This sensor, which allows all-weather day or night ice reconnaissance and also provides a record on film of the area covered, has great potential for the future.

The low point of the year came late in March when one of the chartered reconnaissance aircraft was involved in an accident with a DND aircraft on the ground at Summerside, Prince Edward Island. Although severely damaged, the reconnaissance aircraft was unoccupied when the accident occurred. The people in the DND aircraft were killed.

Reconnaissance time in chartered aircraft totalled 2,846 hours in 1976-1977. Ice observers participated in 970 hours of northern patrols in DND aircraft. Ice forecasting support to the Canadian Coast Guard continued as the first priority, but increasing effort was directed to support of offshore explorations such as those in the Beaufort Sea, and to serve the fishing

industry in northern Newfoundland.

The Ice Climatological Division, although hampered by restricted manpower, provided statistical analysis and special reports for local areas on the eastern seaboard. With assistance from the Transportation Development Agency of the Ministry of Transport, the division prepared data for an arctic ice atlas.

Training

The AES Training Branch provided formal training programs in operational meteorology for professional and technical personnel of the Department of Fisheries and the Environment and the Ministry of Transport. Much attention was directed to the development and presentation of training courses related to technological changes in meteorological operations, particularly the application of computer programs and the use of satellite data.

Professional courses for new employees were given to anglophone meteorologists at AES headquarters. Francophone meteorologists received part of their training at the University of

Quebec in Montreal and completed their courses at AES headquarters. An AES course in applied meteorology was provided to students taking M.Sc. degrees in meteorology at the University of Alberta, the University of Toronto and McGill. In all, professional training was provided to 26 students.

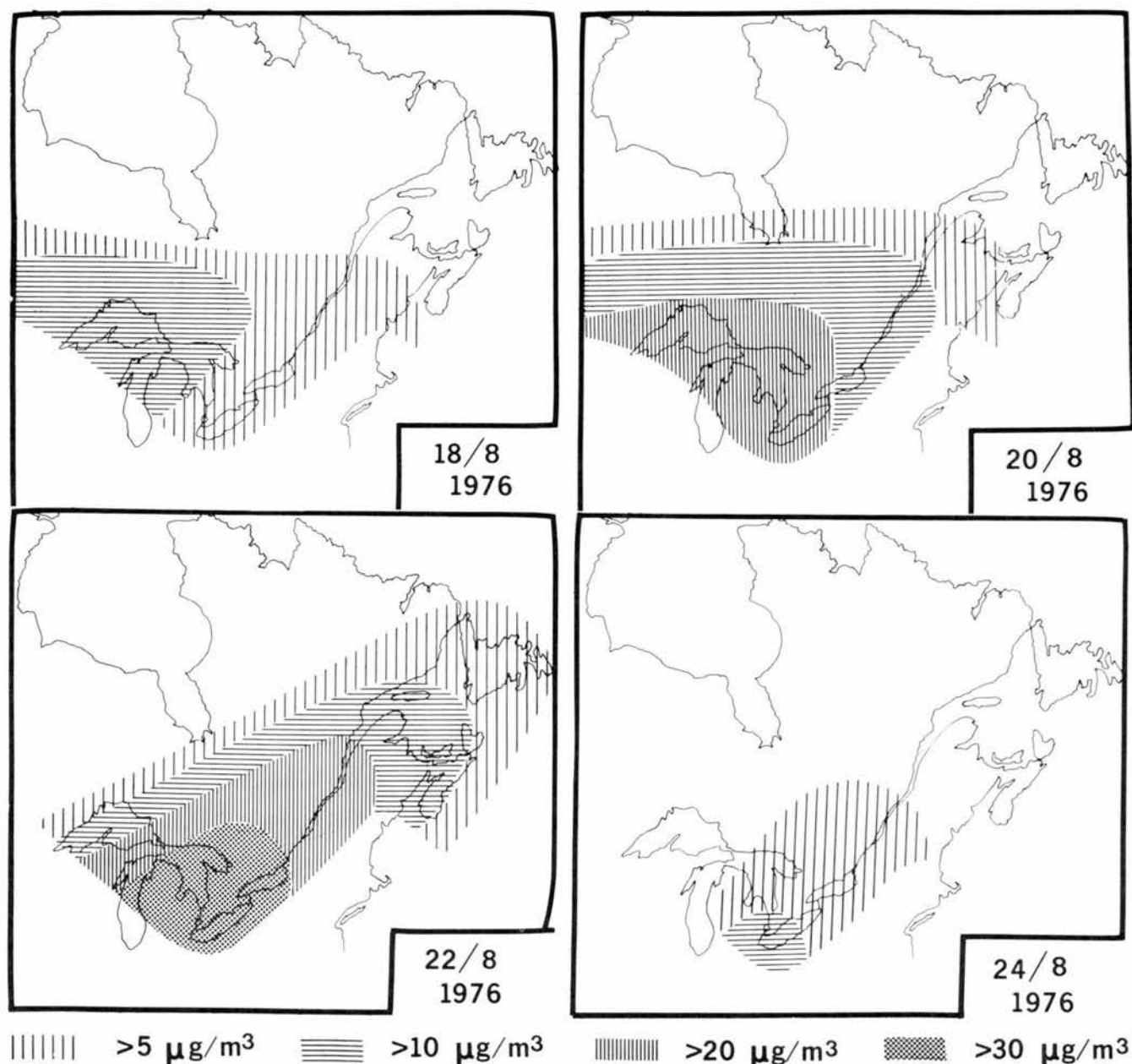
Courses prepared by the Professional Development Division for experienced meteorologists were presented at AES headquarters and in Winnipeg, Halifax, Trenton and Comox. Correspondence courses in applied meteorology were provided to meteorologists and meteorological technicians. Approximately 250 professional and 120 technical personnel received training through professional development programs.

The AES Meteorological Training Centre in Ottawa provided training courses to more than 1,200 meteorological technicians, radio operators and air traffic controllers.

Atmospheric Research

In the field of air quality, AES activities were focussed on a number of major departmental research programs including the

DEVELOPMENT OF AN EPISODE OF HIGH SULFATES
ÉVOLUTION D'UNE CRÊTE DE CONCENTRATION DE SULFATES



An intensive study of sulfate concentrations in the atmosphere was undertaken by AES and EPS in the summer of 1976. The episode of high sulfate levels illustrated was typical of several that occurred during the study period. The levels began building in southwestern Ontario between August 18 and 20. Polluted air masses, originating over highly industrialized areas of the USA were carried by southwesterly winds. Concentrations increased and the affected area expanded to the north and east. By August 22 all of southeastern Canada was encompassed. A cold front from the northwest, originating over uninhabited areas reduced concentrations over the entire region by August 24. Data from the study will be used to assess health and environmental affects, set air quality standards, and decide on eventual regulatory action.

LRTAP and AOSERP programs.

AES co-ordinated a departmental review of the long-range transport of air pollutants and the associated increasing acidity of precipitation in eastern Canada. This review culminated in a decision by DFE Management Committee to develop an integrated program on the problem of long-range transport, with AES as lead agency.

Two studies were carried out in support of the LRTAP Program. An intensive study during August investigated the distribution of sulphates in the air and precipitation in eastern Canada, and confirmed the fact that air pollution is a serious regional problem as well as a local one. A 50-station network for sampling precipitation was established to investigate regional differences in wet deposition of pollutants in Canada. Assistance was provided to Inland Waters Directorate to operate a 12-station national precipitation network to monitor organic constituents (PCBs, etc.).

To complement these projects, work began on a model to predict levels of air pollutants from emission inventories and meteorological data.

Contributions to AOSERP continued with the routine operation of a network of 10 climatological stations and a 500-foot tower,

providing a meteorological data base for the oil sands area. Field studies investigated pollutant dispersion, and transport and deposition surrounding existing tar sands processing plants.

A variety of projects were undertaken under the general heading of air quality environmental monitoring, research and development. Studies included:

- installation of meteorological and air quality monitoring equipment in the CN tower in Toronto;
- a study of oxidants (e.g., ozone, nitric oxides) in urban smog in Toronto; and
- a study of plume dispersion and transport of SO₂ oxidation in Sudbury.

Mathematical modelling was used to investigate plume dispersion, transformation and removal processes. Computer models for predicting concentrations of pollutants were developed, to expand impact assessment capability in the regions.

Pollutant-sensitive biological indicators such as plants and lichens were successfully used to delineate areas of high pollutant concentration in studies at Saint John, New Brunswick and in the tobacco-growing areas in southwestern Ontario. Lichens were also used in the oil sands area and the High Arctic to determine the removal rate of pollutants

from the atmosphere.

A major study was conducted with the Canadian Forestry Service to investigate meteorological factors influencing spruce budworm moth dispersal in New Brunswick forests. It is hoped that this knowledge will lead to improved efficiency in spraying operations.

Several studies undertaken during the year were part of the AES contribution to international programs of the WMO Commission for Instrumentation and Methods of Observation. These included comparison of instruments for measurement of soil moisture, and examination of methods for measuring snow and evaporation rates.

The flux or transport rate of water vapor to and from the earth's surface depends on the physical characteristics of the atmosphere's lower 1,000 metres, the boundary layer. An intensive study was conducted over the frozen, snow-covered surface of Lake Simcoe to investigate fluxes and their relationship to boundary layer parameters.

In support of the Saint John Basin World Weather Watch project of the WMO, a model was developed to determine precipitation in the area and input into stream-flow. A study of the water balance on a national scale, including precipitation, evaporation and runoff, was expanded to include monthly

averaged energy balance components.

In the third summer of Project Stratoprobe, undertaken by AES with the help of the National Research Council (NRC), universities and industry, two balloon flights from Yorkton, Saskatchewan, sampled the key constituents of the stratospheric ozone layer to 27 and 35 kilometres. As a result of these experiments, recommendations were made to the minister, who announced that regulations would be introduced to restrict the use of chlorofluoromethanes in aerosol spray cans.

An improved computerized weather prediction system for the Beaufort Sea area was in operation at the Arctic Weather Centre in Edmonton during the summer of 1976. Some of the forecasting techniques used in the Beaufort Sea were adapted for application in other areas of Canada.

Real-time transmission of enhanced Very High Resolution Radiometer data from the Satellite Data Laboratory to regional forecast offices was introduced in 1976. A communications link to the United States GOES-TAP network was installed to acquire imagery from the geostationary satellite for research and development.

Research developments in Montreal allowed an increase in

resolution and accuracy of the numerical weather prediction model operated by the Canadian Meteorological Centre. Routine transmission of numerical forecasts to the National Meteorological Center in Washington began.

A continuation of the joint DFE-NRC rainfall enhancement project was carried out at Yellowknife, Northwest Territories, during the summer of 1976. Following seeding with silver iodide, significant increases in ice crystal concentrations were detected.

Climate research saw considerable progress during the year. A completed global general circulation model was being run and preliminary results were being analyzed. Modelling studies of the impact of chlorofluoromethanes on the ozone layer and on the thermal balance of the earth were carried out, and a variety of other models were developed.

A climate monitoring group was founded to maintain up-to-date information on climatic variations. Work on longer-term temperature trends continued. The long-term mean temperature in Canada is undergoing relatively large fluctuation with no obvious trend at present. There is some evidence that climate variability has increased but this conclusion

was being analyzed more fully.

Instrument Design and Development

During the year, Instruments Branch became involved in a growing number of activities carried on jointly with the private sector. A milestone was reached when a consolidated contract was placed with one manufacturer, the Sangamo Company of Leaside, Ontario, to establish a meteorological instrument technology centre. The centre is to supply a wide variety of standard meteorological instruments to AES over an extended period. Provision was also made in the contract to supply repair and engineering services, and to establish a domestic source for such instruments and services for both government and private markets.

As a spin-off from the Beaufort Sea Ice Automatic Station developed in 1975, a joint undertaking by AES and Bristol Aerospace Ltd., Winnipeg, Bristol now markets many of the modules designed for the station under the registered name MAPS (Modular Acquisition and Programming System). MAPS modules were incorporated in the nine-station

automatic climatological data system developed by the Instruments Branch and the Western Region for the AOSERP Program.

Several other instruments developed to meet AES and MOT requirements were licensed for commercial production in Canada: the minisonde, for inexpensive soundings of the lower layers of the atmosphere; the MATER (Magnetic Tape Event Recorder) for collecting climatological data from semi-remote locations; and a Runway Visual Range Computer, for reporting visibility data in control towers at all major Canadian airports.

A number of other programs combined Instruments Branch and industry involvement. Two of the larger programs were a contract with Computing Devices of Canada, Ottawa, for six computer-based systems to process and transmit weather radar data; and the tender call for development of 35 ADRES (Aerological Data Reduction System) mini-computer systems. These systems, when installed at upper air stations throughout Canada between 1978 and 1980, are designed to relieve radiosonde operators of routine data computing and coding responsibilities, allowing them to monitor the output of the system and to evaluate and correct it in ambiguous cases.

AES instrumentation activities

in Canada's Olympic year included meteorological support to officials and contestants in the Olympic sailing events on Lake Ontario. A spar-buoy lake tower and companion shore station provided special marine observations by radio and teletype to the meteorological support centre. This one-time, one-of-a-kind system was primarily an in-house project, with relatively little commercial support.

International Affairs

AES scientists continued to be active in various intergovernmental bodies and international scientific organizations working in areas such as air pollution (IJC Air Pollution Advisory Board); the long-range transport of air pollutants (OECD and Economic Commission for Europe working groups); multiple source modelling of urban pollution (NATO-CCMS Pilot Study on Assessment Methodology and Modelling); environmental monitoring and assessment (WMO and World Health Organization working groups, United Nations Environment Program, International Council of Scientific Unions); atmospheric chemistry and global pollution

(WMO); climatic change and the assessment of human activities as a change-forming mechanism (WMO working groups, Global Atmospheric Research Program); and the input of airborne material to receptor surfaces (WMO Rapporteur on Plant Injury by Air Pollution).

AES continued to operate the World Ozone Data Centre on behalf of the WMO. Staff members represented Canada on all of the eight technical commissions of the WMO and on several of the WMO working groups and panels. Four sessions were held by these commissions during the year, including a meeting of the Commission for Hydrology in Ottawa with Canada as host. In the second half of the fiscal year, Canadians presided over four of the eight technical commissions, an unprecedented event in the annals of WMO.

With Ocean and Aquatic Sciences, AES helped to plan the First GARP Global Experiment (FGGE), to be held from December 1, 1977, to November 30, 1979. Canada will provide some 85 drifting buoys to measure surface pressure and temperature over the data-sparse southern oceans. As the largest single contributor to this program, Canada will take on a lead-nation role, co-ordinating the deployment of the buoys and

contributing to the monitoring of their performance.

Environmental Management Service

The Environmental Management Service is made up of the Canadian Forestry Service, the Inland Waters Directorate, the Canadian Wildlife Service, the Lands Directorate, and the Policy and Program Development Directorate. The combined expertise of these services and directorates is applied to addressing wide-ranging and complex environmental concerns that fall within the mandate of the department.

EMS headquarters, located in the National Capital Region, is composed of staff directorates corresponding to the organizations mentioned above, together with the office of the assistant deputy minister. The headquarters establishments are concerned with policy development, national program planning, interregional activities, national data systems and advisory support to the assistant deputy minister.

To provide service at the regional level there are also regional headquarters at Halifax, for the Atlantic Region; Quebec City for the Quebec Region; Burlington for the Ontario Region; Edmonton for the Western and Northern Region; and Vancouver for the Pacific and Yukon Region.

EMS also includes four national forestry institutes and two forest products laboratories, a national wildlife research

centre, and the Canada Centre for Inland Waters at Burlington, Ontario.

During the year, EMS further developed several national programs involving two or more of its directorates or services. These integrated programs are concerned with such items as environmental impact assessment, toxic substances, coastal zone studies, and land inventory and land use planning.

In the area of environmental impact, EMS was involved in studies related to selection of northern pipeline routes. It also helped develop guidelines for environmental assessments as well as reviewing environmental impact statements for several major projects.

Particular attention was given to the identification and quantification of potentially hazardous toxic substances covered in the Environmental Contaminants Act. This is supported by a strong program to study the effects of selected toxic substances on wildlife and vegetation.

A joint federal-provincial study was initiated on the estuary of the Fraser River to provide guidelines for its future development. EMS contributed environmental and renewable resource management expertise to this project as part of its broader involvement in planning

the use of Canada's coastal areas.

In the land inventory and land use planning program, work proceeded on ecological (biophysical) land inventories and related land capability assessments, on inventories of present land use, the monitoring of land use change, and studies supporting land use planning.

Canadian Forestry Service

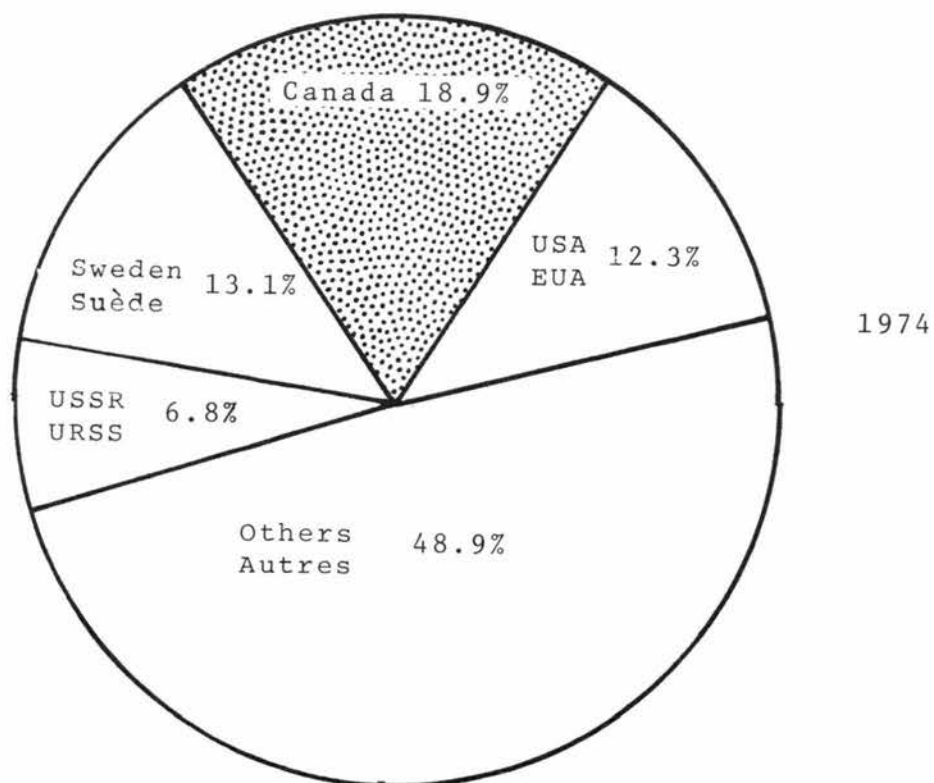
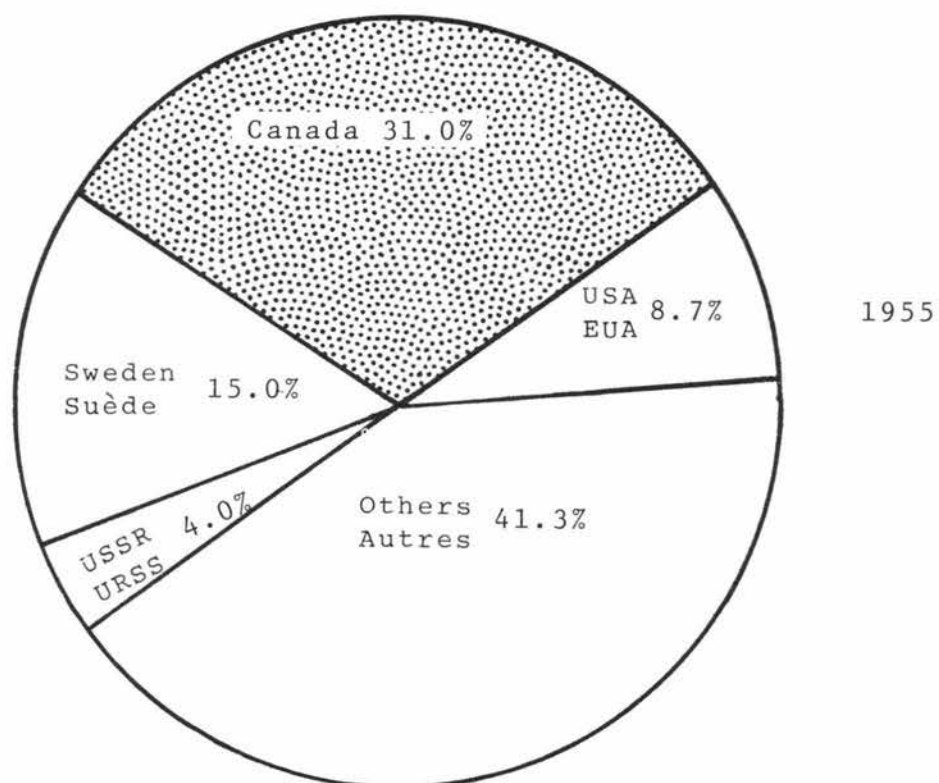
The objective of the CFS is to promote the effective management of Canada's forest resources and terrestrial environment for the economic and social benefit of all Canadians. To achieve this, the service initiates forest policy development; undertakes data collection and analysis for forest policy and program planning; and conducts research and development for protection, production, environmental and amenity forestry programs. The service is also responsible for programs in national and international forestry relations and in information and technology transfer.

Forest Policy

At the June, 1976, meeting of the Canadian Council of Resource and Environment Ministers (CCREM), the minister invited provincial forestry ministers to co-sponsor development of a national forest policy for Canada. Provision of such a policy is regarded as an important step towards improved management of Canada's forest resources. As a result of the minister's invitation, federal and provincial forestry officials held several meetings preparatory to the CCREM 1977 annual meeting. Development of a national forest policy under the aegis of CCREM was recommended and several approaches to it were suggested.

Forestry Relations

Under the Canada-USSR Exchange Agreement, a supply of Soviet tree foliage was brought to Canada for processing and evaluation as animal feed and for comparison with foliage from Canadian tree species used for the same purpose. A Canadian delegation visited the USSR to study reforestation in that country and to look for novel techniques having possible application here. A Soviet delegation, headed by the Soviet forestry minister, came to Canada to study forest protection.



CANADA'S DECLINING SHARE OF WORLD FOREST PRODUCTS MARKETS

The service played a lead role in assembling a strong Canadian delegation for the XVI World Congress of the International Union of Forestry Research Organizations in Oslo. It also continued to take part in international forestry activities through OECD, the ECE Timber Committee, the European Economic Community, and the FAO, including the FAO subsidiary body the North American Forestry Commission.

The service provided advice to Canadian aid agencies and arranged assignment of technical experts to forestry projects abroad. It also organized programs for foreign trainees in forestry establishments in Canada.

Production Forestry

Better and faster-growing trees, which will help to alleviate impending wood shortages, were expected to result from cooperative operational tree improvement programs now being developed in three provinces. This stems from pioneering genetics and tree-breeding programs carried out at Petawawa Forest Experiment Station as well as more recent work at several regional forest research centres.

A new program of hardwood forest management trials and re-

search is proceeding in an effort to maximize forest biomass production in the Maritimes. Studies were also under way on the effects of intensive hardwood harvesting on regeneration and ecology, and work continued on the use of poplar hybrids for intensive wood production.

The pelletizing of black spruce seed for improved regeneration, and computer simulations and operations research methods developed for better forest management, were effective new tools being made available to resource managers by the CFS.

Recently developed remote sensing techniques aided forest inventory work and resulted in greatly improved inputs for the national forestry statistics project.

Other important features of the year's work included improved co-operation with provincial agencies and industry in the matter of seed procurement, and the award of a major contract for a review and analysis of benefits that might be expected from an intensification of forest management efforts in Canada.

Environmental Forestry

Considerable work continued on the effects on soil and vegetation of atmospheric pollution caused by industrial activity.

This included studies of the long-range transport of air pollutants and work on the impact of sulphur dioxide on forest species around the Athabasca Tar Sands operation.

Further work proceeded on assessing the environmental impact of certain forestry practices such as resource road construction and mechanized harvesting. Progress was made on producing guidelines to achieve modified forestry practices that will be ecologically and economically sound alternatives to conventional forestry methods.

Descriptive projects covering biological and geophysical features of the Waterton Lakes National Park and the Yukon Territory have been completed. These projects were a contribution to the development of multiple land use plans for these areas. Similar work was in progress for Banff and Jasper national parks.

Forest Protection

The service continued to provide the provinces with information on forest insects and diseases, made

CANADA'S FOREST PRODUCTION 1920-1976 PRODUCTION FORESTIERE CANADIENNE DE 1920 A 1976

Year	Lumber M. f.b.m.	Wood Pulp M. tons	Paper & Paperboard M. tons
Année	Bois de charp. M pi-pl	Bois de pâte M de tonnes	Papier et carton M de tonnes
1920	4,298,804	1,960	1,215
1930	3,989,421	3,619	2,927
1940	4,629,052	5,291	4,319
1950	6,553,898	8,473	6,812
1960	8,012,226	11,461	8,923
1970	10,711,645	18,308	12,403
1971	12,030,735	18,234	12,303
1972	13,279,062	19,239	13,097
1973	14,751,564	20,462	13,870
1974	12,973,302	21,691	14,570
1975	10,421,411	16,659	11,096
1976 (est.)	15,381,000	19,894	13,191

recommendations to reduce forest losses, and helped plan and assess pest control operations such as the aerial spraying during the year of some 19 million acres (8 million hectares) of spruce-budworm-infested forests in eastern Canada. In view of the magnitude of the spruce budworm problem and of the possible side effects of chemical insecticides, the service increased its research program in an effort to find alternatives to chemical insecticides. Monitoring of the large-scale control operations was also increased.

A number of computerized forest fire management systems developed by the service were in operational use in Ontario and Quebec. A computer model was completed for use in achieving the most efficient allocation of airtankers in fighting forest fires. A method of using LANDSAT imagery for mapping types of forest fuel (the mass of material that can contribute to forest fires) was also proving very useful.

Forest Products

A preliminary study of large-scale production of methanol from forest biomass was commissioned by the Environmental Management Service. This indicated sufficient economic potential to jus-

tify a more detailed investigation. An interdepartmental steering committee, with the deputy minister as chairman, was set up to examine technological, social, economic and jurisdictional implications of production of liquid fuels from forest materials. Within the CFS there was a reallocation of resources to emphasize forest management for energy production and for provision of industrial fuels from wood and harvest residues.

Panel materials using adhesives made from industrial lignin residues were placed in a substantial number of new houses and public buildings for in-service assessment. If these tests are successful, it is expected that the materials will be accepted by Central Mortgage and Housing Corporation. Cost reductions associated with the use of such adhesives should lead to expanded export markets for panel products.

Opportunities for the production of animal feeds from wood residues were pursued by exploring the effects of explosive decomposition with steam on the digestibility of such materials.

The nutritive value of foliage was also investigated. In co-operation with Agriculture Canada, treated foliage was successfully fed to poultry. Ruminant feeding trials were also

in progress.

As part of the program to obtain further useful products from harvested trees, a steam press was developed to produce thick panels from wood residues. At the end of the year this press was in the industrial prototype stage.

A non-leachable fire retardant developed by the service for protecting a range of wood products was being produced commercially in Canada and elsewhere.

A new finger-jointing process for lumber was demonstrated and patented. This system permits rapid curing of joints without the conventional radio-frequency heating.

Several years' work culminated during 1976 in the Canadian Standards Association's acceptance of machine-graded mixtures of hemlock and fir species (known technically as hem-fir) for use in glulam (glue-laminated) beams. This work, which was prompted by a growing scarcity of traditional Douglas fir laminating stock, resulted in the production of superior beams.

Inland Waters Directorate

IWD plays a leading role in the

planning and formulation of water management programs and policies, especially in international and interprovincial water systems. To support this role the directorate conducts research and data collection programs on the quantity and quality of Canada's inland waters. IWD also carries out river basin planning and implementation and flood damage reduction programs with the provinces under the provisions of the Canada Water Act. The research programs of the Canada Centre for Inland Waters and the National Hydrology Research Institute contribute to effective management of water quality and quantity throughout the country and in boundary waters with the United States such as the Great Lakes. The Canada Centre for Inland Waters is the World Health Organization's official collaborating centre on surface and ground water quality, making significant contributions to improved water management in other countries.

International Studies and Water Policy

The directorate played a leading part in a study of the proposed Garrison diversion unit in North Dakota for the International Joint Commission. The IJC study board found that this diversion,

as proposed, would have a number of adverse effects on Canadian waters. It recommended major alterations to the project which would eliminate or mitigate those effects.

The directorate also drafted a federal policy statement on inland waters which was approved by cabinet after being reviewed by the Interdepartmental Committee on Water. Several senior members of the directorate served on the interdepartmental task force examining the domestic and international implications of the drought in Western Canada in early 1977. Meanwhile studies went ahead for the five-year review of the Great Lakes Water Quality Agreement with the United States.

Department staff at the Canada Centre for Inland Waters played a major role in the work of the Upper Lakes Reference Group on pollution in Lakes Superior and Huron. This was the first international scientific study of these large bodies of water, and it resulted in important recommendations for preserving their relatively unpolluted state.

Research at the Canada Centre for Inland Waters documented the major atmospheric source of pollutants to the Great Lakes. Rain and snow were found to contain nutrients and many toxic chemicals, including pesticides

and PCBs. Mathematical models and precipitation chemistry data were used to estimate the atmospheric loading of such pollutants for the Great Lakes.

Abroad, the directorate took part in the United Nations Water Conference in Argentina in March, 1977. On behalf of the World Health Organization, the Canada Centre for Inland Waters reviewed and advised on water quality assessment surveys in the Western Pacific, Latin America, Eastern Europe and Southeast Asia.

Research on Canadian Waters

During rainstorms in urban areas, which have been studied under private contract for several years, disease-causing bacteria and viruses were found in storm sewer outfalls throughout the duration of the rainfall. Storm water runoff was found to be a significant contributor of chemical pollutants to lakes and rivers. A storm water management mathematical model was developed that takes special account of Canadian climatic conditions and can be used to reduce costs of dealing with storm water.

Studies of the pathways of pollutants in the aquatic environment led to a better understanding of natural lake systems. Other studies have shown that marsh sediments and plants accu-

multate heavy metals, and only negligible amounts of these pollutants are contained in the outflow from marshes.

Research on the movement and action of water in lakes included a study of the thermal structure changes in Kootenay Lake, and the development of computer models for predicting nearshore thermal plumes (jets of warmer water) and for waste effluent dispersion. A model study of Wheatley Harbor on Lake Erie was carried out to find ways to improve conditions for navigation at the harbor entrance and reduce wave action inside the harbor.

The Water Resources Branch studied the physical characteristics and effects of moving ice on the Mackenzie River and the stability, evaluation and control of avalanches on slopes in the Cordillera. The branch developed a radio echo sounding device for measuring the volume and water equivalent of icefields and glaciers, and remote sensing techniques to assess glacier surge, snowline definition and snowmelt.

Research on subsurface water quality included studies on the effect of gasoline leaks, sanitary landfill operations, radionuclide disposal, irrigation practices and open-pit mining. Relationships between groundwater quantity and related permafrost

phenomena were investigated in the Canadian Arctic.

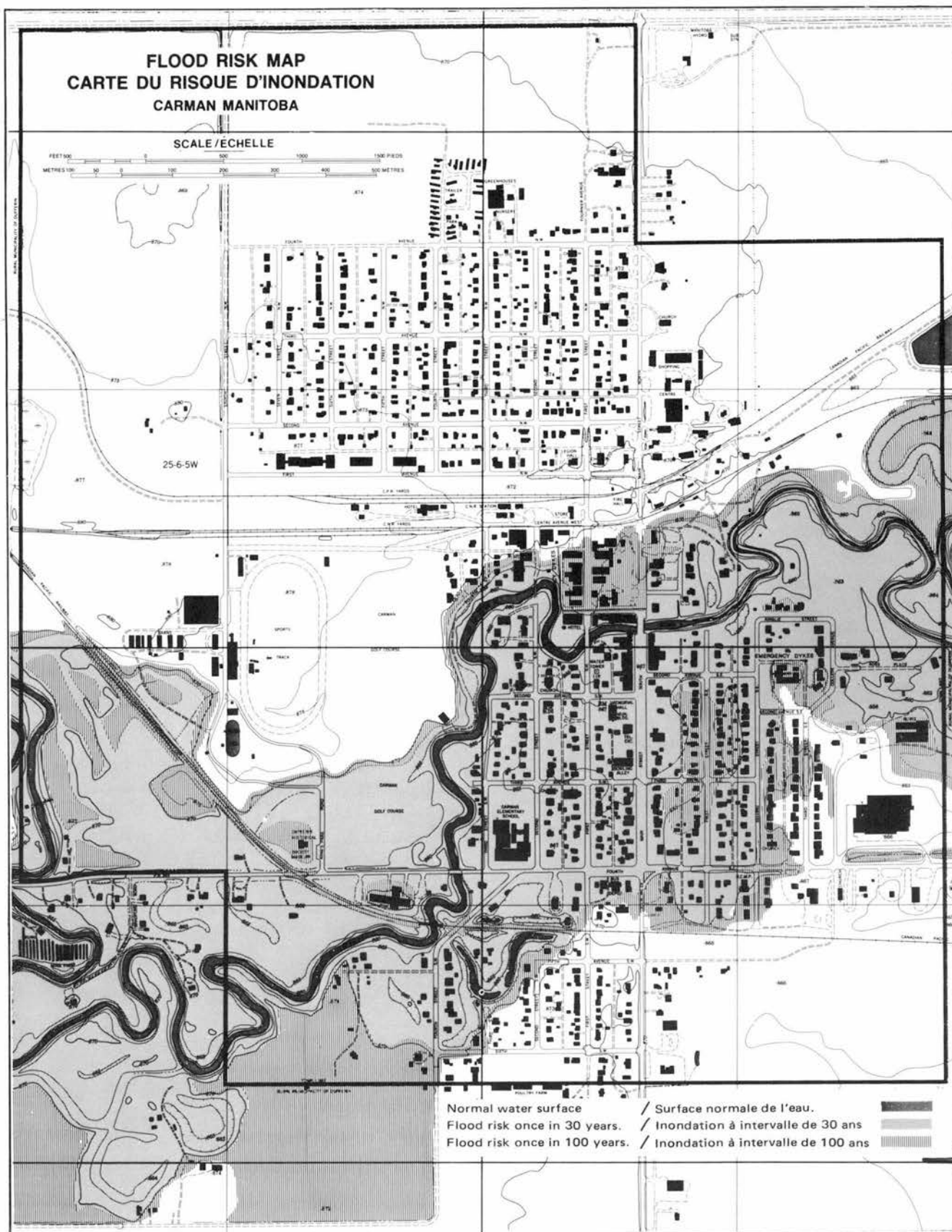
A mathematical model for predicting surface runoff from precipitation data was modified to incorporate snowmelt as part of the input. Data gathered in several Canadian basins were used in this model to arrive at estimates of flows in ungauged rivers.

Flood Damage and Water Management

Under the national Flood Damage Reduction Program, agreements were signed with Quebec and Manitoba, and a memorandum of agreement was initiated with the Northwest Territories on flood risk mapping. Negotiations reached an advanced stage with Saskatchewan, while continuing with Alberta, Nova Scotia, Ontario and British Columbia. This program provides for the mapping of flood-prone areas on a shared-cost basis, with a view to preventing or discouraging further development in those areas.

In the wake of the Great Lakes shore damage survey, a Canada-Ontario joint task force was formed to map flood risk areas, monitor shoreline erosion and promote public awareness of shoreline hazard lands.

A flow regulation study of the Montreal region was completed,



Map showing flood-prone areas at Carman, Manitoba, indicating the areas of high risk. The federal-provincial Flood Damage Reduction Program provides for the mapping of such areas, with a view to discouraging further development in those areas.

and Canada and Quebec formally agreed to implement some of the study board's recommendations through construction of dikes to protect flood-sensitive areas. Also completed were the Fraser River upstream storage study, an important part of the Columbia -- lower Fraser Valley flood control program, and studies in connection with the Churchill River agreement between the federal government and the Provinces of Saskatchewan and Manitoba to determine the possible effects of the proposed Wintego dam. Meanwhile, work continued on water resource studies for the St. Lawrence, Souris and Shubenacadie rivers.

Federal-provincial projects for flood control and water management were under construction along Lake St. Clair, in the lower Fraser Valley, and in the Okanagan and Qu'Appelle river basins.

Negotiations were under way with Alberta, British Columbia and Saskatchewan for co-ordinated planning activities in the Mackenzie basin. The governments took steps to bring together all available information on this basin and agreed to undertake further studies there.

Water Data and Information

The Canadian Water Resources

Document Reference Centre (WATDOC) has served the Canadian water resources community since 1972. With contributions from other agencies, WATDOC builds information bases dealing with Canadian water resources and through negotiations obtains access to similar information bases in other countries. This has resulted in what is probably the largest collection of water resources references available through one organization anywhere in the world.

Reports on water quality in the major waters of the Yukon Territory and Northwest Territories and the provinces of Prince Edward Island, Saskatchewan and Alberta were completed in 1976-1977. These were based on data stored in the Inland Waters Directorate's National Water Quality Data Bank (NAQUADAT). Access to the data system was facilitated by the publication of a NAQUADAT users' manual.

The development of the Hydrographic Data Acquisition System (HYDAC-100) was completed, along with a data reduction and plotting system for use on small boats. These systems provide a very efficient low-cost method of obtaining and analyzing data on the configuration and capacity of rivers, reservoirs, lakes and estuaries.

Cost-sharing agreements with

all provinces permitted continued collection on a national basis of streamflow and water level data. Water quality data collection continued at important interprovincial and international border locations.

Canadian Wildlife Service

The Canadian Wildlife Service is responsible for the protection and management of migratory birds through development of regulations, habitat management and supporting research and surveys. With the provinces and other wildlife agencies the Service undertakes co-operative programs of research, management and interpretation related to other forms of wildlife. It also provides advice to other federal agencies and to territorial and provincial agencies.

Migratory Birds

As part of the James Bay shorebirds study, more than 17,000 birds were dyed and banded from 1975 to 1977, and the migration routes for some species were defined for the first time. Records indicated that several species fly nonstop from James

Bay to the Bay of Fundy and the New England coast, then continue nonstop to South America. Highly critical stopover areas on migration routes were identified for future protection. The complex ecological conditions of the James Bay region were also investigated with a view to providing protection for the millions of birds which migrate through this area.

Banding programs, projected over several years, were planned to obtain data on the population characteristics of snow geese in the Eastern Arctic.

CWS co-operated with native people in Northern Canada to document the annual harvest of migratory birds taken by Inuit and other native peoples in the Northwest Territories.

Important migratory bird habitats held by government agencies in Eastern Canada were identified by CWS and the six eastern provinces. Other unprotected wetlands were pinpointed and means reviewed to conserve the most critical ones. Research was carried out on shorebird habitat in part of the Minas Basin in the Bay of Fundy, and on wetlands ecology in the Columbia Valley, to determine the factors limiting waterfowl reproduction.

Studies were made of the distribution and populations of seabirds on the Pacific coast and

shorebirds on the upper Bay of Fundy. An inventory of fish-eating birds, which will eventually cover the Canadian portion of the Great Lakes, began in 1976 with Lake Ontario. This documented the perilous state of the herring gull population, the expansion of ring-billed gulls in the Toronto Harbor area, and the successful attempts of Caspian terns to colonize the harbor region. In the North, seabird reproduction studies continued on Prince Leopold Island as part of the department's assessment of the influence development activities have on wildlife in the Eastern Arctic.

The whooping crane continued its comeback. In March, 1977, there were 99 of these rare birds in the wild, including those migrating between Wood Buffalo National Park and Aransas on the Gulf Coast, and those migrating between Grays Lake, Idaho, and New Mexico.

Work at Wood Buffalo National Park concentrated on crane biology, with a view to establishing another whooping crane population in the wild in Western Canada. Sandhill cranes in the Interlake area of Manitoba were studied as possible foster parents for young whooping cranes.

Wildlife Research and Interpretation

A decade of attempts to acquire proper facilities for CWS scientific work conducted at headquarters culminated in the establishment of the National Wildlife Research Centre in Hull. Three CWS divisions were based there: Toxic Chemicals, Pathology and Bioelectronics, and Interpretation. Two others were to follow when space became available.

In the North, the extensive research project on polar bears continued, and results have been particularly useful in assessing the impact Beaufort Sea drilling has had on wildlife. The new studies of the effects of aircraft disturbance on muskoxen and caribou increased appreciation of the hazards of northern development. A major population study of the Bluenose caribou was completed, and studies continued on grizzly bears in four different ecosystems. The project on the range requirements of bison and cattle in the Slave River lowlands was finished, and CWS sought the reason for the considerable decrease in bison numbers in the region.

Elsewhere, studies proceeded on the damaging influence of mice and voles on forest regeneration, both in the areas newly planted around tar sands exploitation in

Alberta and in spruce forests of northwestern Ontario. The effects that variations in timber harvesting practices have on moose in Ontario and on deer in Nova Scotia were being looked at.

Success attended the experimental breeding of peregrine falcons at the CWS research station at Wainwright, Alberta, and 38 young were released to the wild. The project will now move to a sustained effort to reintroduce young into areas where the peregrine's breeding population has seriously diminished in recent decades.

The CWS actively sought to improve the effectiveness of the Convention on International Trade in Endangered Species of Wild Fauna and Flora by establishing a system of import and export permits.

Prescribed fire, to maintain habitat diversity and preserve grasslands from encroaching poplar, was used as a management tool in Prince Albert National Park. If successful, this technique has broad application in other areas of the Great Central Plains.

Mammal research included the study of large mammal ecology in Riding Mountain National Park, studies on grizzly bears in Jasper National Park and bison-wolf prey-predator relationships in Wood Buffalo National Park and

environs. Also, a mammal inventory was conducted in Fundy National Park.

Fewer birds were killed in the extensive 1976 forest spraying program in New Brunswick than in 1975, owing to the use of a less bird-toxic insecticide and a different spraying technique.

Herring gull eggs were used in an annual monitoring scheme to follow trends of contamination in all the Great Lakes, as part of the program under the Canada -- United States Great Lakes Water Quality Agreement. Reproductive failure of Lake Ontario herring gulls has been caused partly by poor incubation by adults with high toxic chemical loads, and partly by a toxic effect on the embryo.

After a number of years of research on effects of marine oil on seabirds, a breakthrough came in 1976 with the discovery that tiny amounts of swallowed oil sharply reduce the ability of the birds' intestines to absorb nutrients.

Cormorant colonies in the upper St. Lawrence were intensively studied, but the mortality of 1975 did not recur and there was no evidence of Newcastle disease.

Once again, bison were vaccinated against anthrax in Wood Buffalo National Park and no anthrax outbreak occurred.

Radio tracking equipment was provided for a variety of field studies, and telemetry systems were developed to monitor egg temperature and incubation efficiency of peregrine falcons and herring gulls.

Public interpretation programs continued at wildlife centres at Percé and Cap Tourmente, Quebec; Midland, Ontario; and Creston, British Columbia. Planning for the Prairie Wildlife Centre near Swift Current, Saskatchewan, was completed, with construction to begin in 1978.

Lands Directorate

The Lands Directorate promotes the efficient, effective and environmentally sound use and management of Canada's land resource. To achieve this, the directorate plans, supports and participates in programs designed to meet the land-related obligations arising out of the Department of the Environment Act. Some of these include the preparation of inventories of land characteristics, land capability and suitability, and land use; the formulation and assessment of land use alternatives; and the promotion of ecologically sound

land use planning.

Policy Development and Advice

During 1976-1977, the directorate chaired the Interdepartmental Task Force on Federal Land Use Policy. The directorate also represented the department on the Treasury Board Advisory Committee on Federal Land Management and provided advice to other committees such as the Steering Committee on Environmental Monitoring and the departmental Liaison Committee on Atomic Energy.

Environmental Impact Assessment

Since 1972, the Lands Directorate has acted as lead departmental agency in the James Bay Environmental Studies Agreement with the James Bay Development Corporation. In May, 1976, this agreement was extended for another three years. Also in May, the department and the corporation co-operated in the presentation of the James Bay Environment Symposium, which reviewed the findings of the research and inventory program to date.

The directorate participated in the investigation of the environmental aspects of native land claims, continuing a role it began in 1975 in the negotiation of the precedent-setting agreement with the Cree and the Inuit

of northern Quebec.

Under the federal Environmental Assessment and Review Process the directorate provided advice and assistance on a number of government-sponsored development projects. The Atlantic regional office was involved in environmental impact assessments relating to the Fundy tidal power development and the Wreck Cove hydroelectric project. The Pacific and Yukon regional office was concerned with environmental studies and reviews associated with the proposed reconstruction of the Haines Road -- Alaska Highway, the expansion of the Roberts Bank port, the construction of the Alaska Highway pipeline and the evaluation of alternative port sites for west coast oil tankers.

Land Inventories

During the year, the Lands Directorate provided the chairman and the secretariat for the newly established Canada Committee on Ecological Land Classification (CCELC). The committee was formed to develop and promote the application of a uniform ecological approach to land classification in Canada. The directorate organized several workshops, established a report series and launched a newsletter. The published proceedings of the first

CCELC meeting provide a comprehensive review of land classification in Canada.

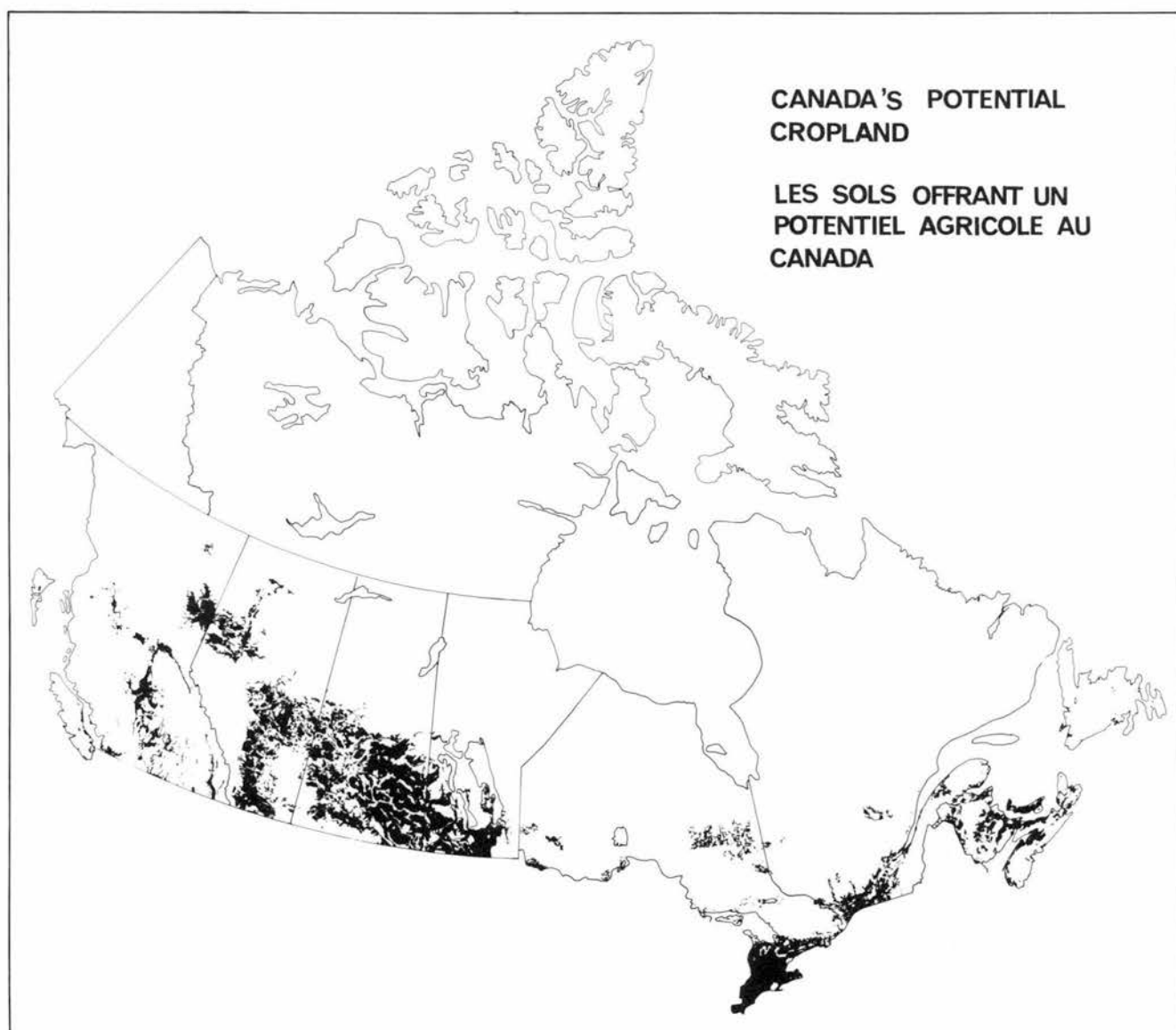
Within the directorate, research covered ecological land classification methodology and the integration of water data, the refinement of vegetation classification, and the applications of remote sensing, particularly to land inventory.

Land Resources Mapping

Under the largest of the directorate's mapping programs -- the Canada Land Inventory (CLI) -- the total number of maps published reached 858, an increase of 165 over the previous year. In association with the CLI program, the directorate advised the government of Greece on the establishment of a land inventory for forested regions.

For those areas not covered by the CLI, the Lands Directorate continued its development of a biophysical land classification mapping program. Biophysical inventories were conducted in three regions, the Atlantic (Labrador), Ontario (Hudson Bay Lowlands) and Quebec (Belle Rivière); an ecological reconnaissance map was published for Labrador.

Other mapping programs included the extension of the Northern Land Use Information Series to



This Canada Land Inventory map shows the distribution of good cropland in Canada. Much of this land is concentrated in areas that are rapidly urbanizing.

cover the regions of Great Bear Lake, Banks Island and Coronation Gulf and continued research for two map folios, one describing Canada's critical lands, the other illustrating the conversion of land to urban uses. The Pacific and Yukon regional office published maps that identified future resource-use options for the Fraser River delta and estuary Region. In the Ontario Region, mapping of land use data in the Saugeen Valley and the Rideau-Trent-Severn corridor neared completion.

Land Use Studies

A Canada-wide review of provincial land use policies, programs and legislation continued with the publication of two more reports in the series covering Manitoba and British Columbia. To examine the ways in which land use is affected, the directorate conducted studies of agricultural land reserve legislation in British Columbia; land ownership legislation in Prince Edward Island; and federal policies in Kings County, Nova Scotia, Cowichan Valley, British Columbia and Wellington County, Ontario. The rapid loss of agricultural land prompted the Lands Directorate, and more particularly the Ontario regional office, to analyze agricultural land use

change, a study was initiated to determine the amount of despoiled land in Canada and the current regulations in force to reclaim and rehabilitate these lands. Looking to the future, the directorate has developed a model to project the demand for land for such uses as agriculture and forestry and the availability of land to satisfy them.

Information Systems

Analysis of the large volume of CLI land capability and land use data contained within the Canada Geographic Information System continued with the release of national statistics on the provincial distribution of land suitable for outdoor recreation. Similar statistics for agricultural land, released in the spring of 1976, formed the basis of a report that describes the rural-to-urban land conversion process in urban fringes.

Environmental Protection Service

The Environmental Protection Service (EPS) develops and enforces regulations, guidelines and requirements that are used, along with federal laws, to protect the environment. The service also advises other federal departments whose legislation involves environmental matters, and is a point of contact for the public on environmental protection issues.

EPS maintains bacteriological and chemical laboratories across Canada as well as the Air Pollution Technology Centre in Ottawa, the Northern Technology Centre in Edmonton, and the Wastewater Technology Centre at the Canada Centre for Inland Waters in Burlington.

Headquarters staff in the national capital area are responsible for policy development, planning, co-ordination, direction and administration of the national programs. Regional offices are points of contact with the provinces and with industry on environmental protection matters, and they implement local aspects of regional and national programs.

Of particular interest during the fiscal year was the introduction of amendments to the Fisheries Act, jointly administered by EPS and the Fisheries and Marine Service.

Water Pollution Control

The objectives of this program are to clean up existing water pollution problems and to prevent pollution from new sources, in order to maintain water quality at a level suitable for the protection of fish and for other uses.

The basic strategy of the water pollution control program includes (a) development and implementation of minimum effluent control requirements based on the best practicable technology for specific industrial sectors, to apply uniformly across Canada, and (b) the development and implementation of more stringent control requirements when an adequate level of protection is not provided by the baseline standards.

Primary legislative instruments used in the program are the Fisheries Act, the Canada Water Act and international agreements (e.g., the Canada -- U.S. Great Lakes Water Quality Agreement, and the Canada -- U.S. Bilateral Shellfish Agreement).

During the 1976-1977 fiscal year, effluent regulations were promulgated for the base metal mining and the meat and poultry industries, and for the control of vessel wastes (sewage) on the

Great Lakes.

A review of water pollution abatement in the pulp and paper industry to the end of 1976 indicated reductions in suspended solids (SS) and biochemical oxygen demand (BOD) of 39 per cent and 22 per cent respectively, compared to 1969 levels. Reductions of seven per cent SS and 15 per cent BOD were achieved nationally between 1974 and 1976. The review also indicated that 49 of 129 mills were in compliance with SS requirements, and 85 mills with BOD requirements. Thirty-six mills out of 98 tested met effluent toxicity requirements.

A status report on abatement of water pollution from the Canadian petroleum refining industry was published during the fiscal year. The study indicated that between 1972 and 1975 significant reductions were achieved in the discharges of phenols, sulphides, ammonia, nitrogen and suspended solids. At the end of 1975, 14 of 38 operating refineries were in compliance with the regulations and guidelines.

From 1975 to 1977, EPS coordinated a national inventory of municipal waterworks and wastewater treatment systems. The inventory was carried out in co-operation with other federal government departments, provincial agencies and the Federation

of Associations on the Canadian Environment. The inventory, covering facilities serving approximately 60 per cent of Canada's population, has been integrated into the computerized information system WATENIS (Water Effluent National Information System) which is being developed by the service. The design and programming of the MUNDAT system, a component of WATENIS for municipal waterworks and wastewater treatment systems, was completed. A data base for petroleum refinery data in the Northwest Region was developed as a pilot project to demonstrate the usefulness of the WATENIS system for industrial data.

A number of industrial wastewater treatment projects to determine and demonstrate best practicable technology were carried out in 1976-1977. New and improved methods of treating both industrial and municipal wastewaters are constantly being developed to minimize the adverse effects of such discharges. The projects included the biological removal of nitrogen from effluents to reduce the growth of aquatic plants; a demonstration pilot plant at a gold mining operation in the Northwest Territories to destroy cyanides and remove arsenic, to prevent these highly toxic substances from draining into nearby

watercourses; and studies on wastes from uranium mining operations to ensure safe disposal to the environment.

During the year several studies concerned with the characterization, treatment and ultimate disposal of digested (treated) sludge were undertaken, including a survey of Ontario sludge disposal practices and a study of the impact of phosphorus removal chemicals on the sludge digestion operation. These studies revealed problem areas in present procedures for handling and disposal of municipal wastewater sludges which require further attention.

To promote and ensure early application of new wastewater treatment technology by industry and municipalities, EPS conducts a technology transfer program including seminars, courses and publications. During 1976-1977 the service co-sponsored eight seminars in co-operation with technical societies, associations, universities and provincial environmental agencies and published 42 reports, seminar proceedings and speeches for the technical community.

Work continued on the course for wastewater treatment plant operators which is being prepared in co-operation with the Water Pollution Control Federation. The course, aimed at the cost-

effective operation of treatment plants for efficiency and for energy conservation, was approximately 70 per cent completed. Development of two skill packages for the third level of the program was also begun.

Under the Interdepartmental Committee on Research and Development in Sewage Collection and Treatment (SCAT), 11 contract projects were undertaken on subjects related to the improvement of sewage collection systems, upgrading sewage treatment plant performance, ultimate disposal of sewage sludges and small sewage disposal systems for individual homes. The main purpose of the program is to demonstrate ways and means of reducing municipal and domestic wastewater collection and treatment costs, in order to reduce CMHC loans under the Sewage Loan Fund and as individual mortgages.

The new Development and Demonstration of Pollution Abatement Technology (DPAT) Program, designed to stimulate new technology for the abatement of pollution in Canada, completed its second year with 90 per cent of available funds committed for environmentally significant projects. One of the major projects is concerned with the complete recycling of all process effluents in a bleached draft pulp mill, making it virtually a

closed system. This promises to be the most significant advance in pollution control in the history of the pulp and paper industry.

In British Columbia, a federal-provincial study of water quality and pollution sources in the Thompson River was completed.

In the Atlantic Region, four shellfish areas, representing 7,500 acres previously closed due to contamination, were reopened. The reduction in contamination is largely attributable to successful implementation of pollution abatement measures. Major reductions in industrial pollution from pulp and paper mills in New Brunswick and Newfoundland were effected. Agreement was also reached on temperature limits of effluent and protective measures for fish at the water intake of the Point Lepreau Nuclear Power Station in New Brunswick.

Ontario Regions's Water Pollution Control Division submitted a brief to the Ontario Environmental Assessment Board outlining environmental concerns about proposed expansion of uranium mining operations. The brief contained technology assessments of mining activities as well as a discussion of federal environmental legislation and regulations governing mining operations.

A joint federal-provincial program to gather industrial

effluent data was started in the Quebec Region. Sixty-six factories were surveyed, bringing to 115 the number of such surveys undertaken by the region. The data will serve as baseline information for future government-industry negotiations.

EPS in the Northwest Region worked with various provincial and territorial agencies in Alberta, Saskatchewan, Manitoba and the Northwest Territories to ensure that adequate pollution prevention measures were incorporated in 35 DREE-funded projects, as well as two mines, a chemical company and several food processing plants.

Air Pollution Control

The objectives of the department's Air Pollution Control Program are to define the air pollution problem in Canada, to promote desirable levels of air quality and to control emissions of air contaminants deemed to be a significant danger to public health or the environment.

During the year, regulations under the Clean Air Act were published in the Canada Gazette for emissions of mercury from

mercury cell chlor-alkali plants and for emissions of asbestos from asbestos mines and mills. Standard reference methods in support of these regulations were completed. Regulations for disclosure of information by industry concerning mercury and arsenic emissions from metallurgical industries were promulgated, also under the Clean Air Act. National emission guidelines for the Arctic mining industry were published in the Gazette.

Work continued on the development of regulations for emissions of vinyl chloride from vinyl chloride and polyvinyl chloride manufacturing operations and for emissions of arsenic from gold roasting operations, from iron-ore processing and from non-ferrous smelters. Development of standard reference methods in support of these regulations proceeded during the year.

At the year's end, work was in progress on guidelines for boilers and incinerators, the pulp and paper industry, non-ferrous smelters, thermal power plants, natural gas processing plants, petroleum refineries, ferrous foundries, iron and steel plants, ferro-alloy plants and the fertilizer industry.

National Ambient Air Quality Proposed Objectives at the maximum tolerable level were an-

nounced for sulphur dioxide, suspended particulate matter, the combination of sulphur dioxide and suspended particulate matter, carbon monoxide, oxidants and nitrogen dioxide. Objectives were also announced for hydrogen fluoride and hydrogen sulphide at the maximum desirable and maximum acceptable levels.

Thirty-two additional Clean Air Act inspectors were appointed and 19 analysts were designated.

The air pollution Technical Information Service continued to serve technical information needs across the country. During the reporting period more than 3,000 information requests were answered. The service now holds more than 95,000 separate articles on microfiche concerning government and industry conference proceedings, research projects, and government regulations and standards; 11,000 of these articles were added during 1976-1977. During the review period 31 technical reports on air pollution control were published.

The department, through its Emission Testing Laboratory, continued to co-operate with the Ministry of Transport in support of the new-car emission regulations compliance program. New car emission standards for hydrocarbons, carbon monoxide and nitrogen oxides will remain unchanged

until the 1981 model year. A new standard limiting carbon monoxide emissions during the idling mode was being developed for 1979 model year automobiles. In addition, the department was developing new labelling requirements for low-emission tuning of motor vehicles. Further assistance was given to the provinces to develop programs to reduce emissions from vehicles already in use.

The National Air Pollution Surveillance Network, operated as a co-operative endeavor by all levels of government, was expanded and improved. It now comprises 541 instruments, including 252 continuous gaseous pollutant monitors located at 153 stations in 52 cities. A statistical analysis of nationwide trends in the concentrations of six pollutants in the ambient air was completed for the period 1970-1974. A general trend of decreasing air pollution levels was found during that period.

A survey for fluorides in the ambient air at Cornwall Island was completed during the review period. Carbon monoxide levels in the ambient air in Whitehorse and at Lake Louise were monitored. A complete ambient air pollutant monitoring station was put into operation in Abbotsford, British Columbia, to provide data for the British Columbia Lower Mainland Air Quality Study. EPS

and the Atmospheric Environment Service jointly conducted an ambient air sulphate study during August, 1976. Stack tests were completed on several asbestos mining and milling operations, chlor-alkali plants and sewage sludge incinerators, and on one municipal incinerator, one gold ore smelter and one internal combustion engine power generating station.

As part of a continuing assessment of air pollutant levels across the country, inventories were completed for emissions of sulphur oxides, suspended particulates, carbon monoxide, hydrocarbons, nitrogen oxides, zinc, cadmium and arsenic, based on data for 1972.

The department continued to provide technical and advisory services to the provinces on the control of air pollution. Assistance was given to Saskatchewan to develop regulations for the potash industry and Manitoba to plan air pollution control programs for two smelters. Technical advice and assistance were provided to Newfoundland in the assessment of a fluoride pollution problem, to Nova Scotia concerning the operation of a chlor-alkali plant and to New Brunswick in its continuing sampling program in the Saint John and Lorneville areas. The Canadian Public Health Associa-

tion Task Force on Arsenic in Yellowknife received technical advice and assistance from the department.

Under the DPAT Program, 11 air pollution related proposals were assessed.

A contract was signed last year with British Columbia Forest Products Ltd. to develop and demonstrate a new design of granular bed scrubber, to capture very fine particulate emissions. Initial installation and operational problems have been resolved and the results were encouraging. Under the contract signed with the St. Anne-Nackawic Pulp and Paper Company Ltd. in New Brunswick, installation of an alkaline cross-flow scrubber, to destroy odors and recapture chemicals that may be recycled, was on schedule.

Other highlights of the Air Pollution Control Program included:

- . participation with Alberta and the industry in a review of air pollution aspects of the projected Syncrude operations;
- . initiation of legal proceedings under the leaded gasoline regulations against a company that imported gasoline containing more than the allowable maximum content of lead;
- . completion of studies on emissions and control technology in the wood pulping industry, and in the vinyl chloride and polyvinyl chloride manufacturing industries;
- . evaluation of four in-stack continuous particulate monitoring devices in a secondary lead smelter;
- . participation with Ontario in the measurement of emissions of polychlorinated biphenyls from two sewage sludge incinerators, two municipal waste incinerators, two municipal waste incinerators, two capacitor plants and one transformer filling plant;
- . initiation of a project to measure trace quantities of potential carcinogens within the classes of chlorinated aromatic hydrocarbons, nitrosamines and organometallic compounds, in ambient air.

In the Northwest Region, a study to identify the nature and extent of arsenic contamination in Yellowknife was made available to the Yellowknife Standing Committee on Arsenic and the Canadian Public Health Association Task Force on Arsenic in Yellowknife. Support was provided to the Province of Saskatchewan for the development of regulations for the potash industry.

Less than 3 per cent of sam-

ples taken at both petroleum refineries and retail outlets in the Quebec Region showed infractions of the leaded gasoline regulations. Three new monitoring stations were added to the National Air Pollution Surveillance Network in the region, and four were added in the Pacific Region. EPS also made an environmental assessment of B.C. Hydro's proposed Hat Creek thermal plant.

Environmental Impact Control

Planning for reorganization of this directorate took place during the fiscal year, culminating at the end of the year. The new directorate, Environmental Impact Control, embodies the activities of the previous Environmental Conservation Directorate, with responsibility in six broad areas: environmental contaminants, ecological impact control, federal facilities, environmental emergencies, noise and waste management.

Chlorobiphenyl Regulation No. 1 was published in the Canada Gazette on February 26, 1977. Gazette notices were also published requiring all those engaged in the manufacture, sale

or use of polybrominated biphenyls, polychlorinated terphenyls, polychlorinated biphenyls (all toxic chemicals) or Mirex (a fire retardant and pesticide) to notify the minister of fisheries and the environment. The PCB and Mirex task force reports were in preparation.

Advice was provided to the Department of Agriculture on the registration of new pesticides and on re-evaluation of those currently in use (under the Pest Control Products Act), with respect to environmental contamination, disposal and decontamination. A paper on pesticide use and control in Canada with input from the Departments of Agriculture, Fisheries and Environment and Health and Welfare was coordinated by EPS for the Canadian Council of Resource and Environment Ministers.

HAZMAT, computerized list of the properties of hazardous materials, was developed for reference by federal government departments. EPS staff contributed environmental information for the development of a uniform code for the transport of dangerous goods. Interim codes of good practice were also prepared for the safe handling, storage and disposal of environmentally hazardous wastes.

The fiscal year 1976-1977 was the first full year of adminis-

tration of the Ocean Dumping Control Act; 261 formal permit applications were received, and 248 were approved. The primary reason for rejecting 13 applications was the identification of prohibited and restricted substances in the material to be dumped.

EPS continued to participate in the Environmental Assessment and Review Process by completing initial environmental evaluation guidelines; by providing secretariat services to the Committee on Environmental Assessment and the five regional screening and co-ordinating committees; and by providing inputs to a number of panel projects. In addition, the Guide for Environmental Screening and a document explaining the roles of federal government departments and agencies in the environmental evaluation of major projects were completed. Through active liaison the service continued to assist other government departments with the requirements of the Environmental Assessment and Review Process.

Efforts to develop codes of good practice for activities with potential effect on the environment continued, including environmental guidelines for gas pipelines, general construction, offshore drilling, and the oil and gas industry.

Technical information and

recommendations provided by EPS to government and the private sector included the semi-annual review for the industry-government agreement for Nanisivik Mine; administration leading to the establishment of the West Coast Oil Port Enquiry; offshore drilling and related environmental studies; participation in the assessment of a TERMPOL submission for an oil port proposal at Kitimat, British Columbia; and considerations related to northern gas pipelines.

The 1976-1977 fiscal year marked the fourth year of EPS administration of the Federal Clean-up Program. The work involves assessing environmental problems associated with existing federal facilities, providing environmental engineering advice to other federal departments and ensuring implementation of remedial measures for pollution control. EPS continued to co-ordinate the disposal of hazardous wastes from federal facilities in the national capital area.

Under the Clean-up Program nearly \$10 million was allocated to federal departments for the clean-up of pollution problems at more than 60 locations across the country. The Departments of Transport, National Defence, and Indian and Northern Affairs

received the largest shares.

Projects included:

- . completion of the installation of dust control equipment at the Canadian Grain Commission elevators at Prince Rupert, B.C. (total cost \$2 million);
- . completion of a water treatment system at the Pukatawagon Indian Reserve School in Manitoba (total cost \$50,000); and
- . construction of a wastewater treatment system at CFB Cornwallis, Nova Scotia (estimated cost \$1.5 million).

In addition, guidelines and codes of good practice for controlling pollution at federal establishments were completed for distribution to all government departments and agencies. Monitoring and surveillance of federal facilities continued, as did referral of new projects by other government agencies for environmental review and design recommendations.

Technical information, advice and recommendations were provided to various levels of government and the private sector on the effects of noise as well as on diverse noise-emitting products. Involvement in noise problem assessments at various federal facilities resulted in the preparation of recommendations concerning potential solutions and the development of procedures

for dealing with future problems.

During 1976-1977, the National Environmental Emergency Centre received more than 700 spill reports involving over 3.3 million gallons of petroleum products and 240,000 metric tons of other hazardous materials. The computerized National Emergency Equipment Locator System (NEELS) was made available to the National Police Service Information Centre, permitting all affiliated police authorities across Canada to use this unique system. Training materials for the use of NEELS were prepared and several training seminars were given.

In the Ontario Region, an oil spill into the St. Lawrence River near Alexandria Bay, New York, on June 13, 1976, prompted an action under the joint Canada -- U.S. Contingency Plan, with the Canadian and U.S. coast guards co-operating in the \$10 million clean-up. A second spill on December 23 near Parry Sound was handled by clean-up crews, with the majority of the oil burned on site; subsequent investigations revealed no significant damage to private property, fish, wildlife or recreational facilities.

EPS staff initiated and, with other government departments and agencies, prepared a contingency plan which delineates government

responsibilities for major oil spills in the southern Beaufort Sea. Guidelines for the preparation of contingency plans relating to oil and gas pipeline facilities were also drafted. Advice and technical information on ways to handle oil spills were provided to petroleum firms operating in Canada, through seminars and the 25 reports on environmental emergencies published this year.

The Spill Technology Newsletter was initiated to assist in the dissemination of knowledge on oil spill countermeasures. Interest in the newsletter proved to be considerable, with requests coming from more than 1500 specialists in the oil spill control field, in Canada and in 16 foreign countries.

A number of studies were initiated to improve oil spill control and countermeasures technology.

EPS staff members provided training seminars in environmental emergency procedures for field personnel and, with industry, continued the production of videotapes for training personnel in oil spill response techniques.

Under a strengthened mandate to conserve materials and energy, EPS initiated numerous projects including a review of the viability of a waste rubber recovery system on the Prairies; the first

national examination of the carbonated beverage container industry; an analysis of the energy and materials conservation options for waste paper management; a study of the impacts of altering the durability of major consumer appliances and automobile tires; and the development of methodology for a Canadian waste exchange, to increase access to and recycling of waste material.

EPS provided practical demonstrations of the federal government's conservation policy through Project Conservation, a waste paper management program, in EPS offices in Hull, Quebec, and the development of an at-source paper separation system at CFB Borden, Ontario.

Under the national municipal waste data base program, initial data gathering was started in large urban centres. Traditional waste management technology areas undergoing continuing study and development included measurement of soil-waste interaction and behavior of PCBs in soils. Under the Canada -- U.S. Great Lakes Water Quality Agreement, selected landfill sites were monitored with the aim of developing a predictive model for the underground movement of polluting substances. EPS convened two round-table conferences, on landfill site monitoring and gas

generation and control, as well as introducing workshop-style seminars on a national basis. A comprehensive directory of Canadian activities in the field of waste management was published.

In the Northwest Region, 565 new federally-initiated projects were registered and screened. Comprehensive environmental requirements for upgrading DEW Line stations were developed and delivered to the United States Air Force. Personnel were provided to supervise and co-ordinate the clean-up of radioactive materials in Uranium City, Saskatchewan. Training was provided to 33 operators and supervisors of sewage treatment plants at federal installations.

Reports entitled Assessment of Environmental Protection Activities on the Mackenzie Valley Gas Pipeline Project and Recommended Environmental Standards for the Design and Construction of a Mackenzie Valley Gas Pipeline were published.

Seven seminars were held in the region on solid waste management, with attendance from municipal, provincial, industrial and federal areas. A joint federal-provincial study of hazardous wastes in Manitoba, Saskatchewan, Alberta and the Northwest Territories was negotiated. Products containing PCBs, banned under the Hazardous Products Act, were

collected from hospitals, universities and laboratories.

In the Pacific Region, contingency plans for environmental emergencies were completed, and sensitivity mapping of coastal areas identified those in need of protection from spills. A report on PCB contamination in the region was published.

A contaminants control program was created in the Quebec Region, where a survey of mercury in the environment was begun. An inventory of PCB users was also established.

Administration Program

Planning and Finance Service

The Planning and Finance Service operates through eight directorates which provide policy support and common services to the department. Summaries of the programs and activities of each directorate follow.

Policy, Planning and Evaluation Directorate

This directorate incorporates the three distinct but related functions included in its title. As a central policy group, it focusses on policy areas that transcend specific responsibilities of individual services. The planning group oversees the departmental planning process and, in concert with Finance, is responsible for the preparation of the annual program forecast. The evaluation group provides direction and advice to the department on the development and implementation of performance measurement systems and evaluative techniques.

The work of the directorate over the past 12 months included refinement of the process for developing the departmental program forecast and conducting the actual program forecast for 1978-1979. As well, the

directorate played a substantial role in developing the environmental contaminants program through the assistance it provided in setting out the administrative procedure for implementation of the Environmental Contaminants Act, identification of program requirements and development of supporting documentation.

To enable the department to operate more effectively under the current conditions of economic restraint, the directorate has been asked to conduct an in-depth budget review of all departmental activities, and to identify areas where efficiencies can be realized and where programs can be made more effective. This process will enable financial resources and manpower to be reallocated to areas of highest priority.

Liaison and Co-ordination Directorate

The Liaison and Co-ordination Directorate makes recommendations and co-ordinates departmental activities on environmental and renewable resource issues with international, federal-provincial or interdepartmental dimensions.

The directorate has continued to co-ordinate the federal contribution to the Canadian Council of Resource and Environment Ministers. Items considered by the council at its meeting in June, 1977, included shorezone management, flood hazard reduction and national forest policy.

In association with AES, the directorate contributed to the development of an integrated and co-ordinated study on the long range transport of air pollutants. The directorate is co-ordinating the comprehensive fifth year review of the Canada -- U.S. Great Lakes Water Quality Agreement. It is also involved in other transboundary environmental matters including the Garrison diversion project, the proposed Eastport oil tanker port, the construction of a thermal electric plant on the East Poplar River, and west coast tankers. New emphasis was placed on developing techniques for assessing the potential environmental impact on Canada of policy and program developments in the United States.

Staff members co-ordinated Canadian preparations for and participated at meetings of the senior advisers on environmental problems to the Economic Commission for Europe, the Governing Council of the UN Environment Program, the OECD Environment

Committee and the NATO Committee on the Challenges of Modern Society.

The directorate also co-ordinated two visits between the Commission of the European Communities and Canadian officials during which areas for further environmental co-operation were identified. In addition, it co-ordinated the departmental contributions to exchange activities conducted under the aegis of the Science and Technology Agreements with Belgium, the Federal Republic of Germany, France and the Soviet Union.

The directorate continued to provide the secretariat for the co-ordination of Canadian participation in the UNESCO Program on Man and the Biosphere, an internationally co-ordinated research program on rational use of global resources and their conservation.

Finance Directorate

The Finance Directorate provides the central financial management function for the department and in particular responds to requirements identified by the Treasury Board, by the auditor general and by internal audit

procedures carried out within the department. In co-operation with the Department of Supply and Services, a joint study was launched to examine the feasibility of introducing a new computerized system of financial management and control.

Internal Financial Audit Branch

The Internal Financial Audit Branch is responsible for the auditing of financial and related systems in the department. It plans and schedules these audits which are conducted by the Audit Service Bureau of the Department of Supply and Services, and prepares reports for an audit committee and the deputy minister. During the year audits of financial systems were conducted at selected establishments, which represent systems in effect throughout the department. Payments made by provinces covered by cost-sharing agreements, and subsidy payments or conditional grants to fishermen and processing plants were also audited.

Departmental Management Services Directorate

Major effort was devoted to the clarification of roles in the administrative field, analysis and recommendations concerning word processing units, and the launching of Project Red Tape -- designed to identify major administrative burdens in the department.

Operational reviews were carried out at major centres across the country, leading to a general improvement in efficiency. The Environmental Libraries Automated System (ELIAS) was expanded and its introduction to regional offices began. The directorate also organized an energy conservation program for the department; the goals set for the first year were exceeded.

Personnel and Organization Directorate

The Personnel and Organization Directorate is divided into two principal spheres of activity. A headquarters group is concerned with all facets of development of personnel policy. Headquarters

staff also carry out operational classification, staffing and staff relations responsibilities for all groups for which these functions have not been delegated or decentralized.

A second group is concerned with day-to-day operations. This is accomplished through nine area personnel offices, two in the national capital area and the remaining seven in Vancouver, Edmonton, Winnipeg, Toronto, Quebec City, Halifax and St. John's.

During the fiscal year, 8,100 separate staffing actions were undertaken. Some 2,607 persons left the department for a variety of reasons ranging from transfers to retirements, and including resignations, lay-offs and end of term employment.

Budgetary restraints and policy decisions on "make or buy" have led to greater emphasis on human resources planning. Concrete steps have been taken toward the development of a more efficient personnel information system. A full-time senior personnel administrator was appointed to ensure equal opportunities for women, and native employment.

Special attention was given to bilingualism to improve service to the public in both languages, make a reality the choice of language of work by employees and

provide equal opportunities to employees regardless of language.

Computing and Applied Statistics Directorate

The directorate provides functional direction to the many and varied electronic data processing activities in the department and to the applied statistics consulting and advisory services undertaken in support of departmental programs. It also directly provides applied statistics consulting and analysis services; scientific computing; and design, development and implementation of computer-based information systems.

The directorate was involved in 124 projects requiring the provision of advice and assistance in statistics or scientific computing. These projects included such wide-ranging applications as the evaluation of fisheries inspection procedures, the development of sampling procedures for pollutant trend detection in rivers, and the development of methods to select departmental projects which will have the greatest net present value. A powerful minicomputer

was acquired during the latter part of the year. In addition to reducing computing costs, this will allow the Applied Statistics and Scientific Computing Branch to assist other minicomputer users in the department with hardware and software problems.

The directorate conducted a major study of the practicality of acquiring compatible in-house computers as against using external service bureaus to replace existing electronic data processing facilities at the Canada Centre for Inland Waters, Burlington; AES, Downsview and the Bedford Institute of Oceanography, Dartmouth. In another study, the status of various incompatible automated financial accounting systems was reviewed.

After extensive evaluation of tender responses, a new contract with a computer service bureau was signed, providing for reduced rates for both the directorate and several other computer-using organizations in the department. The data preparation service was modified to reduce the proportion of keypunching done in house while providing an expanded and more efficient service through the use of multiple contract agencies. The development of the Environmental Libraries Automated System (ELIAS) neared completion and received considerable attention in the department, in other

government departments and internationally. The Water Effluent National Information System (WATENIS) was further advanced by the completion of the design phase for the petroleum refineries industry.

Emergency Planning Branch

The Emergency Planning Branch is responsible for developing departmental policies and procedures for use in war and peace emergencies, within the framework of national, NATO and Allied practices. It also co-ordinates departmental civil emergency planning activities with those of other federal and provincial departments.

During the year the branch participated in a number of interdepartmental, NATO and Allied committees. It took part in preparation of the Canadian input for two NATO exercises and participated in the exercises. The headquarters readiness plan was rewritten and regional plans updated. The departmental "war book" and the essential records were reviewed and updated. The branch also conducted a course for the benefit of the Fisheries Emergency Control Organization.

Office of the Science Advisor

The Office of the Science Advisor is a policy and science program support directorate. It provides advice to the minister and to senior departmental management on the state of scientific knowledge on issues affecting the policies, interests and responsibilities of the department. The office also co-ordinates scientific activities that involve several services or departments.

In 1976-1977 the OSA continued to co-ordinate the department's activities in the area of energy and environment. An important part of the work concerned nuclear energy and resource development policy. The office was active in interdepartmental negotiations on revisions to the Atomic Energy Control Act and on the Federal-Provincial Task Force on Radioactivity, particularly with regard to removing radioactively contaminated material from properties in Port Hope, Ontario, and Uranium City, Saskatchewan. In the area of renewable energy resources, work performed under contract to the office resulted in two publications: Images of Canadian Futures: The Role of Conservation and Renewable Energy and Solar Home Heating in Canada: Problems and Prospects. The OSA played a major role in developing the departmental submission to the Ontario Royal Commission on

Electric Power Planning. Collaboration with the Department of Energy, Mines and Resources on an interdepartmental energy analysis program resulted in a major joint report entitled Energy Requirements Associated with Selected Canadian Energy Developments.

Other co-operative ventures during the year included providing Canadian representation to the OECD Energy and Environment Group; seconding an officer to UNEP; drafting a UNEP discussion report on environmental aspects of nuclear power; and executive interchange with New Zealand with respect to energy development, energy conservation and the use of renewable energy resources.

Through the Advanced Concepts Centre of the directorate, work continued on examination of the implications of a conserver society, as well as identification and introduction of environmentally appropriate technologies, futures studies and environmentally sustainable economic development. The directorate chaired an interdepartmental advisory group to a multidisciplinary university study on the conserver society, and a federal-provincial advisory committee for an experiment-demonstration in Prince Edward Island (The Ark) involving environmentally-sustainable biological production and renewable energy. A program

was continued with CIDA to explore ecologically sound development concepts in both industrialized and developing countries.

The Office of the Science Advisor, with the support of nine science-performing departments, negotiated successfully with the National Research Council and Treasury Board for continuation of the Visiting Fellowships in Government Laboratories Program, on behalf of these departments.

Public Information

Public information activities played a sustained role in support of all services.

A wide variety of information activities were completed by Information Services Directorate, which co-ordinated departmental information, and by the information groups of Fisheries and Marine, Atmospheric Environment, Environmental Management and Environmental Protection services, as well as by information officers in the regions. Press releases, press conferences and briefings, background documents, press kits and individual contacts with journalists were all designed to provide information to the news media quickly and efficiently.

The decision by Canada to declare a 200-mile extension of fisheries jurisdiction on January 1, 1977, probably the most newsworthy event of the year, required extensive and sustained media liaison.

Articles highlighting various facets of the department were written for business, professional, special interest and general interest publications.

Speeches were written for senior officials for delivery to a wide variety of publics, and a print and broadcast monitoring service was provided by ISD and by FMS Information Branch. Displays were erected at several

regional fairs and exhibitions, and tours arranged for students and adult groups.

To provide better communications within the department, Contact, a bilingual, bi-monthly departmental magazine focussing on people, their jobs and their outside interests was launched.

The monthly Fisheries and Marine News, which featured current activities of FMS, also began publication. Zephyr, the AES national staff magazine, continued to appear, as did newsletters produced by several regional establishments.

A variety of publications were offered for the first time. Outstanding among them were: Canadian Forestry: The View Beyond the Trees by Charles R. Stanton, a full-color, richly illustrated book co-published with Macmillan Company of Canada; Canadian Fisheries: The Quest for Prosperity, a popular version of a policy document on commercial fisheries, completed after a thorough enquiry into the industry; The Seal Hunt, a fact-filled historical booklet illustrated with prints by the Canadian artist David Blackwood; and a brochure describing the policy and the step-by-step procedure of the Environmental Assessment and Review Process.

Among EMS films released was the well-received "A Great White

Bird," describing the epic struggle to save the endangered whooping crane. "The Forest Under Siege" showed efforts to save forests from destruction by insects, and "River (Planet Earth)" illustrated man's use and abuse of waters. Film clips completed by EPS included "There's No Place Like Home" and "Don't Soil Our Sewers."

French Information Programs

A French editing unit was established in Montreal to edit and prepare for publication the French-language versions of existing operational, administrative, scientific and technical, and general information material.

The unit was officially established on April 1, 1976, and started editing on May 25, 1976.

External and administrative delays hampered the unit's installation and start of activities. Nevertheless at fiscal year's end the unit had completed French adaptations of 32 titles, and was working on 55 other documents. In all, this comprised the processing of 900,000 words, part of a backlog accumulated over several years.

Public Enquiries

A major role of public information groups is to respond to

enquiries on a wide variety of topics from the general public, researchers, teachers, students and special interest groups.

Within the Information Services Directorate alone some 13,000 telephone enquiries were dealt with and more than 22,000 written enquiries answered. About 2,000,000 copies of departmental publications were distributed on pollution, wildlife and forestry. Specific areas of interest included water pollution, air pollution, fisheries, meteorology, land use, alternative technologies and environmental assessment.

At least 110,000 further enquiries were referred by ISD for response, or were received directly by service information teams; these included 90,000 requests for information received at the Canadian Wildlife Service. Most of these requests came from students in Ontario and Quebec. More than 800,000 printed items were mailed.

Periodic lists and cumulative catalogues of printed and audiovisual materials were distributed to libraries and other resource centres, to assist them in obtaining information available from the department in both official languages.

Federal Environmental Assessment Review Office

The Environmental Assessment and Review Process (EARP) was established in 1973 by cabinet decision to assess the environmental consequences of federal projects and activities before final decisions are made, and to incorporate the results of these assessments in planning, decision-making and implementation.

All federal departments and agencies are subject to this directive except proprietary Crown corporations and regulatory agencies that are invited to participate in the process. Federal projects are considered to be those that are initiated by federal departments and agencies, those for which federal funds are solicited and those involving federal property.

EARP is administered by the Federal Environmental Assessment Review Office (FEARO) which reports to the minister on the functioning of the process.

In accordance with the process, departments and agencies make initial screenings of their own activities to identify their environmental effects. Projects with potentially significant environmental impacts are referred to the executive chairman of FEARO for a formal assessment. Each project submitted is reviewed by a separate independent panel of experts. The panel develops guidelines for prepara-

tion of an environmental impact statement. Preparation of the statement itself is the responsibility of the initiating federal department or agency. After studying the environmental impact statement, obtaining public response to this statement and receiving any additional advice considered necessary, the panel submits a report to the minister. This report includes an examination of the major impacts of the project and recommendations concerning the project's implementation. The project may not proceed before the panel has presented its recommendations.

Important amendments to the Environmental Assessment and Review Process were made by cabinet in February, 1977. Federal departments are asked to provide to FEARO all essential information required to evaluate the process. The executive chairman of FEARO may appoint panel members from anywhere within the federal public service. Panel members from outside the public service may be appointed by the minister. Prior to 1977, panel members were appointed from the Department of Fisheries and the Environment, in addition to one member from the initiating department. Federal departments are asked to involve the public in the initial planning stages of potentially signi-

ficant federal projects. The amendments also established a financial policy on the allocation of environmental assessment costs between the federal government and non-federal government proponents of projects covered by EARP.

Eight of the 15 projects under review in 1976-1977 were referred to FEARO during the fiscal year. The work of the panel assessing the Wreck Cove hydroelectric project in Nova Scotia was near completion with the final drafting of the environmental impact statement under way. Other projects in advanced stages of panel review were the Eldorado Nuclear uranium refinery (Ontario Site), Polar Gas, the extension to Vancouver International Airport and the Roberts Bank bulk loading facility expansion.

Scientific and Technical Information

Progress in science and technology depends on the free flow of scientific and technical information. Consequently, this information is an integral part of any research and development program, and in DFE is the primary means by which research results are translated into useful applications for the well-being of Canadians. The major products of scientific and technical information are publications, on-line data bases and customized information packages. Access to the information by users is aided by publication exchange, abstracting and indexing services, computerized retrieval systems, conferences, workshops and specialized library systems and services.

The amount of scientific and technical information generated by DFE is among the largest of any federal department. To ensure that this valuable knowledge resource is credible and relevant, considerable efforts are made to evaluate and manage the information effectively. This involves peer review, adherence to internationally accepted standards and development of information networks and exchange agreements at the federal, provincial, national and international levels. (Details of scientific and technical information activities appear earlier in this report under the appro-

priate programs.)

Total publication output exceeded 1,000 items in 1976-1977, covering the spectrum from complex scientific articles in international journals and textbooks to technical reports, manuals and interpretive articles describing research applications of direct use to Canadians.

Prizes given by the Wildlife Society of America for the best publications in wildlife and fisheries research were won by The Northern Interior Grizzly Bear and Adaptive Control of Fishing Systems, published by the Canadian Wildlife Service and the Journal of the Fisheries Research Board of Canada (JFRBC) respectively. In addition, JFRBC was rated the best journal of its kind in the world.

Highlights of the Environmental Services' publication program were Bird Hazards to Aircraft, Forestry on Indian Lands of Canada, Wind for Power, a Coastal Zone Atlas indicating shore damage to Lake Ontario, initiation of the Spill Technology Newsletter, and two special publications. One of these was devoted to Project Stratoprobe, which studied climatic effects related to the ozone balance of the stratosphere, and the other, Lake Erie in the Early 70s, described the physics, geology, chemistry and biology of Lake Erie.

A major accomplishment of the Fisheries and Marine program was publication of 15 studies identifying the scientific requirements and priorities for managing fisheries and aquatic resources in Canada. Special issues of JFRBC were devoted to Lake Erie, the aquaculture and pollution sessions of the Pacific Science Congress, and Canadian physical oceanography. Other publications ranged from Sailing Directions and Small Craft Guides covering all three oceans and navigable waterways of Canada, to manuals on Fish Health Protection Regulations, monographs on the biological statistics of fish populations and the status and potential of Newfoundland's fisheries, and an environmental risk index for the siting of deepwater oil ports.

Much of DFE's scientific and technical information is now retrievable through computer terminals similar to those used by airlines. The Water Resources Document Reference Centre (WATDOC) operated by the Inland Waters Directorate builds and manages the Canada Water Data Base as its major continuing commitment. Recently WATDOC accepted responsibility for two new data bases. Selected Water Resources Abstracts was obtained for dissemination in Canada from the United States Department of

the Interior. The Delft Hydraulics document file obtained from the Netherlands is being converted to machine readable form by WATDOC. These and other WATDOC-supported data bases are publicly accessible for on-line searching across Canada. Users include all levels of government and the private sector.

The expertise developed in building and running data bases led to a recent cross-linkage between WATDOC and the FMS Scientific Information and Publications Branch to develop a Canadian Aquatic Sciences and Fisheries Information System. This development came about because FMS is the Canadian input centre for the international Aquatic Sciences and Fisheries Information System sponsored by UN agencies. A trial data base, Aquatic Sciences and Fisheries Abstracts, is being evaluated for the UN on the WATDOC system and the complete data base will soon be available for access nationally.

During the year, 7,000 microfiche were added to the specialized air pollution Technical Information System. There are now more than 100,000 entries in this computerized system, used to respond to more than 3,000 enquiries from Canadian scientists, engineers and other professionals in government and industry during

the year.

The National Emergency Equipment Locator System (NEELS) is an on-line service operated by the Environmental Emergency Branch of EPS. NEELS' prime purpose is to assist in locating spill clean-up and containment equipment in the event of an environmental emergency. It is now available to the National Police Service Information Centre, permitting access by all affiliated police authorities in Canada.

Almost all data bases relating to environmental matters are also accessible through the departmental Library Services Branch which provides scientific and technical information services for DFE staff. The library maintains a depository collection of departmental publications which is strengthened by exchange and shared-service agreements with many university and provincial libraries. A bi-national agreement to exchange documents with the United States Environmental Protection Agency makes the library the national distributor for this information. A recent highlight was the initiation of the Environmental Libraries Automated System, a sophisticated access system designed to reduce many of the manual tasks of library cataloguing currently performed by more than 50 libraries in the DFE network.

By participation in other networks and national and international referral services, the departmental library maintains inventories of expertise in scientific and technical areas. As the department's focal point in the UN Environment Program's International Referral System, the library responds to information requests originating from other countries.

Much of the effort made to aid transfer of information would be wasted if the information was not received by its target audience in a form that could be readily understood and used. Communication and understanding of scientific information presents little problem among scientists. However, transfer of information and technology to non-scientist users requires the interpretation of useful research and adequate training and education of potential users. Most of the technology transfer resulting from DFE research programs take place between a number of federal-provincial-industry regional working groups.

Technical information has brought many benefits to Canadians in recent years: improved storage life and quality of fish products; development of new fisheries and rehabilitation of old ones; new technologies for wastewater treatment systems and

air pollution control; siting of oil rigs based on wave-climate studies; development of energy policies based on long-range climatic research; and development of improved and cost-effective logging and mill operations with minimal environmental degradation.

A national network of scientific and technical information services is being developed by the National Research Council in concert with existing scientific information centres such as those in DFE. Through its involvement in the development of such networks, DFE will continue to improve its scientific information services and the transfer of technology to users.

Related Responsibilities of the Minister

The minister of the environment also has the responsibility of tabling the following reports in the House of Commons:

Canada Water Act, Operations
Canadian Saltfish Corporation,
Annual Report
Canadian Saltfish Corporation,
Budget
Clean Air Act, Operations
Fisheries Development Act,
Operations
Fisheries Prices Support
Board, Annual Report
Freshwater Fish Marketing
Corporation, Annual Report
Freshwater Fish Marketing
Corporation, Budget
International River
Improvement, Operations
Ocean Dumping Control,
Annual Report