Fisheries and Oceans
Pêches et Océans

Annual Report

1981-82

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DEPARTMENT OF FISHERIES AND OCEANS

ANNUAL REPORT

1981-82

Published by:

Communications Directorate
Department of Fisheries and Oceans
Ottawa, Ontario, Canada
K1A 0E6

DFO/972

© Minister of Supply and Services Canada 1983
Cat. No. Fs 1-1982
ISBN 0-662-52539-6

Minister of
Fisheries and Oceans

Ministre des
Pêches et des Océans

Ottawa, Canada
K1A 0E6

To His Excellency the Right Honourable
Edward Schreyer, C.C., C.M.M., C.D.,
Governor General of Canada

May it please Your Excellency

I have the honour herewith, for the information of Your Excellency and the Parliament of Canada, to present the the Annual Report of the Department of Fisheries and Oceans for the fiscal year ended March 31, 1982.

Respectfully submitted

Pierre De Bané

Canada

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Canada

Government of Canada
Fisheries and Oceans

Deputy Minister

Gouvernement du Canada
Pêches et Océans

Sous-ministre

The Honourable Pierre De Bané
Minister of Fisheries and Oceans
Ottawa, Canada

Dear Mr. Minister:

I have the honour to submit the Annual Report of the Department of Fisheries and Oceans for the fiscal year ended March 31, 1982.

Respectfully submitted,

Dr. A.W. May

Ottawa, Canada
K1A 0E6

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Under the Department of Fisheries and Oceans Act, the duties, powers and functions of the Minister of Fisheries and Oceans include (i) sea coast and inland fisheries; (ii) fishing and recreational harbours; (iii) hydrography and marine sciences and (iv) the coordination of the policies and programs of the Government of Canada respecting oceans.

The department is composed of four main organizational components: Atlantic Fisheries, Pacific and Freshwater Fisheries, Fisheries Economic Development and Marketing, and Ocean Science and Surveys. A separate group deals with the department's responsibility with regard to small craft harbours.

The objectives of Fisheries and Oceans are to ensure:

- the comprehensive husbandry and management of Canada's fisheries resource base, through the protection, rehabilitation and enhancement of individual fish stocks and the aquatic habitat upon which these resources depend;

- the "best use" of fisheries resources, through a variety of measures affecting when, where, how and by whom these resources are harvested, processed and marketed to obtain optimal social-economic benefits;

- an adequate hydrographic survey and chart production program to enable hydrographic charts and other publications to be produced for safe navigation in Canadian waters;

- the acquisition of the necessary knowledge base pertaining to oceanic processes and environments to support activities related to defence, marine transportation, the exploitation of offshore energy resources, and the management of the fishery resource and its aquatic habitat;

- the provision of a national ocean information service;

- the provision and administration of a national system of harbours in support of commercial fishing vessels and recreational boating.

Operations of the department, which is highly decentralized, are carried out from Ottawa and regional offices and research establishments throughout Canada. A summary of the activities in fiscal year 1981-82 follows.

The Fishing Industry

Commercial fish landings in Canada in 1981 amounted to approximately 1,380,000 tonnes, representing a landed value of $826 million. Compared with the previous year, landings increased by 3 per cent, while value was up almost 12 per cent.

The total market value of Canadian fisheries production was approximately $1.9 billion, up almost 15 per cent from the 1980 level. Of that total, Atlantic coast production amounted to $1.3 billion and that of the Pacific coast, $519 million, the latter total representing an improvement of more than 28 per cent over 1980.

The value of Canadian exports of fishery products exceeded $1.5 billion, a 19 per cent increase compared with 1980, maintaining Canada's position as the world's No. 1 fish exporting nation. The United States remained the most important market for Canadian fishery products, followed by the European Economic Community (EEC) and Japan.

Although the harvesting situation remained relatively stable, processors were hit hard by a cost-price squeeze, particularly on the east coast. Lower prices for some species, overall weaker consumer demand, increased competition on foreign markets, the effect of high interest rates and higher harvesting and processing costs, resulted in significant operating costs, trawler tie-ups and a number of plant closures.

As a result of the economic problems experienced by many processors, in late December, 1981, the department provided $15 million for a short-term temporary assistance program to help sustain the industry and stabilize fishermen's earnings.

While continuing measures to ensure the conservation of fish stocks and the stability of the industry, the federal government awaited the results of a comprehensive review of fisheries policy on the Pacific coast (the Pearse Commission), and early in 1982 set up a task force under Dr. Michael Kirby to study aspects of the Atlantic fisheries.

Atlantic Fisheries

Major initiatives under Atlantic fishery development programs during the year included fish quality improvement, energy efficiency, resource enhancement, cost-reducing technology and technology development and transfer.

The quality program concentrated on evaluations and demonstrations of boxing fish at sea and on fish holding studies, especially the effects of bleeding and gutting. The program also included development and demonstration projects on mechanical methods for bleeding, as well as a simple low cost gutting machine for inshore operation.

Under the energy program, demonstration of energy-efficient catching methods such as longlining, Scottish seining, and pair fishing as alternatives to more energy-intensive dragging methods were continued. Vessel modifications, such as nozzle installations, were carried out in order to reduce fuel consumption during dragging operations. A Nova Scotian firm designed and constructed a fuel monitoring system for the Fisheries Development Branch, and the fuel consumption characteristics of several vessels were recorded.

The resource enhancement program included an ocean quahaug and surf clam project which concentrated on locating and estimating stock sizes, and demonstrating their commercial availability using hydraulic dredges. Several projects were undertaken to demonstrate the feasibility of producing stockfish under Atlantic Canada climatic conditions, thereby opening possible new markets for groundfish.

In the area of technology development and transfer, a contract was let to manufacture a commercial prototype of the scallop shucking machine developed by DFO engineers. The concept of labor saving self-hauling rope reels for Scotting seining was further developed and design and contruction undertaken. Canadian manufacture of automated longline systems was encouraged through demonstrations of random baiters.

The Newfoundland Bait Service underwent some changes in structure, with eight bait holding units replaced and upgrading work carried out at two bait depots. Increased demands for bait were experienced due to large numbers of fishermen returning to bait trawls.

The Inshore Fish Handling Program continued its objectives to provide infrastructure improvements in the form of net bag unloading, onshore hoists, truck loading units, insulated containers and ancillary equipment throughout 1981/82. At the year-end, a total of 192, out of 200 qualifying communities, had an operational fish handling system.

Joint development programs between DFO and DREE included the P.E.I. Comprehensive Development Plan. This 3-year joint development initiative is concerned with economic self-determination of the inshore fishing communities of P.E.I. Emphasis was placed on development opportunities uniquely adaptable to conditions on the Island in such fields as cost-reducing technology in harvesting, aquaculture, resource management, and fish quality improvement.

Other joint programs by DREE and DFO included the 5-year S.E. New Brunswick Fisheries Development Program and Coastal Labrador-Canada Fisheries Development Program. The main elements of the S.E. New Brunswick Program involved upgrading canneries and processing plants; assisting improvements to infrastructure in harvesting, handling, and distribution facilities; assisting commercial aquaculture operations to utilize and improve the latest technologies in rearing and harvesting of shellfish, salmonids and other species; and providing training, education and consultation with fishermen and processors to facilitate the change to new technologies.

DFO/DREE Coastal Labrador Program concentrated in the area of fish landing, handling and processing improvements. A major fisheries utilization study in recognition of the unique transportation characteristics affecting the fishery on the Labrador Coast was conducted. Total expenditures on the 1981/82 Atlantic development program amounted to more than $8.8 million.

Initiatives under the broad title of "foreign arrangements", which included the over-the-side sales and the Newfoundland inshore fish plant delivery programs, resulted in significant benefits to the fishing industry.

Herring over-the-side arrangements in the Bay of Fundy involved sales of about 12,000 metric tons to foreign partners, resulting in payments to fishermen of approximately $3.2 million. This herring was marketed in Eastern bloc countries and therefore did not compete with products from Canadian processors.

As in previous years, foreign arrangement programs continued for mackerel and gaspereau in the Maritimes involving agreements with two fishermen's organizations. In addition, cod was purchased by foreign vessels under charter to the Canadian Saltfish

Corporation or the Newfoundland Fishermen's Food and Allied Workers Union. The Torngat Co-op program, implemented in 1981, allowed native fishermen to spend part of the season in the Hebron-Saglek area in northern Labrador to relieve over-fishing on the traditional char fishing grounds in the Nain area.

Under the Newfoundland Inshore Fish Plant Delivery program, northern cod allocations were made directly to industry trade associations in the Atlantic provinces, in addition to Canadian fishing vessels to permit chartered foreign vessels to supply cod to inshore seasonal processing plants.

Total landings involved in the foreign arrangements program were approximately 17,620 metric tons, for a landed value of $5,368,000, representing 0.6 per cent of the total value of fish landings for 1981.

In the area of resource allocation, the year saw the introduction of sector management for vessels less than 19.8 metres (65 ft.). Three sectors were established corresponding to DFO's Atlantic management regions - Gulf, Newfoundland, and Scotia-Fundy. This approach permits better control of access among fleet sectors, and allows fishing capacity to be better matched to available resources within the boundaries of these areas.

Beginning with the 1982 Groundfish Management Plan, the concept of enterprise allocations was introduced in the offshore sector on a trial basis in an attempt to overcome the damaging effects of unbridled competition in harvesting the offshore quotas. Similarly, the allocation concepts of vessel quotas were experimented with in the Bay of Fundy herring purse seine and the Northern shrimp fisheries.

The commercial salmon fishery in New Brunswick was re-opened during the year after a 9-year closure, during which time approximately 490 eligible fishermen were compensated. Fishermen were given a choice of resuming fishing activities or retiring their licences for an amount not less than $2,000.

Some 12,000 fishing vessels and 21,000 fishermen were registered in the Gulf and Scotia-Fundy regions during the year, representing an overall decline of 5 per cent in the number of fishermen. In Newfoundland the number of licensed fishermen decreased by 20 per cent to 28,495, while the number of vessels registered (16,711) represented a decline of 15 per cent.

The Observer program continued as a valuable aid in controlling the foreign and domestic offshore fisheries, as well as providing a wealth of biological data. Observers spent more than 12,000 sea days aboard vessels monitoring fishing operations on the Atlantic coast.

Fixed wing aircraft and helicopters were again used to monitor the East Cost seal hunt, which was deemed successful despite poor weather conditions. Eight Canadian and three Norwegian vessels participated, with Canadians taking the full quota of 55,000 harp seals.

Pacific and Freshwater Fisheries

Pacific Region

Overall, the Pacific salmon fisheries in 1981 enjoyed an above-average year, with sockeye returns being much stronger than predicted due to a northern diversion of fish through Johnstone Strait, and with returns to the Skeena, Rivers and Smith Inlets and Barkley Sound areas also being stronger than expected. Pink salmon were also abundant, however chum, chinook and coho catches were below average.

After consultation with industry, an area licensing system for roe herring harvesting was implemented during the year, aimed at alleviating congestion on the fishing grounds and to allow the fishery to proceed in a safe, controllable manner in the face of relatively limited stock sizes. From the management point of view, the system worked well, with harvests being made safely in areas where otherwise no fishery could have been possible.

Another significant achievement during the year was the introduction of a computerized licence system which has resulted in a more efficient and accurate licensing operation. Terminals are located in Vancouver and Prince Rupert as a convenience to fishermen renewing their vessel licences. Sport fish licences were introduced for the first time, with sales amounting to $1,730,540, for a total of 282,247 licences.

The region experimented with a new approach to enforcement on the Fraser River through the use of helicopters. Although costs were significant, the surveillance activities greatly reduced poaching of salmon in the river during the day and resulted in the confiscation of a significant quantity of gear used by the poachers.

In the area of fisheries development, numerous projects were undertaken with a view to reducing energy consumption, increasing catch per unit of effort, improving selectivity of fishing gear and to improve safety at sea.

Included in the development projects were experiments with underwater video recording equipment to accurately observe fishing gear in action; an investigation into the possibility of establishing a commercial fishery for lamprey eels in Babine Lake; a study into the effectiveness and economic viability of a longline fishery for albacore tuna; assistance in developing a salmon fishery in the Taku River, a northern area of low economic opportunity; continuation of the project to develop impoundment techniques for capturing, transferring, holding and harvesting roe herring; and development and demonstration of mussel culture techniques.

The Economics Branch completed the first phase of a major program to redevelop the commercial catch statistics system, established a cooperative program to collect, analyze and publish B.C. production statistics in cooperation with the provincial authorities, and played a leading role in planning a fishing vessel buy-back program. Support was also provided in the area of economic and social planning with regard to the Department of Indian and Northern Affairs' fishing fleet acquisition project at Prince Rupert.

The Salmonid Enhancement Program (SEP), initiated in 1977 as a long-term program with the objective of doubling salmonid catches in the Pacific Region, entered its fifth year of operation characterized by record egg takes and increasingly large returns of salmon.

In their first year of operation, Chilliwack and Nitinat hatcheries both met expected egg-take targets and set a Canadian egg-take record of 28 million, exceeding the expected 10 million. Eggs taken for Pallant Creek hatchery were almost four times the expected number and the hatchery is now operating at full capacity following an excellent return of chum salmon.

Fulton River and Pinkut Creek facilities contributed over fifty percent of the total sockeye harvest for the Skeena River and the total sockeye catch of 1.38 million was the largest on record. An all-time record of 65,000 fish returning to the Big Qualicum hatchery has been the result of coho enhancement on this river.

Construction contracts for Kitimat, Chehalis, Tenderfoot and Inch facilities were let during the year and work is continuing on schedule.

Volunteer enhancement projects on a small scale continued to increase and business concerns such as B.C. Forest Products, MacMillan-Bloedel and the Vancouver Sun newspaper, have also become involved in enhancement projects, with the technical assistance of the department. Community groups, contracted by SEP to carry out a variety of enhancement projects, employed 135 people on a full-time or part-time basis in 14 projects.

With the end of Phase I in sight, planning for SEP Phase II began with a list of enhancement opportunities compiled late in the year. The planning process encompasses a two-year period with recommendations on the future program to go forward to Cabinet early in 1983.

Western Region

Fisheries development projects included exploratory fishing for Pacific herring in the Beaufort Sea area and the experimental processing of the roe obtained. Samples were processed and forwarded to potential buyers for evaluation.

Staff supervised a saputit (fish weir) char fishery operated by Inuit fishermen at Victoria Island, NWT. Mechanical winter fishing units were modified and operated in the NWT and at a northern Manitoba lake.

An animal feed supplement from fish wastes was produced at Lac La Biche, Alberta, and feeding trials under the supervision of the provincial Department of Agriculture were performed using this supplement in lieu of soybean meal.

Staff was involved in supervising the production, processing, canning and pasteurization of 2722 kg of whitefish roe in collaboration with industry, as well as providing support in the market development of the product. Further development of processing was carried out to enhance the marketability of minced parasitized whitefish and tulibee. Assistance to industry in the processing and market development of barbot was also provided.

Surveillance and data gathering continued throughout the NWT, with increased effort devoted to public relations and community relations concerning regulations, survey activities and general management principles and plans. The level of service provided in

the Arctic improved with the posting of a second fishery officer at Rankin Inlet and the staffing of two native trainee positions.

The regulation and monitoring of the fisheries of the Territories continued, with emphasis on the commercial fisheries for lake whitefish in Great Slake Lake and for arctic char in the Cambridge Bay region, as well as the sport fisheries of Great Bear Lake and the east arm of Great Slave Lake. In addition, an investigation was started into the population, size and timing of the migration of beluga whales along the west coast of Hudson Bay.

Ontario Region

Various initiatives were undertaken during the year to promote the development of the full potential of the fishery resource in the region and provide for its long-term conservation.

A key initiative was the negotiation and ratification of the Strategic Great Lakes Fishery Management Plan between Canadian and U.S. fishery management agencies. The plan established an integrated management framework within which agencies can cooperate to restore and enhance the Lakes' valuable fishery resource.

As its part of the development plan, the region initiated a number of projects to identify new opportunities within the fishery. These included exploratory smelt trawling in Lake Huron, sturgeon fishing in James Bay estuaries, demonstration trapnet fishing in Lake Ontario and monofilament trapnet trials in Lake Superior.

With the dramatic increase in pink salmon in the Great Lakes, an exploratory survey was conducted in Lake Superior to assess the feasibility of a commercial fishery. Further work is planned to assess the size of the stock and to evaluate alternative harvesting techniques.

The Sea Lamprey Control Centre at Sault Ste. Marie continued its successful program to suppress the parasitic lamprey populations. Chemicals selectively toxic to lampreys were applied to 27 streams and lake embayments on the Canadian side of Lakes Huron and Superior, and in Lake Ontario. Surveys were carried out to detect larval populations in other streams, while spawning and parasitic phase adults were collected to assess population levels and effectiveness of controls. Construction of additional barrier dams was delayed pending completion of a federal-provincial agreement on lamprey barriers.

Fish Inspection

The National fish inspection program is aimed at ensuring that imported products, and Canadian fish and fish products destined for domestic and export markets, do not present a health hazard to the consumer and comply with Canadian and importing country grade, identity, composition, and labelling requirements. To this end, fish and fish products were inspected onboard vessels, at unloading sites, on transport vehicles, and during processing and storage. Fish handling, holding, transportation and processing facilities were inspected to ensure compliance with construction, equipment and operating requirements and good manufacturing practices.

Enforcement action was taken to prevent the marketing of tainted, decomposed, or fraudulently labelled fish and fish products and to ensure that all fish and fish products entering inter-provincial or export trade were processed in registered fish processing plants. During the year some 47 charges were laid under the Fish Inspection Act, resulting in 40 convictions. Twenty-seven plant certificates of registration were revoked for construction, equipment, and operating deficiencies.

As a result of an evaluation of Inspection procedures, a national workplan is being developed which will include a national management information system. The work plan includes a plant rating and classification system which is currently undergoing field trials.

Industry demand for certification of domestically produced products destined for export increased again due to the requirements of importing countries and buyers. Inspection of imported fish products also increased. During the year imported products totalling 54,500 tonnes were inspected; 284 lots totalling 758 tonnes were refused entry into Canada.

In line with the overall departmental objective of improving the stability and viability of the Canadian fishing industry, Inspection began implementing the various elements of the Quality Improvement Program. Vessel certification inspections of fishing vessels greater than 13.7 metres began in September, 1981. Joint industry government technical committees finalized proposed product grade standards for canned snow crab meat, herring, and groundfish and these were distributed to industry for testing, evaluation, and comment in preparation for the development of a final standard for application in 1983-84.

A major point-of-sale grading pilot project was undertaken in the Bonavista Peninsula in Newfoundland, with the co-operation of all segments of industry. It demonstrated that improved onboard handling practices such as bleeding, gutting, washing and icing, coupled with landed quality grades and price differentials based on quality will result in increased volumes of higher quality fish being landed at the dock.

The Inspection and Technology Branch provided staff expertise for four workshops on quality control programming, sponsored by the province of New Brunswick. Inspection and technology divisions on both coasts participated in a program to develop the Brazilian fish inspection system (DIPES), as part of a three-year agreement between Canada and Brazil.

Fisheries technology laboratories continued to provide research support for departmental initiatives related to quality improvement and underutilized species. These included quality studies on Newfoundland trap cod in relation to improved handling practices; storage condition of roundnose grenadier as affected by handling procedures; histamine formation in mackerel and sugar-salt cured herring; investigations of handling and storage conditions on post-mortem formation of ammonia in Pacific dogfish; application of salt-fortified chilled sea water for use in salmon transport; compositional and roe quality studies on roe herring held in impoundments; application of modified atmosphere (carbon dioxide) to storage of salmon in bulk containers; innovative approaches to reduction of faecal coliforms in Pacific oysters; and identification of the cause of mushy texture in Pacific hake following thermal processing. In addition, research was conducted on analytical methodology in support of regulatory functions and contract direction provided under the federal Processing, Distribution and Retailing program.

Fisheries Research

Scientific data from departmental fisheries research programs are used in the establishment of catch quotas, development of regulations, negotiation of intergovernmental agreements, design of enforcement programs and other areas of decision making within fisheries management. In addition, information and advice on the resource base are provided directly to the fishing industry and related enterprises. The biological monitoring of fishery species, population survey cruises, associated data analyses and population modelling of fishery resources constitute more than 50 per cent of the research effort in the three Atlantic regions. Advice is also provided to competing users of aquatic habitats on the potential effects of their activities on the aquatic environment.

The Resource Services Directorate in Ottawa functions as a forward-looking conceptual centre with a national perspective. It encourages innovation and emphasizes cost-effectiveness in evaluating ongoing and future fisheries research programs. The Directorate provided committee chairmen for the Canadian Atlantic Fishery Service Advisory Council (CAFSAC), and International Commission for the Conservation of Atlantic Tunas (ICCAT), and commissioners to the International Whaling and the Inter-American Tropical Tuna Commissions; organized a departmental workshop on trawl surveys; expanded a computer program for resource assessment; coordinated technology transfer to the private sector; coordinated and drafted a vessel acquisition strategy plan; conducted analyses supporting introduction of enterprise allocations for Atlantic off-shore groundfish industry, and was involved in planning the department's role in aquaculture development.

In the Newfoundland Region, approximately 80 per cent of the research budget was committed to resource assessment activities, including biological monitoring of fishery species, population surveys and modelling. Resulting stock assessments constituted the basis for scientific advice in managing the fisheries from coastal Newfoundland and the Grand Banks in the south, to the Labrador Sea and Davis Strait in the north.

An analysis of juvenile redfish recovered from stomachs of cod collected on the Flemish Cap over four years demonstrated the potential for determining, from predator stomach contents, the juvenile distribution and relative year-class success of major prey. For the first time, significant numbers of juvenile flatfish were captured with the small mesh shrimp trawl, providing for the standardization of gear and commencement of a time series for recruitment estimation. The 1981 herring sampling data indicated a change in the spawning type composition of herring stocks along the southeast coast of Newfoundland, possibly resulting from the reduction in stock size of spring spawners. Aerial surveys showed some potential in the estimating of capelin distribution in inshore waters. Research at the Comfort Cove experimental area provided the first documentation of annual fluctuations in standing stock, recruitment and growth in an American lobster population. An analysis of optimum substrate volume in monofilament and polyethylene collectors for use in scallop culture was completed. Various refinements were realized in the development of a harp seal population model and a systematic aerial survey of whales was carried out in the Newfoundland-Labrador area for the second consecutive season.

A major inventory and review of the sensitivity of headwater lakes in Newfoundland to acid rain was initiated. Several options were developed for reducing by 20-60 per cent, the interception of non-Newfoundland-Labrador origin salmon in the Newfoundland commercial fisheries. Winter temperature and egg deposition were used successfully to predict Atlantic salmon smolt year-class strength. An improved helicopter transport system for salmon fry was tested and proved to be extremely successful. Planning was completed for an enhancement program to more than double production of Atlantic salmon in Newfoundland. Sea trials of the hydroacoustic data acquisition system (HYDAS) to permit computer analysis of fish echoes proved highly successful.

The two-ship survey on the Flemish Cap in 1981 represented a significant step towards testing specific study designs of standard ichthyoplankton surveys. Histopathological changes were discovered in the liver and gills of fish exposed to very low (i.e., 50 ppb) levels of Hibernia crude oil; it was also found that various lipids are changed by chronic oil exposure. The increased usefulness of MFO (mixed function oxidase) as a biological monitor was established. Newfoundland researchers collaborated in various national and international research advances in microbial chemistry and fish disease.

In the Scotia-Fundy Region, the principal research thrust was directed toward stock assessment, habitat protection and resource enhancement, including aquaculture. Biological advice on various marine freshwater and diadromous species was provided to fisheries managers, management agencies, and various international fisheries organizations.

Salmonid investigations in New Brunwick were conducted on the Miramichi, Restigouche, and Saint John Rivers. Four major enhancement projects in Nova Scotia were carried out on the Liscomb, La Have, East (Sheet Harbour) and Medway River. Cooperative projects with other agencies on trout studies were maintained and expanded. Catch and effort data collection for Atlantic salmon and gaspereau was expanded, and electronic storage and analysis of this data were improved.

Updated advice on the management of the crustacean, molluscan, and marine plant resources was provided. This included a recommendation for an increased minimum legal size for lobster in certain districts. A survey of lobster fecundity and

parasitism around the Maritimes was continued and the offshore lobster fishery was monitored. Production, distribution, and marketing data on Maritime lobsters were compiled in a discussion paper on the management of the fishery. Snow crab stock assessments, sampling technique development, and stock discrimination studies were continued and base line surveys for deep-sea red crab and Jonah crab along the Scotian Shelf between Browns Bank and Banquereau Bank were completed. Marine plants research included Irish Moss and kelp biomass estimates, harvesting strategy studies and assessment of the importance of macrophytes to commercial animal species. A massive sea-urchin die-off was surveyed, and control methods for the species were investigated. Scallop population studies were conducted on Georges Bank, the Scotian Shelf, in the Bay of Fundy and in Northumberland Strait. Biological data on squid (Illex illecebrosus) were collected through domestic research cruises and joint cruises with France and the U.S.S.R. New approaches to data analysis were developed which promise an improved understanding of squid population dynamics. Exploratory surveys of underexploited molluscan species identified concentrations of the ocean quahog and the hard shell clam. An assessment of the important oyster population of Caraquet Bay, New Brunswick, was completed and federal-provincial cooperation on the Caraquet Bay Oyster Development Project was continued. Blue mussel and oyster spat settlements were monitored and studied to provide scientific advice to the aquaculture industry.

A large body of biological and statistical data collected by DFO research vessels, by the International Observers Program, and by observers deployed aboard domestic vessels was used to prepare stock assessments of groundfish and pelagic species. A juvenile silver hake survey on the Scotian Shelf involving the LADY HAMMOND and the U.S.S.R. vessel EKLIPTIKA was completed. The Scotian Shelf Ichthyoplankton Program (SSIP) provided data on the early life history stages of the major commercial species. Grey seal population structure and trends, and migration patterns were studied as a basis for management advice. Applied fisheries ecology research included a study of the origin of the Fundy Basin shad stock, positive identification of Pacific coho salmon in the Bay of Fundy, herring behaviour and the effects of Miramichi dredging on fish populations and fishing success. Studies on lobster biology focussed on larval survival, egg predation, nutrition, long-term growth and reproduction. Research was also conducted on salmon aquaculture, and the effects of low pH on survival and recruitment of Atlantic salmon.

In the Gulf Region, the year was marked by reorganization and establishment of new programs to meet the needs of the region while at the same time continuing ongoing research programs. Management advice was provided on the basis of impact studies, population assessments; longer-term studies yielded improvements in stock assessment methodology, and increased understanding of certain marine communities. Emphasis was on improved herring abundance estimates and recovery prediction, discrimination of capelin stocks, and possible impact of cod abundance on snow crab production. Studies of 200 lakes and 30 salmon rivers were conducted as part of a 3-year program of measurement of the chemical and biological impact of acid rain. The effects of acidification on vital processes, such as egg and fry development of speckled trout, were also studied. The environmental impact of marsh reclamation structures (aboiteau) on the flats of the St. Lawrence, and dredging in the Grande Entrée lagoon of the Magdalen Islands were also investigated. Local benthic communities on the lower north shore of the Magdalen Islands were studied in anticipation of ecological changes resulting from hydroelectric developments in the local rivers. Gross assessment of lobster production in the lagoons of the Magdalen Islands was completed and studies of larval drifting and depth preference were initiated. Analysis of data from observations on cetacean strandings, particularly in the northwest Atlantic and around New Zealand, were completed. The conclusion that mass mortalities serve as a population-regulation mechanism was prepared for presentation in a scientific report of the Whales Research Institute, Tokyo. A detailed history of whaling on Canada's east coast was completed. A study of the depletion of beluga whale populations in Hudson's Bay and Ungava Bay suggested that these populations are threatened with continued whaling operations. A detailed study of northwest Atlantic commercial whaling catch/effort data was completed and a final paper was prepared for publication. A number of papers, and working documents relevant to Canadian and international whaling concerns were prepared for IWC meetings and other seminars and workshops.

In Ontario Region, several projects were carried out to identify new opportunities within the fishery, including assessment of alternative harvesting techniques with the successful establishment and dramatic increase of pink salmon - an accidental introduction to the Great Lakes. An exploratory fishing survey was made in Lake Superior to assess the feasibility of a commercial fishery. Further investigations of the biology of the pink salmon, magnitude of the stocks and effectiveness of

alternative harvesting techniques were initiated. The primary focus of the Great Lakes Fisheries Research Branch was the understanding and correction of problems of habitat deterioration and chemical contamination. Research was directed at assessing the distribution of chemical pollutants in fish and identifying the sources of contamination. Confirmation of the presence of the highly toxic dioxin in fish from Lake Ontario further emphasized the need for improved control of chemical dump sites in the Niagara River area. Surveillance studies were conducted to measure the health of lakes and laboratory toxicology studies contributed an overall understanding of the effects of chemical substances on fish health and reproductive success. Extensive studies were made on the impact of acid rain on fish populations in Ontario, the data contributing significantly to Canada-U.S. negotiations on air quality.

In the Western Region, studies toward understanding the ecological importance of the contamination of natural freshwater systems by acid precipitation, heavy metals and radionuclides were conducted on certain experimental lakes. As a result, the early stages of the lake acidification process, in both stratified and unstratified systems, were documented in detail and concomitant key organisms and processes were identified. At Southern Indian Lake in northern Manitoba the effects on the fishery of the impoundment of Southern Indian Lake and the diversion of the Churchill River for hydroelectric development were studied. Limnocorral experiments were continued toward determining key sources, processes and organisms in the post-impoundment mercury contamination of the lake system. Pollutant research continued on synthetic pyrethroid insecticides, on a dioxin compound associated with the widely-used herbicide 2,4-D, a forestry pesticide fenetrothion, and a series of aromatic hydrocarbons, nuclear reactor coolant and oil-dispersant mixtures. A major review of organic and inorganic pollutants in Arctic marine mammals was prepared for the International Council for the Exploration of the Sea. Long-term investigations on arctic charr ecology and productivity, lake whitefish population genetics, nutrition of hatchery-reared fish, water chemistry and pothole lake culture entered their final phase. The fish pathology unit continued research and diagnostic investigation of diseases of trout, lake whitefish and walleye. Fisheries resource inventories and habitat assessments continued along the southern coast of the Beaufort Sea in anticipation of increased industrial activity in the area. The second year of a monitoring program in the vicinity of

Nanisivik Mine (Baffin Island) was completed. The region continued its involvement with inter-departmental and senior policy coordination on northern resource development projects and environmental regulations in the north.

Highlights of Pacific Region Fisheries Research Branch activities included significant advances in non-linear estimations which have led to a revised growth model for fish. The separation of chum salmon stocks in a mixed gauntlet fishery was developed using a combination of morphometric and electrophoretic discriminators. A different technique was used to identify sockeye salmon stocks within the Barkley Sound fishery. This involved the examination of test fishery samples for internal parasite tags. The method was refined to provide real-time stock analysis as a basis for fisheries management decisions.

Studies continued on the size and time release of juvenile hatchery-reared chinook and coho salmon. Current results indicate that with control of these two factors the rate of return to the fishery and hatchery can be increased three to ten times. A further refinement has the added advantage of limiting the number or percentage of precocious males or "jacks", which are virtually worthless to the fishery and genetically damaging to the brood stock. A survey of fleet dynamics of the west coast troll fishery was initiated. A combination of data collected from observers placed on board was complemented by time lapse photography of radar images. Data on fleet movements and fishing success are now being analyzed in relation to oceanographic conditions, especially thermal fronts as determined by satellite imagery analysis.

The first year of a three-year project to study the feasibility of impounding herring for the roe fishery was highly successful. Herring captured and transported to floating sea pens some months before the onset of natural spawning were held with great success; mortalities were low and spawning was inhibited. Mature herring with a high roe-to-body weight ratio were maintained in peak condition for a six week period. The results from this year's work already point the way towards an alternative harvesting strategy for this most valuable fishery.

Fish Habitat Management

As part of a Canada-wide effort to revitalize the department's fish habitat management program, work began on preparation of a national statement of habitat policy. In addition, a review of policies and programs in Pacific Region was completed, and the resulting

report emphasized the need for clear policies and a more decentralized regional habitat program.

The department concluded its second year of studies and public awareness as part of the four-year federal acid rain program. This program, designed to produce evidence to bring about the early control of atmospheric emissions which cause acid precipitation, involves a significant commitment of staff and resources by DFO.

On the East Coast, histopathological changes in the liver and gills of fish exposed to low concentrations of Hibernia crude oil was discovered. Upstream passage for salmon and other fish was improved at the causeways across the Petitcodiac River in New Brunswick and Pictou Harbour in Nova Scotia. The department also devoted considerable attention to the concerns of fishermen during the first year of a two-year dredging project to improve shipping in the Miramichi River, New Brunswick. Polycyclic aromated hydrocarbons (PAH) found in lobsters resulted in the closure to fishing of part of Sydney Harbour in Nova Scotia. PAH is a contaminant known to be carcinogenic.

In the Great Lakes, the department confirmed the presence in fish of the highly toxic chemical known as dioxin, stimulating increased attention on the need for improved industrial control. In an effort to rehabilitate lake trout fisheries in the upper lakes, a program to control the parasitic sea lamprey continued, in conjunction with the United States.

A scientific review panel headed by Dr. John McInerney of the University of Victoria provided a technical assessment of the effects of mine tailings discharge into Alice Arm, British Columbia. This important report concluded that the discharge would have little adverse impact on the marine environment in Alice Arm and recommended that an abatement program be initiated at the mine to control certain heavy metals, and that environmental monitoring be continued.

In Canada's northern territories, a significant fisheries resources and habitat study of the Yukon River commenced as part of a water management investigation. Work also began on the preparation of a fisheries position paper for the environmental assessment and review (EARP) of Beaufort Sea hydrocarbon developments.

Economic Development Directorate

The Economic Development Directorate is the departmental focus for economic policy and economic programs. Within the Economic Policy Branch, the Economic Research Group, in cooperation with economists of the Atlantic Fisheries Service, organized the building of a simulation model of the Atlantic offshore trawler fleet. This model was of considerable assistance to departmental management in assessing the likely impacts of introducing a company quota system in 1982 for the four large companies. The model has also been used in estimating fleet replacement requirements over the next five years and in simulating the effects of technological and fisheries policy changes.

The preliminary report of the socio-economic implications of offshore oil and gas development on Atlantic fisheries was further developed and published. The implications of this report were of considerable value in interdepartmental discussions relating to the future development of Hibernia and other Atlantic oil fields.

Work continued on background studies related to the Georges Bank boundary dispute. A report was also completed on the methodology for evaluating the social and economic costs of the impacts of acid rain on Canada's fisheries resources. Further studies on the actual cost impacts are in progress, in cooperation with relevant federal/provincial agencies.

The Sixth Canadian Sport Fisheries Conference in Calgary, convened by DFO in cooperation with the Alberta Department of Energy and Natural Resources, was attended by representatives of provincial and territorial governments, organized anglers' groups, sport fisheries tourism interests and representatives from France, the United States and the Food and Agricultural Organization. Preliminary results of the 1980 Survey of Sport Fishing were discussed and plans were made for future surveys. Analysis and research continued on the economic problems of managing fisheries utilized by both recreational and commercial fishermen.

The Group assisted in the development of position papers required by the Kirby Task Force on the Atlantic fisheries and prepared five-year forecasts of the contribution which fisheries resources would make to the gross domestic product for use by the Ministry of State for Economic and Regional Development (MSERD) and other central agencies.

The Statistics and Analysis Group continued to supply a wide range of services to the department and to industry. National fisheries statistics, compiled and published monthly by the Statistics Unit, covered landings, products and inventories, exports and imports. In addition, the Annual Statistical Review and the Canadian sections of the OECD Review of Fisheries and the FAO Yearbook of Fisheries Statistics were also compiled. In order to meet the future demands of various users of fishing statistics, major initatives were undertaken to improve their quality and timeliness.

The Surveys Unit advised a wide range of clients on the design and implementation of surveys, in addition to carrying out its responsibility for the 1980 Survey of Sport Fishing in Canada. Responsibility for this survey entailed the development of methodology, questionnaire design and printing, coordination of the field work, editing, coding and analysis of survey data. Over 55,000 responses from all provinces, territories and visiting anglers from the U.S. and abroad were processed during the year.

The Analysis Unit, in cooperation with experts from the private sector, conducted a wide range of studies designed to provide the Department with a better understanding and appreciation of the various elements and participants in the commercial fishing industry and their inter-relationships. The more important of these studies included a structural-behavioural analysis on the Atlantic groundfish industry with an assessment of the quality improvement program; the design and implementation of a physical capacity survey of processing plants in Atlantic Canada; a study designed to measure the impact of energy price increases on the industry; a market demand analysis of groundfish products in the U.S. market; and for the first time, in cooperation with department biologists and industry, a study to measure the effect of mesh size on redfish catches and the economics of the resulting products produced. Various initiatives were also developed and explored to enable the Department to obtain better financial and economic information on the various components of the industry.

The Policy Development and Strategic Planning Group continued its work of developing and coordinating long term departmental plans and policies in order to support senior management in decision making and ensure

effective implementation of the government's overall economic objectives. This included preparation of the 1983-87 Strategic Overview which sets out DFO's plans and alternative strategies for economic development of Canadian fisheries.

Work was completed on the identification of many of the key questions that are likely to arise from offshore petroleum developments particularly in Atlantic Canada but also in the Arctic, in order to identify priorities for short term policy inputs and to further assess the long term socio-economic impacts of offshore developments in specific areas.

The activities of the Economic Programs Branch covered the areas of financial support, fishermen's assistance, and program policy with respect to FIRA applications, and interdepartmental and central agency programs.

The Financial Support Group continued to administer the Fisheries Improvement Loans Act. During the year, 700 loans amounting to $12.6 million were made by chartered banks and other designated lenders and registered under the program. Staff also continued to provide management and support services to the Fisheries Prices Support Board and consulting and administrative services to the Canadian Saltfish Corporation and the Freshwater Fish Marketing Corporation.

The Fisherman's Assistance Group continued to manage the Fishing Vessel Insurance Plan (FVIP) and the Fishing Vessel Assistance Program (FVAP). The FVIP insured roughly 8,000 commercial fishing vessels with a value of approximately $200 million. Some 470 claims were settled for a total indemnification of approximately $6 million. The FVAP was responsible for the granting of $7 million in subsidies for the construction of 408 fishing vessels under 22.9 metres (75 feet) in length. Of this total, 287 vessels were for use in the Atlantic fishery and 121 for the inland fishery. In addition, $300,000 was spent on the modification or conversion of 73 vessels.

The Program Policy Group was in frequent contact with the Foreign Investment Review Agency and provided assessments for each proposed investment in the fisheries sector involving foreign capital. The number of cases handled increased over the previous year. Deteriorating economic conditions were responsible for a substantial drop in the number of large incentive

grant applications in the fisheries sector assessed during the year. On the other hand, policy input to the planning of subsidiary agreements for economic development sponsored by DREE increased significantly over 1980.

There was a notable increase in liaison work with other departments. Most of this was focused on matters pertaining to fishermen which involved unemployment insurance and taxation. A formal system of responding to demands for departmental input to the activities of MSERD was adopted during the year. This enabled a more efficient, timely, and better coordinated response to the higher volume of development proposals considered within the economic envelope.

Marketing Directorate

The marketing function within the Department was upgraded to a Directorate during the year in recognition of the growing importance of this area in fisheries management. The main objective of the directorate is to ensure that an optimum quantity of Canadian fisheries products can be marketed in a manner which provides maximum benefit to Canada's fisheries sector.

In line with this objective, the Marketing Services Branch was reorganized along species lines to better reflect the necessary market-led orientation and planning required to ensure that maximum benefits are derived from the resource. Branch activities included on-going monitoring in terms of sales and trade, assessment of domestic and foreign markets for fishery products, identifying business opportunities in new markets for existing and new products, monitoring changes in supply, demand and prices, tracking developments in the various domestic market segments, and in foreign markets as they impinge on Canadian trade performance.

Regular market bulletins provided coverage of groundfish, pelagic, shellfish and freshwater fish. In addition, special market assessment reports were prepared for fisheries management, the Fishery Prices Support Board and the industry, including market advice to assist in formulating appropriate policies and programs.

A major achievement during the year was the preparation, on a species basis, of the Annual Market Forecast, along with specific action plans. The two documents provided useful guidance to both government

and industry for market planning and decision-making purposes. In addition, regular consultations were held and marketing advice provided to industry members and the Canadian Association of Fish Exporters to apprise them of opportunities and problems, (e.g. over-production of small size salt fish; widening of marketing base for bloater producers). As well, marketing advice was given to fisheries managers responsible for resource allocation and as an input to international fisheries negotiations and bilateral fisheries agreements.

The work of updating the Worldwide Fisheries Marketing Study continued. The study provides a long term outlook of market prospects for Canadian fishery products, taking into account global demand/supply, foreign policies and competition.

In response to the need for a more market-oriented approach to fisheries management, a Market Extension Services Branch was established during the year. Several product diversification and package innovation opportunities were identified by the Branch, and in cooperation with industry, specific pilot marketing programs and demonstration projects were undertaken.

For example, the evaluation of market opportunities for smoked fish triggered processor interest in setting up a facility to produce mold-cured products; the need to improve groundfish utilization led to commercial size stockfish production experiments and promotion of year-round drying; assistance was provided for the design and test marketing of a new container for shellfish; and an analysis of fishery product imports was completed which will be used in identifying product development initatives for import substitution. A fresh fish market opportunity study was also completed.

The Promotion Branch undertook the development of strategies for promotion and advertising of Canadian fish and seafood products, designed to improve fish consumption and market returns to the industry, based on extensive consumer research completed by the Directorate.

With regard to export markets, work continued on the development of promotional strategies to improve the image of Canadian fish and seafood products in major international markets. A major achievement in this area during the year was the publication of a

Fisheries Trade Book covering Atlantic, Pacific and Freshwater species, to serve as a sales aid and promotional tool for use by the industry and government. Copies of the book have been distributed abroad and the response has been very favourable.

In addition, the Promotion Branch worked closely with industry associations and individual companies to provide expertise and assistance in the development and implementation of promotional programs.

The Fisheries Food Centre continued to be the focal point for specific promotional activities and the dissemination of information and assistance to the industry, retailers, media, foodservice operators and consumers. The centre's activities included recipe development, metric conversion, product testing, food demonstrations, television and radio appearances, conferences and other activities in support of fish and seafood.

During Fish and Seafood Month activities in November, the Centre handled an estimated 125,000 requests from consumers and industry sectors as a result of this program.

The Food Centre continued to provide assistance to other government departments and represented Canada at a number of major food shows and exhibitions in the U.S.A., Europe, Japan and Hong Kong.

Another innovation during the year was the establishment of a Marketing Program Administration Branch, with the objective of providing assistance to industry by improving profitability through better cost control and production planning based on maximizing market returns. In a pilot project, a multi-species processing/marketing firm was chosen as a test company and cost-control and production planning systems were successfully designed and implemented with support from the Economic Development Directorate.

In other areas, the Branch assisted the Fisheries Prices Support Board in its review of a request to provide assistance to the industry, as well as reviewing industry claims under the Groundfish Deficiency Payment Program.

A proposal was also initiated to develop a comprehensive computerized marketing information system encompassing all segments of the fishery, designed to assist departmental management in decision-making and long term/strategic planning, with particular reference to marketing.

International Directorate

In the area of international activities the International Directorate continued work related to the eleven international fisheries commissions to which Canada belongs, work related to the establishment and implementation of bilateral fisheries treaties to which Canada is party, and pursued specific fisheries trade issues and opportunities.

Problems developed regarding implementation by the European Economic Community of its obligations under the Canada-EEC fisheries treaty, which provides guaranteed allocations of certain stocks to the Community until the end of 1987 in return for improved tariff treatment for certain Canadian fish products and for a limitation of the Greenland salmon fishery. Efforts were focused on resolution of these problems. A major effort was also made to minimize the impact of anti-sealing forces in Europe in the European parliament and on markets for sealskins.

Problems continued in fisheries negotiations with Spain and resulted in an impasse for 1981, with no allocation for Spain in the Canadian zone during the period. The Spanish market for Canadian fish products was adversely affected by this situation.

Fisheries consultations with Japan resulted in arrangements which furthered the goodwill relationship. Canadian exports to Japan of fisheries products recovered to about the $190 million level, up from about $112 million in 1980.

Discussions underway for three years resulted in the successful negotiation in February, 1982, of an International Atlantic Salmon Convention to focus on intercepting fisheries, including those off West Greenland and ratification discussions are underway.

The directorate continued its key role in achieving Canadian objectives in the Northwest Atlantic Fisheries Organization, with continued success in establishing conservation measures (in particular, safe total allowable catch limits) and Canadian allocations in the area beyond the Canadian 200-mile limit.

Progress was made in discussions with the USA on the development of a comprehensive Canada/United States Pacific Salmon agreement. Ratification was achieved on the treaty negotiated with the USA to resolve the dispute over fishing for albacore tuna on the Pacific coast, and implementation proceeded without problems. Following ratification by Canada and the USA of the treaty to refer the Gulf of Maine boundary dispute to the International Court of Justice (ICJ), work proceeded on preparation of the Canadian case. Intensive negotiations were pursued to resolve problems between the two countries on management of Georges Bank scallop and groundfish stocks, pending establishment by the ICJ of the international boundary, as well as to protect significant Canadian markets for these species in the USA.

Work continued on analysis of the trade opportunities for fisheries products in the EEC, Spain, Portugal (where significant increases in Canadian exports were achieved) and Eastern Europe and on the monitoring of activities of third parties which might affect exports of Canadian fish products.

In the area of trade policy, Canada's contention that the United States 1979 embargo on Canadian tuna products was contrary to USA obligations under the General Agreement on Tariffs and Trade (G.A.T.T.), was upheld in a decision by the G.A.T.T. Council. In addition, G.A.T.T. consultations were held with the EEC regarding its imposition of reference prices July-August 1981 on the importation of cod products and with Spain concerning its import licensing system on fish products.

The Ocean Science and Surveys (OSS) sector of the department is responsible for national programs in oceanography and marine ecology including the acquisition and dissemination of ocean-related data and information and the surveying and charting of navigable waters in Canada's coastal and inland areas.

At headquarters, the Marine Sciences and Information Directorate carries out its responsibilities through the Ocean Science Affairs Branch, the Marine Environmental Data Service and the Scientific Information and Publications Branch. The policy formulation, coordination and main production elements of the Canadian Hydrographic Service are also located at headquarters.

Oceanographic research and hydrographic field programs are directed from regional offices located at the Bedford Institute of Oceanography, Dartmouth, N.S.; the Institute of Ocean Sciences, Sidney, B.C.; the Bayfield Laboratory for Marine Science and Surveys, Burlington, Ont.; and the Champlain Centre for Marine Science and Surveys, Quebec, Que.

A summary of the year's activities is as follows:

Marine Science and Information Directorate

Ocean Science Affairs Branch

The Ocean Science Affairs Branch provided a focus for various national and international matters related to oceanography, such as the development of oceanographic policies for senior management and the provision of oceanographic information and advice to committees and working groups. Major areas of concern included the Energy Research and Development Program, various Arctic marine transportation issues, amendments to the Canadian Shipping Act, Beaufort Sea developments, the Canada Oil and Gas Act, the Northern Hydrocarbons Planning Strategy and marine terminal assessment procedures (TERMPOL code). The Branch also provide an OSS focus for the Unsolicited Proposal Program of the Department of Supply and Services, the Program for Industry Laboratory Projects, the oceanographic component of State of the Environment Report of the Department of the Environment, the Departmental Science Subvention Program to Canadian

universities, the fund for research contracts in support of the Ocean Dumping Control Act, departmental participation in the Natural Sciences and Engineering Research Council Post-Doctorate Fellowship Program, as well as coordinating departmental remote sensing requirements. On the international scene input and personnel were provided to many ocean-related intergovernmental activities such as those of the Intergovernmental Oceanographic Commission (IOC), the London Dumping Convention, the International Council for the Exploration of the Seas (ICES) and the Remote Sensing Advisory Group of the European Space Agency.

Marine Environmental Data Services

The Marine Environmental Data Services (MEDS) Branch continued to collect and dispense oceanographic data in response to national and international commitments. The implementation of a policy for oceanographic data management has led to the introduction of a Canadian Marine Data Inventory (CAMDI) designed to manage the national and regional inventory of OSS data holdings. More than 5,700 data sets from all regions were coded, verified, keyed-in and inserted into the CAMDI data base. The first catalogue of OSS Marine Data holdings was published in 1981.

A major milestone was reached this year with the publication of the English version of the MEDS User's Guide. The first issue of the MEDS information circular was also published. It described in detail the OSS data management policy.

MEDS became active in remote sensing through its involvement in the RADARSAT program. MEDS is analyzing Synthetic Array Radar data to produce directional wave spectra and compare the results to waverider records routinely archived at MEDS. Considerable time and effort was also devoted to the design and implementation of an interactive system for horizontal and vertical contouring and line-editing. The horizontal system (without the line-editing) is now available and development work is continuing.

Scientific Information and Publications Branch

The Scientific Information and Publications Branch (SIPB) is the department's national focal point for scientific and technical information (STI). It constitutes the link between departmental and other Canadian research and development and the department's clients by evaluating scientific evidence emanating from research institutions and ensuring that information is published in valid, credible, comprehensible form. It plays an equally strong role in information transfer by documenting and retrieving scientific and technical information, in concert with the departmental libraries, to ensure accessibility of published information to numerous users.

In its capacity as publisher, SIPB produced and distributed over 12,000 printed pages during the year, including the monthly Canadian Journal of Fisheries and Aquatic Sciences, which has a world-wide reputation. Other results of scientific endeavour were reported in the Bulletin series and Special Publications series whose titles range from Physiological Bases of Phytoplankton Ecology, Nutrition and Feeding of Rainbow Trout, and Oceanography of the British Columbia Coast, to the Directory of Marine Scientists in Canada, and Bottom Trawl Surveys. Research results of more regional interest appeared in the seven national Report series coordinated by the Branch and produced in the regions. Complementing the aforementioned series, which are primarily for a scientific audience, are those published on behalf of the Canadian Hydrographic Service and aimed mostly at the boating public: Sailing Directions, Small Craft Guides, Tide and Current Tables and Water Levels.

To ensure orderly flow and easy accessibility of information to users, SIPB continued to work toward developing and building data bases, and continued to index, exchange, and translate scientific and technical information, the latter in cooperation with the Canada Institute for Scientific and Technical Information and the U.S. National Marine Fisheries Service. Through its function as the national focal point and input center for the Aquatic Sciences and Fisheries Information System sponsored by the U.N. Food and Agriculture Organization/Intergovernmental Oceanographic Commission it afforded Canadians the access to nearly 90,000 titles online. Besides answering over 6,500 requests for information, the Branch made known the availability of current DFO literature through a bi-monthly listing, SCITECH Publications, and its annual index.

With the assistance of an information management consultant, SIPB has assessed its information and publication functions and has developed a plan to automate the information and operational control systems to improve their effectiveness.

Canadian Hydrographic Service

The 1981 hydrography program in the Arctic was the most ambitious in a decade. Three ships CSS BAFFIN, CCGS LABRADOR and MV POLAR CIRCLE, were used to survey the eastern approaches to Fury and Hecla Strait. The need for the survey was amply proven when an 11m shoal was found in mid-channel. In the Beaufort Sea, CSS HUDSON, under the operational control of Pacific Region, completed half of the 170 nautical mile long, 10 mile wide, corridor through an area where pingos (ice-caved mounds) pose a serious hazard to deep draft shipping. Earlier, MV POLAR CIRCLE had completed the survey of the Koksoak River. CCGS SIR WILLIAM ALEXANDER, completed a survey of the approaches to Chesterfield Inlet. During the latter part of the fiscal year, an over-the-ice survey of Prince of Wales Strait was initiated.

On the Atlantic coast, CSS BAFFIN carried out "ground truth" surveys for a test of aerial hydrography techniques on Sable Island, completed the survey of Fortune Bay at the request of the Newfoundland government and extended the navigational corridor along the Labrador coast. CSS MAXWELL, supplemented by M.V. NAVICULA, continued the Yarmouth to Cape St. Mary, N.S., survey and started a survey of the Strait of Belle Isle. Harbour surveys were completed at Pugwash, Campbellton and Shippegan and CSS HUDSON and CSS DAWSON completed the multi-parameter survey of Davis Strait to a five-mile line spacing.

In Quebec, the survey of Lac St. Jean, started in 1979, was completed and the survey of the Richelieu River resumed. Nine harbours and their approaches were surveyed from Chandler to Les Mechines.

On the Great Lakes, surveys were completed in the approaches to Kingston, from Sarnia towards Goderich and in the North Channel. The survey to Lake Nipissing was completed except for a small area in West Bay. The survey of Lake Manitoba by contract was started and good progress was made during the first season.

On the British Columbia coast, the PANDORA, the tender for the PISCES submersible, was used as the base for surveys of Okisolla Channel and the eastern approaches to Skidgate Inlet. CSS RICHARDSON carried out a revisory survey in Jervis Inlet, then surveyed Chatham Sound and Port Neville.

Fourteen new charts were published in 1981. The most popular is likely to be the recreational chart of Harrison Lake and River, a tributory of the Fraser River east of Vancouver. Eight new charts were published of the Gulf Islands and Straits of Juan de Fuca as well as three new charts of the west coast of Vancouver Island and three of the Arctic. Two experimental charts of Blind River and Lake Kaminiskeg, just east of Algonquin Park, in Ontario were published through an unsolicited proposal funded by the Department of Supply and Services. Eighty-nine new editions and almost two hundred reprints or overprints were published. The number of charts distributed was 512,000, a slight decrease from the previous year. Some 14,500 Sailing Directions and Small Craft Guides, 87,000 Tide Tables and 25,000 chart catalogues were distributed. A Tidal Atlas of the Bay of Fundy was published.

The efforts of the Geoscience Mapping Unit were concentrated on completing the Fifth Edition of the General Bathymetric Chart of the Oceans (GEBCO) for display at the XIIth International Hydrographic Conference at Monaco in April 1982. This deadline was narrowly met and Canada received considerable praise for the eighteen sheets produced under the auspices of the International Hydrographic Organization and the Intergovernmental Oceanographic Commission, with the cooperation of an international panel of experts. These charts provide the most definitive bathymetric information of the world's oceans yet produced.

Oceanography

Bedford Institute of Oceanography

Atlantic Region Headquarters, O.S.S.

The department's Bedford Institute of Oceanography is the base of operations for the Atlantic Region oceanographic research and hydrographic survey programs. The Institute performs fundamental long-term research in all fields of the marine sciences as well as addressing urgent problems related to current industrial activities; the prediction and management of

fish stocks, the effects of contamination and modification of the marine environment and the engineering difficulties associated with the exploration for and development of, offshore hydrocarbon resources.

Changes in the Labrador Current powerfully affect the marine climate and fisheries of the Grand Banks and the Maritimes, and Atlantic Oceanographic Laboratory (AOL) oceanographers have recently discovered that seasonal changes in the Labrador Current extend much deeper than just the surface layers as was previously thought, a fact which must now be accommodated in the AOL research program on ocean climate for the arctic regions.

To meet the needs of fisheries, petroleum, and environmental agencies for information on the physical oceanography of the Newfoundland continental shelf, AOL completed two documents addressing the mean and time-varying ocean circulation in that area. The first document, dealing with the general circulation on the shelf, combines different types of oceanographic data such as current meter, sea surface (bottom) drifters, sea level, and hydrological observations, gathered over the last 30 years. The second report deals with transient flows, specifically, tidal and wind-induced currents.

Although open areas of water (polynyas and leads) and very thin ice cover only a small fraction of the Arctic Ocean in winter, they account for a major part of the sea surface heat loss. The 1980 Dundas Island polynya experiment, carried out by several Canadian Government groups, including one from the Atlantic Region, was designed to measure and explain the heat balance of a polynya during a one month period. A polynya can serve as a full-scale model of proposed Arctic harbours.

Several advances were made in the description of the deep flow in the North Atlantic. A paper on the Region's Gulf Stream Experiment (1975-1977) was written describing the velocity and temperature fields at 4000 m under the main axis of the Gulf Stream as it crosses 55°W. The analysis of a later current meter array beneath the axis of the stream at 50°W continues.

The Cape Sable Experiment investigated the following aspects of the circulation off Cape Sable, Nova Scotia: (1) seasonal mean flow into the Gulf of Maine, (2) low-frequency (subtidal) variability, (3) tidally-driven "centrifugal" upwelling, and (4) tidal mixing versus thermal stratification.

The waters of the Scotian Shelf edge are characterized by high primary production and zooplankton abundances. Programs are underway to develop biological sensor systems, capable of rapid and detailed spatial resolution, which may be applied to marine ecological studies relating to phytoplankton and zooplankton distributions.

Efforts devoted to the study of chemical processes in the Bay of Fundy increased considerably, partly because of the desire to understand sediment transport and accumulation processes in connection with the Point Lepreau Environmental Monitoring Program, and partly through the assumption of the sedimentary geochemistry program of the Marine Ecology Laboratory (MEL).

As the quality of the marine environment is of vital importance to the management of the living resources of the sea, chemical oceanographers of AOL continued extensive studies of background levels of contaminates from land-based industry and marine transportation.

A long-term program, begun in 1979, to investigate the factors that control year-class strengths in fish stocks continued. Considerable progress has been made in the analysis and interpretation of the Scotian Shelf Ichthyoplankton Survey Program (SSIP) data.

Primary production studies by MEL were chiefly concerned with the physiology and productivity of marine phytoplankton. The objectives are to understand the mechanisms by which phytoplankton production is regulated in the marine environment and to improve the ability to predict primary production from easily measured environmental and physiological parameters. A major cruise was made to the eastern tropical Pacific to study pelagic production processes at two oceanic sites.

Analysis of data from the 1980 Marine Ecology Laboratory cruise to the eastern Canadian Arctic (Labrador Sea, Baffin Bay, Lancaster Sound) provided very satisfying results. Major emphasis was placed on the importance of light, temperature and nutrients in regulating growth and on the capabilities and nature of the response of populations to changes in these environmental variables.

Large zooplankton organisms and juvenile fish are able to escape from nets used to catch the medium-sized zooplankton. A special apparatus (BIONESS) has been developed to sample the macroplankton and was used extensively to obtain vertical and horizontal distributions in a variety of habitats. The sampling program during the biological stability (BIOSTAT) cruise to waters near Costa Rica was highly successfull.

St. Georges Bay, Nova Scotia, which provides an excellent site for ecological studies of a nearshore fish population, was the location for an extensive series of field observations on food and growth of larval mackerel, on primary production, zooplankton production, and on nutrient dynamics.

Bedford Institute's 1981 A.G. HUNTSMAN Award for Excellence in Marine Sciences was presented to a Canadian, Dr. J. Tuzo Wilson, Director of the Ontario Science Centre. Established in 1980, the award is presented annually and honours top marine scientists throughout the world who are not only respected for their calibre in science and in scientific thought, but who will have an influence on the future of oceanography. The award, created at BIO, is supported financially by Canadian industry with marine interests and, by the departments of Fisheries and Oceans and Energy, Mines and Resources. Dr. Wilson's HUNTSMAN Lecture for 1981, given at BIO, was entitled "Recollections of the Development of Plate Tectonics over the past 55 years".

The BIO Library continued efforts to develop a special collection of marine environmental assessment documents. This noncirculating reference collection includes material produced in connection with the environmental assessment of major development projects

off the Canadian east coast and the Canadian Arctic, such as the Arctic Pilot Project, Sable Island drilling, and the Point Lepreau Nuclear Power station. The majority of the projects included in the collection are being (or have been) reviewed under the Canadian Federal Environmental Assessment and Review Process (EARP). The collection will be of use to persons from government, industry and other organizations who are involved in coastal and offshore projects, as well as members of the public.

Dr. Trevor Platt, Head of the Biological Oceanography Division of MEL, was awarded the Atlantic Provinces Interuniversity Council on the Science (APICS) Fraser Medal for 1981. The medal is awarded for outstanding research conducted in Atlantic Canada by younger scientists and engineers. It is sponsored by the Atlantic Provinces Council on the Sciences, is judged by a distinguished panel from across Canada, and consists of a gold medal and cash award.

Institute of Ocean Science

Pacific Region Headquarters, O.S.S.

The Institute of Ocean Sciences, Patricia Bay, B.C. is the base of operations for the Pacific Region oceanographic research and hydrographic survey programs, including programs in coastal and offshore Pacific waters and a small portion of the eastern Arctic including the channels of the Arctic Archipelago.

Among the major accomplishments of the ocean chemistry division was the commencement of a chemical oceanography research program in Alice Arm to study mine tailings behaviour and metal accummulation rates related to the operation of the much-publicized Amax molybdenum mine.

The establishment of a Marine Carbon Research Centre is progressing. Data submission directly to the World Meteorological Organization (WMO) has commenced and laboratories for ^{14}C dating and ^{13}C productivity measurements are being set up.

A review of air-sea carbon dioxyde (CO_2) exchange, the role of photosynthesis, upwelling zones, and Arctic CO_2 source-sink relationships will contribute to construction of a number of CO_2 sub-models. Marine CO_2 monitoring continues, using ships of opportunity and B.C. lighthouses.

A series of ocean enclosed experiments was started to study the fate of metals (lead, mercury, cadmium, copper and manganese) and flocculation in the marine environment, air-sea CO_2 exchange rates, carbonate chemistry and the carbon cycle. In addition metal and organic release and uptake rates in seawater are being addressed in a laboratory experiment.

IOS personnel cooperated with the U.S. National Oceanic and Atmospheric Agency (NOAA) in an air-sea CO_2 and oceanic CO_2 penetration study in the western Pacific. An assessment of environmental levels of certain polyaromatic hydrocarbon compounds and their toxic effects, and the detoxification of metals by protein of mussels are also ongoing.

In the ocean physics division, the study of fjords dynamics continued with the collection of data to describe the seasonal variations in water properties and current structure in the Alice Arm area, including events leading to renewal of bottom water in the fjord system.

Field work in the N.W. Passage was undertaken to provide preliminary descriptions of currents, water level and water masses.

CODE (Coastal Ocean Dynamics Experiment) data was used to complete a description of space and time scales of variability on the Vancouver Island continental shelf and to complete a description of annual and tidal cycles off southwestern Vancouver Island. A refined upper layer model for southern Georgia Strait is being developed, and testing is scheduled.

Analysis and interpretation of several seasons of work on the factors responsible for large-scale, multi-year patterns of plankton distribution and production on the continental shelf was close to completion.

Samples were analyzed and statistical assessments made of community patterns of plankton in order to distinguish sets of fjords with similar planktonic communities.

Benthos studies included analysis of samples taken beneath plankton production zones to test hypotheses linking benthic distribution with zones of low and high plankton production and of low oxygen on the shelf.

A cooperative program involving IOS Physics Division, Bedford Institute of Oceanography Geology Division and various universities was launched to determine the distribution of benthic organisms attached to walls of fjords in relation to natural oxygen deficits (Saanich Inlet), natural silt loads and currents over sills (Knight Inlet and others), and mine tailings (Alice Arm).

In the area of Ocean Information, the compilation and appraisal of data sets continued, with special emphasis on priority Arctic areas. Draft reports in review included physical oceanography for the Beaufort Sea, Queen Elizabeth Islands, N.W. Passage, and Baffin Bay, and chemical oceanography for the Beaufort Sea and N.W. Passage. Also, chemical mass balance studies and a review of physical forcing functions relevant to oil spill trajectory modelling for the Beaufort Sea were completed in draft form.

Work continued to assess the feasibility of archiving Arctic biological oceanographic data including benthos, plankton, whales, and fish.

The first phase of physical oceanographic data compilations for west coast waters, specifically Queen Charlotte Sound/Hecate Strait/Dixon Entrance, and the Georgia/Juan de Fuca system was completed. A review of existing environmental assessments and reports was started prior to west coast offshore drilling activity. A computer catalogue of these reports is on file.

Prior to Environmental Assessment and Review Panel (EARP) hearings and panel recommendations, contributions to departmental positions were advanced regarding such issues as Beaufort Sea development, and the Arctic Pilot Project (APP). An overview/scenario of Beaufort Sea Development projections to the year 2000 was in preparation.

Ocean dumping research and activities related to the granting of dumping permits continued, including work designed to improve existing legislation.

Bayfield Laboratory for Marine Science and Surveys

Central Region, Headquarters, O.S.S.

In honour of the pioneer hydrographer of the Great Lakes, Admiral Henry Wolsey Bayfield, Central Region was renamed during the year the Bayfield Laboratory for Marine Science and Surveys (BLMSS). In addition, the Research and Develoment Division became known as the Oceanographic Division, reflecting the change of the Division's activities away from the Great Lakes to the marine waters of the Arctic, Hudson Bay and James Bay.

The Barrow Strait project, of the Northwest Passage Oceanographic Program, continued with a field survey early in the year utilizing the stable winter ice cover. It consisted of a regional survey of water structure, year-long measurements of flow and a limited number of biological and chemical observations. A notable finding with respect to the potential use of ice-breaking tankers for the transportation of Arctic oil and gas was evidence of coastal upwelling reducing the equilibrium ice thickness by as much as $\frac{1}{2}$ m. The limited nutrient and zooplankton sampling showed differences between the water masses present. Physiological studies of phytoplankton collected under the ice demonstrated photosynthetic potential as early as April. Early reports from the March/April 1982 field survey indicate that the year-long current meter and tide gauge instrumentation operated successfully and that the biological sampling equipment designed for through-the-ice data collection performed well.

Research results from the Hudson Bay Region were presented at the Hudson Bay Symposium hosted by the University of Guelph. This included physical and biological oceanographic properties of freshwater plumes under an ice cover; tidal-induced variation in the salinity distribution and a narrow estuary; the variability of oceanographic parameters in Hudson Bay, and the present and future circulation in James Bay.

In order that supertankers can more safely navigate year-round through Arctic waters, an investigation of the interaction of radar signals with the various ice formations found in the Northwest Passage was initiated in the spring of 1981. The

research will provide an ice classification system with a range of 5-6 nautical miles. Other work in ice studies included the development of a transportable ice physics laboratory and the standardization of sampling and analytical methods for carrying out crystallographic and ice strength tests, ice salinity and temperature.

In conjunction with Environment Canada and the Ontario Ministry of Natural Resources, results of a five-year erosion monitoring program on the Great Lakes provided a new classification of the beach zone in the analysis of regional shore patterns and processes. A Canada/Ontario guide for better shore management was also published.

In the study of estuarine dynamics, research was carried out on the use of dynamic-stochastic modelling for estimating salinity distributions and on the identification and analysis of internal tides in the middle estuary of the St. Lawrence. Results of this and related research were presented at the International Conference on Time Series Methods in Hydrosciences. In conjunction with the Delft Hydraulics Laboratory, a dynamic-stochastic storm-tide model developed at BLMSS, is being applied to predict water levels in Eastern Scheldt estuary, Holland. Research on predicting the effects of changes to the freshwater plume under an ice cover (as caused by hydroelectric development) on ice conditions and the weather of James Bay was also completed.

In addition to supporting hydrographic and oceanographic surveys, the Region's vessels including CSS LIMNOS and CSS BAYFIELD were involved in the scientific and surveillance programs of the National Water Research Institute, Great Lakes Fisheries Research Branch, and other government agencies and universities. The Search and Rescue program continued successfully during 1981 with over 80 incidents recorded.

Collaborations on northern programs have included the National Museum, Ottawa; Institute of Ocean Sciences, Bedford Institute of Oceanography, Arctic Biological Station, Departments of Communications and Indian Affairs and Northern Development, and various universities.

Champlain Centre for Marine Science and Surveys

Quebec Region Headquarters, O.S.S.

The Oceanographic Research group at the Champlain Centre for Marine Science and Surveys (CCMSS) undertook several projects in the Estuary and Gulf of St. Lawrence as well as in the Saguenay Fjord. Dynamics of coastal waters, marine pollution and processes affecting biological production were the main themes of these studies. CCMSS also launched its first research program in the coastal waters of Northern Québec, southeast of Hudson Bay, to study the impact of hydro-electric development on marine and estuarian environments.

The Hydrographic Studies group surveyed Lac Saint-Jean, the Richelieu River and the Gaspé Peninsula.

CMSS also participated in two environmental evaluations for the Arctic pilot project on the possible effects of construction and operation of a gas terminal at Gros Cacouna, some 200 km downstream from Québec.

In May 1981, the Physical Oceanography Division set up a multi-disciplinary program between Sept-Iles and Blanc-Sablon to study the effect of outflow from the rivers on the marine environment of coastal waters located near the north shore of the Gulf of St. Lawrence.

The first phase of a two-year study on the freshwater plume from Great Whale River, southeast of Hudson's Bay, was completed. The study was designed to show the influence of ice covering on the reduction of water turbulence, vertical drag and the development of the plume during an increase in outflow (from March to May). The project, conducted in collaboration with the Biological Studies Division and the universities of Laval and McGill, will ultimately attempt to determine the impact of hydro-electric power plant development on the productivity and physical condition of the coastal region.

Chemical oceanographers conducted a research program on the blue mussel, permitting them to create a model of the organism encompassing seasonal variants of the mussel's retention of metal. This led to an improved usage of the mussel as a pollution indicator.

Other work included an analysis of the distribution and behaviour of mercury in the estuary system of the Gulf of St. Lawrence and a study of polyaromatic hydrocarbons in sediment. Contamination of the Saguenay Fjord by this type of composition has been confirmed and a survey of sediment along the Laurentian Channel has been conducted in pursuit of this study.

The Biological Oceanography Division continued its research on the biological production system of the St. Lawrence River estuary. Preliminary findings indicate that the outflow of freshwater from this river and its tributaries (Saguenay, Outardes, Manicouagan, etc.) could seriously affect the time frame and distribution pattern of phytoplanktonic growth in the estuary.

Preliminary studies on the biomass, productivity and physiology of microflora associated with ice were conducted in the estuary of the St. Lawrence, as well as southeast of Hudson Bay within the confines of the Great Whale River study.

Elsewhere, several projects were conducted on the distribution and production of zooplankton in the estuary of the St. Lawrence and in the Saguenay Fjord.

Small Craft Harbours

Under the Fishing and Recreational Harbours Act the department has the responsibility to develop, administer, and maintain some 2,400 federally-owned fishing and recreational harbours throughout Canada. The Small Craft Harbours Directorate, through regional offices at Vancouver, Winnipeg, Burlington, Halifax, St. John's and Moncton, carries out this mandate.

Program objectives are to develop effective and efficient regional harbour systems to ensure maximum economic and social benefits to Canada from the use of the commercial fishery, and to assist in the provision of harbour facilities to the recreational boating sector through:

- the development and maintenance of harbours by providing adequate protection, berthage, water depth, launching facilities and other harbour infrastructure services to satisfy user needs; and

- the management of harbours, collection of revenues and provision of property services responsive to program needs.

Recreational boating is assisted through the Marina Policy Assistance and Tourist Wharf programs which provide harbour facilities for recreational craft through cost-sharing agreements with other levels of government and the private sector.

Federally-owned harbours administered by Small Craft Harbours comprise properties valued at some $1.7 billion, including some 2,500 leases, licences and agreements. The installation of a Harbour Management System, in the form of either appointed harbour managers or through municipal leases, at a significant number of federal harbours has resulted in a marked improvement in the standard of management at these locations.

During the year, approximately $6 million in program funds were directed to joint funding Canada Community Development Projects with the Department of Employment and Immigration. This resulted in improved harbour infrastructures and employment at local labour, particularly in Eastern Canada.

An additional $10 million was devoted to major harbour upgrading projects in the Gaspé and North Shore areas of Québec as a result of a departmental agreement with the Department of Regional Economic Expansion.

A significant amount of program resources was devoted to rebuilding harbours and upgrading projects across the country. Major projects included those at Wedgepoint and Sandy Cove East, N.S.; Woodwards Cove and Caraquet, N.B.; Matane, Sept-Iles, Cloridorme, Québec; Gibsons, B.C., as well as participation in major marina development in Ontario.

Ship Branch

Project approval was received in 1981 to build two 25-metre fishery patrol vessels to replace the Cumella and Boltenia, two wooden-hulled vessels built in 1951 which operate in New Brunswick and Newfoundland waters respectively. In addition to these vessels, design work was started to replace the Wm. J. Stewart, a West coast offshore hydrographic vessel and the Cape Freels, an offshore surveillance and enforcement vessel for the East coast.

Work neared completion on two fishery research trawlers, the Alfred Needler and the Wilfred Templeman, being built at Pictou, Nova Scotia.

Treasury Board approved a five-year replacement and mid-life refit program beginning in 1982-83 involving 17 vessel replacements and 9 mid-life refits. This program also calls for replacement of approximately 30 launches in the 10 to 14 metre range.

During the year, personnel in the DFO fleet were provided with newly-designed uniforms and working dress, including heavy weather gear. The uniforms are an initial grant with replacement on a scheduled basis.