

fisheries and forestry

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Department of Fisheries
and Forestry

Annual Report
for the fiscal year ended
March 31, 1970



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MINISTER OF FISHERIES AND FORESTRY



MINISTRE DES PÊCHES ET DES FORÊTS

CANADA

*To His Excellency the Right Honourable Roland Michener, Governor General and
Commander-in-Chief 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 Annual Report of the Department of Fisheries and Forestry for the fiscal year 1969-70.

Respectfully submitted,

A handwritten signature in cursive script that reads 'Jack Davis'.

Jack Davis
Minister of Fisheries and Forestry



CANADA

DEPUTY MINISTER OF FISHERIES AND FORESTRY
LE SOUS-MINISTRE DES PÊCHES ET DES FORÊTS

OTTAWA

*To the Honourable Jack Davis, M.P.,
Minister of Fisheries and Forestry,
Ottawa, Canada*

Sir:

I submit herewith the Annual Report of the Department of Fisheries and Forestry for the fiscal year 1969-70.

I have the honour to be, Sir,

Your obedient servant,

A handwritten signature in cursive script, appearing to read "A.W.H. Needler".

A.W.H. Needler
Deputy Minister

Foreword

Summarized in this report are the activities of the first full year of operation of the Department of Fisheries and Forestry, created as a result of the merging of the former Fisheries Department and the Forestry Branch of the former Department of Forestry and Rural Development. The merger became effective March 28, 1969, as a result of the enactment of the Government Organization Act, 1969.

The task of consolidating certain common functions and services in the newly-created department, which was initiated towards the end of the 1968-69 fiscal year, was continued during the year under review to ensure smooth-running administrative functions. A legislative change which will bring staff of the Fisheries Research Board of Canada under the jurisdiction of the Public Service Employment Act on April 1, 1970, involved administrative personnel in reorientation training to meet their changing roles.

The report covers the operations of the Fisheries Service and the Canadian Forestry Service. The activities of the Fisheries Research Board are detailed in reports which are published separately by the board.

A general statement on the fishing industry of Canada serves as introduction to the accomplishments of the Fisheries Service during 1969-70, while the achievements of the Canadian Forestry Service are introduced by a short statement covering a number of topics which have influenced, or may be expected to influence, the programs of the service.

Tables relative to the fisheries of Canada follow the section on the Fisheries Service, and others covering national forestry statistics and figures for timber production on federally-administered lands are presented at the conclusion of the Canadian Forestry Service section.

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After a seven-year expansionary phase, Canada's fisheries in 1969 remained close to the levels established in the two previous years. Although there were improved landings of halibut on the Pacific Coast and higher lobster and flatfish landings on the Atlantic Coast, these were offset by a drop in landings of salmon on the Pacific Coast and of herring, scallop and some groundfish species on the Atlantic Coast. Significant governmental actions affecting the fisheries included continued or new input restrictions in some fisheries, provision for orderly production and marketing in some sectors of the industry and the establishment of a twelve-mile limit defining exclusive fishing zones adjacent to Canada reserved for Canadian fishing.

Government Action

Additional restrictive measures to limit effort in the lobster fishery and thereby improve the earnings of individual fishermen were imposed during 1969. Similar measures in the Pacific salmon fishery were implemented during the year.

The price stabilization program for fresh water perch, in force during 1967 and 1968, was continued in 1969. Continued reduced export prices for some sectors of the frozen groundfish industry led to the establishment of a similar price stabilization program for this industry, together with the establishment of a fund to provide working capital to the industry.

Depressed export prices for salt cod led to the introduction of a deficiency payment program to maintain prices to fishermen for these products at their 1966-67 average.

To provide additional capital to fishermen, the ceiling of government-insured individual loans to fishermen was raised from \$10,000 to \$25,000 and the rate of interest was increased to make such loans more attractive to lending institutions.

Parliamentary approval was sought to establish the Canadian Saltfish Corporation through which it is intended to rationalize the industry by having control over the quality, volume, price and marketing of the greater part of the industry's output, thereby improving and stabilizing the earnings of the primary producers of cured fish and improving the methods of production.

A Freshwater Fish Marketing Corporation was established during 1969 to improve and stabilize the earnings of Canada's inland fishermen through the exercise of control over the production, transportation, processing and marketing of most of the output of the freshwater fisheries.

Canada's program of food relief to developing countries absorbed over one million pounds of salted codfish in 1969

thus eliminating the remaining 1968 stocks and taking part of the 1969 production.

The tariff reductions that were to become effective in 1972 as provided for by the Kennedy Round were instituted by the Canadian government during 1969. These reductions affected imports of fishery products and imports of materials used in the fisheries and fish processing industry.

Pair seine netting for groundfish on the Atlantic Coast and fish farming on the prairies are examples of experimental techniques sponsored by the department during 1969 that appear promising.

During the year the government established exclusive fishing zones on its Atlantic and Pacific coasts and announced its intention of proclaiming fisheries closing lines to define the Gulf of St. Lawrence, the Bay of Fundy and Queen Charlotte Sound in order to assume responsibility for the management of the fisheries in these areas.

Production

The number of commercial fishermen in Canada remained nearly constant at 78,000 during the period 1960-1965, and has since been decreasing at a rate of about 4 per cent per year. The number of fishermen in 1969 was approximately 68,000 with 66 per cent located on the Atlantic Coast, 18 per cent on the Pacific Coast and 16 per cent inland.

From 1960 to 1968 the number of vessels used in Canada's sea fisheries has decreased by about 10 per cent, but capital investment in the fleet has increased by 177 per cent. The number in use in the sea fisheries in 1969 was approximately 42,000 with 826 vessels exceeding 50 gross tons.

Two new trawlers (100 feet or more) added during the year brought the total of such vessels operating on the Atlantic Coast to 149 in comparison to 147 in 1968. Vessels licensed to operate in British Columbia in 1969 amounted to 7,047 compared to 7,541 in 1968. Vessels engaged in salmon fishing in British Columbia in 1969 numbered 6,907 in comparison with 7,330 the previous year.

Commercial landings by Canada's fishing industry during 1969 are estimated at 2,715 million pounds, a decrease of 6 per cent in comparison with 1968. Landings on the Atlantic Coast and on the Pacific Coast were 4 per cent and 35 per cent, respectively, below those of the previous year. The 1969 value of Canadian landings (including items other than fish and shellfish) at \$181.2 million, was below the record high value of 1968 by \$4.7 million.

Total landings on the Atlantic Coast, at 2,426 million pounds, were 104 million pounds below the 1968 record

landings. The 1969 catch represented a value of \$120.8 million to the fishermen, a 4 per cent increase over 1968.

Although the catch of groundfish, at 1,203 million pounds, was below the 1968 catch by 32 million pounds, this remained the major component of Atlantic Coast landings. Cod and haddock decreased in relative importance (from 48.0 and 7.3 per cent respectively of the 1968 catch to 44.9 and 6.7 per cent respectively of the 1969 catch) while landings of flatfish increased from 267.5 million pounds in 1968 to 303.2 million pounds in 1969, or from 21 per cent to 25 per cent of the groundfish landings during these two years.

Over 561 million pounds of groundfish were landed by vessels over 70 feet on the Atlantic Coast during 1969 — about 75 million pounds above the 1968 landings for these vessels. Flatfish and redfish maintained their relative importance in the catch by these vessels (34 and 24 per cent respectively) while haddock increased in importance (from 8 to 11 per cent respectively from 1968 to 1969). Cod accounted for only 24 per cent of these landings in 1969, compared with 28 per cent in 1968.

Herring landings decreased by about 7 per cent compared with the previous year. The 1,073.6 million pound catch valued at \$11.2 million was accounted for mainly by New Brunswick (38 per cent), Newfoundland (34 per cent) and Nova Scotia (21 per cent). It is estimated that about 85 per cent of these herring landings were utilized in meal production.

Lobster landings continued their upward trend and exceeded the 1968 catch by just over 7 per cent. Improved prices during 1969 enabled the fishermen to gross \$29.5 million (an increase of 20 per cent over 1968) for their catch of 40.2 million pounds.

The landings of scallops amounted to 13.8 million pounds valued at \$12.2 million, a decrease of 16.6 per cent in quantity and 10.1 per cent in value in comparison with the previous year. Nearly 78 per cent of these scallops were landed by vessels over 70 feet.

Newfoundland and Prince Edward Island experienced gains in landings in 1969 in comparison with 1968 (gains of 48 million and 2 million pounds respectively). Landings in Nova Scotia, New Brunswick and Quebec decreased by 122 million, 26 million and 8 million pounds respectively. Improved earnings were recorded by fishermen in each Atlantic province (an increase of \$1.9 million, \$2.0 million, \$0.3 million, \$0.2 million and \$0.6 million in Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island and Quebec respectively).

Landings of fish and shellfish on the Pacific Coast, at 174.5 million pounds valued at \$47.5 million, were 35 per cent in quantity and 17 per cent in value below the 1968 landings.

The 1969 salmon catch on the Pacific Coast at 79.0 million pounds valued at \$27.8 million, was the lowest since 1960 and amounted to only 45 per cent of the 1968 record catch. Prices to fishermen increased from an average of 25 cents per pound in 1968 to 35 cents per pound and helped maintain the revenue to the salmon fishermen at 61 per cent of the record high in 1968. Sockeye comprised 30 per cent of the catch with the other four species — coho, chum, pink and chinook — representing 20 per cent, 17 per cent, 17 per cent and 16 per cent respectively. Some 49 per cent of the salmon catch was taken by gillnetters, 32 per cent by trollers and 19 per cent by seiners.

Halibut landings regained their former levels in 1969 with a catch of 33.8 million pounds establishing a new record for value of landings of \$14.4 million. Average prices to fishermen, which had dropped from 35 cents a pound in 1966 to 25 cents a pound in 1967 and 1968, advanced to 38 cents a pound in 1969.

The continued ban on the Pacific Coast on herring fishing for reduction purposes, as a conservation measure, meant a catch of 4.4 million pounds valued at \$221,000. The average annual catch during the years 1960-68 amounted to 337.1 million pounds.

British Columbia landings of other fish and shellfish continued to decline for the third consecutive year with a catch of 57.3 million pounds valued at \$4.1 million.

In the freshwater fisheries, exports for 1969 are estimated at 50.9 million pounds (product weight) — a decrease of 5 per cent from the previous year. The proportion of the total output exported round or dressed remained unchanged from 1968 at 60 per cent, while the other 40 per cent was exported as fillets or blocks. The average export price of round or dressed fish advanced from 35 to 39 cents a pound while that of fillets or blocks decreased from 48 to 45 cents a pound.

Marketing

The marketed value of fishery products for 1969 is not expected to approach the \$385.6 million record established in 1968. Preliminary figures suggest a market value of \$375 million. Exports accounted for \$279 million, a \$21 million increase over the previous year. The United States market absorbed some 67 per cent of the total, Europe 22 per cent and the Caribbean market 7 per cent.

Reduced groundfish landings on the Atlantic Coast meant a smaller output of frozen fillets and blocks of groundfish (down by about 2 per cent from 1968). There were sharp reductions in the production of cod blocks, as well as in the production of fillets and blocks of hake, cusk and pollock. Production of flatfish fillets and blocks increased by about 21 per cent. Governmental intervention in marketing assisted in disposing of the 1968 carry-over and of the 1969 production of 256 million pounds of frozen groundfish. Export prices of some frozen cod products remained relatively low until the latter part of 1969, but most other groundfish products experienced improved export prices during 1969.

On the Atlantic Coast the quantity of groundfish salted increased by about 2 per cent, compared with 1968. Close to 260 million pounds of groundfish were put to salt. Nearly two-thirds of the salt groundfish exported during 1969 (72.5 million pounds) was marketed in the United States, Jamaica and Puerto Rico.

About 80 per cent of the 1969 lobster catch was exported. Exports amounted to 32.5 million pounds (landed weight), valued at \$29.7 million. As in previous years, about 54 per cent was exported in the shell, 40 per cent as meat and 6 per cent canned. For the second consecutive year a decreased proportion of Canada's total lobster exports went to the United States market — about 90 per cent — with the European market increasing its share from 7 to 8 per cent.

The average export price of scallops (over 95 per cent of the annual catch is marketed in the United States) declined somewhat from the previous high level. Exports of scallops for 1969 amounted to 13.1 million pounds valued at \$14.2 million. Figures for the previous year were 13.3 million pounds at \$15.2 million.

An increased quantity of fish meal was produced on the Atlantic Coast in 1969 — 92,000 tons of herring meal and 46,600 tons of groundfish meal, compared to 86,500 tons of herring meal and 47,900 tons of groundfish meal in 1968. About 77 per cent of the meal exports for 1969 (80,100 tons, valued at \$12.2 million) was marketed in the United States.

The canned salmon pack for British Columbia amounted to 621,856 cases in comparison with an average annual output of 1,440,235 cases during the period 1964-68.

The reduced pack (each species, except sockeye, had the lowest pack since 1964) was accompanied by increased export prices for sockeye and pink salmon, while prices for chum and coho salmon remained close to their 1968 levels.

Industrial Development Branch

The Industrial Development Branch is continuing to have an important influence throughout Canada's commercial fisheries by designing and demonstrating improved vessels, gear and equipment, together with exploration for new stocks of fish and shellfish.

The branch consists of a permanent staff augmented by contracted specialists, recruited in Canada and other leading fishing nations. The permanent staff includes naval architects, technologists, engineers and other professionals, whose services are freely available to fishermen and the fishing industry generally.

Exploratory Fishing

The species on which particular emphasis was placed in exploratory fishing operations during the year were Pacific herring, Atlantic queen crab and Atlantic pink shrimp. Ecological studies on queen crab were carried out by the Fisheries Research Board of Canada at St. John's, Nfld., and St. Andrews, N.B., financed by the Industrial Development Branch.

An investigation into the possibility of expanding the fishery for the American eel was continued by Professor V.D. Vladykov, of the University of Ottawa, on behalf of the branch.

In cooperation with the provinces, under shared cost arrangements, explorations for the following species were carried out: Newfoundland — sand lance, capelin, herring and shellfish; Nova Scotia — red crab, swordfish, basking shark, cod and sand lance; Prince Edward Island — marine plants, bar clams, and other shellfish; New Brunswick — queen crab and shrimp; Quebec — marine plants, molluscs and queen crab; Ontario — alewife and smelt.

The Pacific herring project was the second year of a three-year program to explore the offshore waters of British Columbia for new commercial stocks. This project is being undertaken in cooperation with the Fisheries Research Board of Canada, Nanaimo, B.C.

Exploration for Atlantic queen crab continued in the Gulf of St. Lawrence. The presence of additional commercial stocks was confirmed in areas northeast of Bradelle Bank and west of Anticosti Island.

A preliminary survey for pink shrimp was carried out in conjunction with tests of a separator shrimp trawl. Although this project lasted only two months, promising indications of shrimp were found in the Mingan Channel north of Anticosti Island in the Gulf of St. Lawrence. The experiment showed that the inclusion of separator panels in shrimp trawls will alleviate the tedious labour of picking out shrimp which are

ordinarily mixed with a quantity of unwanted fish.

An extensive exploration for shrimp in the Gulf of St. Lawrence region will be carried out in 1970.

Fishing Operations

The development of a midwater trawl fishery for herring, sand lance, capelin and high swimming groundfish was continued. More efficient fishing gear was designed and introduced and large side trawlers converted for stern trawling to accommodate midwater trawl gear. The branch provided technical advice on design, supervision during construction, fitting out and initial fishing trials of Canada's first two stern ramp trawlers designed specifically for midwater trawling and also for the first two combination purse seiner-midwater trawlers.

Work was continued on modifications to Atlantic Western trawls, designed and introduced by the branch. These nets are now widely used by Canadian groundfish trawlers in both the offshore and inshore fisheries.

Prototype quick release clamps for the attachment of the footropes and floats of trawls were successfully tested in commercial operations. Improved versions of these clamps remain to be tested.

The successful introduction in 1969 of a completely new two-boat fishing technique for groundfish, known as "Canadian Pair Seining", resulted in plans being made to convert approximately 50 Prince Edward Island lobster boats to enter this fishery in 1970. In addition plans call for other similar boats to be converted in all the Atlantic provinces.

Experiments with new types of inshore scallop rakes were continued; preliminary trials with prototype equipment indicate that on certain grounds, catching efficiency can be increased considerably with a reduction in towing requirements.

Progress was made in the development of power hand tools for the construction and repair of otter trawls and other kinds of nets. It is planned to carry out tests on commercial fishing gear in 1970.

New designs of traps for queen crab were developed and tested. The salient features of these traps were adopted by the industry, resulting in increased catches.

The branch continued to provide a consultative service to the fishing industry and associated industries (shipbuilders, manufacturers, naval architects, engineers) in fishing gear design, general deck arrangements, shipboard gear and fish handling systems.

Vessels and Engineering

Further development of mechanical washing and refrigeration facilities onboard offshore scallop fishing vessels was accomplished during the year, and suitable equipment is now available to meet chilling requirements for the production of a high grade product.

Study and evaluation were continued of the performance characteristics of a fish unloading device, based on the air-lift principle, for the unloading of vessels under commercial conditions.

Evaluation of new and improved fish hold refrigeration facilities and techniques was also continued. Results from a composite fish hold lining extended evaporator surface showed promise. It is considered that this type of refrigeration hold lining could be used in conjunction with a prechilling refrigerated sea water system for groundfish applications.

Investigations and analyses of development proposals and fish processing operations were carried out to determine their feasibility.

A project was initiated to carry out and evaluate various radar sets used on fishing vessels.

A contract was also let to develop a new type of commercial sonar. Employing a high speed electronic scanner, the new set has a range requirement of 6,000 feet on a five-ton school of herring and presents a 360-degree picture every two seconds. The sonar is to be installed on a fishing vessel in 1970.

Studies in the use of ferro-cement for fishing vessel construction were continued, and a report on progress is being issued.

A start was made on a computerized system of "functional analysis" whereby the operations (against time) of groundfish stern trawlers on the Atlantic can be represented by a computer model. This system enables alternative operating strategies to be evaluated for their financial effectiveness and further refinements will be incorporated in the system.

Studies were continued in such fields as advanced fishing vessel design and stability. Evaluation of conversion proposals was undertaken.

Marine Plants

Assistance in the development of a Canadian seaweed industry on both the Atlantic and Pacific coasts is provided by the branch's Marine Plants Experimental Station, established in 1966 at Miminétagash, P.E.I.

On the Atlantic Coast Irish moss (*Chondrus crispus*) is of

the greatest commercial importance. It is the source of carrageenin, an extract widely used in the food and other industries. A number of commercial enterprises have been established in the Maritimes since the experimental station demonstrated that mechanical means of drying and upgrading the raw product were feasible.

The department's marine plants program has also been helpful in the developmental phase of a seaweeds industry in British Columbia, where considerable interest is being shown in the utilization of the giant kelps, *Nereocystis* and *Macrocystis*.

Fishing Vessel Insurance Plan

During the year the Industrial Development Branch assumed the administration of the Fishing Vessel Insurance Plan, which offers fishermen insurance on their vessels against total or partial loss. Formerly known as the Fishermen's Indemnity Plan, it provided coverage on vessels with an appraised value of from \$250 to \$25,000. Premiums were 1 ½ per cent on vessels valued at \$15,000 and under with a 2 per cent rate on all vessels valued at more than \$15,000.

Following representations to the government urging the inclusion of large vessels in the plan, the Minister of Fisheries and Forestry announced certain changes to be effective in April, 1970. The most important of these are: vessels with an appraised value of not less than \$500 and in the case of steel vessels, those that are not more than 100 feet long, can be insured; for vessels valued at more than \$25,000, the total loss indemnity can be 95 per cent of the insured value, and for partial loss the deductible amount can be 5 per cent of the insured value, at a 4 per cent premium rate; a fisherman whose vessel has an appraised value of between \$5,000 and \$25,000 can pay the 4 per cent premium rate and be entitled to the same indemnity as owners of vessels valued at more than \$25,000; all vessels insured at the 4 per cent rate will have third party liability coverage. The provinces of Manitoba and Saskatchewan were added to the schedule of coverage under the plan.

The total appraised value of the 7,842 vessels insured at the close of the fiscal year amounted to \$41,164,211. This represented an increase of \$3 million in the appraised value over the previous year. Thirty-nine fishermen in the Great Slave Lake area and three Eskimos in the Arctic insured their fishing vessels during the year.

Two hundred and twenty-seven vessel claims were settled, with indemnity payments totalling \$511,439.14.

The indemnity regulations governing fixed fishing gear and shore installations were discontinued in October 1968. How-

ever, all policies still in force on that date were honoured. This resulted in the payment of 12 claims with indemnity payments totalling \$11,341.82. No further claims for such indemnity under this plan will be made as all gear and shore installation policies have now expired.

Fishing Vessel Insurance Plan

Net Premiums Received and Indemnities Paid,
Fiscal Year 1969-70

	Net Premiums	Indemnity
	\$	\$
Newfoundland	87,464.94	72,252.11
Nova Scotia	121,279.96	43,400.25
Prince Edward Island . .	8,030.30	7,595.00
New Brunswick	42,486.84	49,604.92
Quebec	34,241.42	37,663.00
Ontario	3,539.23	2,520.00
British Columbia	368,253.29	298,403.86
Great Slave Lake	1,352.00	—
Arctic	722.60	—
Total	667,370.58	511,439.14

Surplus, March 31, 1970 — \$155,931.44

Vessel Construction Assistance

In 1969-70, the department assisted in the construction of 44 vessels for a total subsidy outlay of \$565,000. This assistance was restricted to wooden fishing vessels in the Atlantic Region. However, towards the end of the fiscal year, the government decided to introduce a Canada-wide program to take effect July 1970.

Under the new regulations, 35 per cent of the approved cost will be paid by the government for eligible fishing vessels of all types, built of any suitable materials, of 45 feet and over, anywhere in Canada.

The estimated cost of the programs of assistance will be about \$5 million for 1970.

The programs are yet a further step to encourage the modernization and improvement of Canada's fishing fleets and to assure their ability to compete with other fishing nations. Their implementation is related to the availability of the various fishery resources by species and area, and takes into account the market demand for fishery products.

Responsibility for administering assistance for the construction of fishing vessels from 45 to 75 feet in length will remain exclusively with the Department of Fisheries and Forestry. The assistance in this range will be paid to the vessel owners.

Assistance for the construction of fishing vessels over 75 feet in length will continue to be provided by the Department of Industry, Trade and Commerce. However, payments will be granted only after prior approval of each application by the Department of Fisheries and Forestry.

Fisheries Development Conferences

During the year the branch undertook secretariat duties and actively participated in a conference on the Canadian Atlantic crab fishery and another on automation and mechanization in the fishing industry. As was the case in previous conferences, sponsorship was shared by the department and the fishery authorities of the Atlantic Coast provinces through the Federal-Provincial Atlantic Fisheries Committee.

Resettlement Program

Federal participation in the Newfoundland Fisheries Household Resettlement Program continued to be administered by the Industrial Development Branch.

Operational since April 1965, the total cost to March 31, 1970, was \$7.44 million, of which the federal share was 67 per cent, or \$5.01 million, and the provincial share 33 per cent, or \$2.43 million.

During the five years 3,240 families were moved, involving 15,938 people. Five hundred and eleven grants were made for community serviced lots.

The average cost of resettlement, per household, was \$2,289. Of this, the federal share was \$1,542 and the provincial share, \$747.

In the fiscal year 1969-70 some 30 communities were evacuated involving 871 families, or 4,219 people, at a cost of \$1.4 million to the federal government and \$0.6 million to the province.

A special "task force" continued to provide basic socio-economic information and analysis on the scope, scale and nature of the program. A data bank system was implemented to further facilitate the program's analysis and evaluation.

Arrangements were made to transfer the federal responsibility for the program from the Department of Fisheries and Forestry to the Department of Regional Economic Expansion, to take effect in April 1970.

Resource Development Branch

The Resource Development Branch (formerly Fish Culture Development) was first established in the Maritime Provinces where it has operated a number of salmon and trout hatcheries for many decades. In 1948 the branch was reconstituted in the Pacific Region when an active bio-engineering group was established to deal with a variety of salmon stream improvement projects. In the early 1950's, a unit was established in St. John's, Newfoundland, and in 1969 the branch commenced operations in the Central Region to deal with fisheries management and pollution problems in the Northwest Territories. The Sea Lamprey Control Unit, which operates out of a laboratory at Sault Ste. Marie, joined the Resource Development Branch in 1966. The latter group has specific responsibilities to control lamprey populations in the Great Lakes.

The branch still operates a number of hatcheries in the Maritime Provinces. However, in this and other coastal regions, staffs of well qualified engineers, biologists and support staff have been developed to deal with a variety of problems in the areas of resource management and expansion, environmental protection, and water pollution control. In recent years the branch has shifted the emphasis of its work from management and expansion to environmental protection including pollution control. The branch's regional programs are described briefly in the following paragraphs.

Newfoundland Region

A program for the development of the untapped salmon production potential of the Exploits River is now underway. Studies have indicated that the two-thirds of the system now inaccessible to salmon has a tremendous production potential.

Construction of smolt-adult assessment facilities on the Sand Hill River, Labrador, started in 1968, was completed during the year. The Sand Hill River project is designed to assess the possible effects of the Greenland and high seas salmon fishery on northern Canadian stocks.

Activities of the Pollution Control Unit were directed mainly at assessment of industrial effluents, mining wastes, and insecticide spray projects. Additions to staff made possible an expansion of work areas receiving attention.

The Electric Reduction Company of Canada which constructed a phosphorus producing plant at Long Harbour, Placentia Bay, in 1968, caused a disastrous pollution problem in early 1969. Spills of the product, elemental phosphorus, and loss of this material in the plant effluent released to the Bay, caused major fish kills. As a result of evidence gathered

by the department and the Fisheries Research Board, the plant was obliged to close down, clean up the spill area by dredging and incorporate elaborate effluent treatment facilities to eliminate the loss of phosphorus. Expertise was drawn from various segments of the department and from other agencies during this emergency operation. A monitoring program followed the clean-up to determine the effectiveness of the remedial action.

Installation of a thermal generating station by the Newfoundland and Labrador Power Commission is well underway. Fish protection requirements associated with the plant's freshwater supply and the warm sea water discharge are being investigated.

The single industrial effluent problem of greatest concern in Newfoundland is that associated with the pulp and paper industry. Studies of mill effluent outfall areas in freshwater and in estuarine locations are being undertaken.

A degree of success in the control of mine waste disposal in Newfoundland and Labrador has prevented development of some severe pollution problems.

A forest spray program for the control of the hemlock looper in Newfoundland in 1969 again used the insecticide sumithion. Monitoring studies indicated that spray rates used had no effect on caged fish in the spray area.

The Lake Investigation Unit commenced a program to evaluate problems associated with angling harvest. Waters along the Trans-Canada Highway west of St. John's are presently under study.

Maritimes Region

The most serious problem in 1969 concerned the preservation of the Atlantic salmon resource on the Saint John River. Water pollution, complicated by hydroelectric development, threatens to exterminate the salmon and other fish runs to the river. However water pollution control, artificial propagation, fish passage manipulation and the scientific allocation of the salmon resource, were combined into a total fishery management plan aimed at preserving this valuable resource. Special commercial and sport fishery regulations were adopted to protect the reduced run from over-exploitation and so provide the necessary number of spawners to continue the run. Over two and one-half million salmon eggs were taken for incubation and rearing at departmental fish culture establishments.

Three million acres of New Brunswick forest land were sprayed with sumithion in 1969 for the control of spruce budworm. Resource Development studies showed no

reduction in populations of aquatic insects or juvenile salmon in the spray area attributable to insecticide spraying.

Pollution from base metal mines in northeastern New Brunswick has not diminished and substantial numbers of Atlantic salmon and trout, particularly in the Miramichi and Nepisiquit rivers, are still jeopardized by the escape of wastes from these operations.

Artificial propagation of salmon has, in recent years, emphasized the production of increased numbers of smolts. The branch has commenced an eight year evaluation program involving the tagging of large numbers of both hatchery and wild smolts. Early results have confirmed that the ocean migration routes of different stocks of salmon vary considerably. It is also evident that distant and high seas fisheries are exploiting some stocks at a much higher rate than others.

The nucleus of a biological and engineering team of fish passage specialists was formed in 1969 and work was begun on evaluating certain existing installations in the region.

Oyster development projects involving the increase of bottom habitat suitable for spat settlement have produced encouraging results. Plans have been made to study off-bottom rearing techniques, since the relatively high cost of seed from an oyster hatchery makes it important to increase the yield from seed to market oysters.

Pacific Region

The establishment of new pulp mills and the expansion of existing ones posed problems relating to the safe disposal of plant wastes, while mining activity continued at an increased pace to present additional problems regarding waste disposal. A good portion of the branch's time was also consumed by problems associated with British Columbia's rapidly expanding forest industry. These problems mainly concerned removal of gravel from riverbeds and the deforestation of watersheds.

A highlight of the salmon development program in 1969 was the continuing Babine project. Major construction included the completion of the first phase of the second spawning channel at Fulton River and the adjoining water supply pipeline from Fulton Lake. The production from the 1968 brood year resulted in a record 70 million fry output from the two development projects at Pinkut Creek and Fulton River which exceeded the highest recorded natural production year (1964) by 20 per cent.

At Big Qualicum River, the chum salmon fry production reached an unprecedented 53.5 million from the river and the two spawning channels. Production of all other species

was favourable. The fall escapement of chum salmon to the river amounted to 100,500, the second largest on record, and was exceeded only by the 1968 total of 140,000 spawners.

Surveys of salmon producing streams were continued with a view to establishing a long range salmon development program in the region. Emphasis in the program is being placed on streams in the lower Fraser Valley, on Vancouver Island and in the central coastal region.

The branch continued a number of major salmon investigations during 1969, ranging geographically from the Nass River in the north to Juan de Fuca Strait in the south. A greater emphasis is now being placed on chinook and coho studies, particularly in the Strait of Georgia and Juan de Fuca Strait areas where the major recreational fisheries are located.

Central Region

In 1969 the Resource Development Branch was established in the Central Region to provide, in conjunction with the Fisheries Research Board, the necessary scientific advice to efficiently manage the fishery resource of the Northwest Territories. The senior biologist assigned to the region travelled through the Territories and held discussions with Fisheries Research Board and Protection Branch personnel to gain an insight into the fisheries problems in the area.

Lamprey Control – Great Lakes

The Sea Lamprey Control Unit continued in 1969 with stream surveys to locate stocks of lamprey larvae in tributaries to lakes Superior and Huron. Chemical control measures to eradicate larval lamprey in streams were undertaken in nine Lake Superior streams and tributary systems, and six Lake Huron streams. The adult lamprey assessment program was continued in nine Lake Huron streams where electrical barriers are operated by the Lamprey Control Unit. There was an over-all decrease in the number of lamprey collected at the barriers in 1969 indicating a decline in the Lake Huron population. A number of related projects to collect additional biological data on sea lamprey stocks in the lakes were continued.

Conservation and Protection Branch

The Conservation and Protection Branch is charged with the maintenance of a wise utilization management program for fish stocks in Canada. To discharge the duties involved requires large numbers of competent personnel located throughout a tremendous inland area and an extensive coastline. Their primary functions are to collect and provide information on the various types of fisheries; to ensure fish environmental protection and safe migrations; to prevent encroachment by foreign fishing fleets and to carry out law enforcement. The great variety of species involved and their varied behaviour patterns, make the problem that much more complex.

The role of the Conservation and Protection staff in regulating and managing the fishery resources also necessitates continual surveillance and assessment of resident stocks in order that upper limits and quotas may be updated. In this regard the adherence to restricted entry and/or catch policies now in force are gradually revealing the intended benefits in that the numbers of salmon, lobster, herring, whales, seals and some pelagic fishes taken are adequately limited to ensure sustainable yields and provide for greater individual monetary returns.

Maritimes Region

Nova Scotia experienced an extreme low water period from June through October and fall runs of salmon were unable to ascend most rivers until late fall. Very little sea ice formed during the winter months and this permitted the spring lobster seasons to open on schedule.

Angling for salmon was fair, with totals of 43,009 for New Brunswick and 3,174 for Nova Scotia. Speckled trout anglers experienced a good season. Saltwater angling was also very good with the exception of tuna fishing which was a failure in Nova Scotia and fair in Prince Edward Island, where interest in this fishery is increasing in the North Lake area.

During the year, 467 prosecutions were effected compared to 658 in 1968. Fishery officers and patrol boats carried out 1,125 seizures for illegal fishing. Acting under the authority of the International Commission for Northwest Atlantic Fisheries, 146 net surveys were completed and any infractions dealt with accordingly.

Thirty departmental patrol vessels carried out extensive patrols, recording 134,875 miles to ensure that illegal fishing activity was curtailed. In addition, 59 search and rescue missions were made.

Some 30,638 licences which produced \$101,089 in revenue, were issued for various types of fisheries.

Catch quotas for fin whales and harp seals of 150 and 50,000 respectively were achieved. Both operations were given considerable attention by the Conservation and Protection staff in order to ensure strict adherence to the regulations.

The lobster Fishery Licensing Policy, which was originally instituted in District 8, was extended to include all districts in the Maritimes Region.

Appropriate actions were taken to overcome problems and conflicts between offshore and inshore fishing operations, particularly as they applied to the taking of herring by large vessels in inshore waters.

Newfoundland Region

Constant patrols along a lengthy coastline to ensure that inshore fishing gear was not damaged by trawlers and draggers placed a heavy burden on the captains and crews of patrol vessels. However, some losses were sustained by inshore fishermen and investigations conducted by departmental officials resulted in a number of actions for reimbursement.

A fleet of 14 patrol vessels was operated by the branch during 1969, logging approximately 85,000 miles over a nine-month period. Departmental vessels took part in two regular search and rescue missions.

The vessels also responded to several calls from fishing vessels in distress. In all instances the disabled vessels were towed to port.

Canadian trawlers and draggers were checked regularly when fishing in areas designated by the International Commission for Northwest Atlantic Fisheries to ensure that proper mesh sizes were being used for regulated species. In total, approximately 425 measurements were taken.

In the very vulnerable fisheries for salmon and lobster, constant attention was given by field staff to prevent and detect illegal fishing and to improve environmental conditions of migrating stocks.

Non-observance of regulations governing the commercial and sports fisheries resulted in about 180 prosecutions, an increase of 20 prosecutions over 1968. Fines imposed by the courts ranged from \$5 to \$125.

Eighty-five vessels, one helicopter, and 4,845 seal hunters were licensed to take part in the seal hunt. The take in the Gulf was on an established quota basis. Fishery officers were stationed on board large sealing vessels and at all areas of hunt. Regulations governing killing methods, opening and closing dates and encroachment by foreign

vessels, were continually monitored by aerial patrols.

Under the new system of evaluating the lobster fishery 4,873 lobster boats were registered, 7,445 lobster fishermen were licensed, and four special Lobster Pound Licences were issued. Lobster landings in 1969 amounted to 3,788,000 pounds, a decrease of approximately 221,000 pounds from the previous year.

The two whale factories at Williamsport, White Bay, and Dildo, Trinity Bay, operated again in 1969. Three whale catcher vessels were licensed and 37 whale hunting licences issued. Continuous checks on areas of kill, sex and size were made by fishery officers. The total take was 376 fin, 50 minke, 5 sperm, 5 humpback, and 3 sei whales.

Bounties paid out for the destruction of predatory bay seals amounted to \$2,310 during 1969, bringing the over-all total since this program began to \$109,000.

Central Region

A small but effective field staff of permanent and casual employees share the responsibility of enforcement of fisheries regulations, gathering of biological and statistical data, educational work with fishermen and shore workers, dissemination of information and acting in an advisory capacity to outside agencies concerned with the orderly development of the commercial, sports and domestic fisheries in the Northwest Territories. These officers are also called upon to observe and assess results of seismic operations in so far as damage to fish populations is concerned.

The Central Region of the branch operates two patrol vessels supported by two smaller water craft, chartered airplanes and, during winter months, three snowmobiles for patrolling the fisheries in this vast territory.

In all, a total of 18 lakes were fished during 1969. The combined catch, all species, was 4,935,000 pounds of which 4,000,000 pounds were taken from Great Slave Lake. The total amount of fish caught in the Northwest Territories the previous year was 4,170,000 pounds.

The value of the 1969 catch to the fishermen was \$1,100,000 compared to \$733,000 in 1968. Market values are estimated at more than \$2,250,000.

There were 225 resident commercial licences, 86 non-resident commercial licences, 131 Indian and Eskimo permits, 1,133 resident angling licences and 4,382 non-resident angling licences issued in 1969. The revenue derived from the sale of these licences was \$11,882.

Participation in sports fishing continues to grow at a rapid rate. Angling licences sold in 1969 totalled 5,515 an increase of 30 per cent from 1968. Resident angling licences were up to 1,133, compared to 840 in 1968, and the number of non-resident licences increased from 3,403 last year to 4,382 for the current year.

Arctic char and lake trout are still the two species most prized by the anglers, but arctic grayling is attracting increased attention.

Pacific Region

Management of the salmon fisheries, both commercial and sport, is the major concern of the branch in the Pacific Region. The British Columbia economy, which continues to expand rapidly, results in many and varied problems related to the harmful effects of industrial and other water-use projects upon salmon environments.

The total of all fish landings in 1969 was 174.5 million pounds, for a landed value to fishermen of \$47.5 million, compared with the 1968 figures of 267.2 million pounds and \$57.3 million respectively. While the poundage showed a sharp decline as the result of the generally poor salmon catches and a practically negligible herring fishery, value held up well on account of halibut and salmon prices. One bright spot in the salmon fishing was the catch of Fraser River sockeye — 957,000 pieces, the highest in ten years. Chum landings were only a third of the record 1968 season, but were approximately double the 1965 brood year. Most disappointing was the pink return with a total hardly more than one quarter of the strong brood year. Rivers Inlet sockeye were weak, as was expected, and landings were comparable to those of the brood years. Coho landings were down sharply with the exception of the west coast of Vancouver Island where they held not far below the ten-year average. The catch of chinooks, 1.1 million pieces, exceeded the ten-year average by a small margin and was comparable to the previous three years.

The herring fishery, closed to all operations except the bait and food fisheries, returned 4.4 million pounds valued at \$221,000. An intensive program was continued to increase spawning stocks and to establish guidelines essential to the management of any future major herring fishery. Halibut landings of 33.8 million pounds, the highest in six years, combined with an average price of 42.6¢ per pound, returned a record \$14.4 million.

Salmon sport fishermen caught 281,000 pieces in 1969, a decline of some 40,000 from 1968. The effort, represented by 305,500 boat-days, was 20,000 greater than last season

Inspection Branch

and showed the continuing annual upward trend. The non-tidal sport fisheries continued to attract large numbers of the public throughout British Columbia and the Yukon Territory. Participation and interest in the sport fisheries, both tidal and freshwater, is increasing as access roads are developed, not only to freshwater fishing areas, but also to many points along the coast from which trailered and car-top boats can be launched for saltwater fishing. This, of course, means expanding responsibility for branch officers, not only in collecting catch and fishing effort data, enforcing regulations and recommending management action, but also in protection of the salmon environment newly opened to the public.

Approximately the same number of salmon, 362,000, as in 1968 were taken by native Indians for home consumption. By far the largest numbers were taken from the sockeye runs to the Fraser River system, and a very significant part of the branch officers' responsibilities in the areas concerned was administration and management of this fishery.

During 1969 field and laboratory personnel of the Inspection Branch continued to maintain a close check on the quality of fish and fishery products to ensure that they met with the standards established under Canadian fish inspection legislation.

Thirty-four countries exported a total of approximately 19,960,000 pounds of canned and 34,250,000 pounds of fresh or frozen fishery products to Canada, involving approximately 12,000 individual inspections and samplings.

In addition, the field staff of the Inspection Branch carried out annual surveys of fresh and frozen fish plants, canneries and salted fish establishments throughout Canada, resulting in the certification of 159 fresh and frozen fish processing plants, 95 canneries and 118 salted fish establishments. Only registered establishments were permitted to process fish for sale outside the province of origin and their plant operation, processing methods and final products were constantly monitored and inspected to ensure sanitary operations and satisfactory end-products.

Laboratory and engineering personnel continued development work on existing projects and initiated new programs of a varied nature intended to solve problems in the handling, processing, preserving, storing and distributing of fish and fishery products in order to consistently achieve and maintain good quality. Plans and specifications for new plants, modifications to existing ones and equipment designs were assessed and discussed with industry. In addition, the Inspection Branch provided industry with information and plans pertaining to the construction of various processing plants and equipment. A number of projects were undertaken by personnel of this branch. Some of these were:

- Superchilling of fresh fillets using CO₂ snow;
- Abatement of pollution due to herring pump water;
- Development of portable sampling units for analyses of ice, water and end-of-line samples in the field;
- Development of fish washers using spray nozzles;
- Studies of water filtration units;
- Construction and evaluation of a shrimp pasteurizer;
- Effect of citric acid on quality of canned crab meat;
- Post-mortem spoilage of crab meat;
- Development of a Code of Practice for processing of Atlantic Snow Crab and of quality standards for locally fished shrimps;
- Shelflife of smoked eels and heat processed crab meat;
- Hydrogen peroxide treatment of pickled herring fillets;
- Holding of Red Crab on ice and in moist, cold air;
- Pasteurization of Snow Crab meat;

Economics Branch

- Development of caviar from lumpfish;
- Development of a monitoring program for pesticides and botulism;
- Determination of heavy metal content in fish and fishery products;
- Effect of sodium bisulphite on colour retention in canned tuna;
- Development of fish unloading equipment.

During July, the Inspection Branch, on behalf of the Government of Canada, hosted at Halifax a most successful Technical Conference on Fish Inspection and Quality Control, sponsored by the Food and Agriculture Organization of the United Nations. Over 200 delegates from 45 countries participated in the conference, at which 106 papers were presented on various aspects of fish inspection procedures and techniques.

Following the conference, twenty-two senior fisheries administrators from developing countries travelled across Canada and, over a period of two weeks, toured fish processing establishments, fish inspection laboratories and stations of the Fisheries Research Board of Canada. During the tour, guidance and instructional talks were provided by personnel of the Inspection Branch.

In November, tests on fish taken from the Saskatchewan River revealed abnormally high mercury levels. As a result, all fish caught by commercial fishermen in the Saskatchewan River system was immediately placed under detention and, following further exhaustive tests, over one million pounds of fish were eventually incinerated. In cooperation with the Freshwater Institute at Winnipeg, an investigation was launched to determine the cause of the problem and to ascertain the extent of the pollution of the waterways.

In late September members of the Inspection Branch, accompanied by advisers from the Canadian fishing industry, attended the Fourth Session of the Codex Committee on Fish and Fishery Products at Bergen, Norway. This committee meets under the auspices of the Codex Alimentarius Commission of the United Nations Food and Agriculture Organization to develop international standards in the fish processing industry.

Economic research and the provision of economic intelligence and advisory services continued to be the main concerns of the Economics Branch during the year.

In the economic-intelligence field are included the collection, compilation and dissemination of fisheries statistics and related data and information. In these activities the branch collaborates with the Department of Industry, Trade and Commerce, the Dominion Bureau of Statistics, and international organizations such as the Food and Agriculture Organization of the United Nations, the International Commission for the Northwest Atlantic Fisheries, and the Organization for Economic Co-operation and Development. In addition special reports are prepared for the departmental administration, other departments and agencies, the industry and the general public. An "Annual Statistical Review of Canadian Fisheries", providing extensive and detailed time series on the fishing industry and fish trade for the period 1953-1968, was published for the first time and plans were made to increase the scope of future issues of this bulletin.

The regional offices of the branch carried out a number of projects in this field during the year. Surveys relating to the need for marine structures, including wharves, breakwaters and haul-outs, were conducted in collaboration with the Department of Public Works. The branch office in the Maritimes Region collected data on landings by individual craft in the lobster fishery, while data on monthly and annual landings collected by the branch in the Newfoundland Region were compiled this year by the Central Data Processing Bureau in Ottawa. Regional economists also participated in a fishery-sector background study in Nova Scotia under the direction of the Program Development Agency of that province.

Staff of the branch in the Pacific Region provided background data and certain basic research associated with the plan, instituted the preceding year, to control entry in the salmon fishery. The chief of the branch was appointed a member of a special appeals committee established in connection with this plan. A study of locational factors affecting the fishing industry in the greater Vancouver area, including those relating to fleet accommodation, fish processing and distribution was also completed in cooperation with the National Harbour Board.

Some progress was made in restructuring the branch at headquarters to accommodate the changing requirements of the department resulting from the increased demands on Canada's fishery resources for commercial exploitation and from the growing economic importance of these resources for recreational use. In addition to improving the

capabilities of the branch in the fields of research and intelligence, a policy and planning cadre is being established.

Work on outdoor recreation has become a substantial part of the activity of the branch. Steps were taken during the year to obtain sports-fishing statistics on a national basis and preliminary reports were compiled on participation in recreational fishing based on information provided by all licensing agencies in Canada. Plans were developed for a sports fisheries statistics workshop on concepts and methods, as a prelude to a national survey of sports fishing in Canada, and consultations were held with a number of North American and European economists on methodology for measuring the contribution of recreational fishing to the economy. An officer of the branch also participated in the interdepartmental committee set up to formulate federal input for a forthcoming conference planned by the Canadian Council of Resource Ministers on natural resource use and outdoor recreation.

The Economics Branch continued to act in an advisory and liaison capacity with several other government departments and organizations. An officer of the branch represented the department on the Treasury Board Advisory Committee on Marine Works and provided a link between the department and the Canadian International Development Agency. Advice was provided for the Fisheries Prices Support Board with reference to price-stabilization and other programs, and an officer of the branch was responsible for providing the department's views respecting fisheries aspects of regional development programs. Most of this work was related to the formulation and implementation of plans under the Fund for Regional Economic Development Act and the Regional Development Incentives Act, both of which are administered by the Department of Regional Economic Expansion. An officer of the branch served on the *ad hoc* interdepartmental committee (which was chaired by the Director of the branch) formed to design legislation to create a crown corporation for the saltfish trade and much of the groundwork for this purpose was carried out by the branch. Members of the branch contributed in a supervisory and review capacity to the Water Resources study of the Atlantic Development Board until its completion late in the year and a paper prepared by the branch on "Economic Development and Future of Fisheries" was published as part of these studies. Towards the end of the year the branch was assigned the task of developing a plan of social security for fishermen.

Some in-house research projects were initiated and others completed by the branch during the year. A comparative investigation was made of the incomes of Canadian and

United States fishermen, regionally and nationally. Several studies of the British Columbia salmon commercial and recreational fisheries were completed, including a model for the projection of changes in the entry-control program in the salmon fishery and an estimate of expenditures and catch by sports fishermen. Comprehensive studies were made of the impact of programs of assistance for fishing-vessel construction and of recent developments in herring fishery and fish meal industry of the Atlantic Coast. An assessment of the effects of trap limits and entry restrictions in the Atlantic lobster fishery was continued and a preliminary draft of a study of the costs and earnings of a sample of lobstering enterprises was completed.

Reports of studies by the branch which were published during the year included: "Returns to Fishing Enterprises (vessels) in British Columbia 1966, 1967 and 1968"; "A Survey of the Labour Force in the Offshore Fishing Fleet, Atlantic Coast" (preliminary); and "Costs and Earnings of Selected Fishing Enterprises, Atlantic Provinces, 1966".

Several research projects were also sponsored by the Economics Branch through contracts and grants. Econometric studies of the demand for fish products were continued at Dalhousie University under a grant in support of research in fishery economics. Studies undertaken by consultants and completed during the year included: "The Past, Present and Expected Future Demand for Atlantic Groundfish Products"; "Salted Codfish in the Atlantic Provinces: An Assessment (Phase one)"; "Analysis of a Saltfish Development Corporation Model"; and "Methodology in Measuring the Recreational Demand for Saltwater Fishing". A further study, an analysis of factors affecting productivity in groundfish processing in the Maritime Provinces and Quebec (continuing work begun the preceding year in Newfoundland), had not been fully reported on at the end of the year.

International Commissions

Canada cooperates with many other nations in obtaining scientific data and formulating management proposals required to ensure the rational development and conservation of fisheries of common concern through membership in nine international fisheries commissions and one international council. These international organizations are established under the terms of formal Conventions and assume responsibility for the investigation of specific living marine resources in the defined areas to which the terms of the respective conventions apply. Canadian representatives on these international bodies are appointed by Order-in-Council and include officials of the Department of Fisheries and Forestry and members of the fishing industry.

The International Council for the Exploration of the Sea was formed in 1902 to encourage and coordinate studies of the marine environment with particular reference to the living resources of the sea. Although the convention area includes the Atlantic Ocean and adjacent seas, the council is primarily concerned with investigations conducted in the north Atlantic area. The seat of the council is in Copenhagen, Denmark, and the member nations are Belgium, Canada, Denmark, Finland, France, Federal Republic of Germany, Iceland, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, United Kingdom and USSR. Canada became a member of the council in 1967 and participates in cooperative oceanographic and biological investigations and in the annual scientific deliberations.

The Fur Seal Treaty of 1911 between Canada, Japan, USSR, and USA, is the earliest example of an international treaty established to provide for the conservation of a single marine species. The treaty became inoperative during the early 1940's and a new Convention on Conservation of North Pacific Fur Seals came into force in 1957. Under the provisions of the convention, commercial hunting of fur seals at sea is prohibited and the annual harvest is taken on the breeding islands. Canada and Japan do not participate in the annual hunt but each receives a share of the pelts taken by the USSR and the USA. Scientific investigations are conducted to provide the data required to ensure that the fur seal populations are maintained at levels which will provide the greatest harvest year after year, with due regard to their relation to the productivity of other living marine resources of the area.

Canada's membership in the International Pacific Halibut Commission dates back to 1923. It marked the first time Canada signed an international agreement on its own as an independent nation of the British Commonwealth. The terms of the convention between Canada and the United States provide for the development and maintenance of the

maximum sustainable yield of halibut in the north Pacific Ocean and Bering Sea. The commission's headquarters is located in Seattle, Washington, where a scientific staff conducts investigations to provide data on which fishing regulations are based. The halibut catch in 1969 was lower than the average catch in recent years but strong market demand and high unit prices maintained the fishermen's income at favourable levels.

The International Pacific Salmon Fisheries Commission was appointed under a convention between Canada and the United States for the Protection, Preservation and Extension of the Sockeye and Pink Salmon Fisheries in the Fraser River system which came into effect in 1937. The offices of the commission are located in New Westminster, British Columbia. The commission is responsible for conducting studies of sockeye and pink salmon in the convention area, regulating the fisheries and providing for apportioning the catch equally between fishermen of the two nations. The 1969 sockeye run to the Fraser River totalled about 4,280,000 fish of which 3,262,000 were taken in the commercial fisheries. The pink salmon production amounted to 1,807,302 fish.

Canada has been a member of the International Whaling Commission since its inception in 1946. In order to conserve the important stocks of large whales in the world's oceans and provide for the orderly development of whaling activities, the commission recommends scientific studies, determines the current condition of whale stocks and adopts regulations including open seasons, total catch quotas, closed areas and protected species. In 1969 Canada's commercial whaling operations were conducted from the land stations located on the Atlantic Coast. The members of the commission include Argentina, Australia, Canada, Denmark, France, Iceland, Japan, Mexico, Netherlands, Norway, Panama, South Africa, USSR, United Kingdom and USA. New Zealand withdrew from the commission during 1969.

The International Convention for the Northwest Atlantic Fisheries entered into force on July 3, 1950, and provides for the investigation, protection and conservation of the fisheries of the northwest Atlantic Ocean to make possible the maintenance of a maximum sustained catch. Canada, Denmark, France, Federal Republic of Germany, Iceland, Italy, Norway, Poland, Portugal, Romania, Spain, USSR, United Kingdom and USA, are members of the commission, which has its headquarters in Dartmouth, N.S. The major conservation regulations adopted by the commission have been related to minimum mesh sizes for trawl nets but in 1969 additional regulations were proposed for certain

heavily fished stocks including closed seasons and over-all catch limits.

In 1968 Canada joined Costa Rica, Mexico, Panama and the United States as a member of the Inter-American Tropical Tuna Commission which was established in 1950. The commission conducts scientific investigations from its headquarters in La Jolla, California, to provide the data required to maintain the populations of yellowfin and skipjack tuna, as well as other species of fish taken by tuna fishing vessels in the eastern Pacific Ocean, at levels which permit maximum sustained catches year after year. In recent years the main conservation regulation recommended by the commission has been a catch quota for yellowfin tuna. In 1969 this quota amounted to 120,000 short tons.

The International Convention for the High Seas Fisheries of the North Pacific Ocean came into force in 1953 with the exchange of ratifications between Canada, Japan and the USA. The purpose of the convention is to ensure that fisheries of joint interest in the north Pacific Ocean are maintained at the level of maximum sustained productivity. The commission, established under the terms of the convention, maintains offices in Vancouver, B.C., and is responsible for promoting and coordinating scientific studies necessary to ascertain the conservation measures required to reach the objectives of the convention and to recommend such measures to the contracting parties. This international fisheries convention is unique in that it includes the "abstention principle" whereby a member nation agrees to abstain from fishing stocks which are being fully utilized by another member nation, are subject to extensive scientific study and are regulated through legal measures for the purpose of maintaining or increasing the maximum sustained productivity.

The Convention on Great Lakes Fisheries between Canada and the United States has well proved its value during its years of existence since 1955. The commission, with headquarters located in Ann Arbor, Michigan, is responsible for formulating and coordinating research programs designed to determine measures needed to make best use of the fish stocks of common concern, recommending appropriate management measures and implementing a comprehensive program to eradicate or reduce the populations of sea lamprey found in the Great Lakes. Control programs in the upper Great Lakes have reduced the lamprey populations to very low levels and this, coupled with an intensive stocking program, has resulted in a marked improvement in the stocks of certain valuable species which had been decimated by lamprey predation.

The first meeting of the International Commission for the Conservation of Atlantic Tunas was held in 1969 with representatives of the following member nations in attendance — Brazil, Canada, France, Ghana, Japan, Morocco, Portugal, South Africa, Spain and USA. The headquarters of this newly-formed commission has been established in Madrid. The commission will study the populations of tuna and tuna-like fishes in the Atlantic Ocean and its adjacent seas, and make recommendations to the contracting parties concerning measures required to maintain the populations of these fishes at levels which will permit the maximum sustainable catch for food and other purposes.

Fisheries Prices Support Board

Under the Fisheries Prices Support Act, the board is responsible for investigating and, where appropriate, recommending action under the Act to support prices of fishery products where declines have been experienced. The basic principle of the legislation is to protect fishermen against sharp declines in prices and consequent loss of income due to causes beyond the control of the fishermen. The board, subject to approval of the Governor in Council, is empowered to purchase fishery products at prescribed prices or to pay deficiency payments to producers of fishery products equal to the difference between a prescribed price and the average price at which such products were sold.

Since 1966 the Fisheries Prices Support Board has operated yellow perch price stabilization programs. Losses resulted on the 1967 and 1968 programs but the 1969 program was operated without loss to the Government of Canada. Under the 1969 program yellow perch fillets were purchased from processors at 40 cents per pound provided fishermen received ten cents per pound for spring perch used in the production of fillets and a minimum of five cents for all spring perch purchased in excess of the prevailing filleting capacity. During the spring season the price to fishermen was actually blended with the result that fishermen received 8.6 cents during the spring season and an average of 11.4 cents per pound during the remainder of the year. In spite of the record 30 million pound Lake Erie yellow perch catch, these were the highest average prices received by fishermen since 1965.

To assist in meeting the Canadian requirements for the World Food Program and to assist in providing additional employment in those areas capable of producing canned mackerel the board has, since 1966, been purchasing canned mackerel for shipment to developing nations. Board purchases, under this program, averaged 17,493 cases during the 1966-68 period. During 1969 the original allocation to processors totalled 23,040 cases. World Food Program requirements necessitated the purchase of an additional 4,000 cases. By the end of the fiscal year the entire board holdings had been shipped on orders received through the World Food Program.

A frozen groundfish stabilization program commenced on May 12 with the objective of forestalling distress selling in normal markets and to raise the market price of selected groundfish products to a point where basic costs were recovered.

At the commencement of the program the market price for cod blocks approximated 21 cents per pound. Through 12

tender calls the board purchased 17.3 million pounds of cod blocks (representing 26% of total production) and 240,000 pounds of cod 5's at prices ranging from 23 ½ to 26 cents. Before the end of the fiscal year the entire supply purchased was returned, at cost, to the industry. It is believed that this program assisted in raising the market price for cod blocks to the 26-27 cent level which was current at year-end.

During the operation of this program frequent consultations were maintained with the industry and with competing nations to ensure that current market information was available and to undertake market assessment.

To assist salted codfish fishermen who had experienced severe price declines as the result of oversupply and currency devaluation in some traditional markets, a deficiency payment program was introduced for the 1969 production season. The deficiency payment received by fishermen amounted to one half the difference between the price actually received for each particular size and grade and a target price which was based upon the returns to fishermen during the 1967 season.

During the 1969-70 fiscal year a total of 5,403 individual payments were made to fishermen or groups of fishermen.

Federal-Provincial Committees

Four main federal-provincial fisheries committees exist for the purpose of coordinating programs in fisheries matters which are of mutual concern to both federal and provincial administrations. They are: the Federal-Provincial Atlantic Fisheries Committee, with representation from Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island and Quebec; the Federal-Provincial Committee for Ontario Fisheries; the Federal-Provincial Prairie Fisheries Committee, with representation from Manitoba, Saskatchewan, Alberta, the Northwest Territories and Northwestern Ontario; and the Federal-Provincial British Columbia Fisheries Committee.

The members of the committees are the Deputy Minister of Fisheries and Forestry for Canada and the deputy ministers of provincial departments responsible for administration of fisheries within their respective provinces.

Atlantic Fisheries

The 12th meeting of this committee was held in Montebello in June to receive recommendations arising from deliberations of the Industrial Development Section. The committee also considered proposals regarding a Canadian Atlantic Fisheries Information Service and recommendations for further subsidies on construction of fishing vessels. Reports were also received on the status of the Fishermen's Indemnity Plan and concerning proposed operations of the Department of Regional Economic Expansion in the fisheries field.

The 13th meeting of the committee was held in Halifax in December to consider the status of research and proposals for administration of the rapidly-expanding Atlantic herring fishery. Representations were also received with respect to Canada's position in forthcoming negotiations with the United States to establish reciprocal fishing privileges in exclusive fishing zones outside territorial limits.

Prairie Fisheries

The 8th meeting of the Federal-Provincial Prairie Fisheries Committee was held in Ottawa in June, 1969. A progress report was received on the status of legislation and regulations for the Freshwater Fish Marketing Corporation. Detailed consideration was given to various measures of assistance to fishermen, including fishery development, Fisheries Prices Support Board, fishing vessel subsidies, the Fishermen's Indemnity Plan, and the Manitoba fishermen's training centre and extension work. The committee also received a report from the subcommittee on research which noted encouraging prospects for pond culture of rainbow trout.

The 9th meeting of this committee was held in Gimli, Manitoba, in November. Highlights of the meeting included tours of the Freshwater Institute facilities of the Fisheries Research Board and of the Manitoba Fisheries Training Centre located at Hnaua. The committee received a report on the initial operations of the Freshwater Fish Marketing Corporation. Other topics considered were credit facilities for commercial fisheries, lake classification programs, fishermen's training programs, and techniques for utilization of coarse fish stocks.

A special meeting of this committee was held in January as a result of the discovery of unacceptably high levels of mercury in some species of freshwater fish. The committee received reports on the background information available on mercury pollution, methods by which maximum permissible concentrations of mercury in fish have been established as a human health standard, and the sources of mercury pollution in the affected watersheds. The committee also considered various courses of action regarding assistance to fishermen and for disposal of fish which were found to be contaminated.

British Columbia Fisheries

The 7th meeting of the Federal-Provincial British Columbia Fisheries Committee was held in Nanaimo in June, 1969. The meeting was highlighted by a tour of the newly completed addition to the Pacific Biological Station. The committee received reports on the need for fish pathologists in B.C.; progress in development of an aquatic plant industry; development of an experimental oyster depuration plant; results of the 1967 Stellako River log drive; and progress on the Provincial Fish Inspection Act and Regulations. The committee also discussed proposals for Cowichan River flood control and Shuswap River diversion; delegation of the administration of the fishery for clams; and a review of the conclusions of the Planta Report with reference to problems within the oyster industry.

A special meeting of the committee was held in Vancouver in December. The committee received and discussed a progress report from consultants concerning the status of the oyster industry. A progress report on the development of the oyster depuration plant was also received, and discussion indicated that initial tests were providing encouraging results.

Statistics of the Fisheries

Fish and Shellfish — Landings and Landed Values, by Areas and Provinces, 1968 and 1969

	Landings		Landed Values ¹	
	1968	1969 ²	1968	1969 ²
	<i>'000 lb.</i>		<i>\$'000</i>	
Sea Fisheries — Total	2,797,189	2,600,178	173,011	168,242
Atlantic Coast — Total	2,530,033	2,425,640	115,737	120,789
Nova Scotia	793,238	671,737	54,622	56,639
Newfoundland	949,749	998,000	28,843	30,785
New Brunswick	537,371	511,757	15,564	15,874
Prince Edward Island	46,991	49,035	8,571	8,777
Quebec	202,684	195,111	8,137	8,714
Pacific Coast — Total	267,156	174,538	57,274	47,453
Freshwater Fisheries — Total	115,154	115,000 ³	12,961	13,000 ³
Ontario	55,707		5,968	
Manitoba	25,734		3,276	
Saskatchewan	10,973		1,384	
Alberta	11,883		917	
Northwest Territories ⁴	4,768		781	
Quebec	1,824		539	
New Brunswick	4,734		94	
Grand Total	2,912,812	2,715,178	185,972	181,242

¹Includes seaweeds, sea mammals, livers, etc.

²Preliminary figures.

³Estimated.

⁴Yukon included with N.W.T.

Fish and Shellfish — Landings and Landed Values, by Areas and Species, 1968 and 1969

	Landings		Landed Values ¹	
	1968	1969 ²	1968	1969 ²
	'000 lb.		\$'000	
Pacific Coast — Total	267,156	174,538	57,274	47,453
Salmon	176,355	79,037	44,887	27,827
Halibut ³	29,390	33,836	7,348	14,400
Herring	6,373	4,415	231	221
Ling Cod	6,317	4,960	629	520
Oyster	7,236	9,130	562	720
Sole and Flounder	10,189	10,649	630	639
Crab	4,372	3,710	787	682
Shrimp and Prawn	1,568	2,119	320	529
Gray Cod	11,353	7,573	778	532
Other Species	14,003	19,109	1,096	1,383
Other Items	—	—	6	—
Atlantic Coast — Total	2,530,033	2,425,640	115,737	120,789
Lobster	37,311	40,166	24,448	29,531
Cod	593,535	540,316	24,350	21,568
Haddock	91,116	81,287	6,853	6,781
Scallop	15,649	13,810	13,411	12,203
Herring	1,155,157	1,073,644	11,989	11,194
Small Flatfishes	235,072	272,832	8,063	10,989
Halibut	3,999	3,593	1,563	1,408
Pollock	33,523	29,532	1,146	984
Salmon	4,639	4,292	2,332	2,282
Redfish	214,824	213,193	5,545	5,751
Swordfish	7,338	7,108	3,728	4,105
Other Species	137,879	145,867	7,189	8,033
Other Items	—	—	5,120	5,960

¹Includes seaweeds, sea mammals, livers, etc.

²Preliminary figures.

³Including halibut landed in United States ports by Canadian fishermen.

The name "Canadian Forestry Service" was adopted in 1969 as the official title of the forestry component of the Department of Fisheries and Forestry, replacing the previously used name "Forestry Branch". Headquarters of the Canadian Forestry Service was re-structured by the formation of the Directorate of Operations and the Directorate of Forestry Relations which, with the previously existing Directorate of Program Coordination, report to the Assistant Deputy Minister (Forestry). These three directorates are responsible, respectively, for coordination and control of resources of the service (personnel, finances, and facilities), liaison with other federal departments and international agencies with respect to forestry, and for coordination and control of research and related programs within the service.

The decision of the government that departmental expenditures in 1970-71 should, in general, be held at 1969-70 levels despite retroactive salary increases averaging approximately 20 per cent which were negotiated in 1969, was of particular concern to the Canadian Forestry Service owing to the fact that salaries and wages constituted 80 per cent of its operation and maintenance budget. Since it was not possible to effect significant savings by curtailment of other programs (capital construction, grants, and contributions), it was necessary, in preparing for the fiscal year 1970-71, to reduce the forestry program and associated staff to the level that could be financed within funds available in the new fiscal year. Staff reductions through lay-off in the closing weeks of the year 1969-70 amounted to 22 professionals and 77 other full-time employees, or approximately 6 per cent of the full-time staff complement of the Canadian Forestry Service. Essentially, all establishments of the service were affected by these program and staff adjustments, but the most far-reaching change involved the merging of the forest research laboratories at Winnipeg and Calgary, serving Manitoba and Saskatchewan, and Alberta and the Territories, respectively. The amalgamated establishment to serve the three Prairie Provinces and the Territories will be accommodated at Edmonton, and small liaison units will be maintained at Winnipeg and Prince Albert.

A special agreement between Canada and the Province of Newfoundland provided financial assistance for an aerial spray program for the control of the hemlock looper in Newfoundland. Additional work, both on an inventory of forest resources and a land capability study, was carried out in the same province under the terms of a previously established agreement.

Operations of the advisory committees concerned with regional forest research problems and with various subject-matter specialties in the forest products field were continued.

International Organizations and Programs

A forest research and development council was set up in Quebec by the Minister of Lands and Forests with membership drawn from the several agencies engaged in forestry research within the province, including the Canadian Forestry Service research laboratory at Quebec City.

Canadian Forestry Service officers participated in reviews of program development in several important problem areas during the year. Timber harvesting problems and programs were reviewed with personnel from the Pulp and Paper Research Institute of Canada; and consultations on the potential of remote sensing techniques, including the use of satellites for inventories of forest resources, took place with officers of the United States National Aeronautics and Space Administration and the United States Forest Service. Developments and needs in forest fire research were discussed with members of the Associate Committee on Forest Fire Research of the National Research Council; and the control of forest pest problems in several provinces was reviewed with representatives of federal and provincial departments and industry through the medium of the Interdepartmental Committee on Forest Spraying Operations. Consultations were also held with officers of the Fisheries Service, the Fisheries Research Board, and representatives of the pulp and paper industry on development of research programs directed towards the abatement of pollution.

The need for a broadly based advisory committee on forestry problems, programs, and priorities has been recognized for some time, and during the year 1969-70, initial steps were taken towards the establishment of the Canadian Forestry Advisory Council, responsible to the Minister of Fisheries and Forestry. It is expected that the advisory council will be fully operative in the year 1970-71.

Canadian Forestry Service participation in the work of international organizations and programs continues at a high level. Although these activities are a primary concern of the Directorate of Forestry Relations at headquarters, the service's contribution involves many officers and includes a wide range of disciplines.

In September 1969, Canada acted as host to the Fifth Session of the North American Forestry Commission (the members of which are Canada, Mexico, and the United States). Forestry matters of mutual concern were studied by the commission with special emphasis being given to forest fire control, forest insects and diseases, forest tree improvement, wildlife and outdoor recreation, and forest engineering.

In November 1969, senior officers of the Department of Fisheries and Forestry attended the Fifteenth Session of the Conference of the Food and Agriculture Organization (FAO) in Rome. This conference approved the upgrading of the Forestry and Forest Industries Division of FAO to departmental status effective January 1, 1970.

Organizational arrangements are proceeding for the World Consultation on the Use of Wood in Housing (with emphasis on the needs of developing countries) which is to be held in Vancouver in July 1971. An attendance of 500 delegates from 40 to 50 countries is expected. The International Union of Forestry Research Organizations (IUFRO) is collaborating with the Canadian Forestry Service in arranging the meeting which is co-sponsored by FAO and the United Nations Centre for Housing, Building and Planning.

Canadian participation in other activities of FAO included the chairmanship of the Advisory Committees on Pulp and Paper, and Forestry Education, and the attendance of one federal and one provincial officer in the FAO Study Tour on Forest Fire Control held in Australia early in 1970.

Liaison was maintained with the Commonwealth Forestry Bureau and the Commonwealth Institute of Biological Control during the year. Financial support for the Commonwealth Forestry Institute at Oxford was continued, and a financial contribution was also made with respect to the English and French language forest terminologies which are being prepared under the auspices of the IUFRO/FAO Committee on Bibliography and Terminology.

In 1969-70, Canada continued to play an active role in other international organizations. In IUFRO, for example, personnel of the Canadian Forestry Service served on the permanent, enlarged, and organization committees and on several working groups including those for wood protection, wood properties, logging mechanization, and forest fire

Forest Land and Soil

control. A number of officers also participated in meetings and study tours of the Economic Commission for Europe (Timber Committee).

The Governments of Canada and the United States recently agreed to the adherence of the provinces of New Brunswick and Quebec to the Northeastern Interstate Forest Fire Protection Compact. The primary purpose of the compact is to provide for cooperation in planning and executing forest fire control measures in the northeastern region of the United States and adjacent areas in Canada.

The Canadian Forestry Service continued to cooperate closely with the Canadian International Development Agency (CIDA) in capital and technical assistance programs concerned with forestry and forest industries in developing countries. It provided advice on a forest survey project in the State of Sabah, Malaysia and reviewed earlier surveys in Asia and Africa. In addition to making arrangements for Canadian forestry experts to undertake assignments in developing countries, the service has also assisted CIDA in placing forestry students from abroad in Canadian universities and forest ranger schools and in arranging practical summer training with Canadian forestry establishments. These activities included the preparation, or assistance in preparation, of training programs and study tours which frequently required participation by other federal and provincial departments, educational institutions, and forest industries. These agencies also cooperated with the Canadian Forestry Service in handling visits from abroad of individuals and groups interested in developments in Canadian forestry.

The land classification effort in the Canadian Forestry Service has resulted in further contributions to the Canada Land Inventory. Five forestry capability maps have been published and forty-eight more are in the process of publication. These maps are based on the national classification system which is maintained and updated by Canadian Forestry Service specialists in cooperation with the National Committee on Forest Land. Canada Land Inventory operations are carried out by the staffs of the provincial forestry departments with technical advice from the Canadian Forestry Service. In addition, Canadian Forestry personnel are completing forest capability mapping on 10 sheets to expedite inventory coverage of the 1-million-square-mile Canada Land Inventory area.

The Bio-physical Land Classification System (developed by specialists in provincial forestry departments, university forestry schools, and the Canadian Forestry Service) has been used extensively to classify approximately 10 million acres annually in British Columbia. This work is a forerunner to Canada Land Inventory mapping. The same system has been used in the Labrador land resource survey which includes capability rating of land for forestry, recreation, and wildlife. It is also being assessed for possible use in national parks and in arctic and tundra environments.

During the year, studies were completed on site factor and tree growth relationships in important commercial forest areas of Newfoundland. Similar work, relating soil and site factors with tree growth and behaviour, is continuing in Alberta, Quebec, and the Maritimes. The purpose of these research projects is to provide information useful for forest management practice and planning.

The increase in forest-soil researchers referred to in the 1968-69 Annual Report led, in the current year, to new or expanded programs in forest-soil science and to multi-disciplinary programs in which a stronger contribution in soils expertise is being made.

The small teams of forest-soils researchers in each of the six regions all work within the context of Canadian forest management practice which is evolving from an extensive to an intensive phase. All soils programs seek, as their broad objective, a better understanding of the behaviour of forest soils under this more intensive forest management which not only aims at increased timber production, but is also concerned with other forest values such as water, wildlife, and recreation. This approach will provide the key to new forest practices better able to sustain and enhance total forest productivity.

Because of the nature of forest growth and the complex,

delicately balanced relationships between it and soil characteristics, forest-soils research programs are often long-term and frequently embrace a number of disciplines. The forest hydrology program in Alberta, which was started in 1963, typifies such long-term research. During the year, work was completed on mapping and classifying the forest cover, ground vegetation, and broad soil types of the Marmot Creek Experimental Basin. Such a watershed resource inventory is a prerequisite for effective management planning. In addition, soil surveys were completed on three experimental basins in the Alberta foothills. Information from these surveys will be used in making hydrological appraisals of soils in other areas where water production may be a factor in the land management program.

Good progress also continues to be made in those areas of soil chemistry and soil biology reported on last year, but the main expansion in research has centred on forest fertilization and nutrition. To fulfil the demands likely to be made on the Canadian wood resource by the year 2000, the fertilizing of near-mature stands appears to be the most economically promising approach to take. However, much is uncertain and unknown about the technique; and strenuous efforts are being made to provide, as rapidly as possible, reliable information that will permit the adoption of sound operational practices.

The regional research programs in fertilization are viewed nationally so that any possibility of duplication of effort is avoided and no situation warranting research escapes attention. Good progress can be reported in fertilizer research programs covering Douglas-fir and western hemlock in the British Columbia Cordillera, lodgepole pine on the Prairies, jack pine on the outwash sands of northern Ontario, balsam fir on the Appalachian schists of the Gaspé, the spruce-fir forests in the Maritimes, and the spruce-birch mixedwoods on the glacial till of Newfoundland.

The fertilizer field trials were laid out according to the requirements of modern statistical design and a variety of the main nutrient elements were tested. Although approximately five years have to elapse before a growth stimulus can be fully assessed, early results from a number of experiments indicate promising growth responses from nitrogen application and, in some cases, from nitrogen plus phosphorus. Because older completed research within the service has already demonstrated responses to potassium and magnesium, much experimentation is now directed towards the discovery of the optimum mixtures and applications of fertilizers that could be recommended for use by forest managers.

Individual regional teams conducting fertilization and nutri-

tional research include silviculturists, soils specialists, and tree biologists to ensure a balanced approach to the work that will yield the most useful results. Such results, combined with appropriate land classification data, should materially assist forest managers in achieving increased tree growth, shorter rotations, full-tree logging operations, and other objectives dictated by the trend to more intensive forest management.

Silviculture and Tree Biology

Research and development programs in silviculture and tree biology continued in all Canadian Forestry Service regions and at the Petawawa Forest Experiment Station. This work is aimed at developing biologically and economically sound methods for managing Canada's forest resources. More specifically, new or improved techniques are required to achieve adequate regeneration on cut-over and/or burned-over forest lands; they are also needed to increase productivity of existing and future stands and to achieve the economic conversion of unproductive land, such as heath and bogs, into productive forest.

During the year, considerable progress was made on many aspects of the regeneration program and highlights of this work are summarized. In British Columbia, the major program in container planting of western conifers continued. Species used in this work included Douglas-fir, western hemlock, Sitka spruce, lodgepole pine, and white spruce. The object of this program is to determine comparative economic and biologic effectiveness of several reforestation systems and to develop one which will reduce stand establishment costs, ensure plantation success; and, through mechanization, reduce labour input in growing and planting seedlings. The study encompasses large-scale testing, pilot-scale planting trials, establishment of plantations to compare various types of experimental stock, and the development of nursery methods. Results from much of this work suggest that low survival can often be traced to seedlings that are too small or exhibit poor vigour. These factors may override differences due to container size and design, season of planting, and planting site; consequently, several studies have been initiated to improve techniques for growing the seedlings in their containers. Operational trials have shown that increased planting rates, with consequent financial savings, can be expected when containers are used instead of bare-root stock. A pilot nursery to produce container-grown seedlings is to be developed in cooperation with the British Columbia Forest Service so that total costs of a container operation can be obtained and analyzed.

In Ontario, regeneration work expanded with a program of operational trials of techniques to improve jack pine stocking by various methods of thinning or planting. Operational tests of site preparation and planting procedures for white spruce, red spruce, and white pine were completed; and the relative efficiency of each of the treatments was determined with respect to survival and costs. Trials of mechanical collection of black spruce and jack pine cones proved that this approach is feasible and that it may reduce the cost of seed required for reforestation purposes.

Research in natural and artificial regeneration has been underway in Newfoundland since 1950, and, during the past year, a comprehensive review of this work was made and a report issued together with several more detailed publications relating to individual investigations. It has been found that cut-over or burned-over forest land usually regenerates adequately, but artificial regeneration is required where burning has followed logging, where areas have been burned twice, and, in some instances, where cut-over areas are characterized by the presence of sheep laurel in association with a deep mat of humus. Other investigations have shown that direct seeding may be used successfully to restock non-regenerating burns and that Sitka spruce is a potentially useful species for the Island of Newfoundland. In 1969-70, a closely integrated, multi-discipline research program was instituted to seek solutions to the more pressing forest regeneration problems of the province.

An extensive reappraisal and reorganization of research programs in tree genetics was undertaken during the year. A cost-benefit analysis of tree improvement programs was started, the results of many long-term experiments were published, and improved communications were established between Canadian Forestry Service scientists and industrial representatives. Research also continued on seed sources for reforestation with the aim of providing guidelines for forest managers. In this work, particular emphasis was placed on species such as white spruce, black spruce, jack pine, and western hemlock which have major economic importance and possess sufficient genetic variability to make appreciable improvement possible.

In other work on tree breeding and improvement, a study of 89 white spruce races grown on 15 sites from Fredericton, New Brunswick to Fort Frances, Ontario, revealed that some exhibited up to 22 per cent greater height growth and 5 per cent greater survival than the average. Investigations of the red spruce-black spruce complex in New Brunswick have indicated that certain hybrids of red and black spruce have a significant increase in resistance to spruce budworm when compared with pure red spruce. Other work on native spruces in Quebec suggests that hybrids between red and black spruce may have a greater silvicultural potential for planting than pure red spruce because the hybrids appear less susceptible to winter desiccation, and subsequent vigour and growth is enhanced.

The Forest Tree Seed Unit at Petawawa continued to provide seed for research purposes and seed testing within the service and to exchange seed with other organizations. The

Forest Inventory and Mensuration

requests for seed and information in 1969 were more than double those of 1968. In other work at Petawawa, it was found that black spruce cones damaged by insects did not open under standard kiln temperatures and procedures; re-soaking and three successive kiln dryings increased seed recovery by 77 per cent.

During the year under review, the Canadian Forestry Service engaged in both operational and research projects in the fields of forest inventory and mensuration. Operational tasks relating to federal lands included forest surveys, vegetation mapping, and the provision of consulting services. This work was undertaken usually at the request of other government agencies having responsibility for the management of such lands.

Operational projects completed include a report summarizing inventories of the more important timbered areas of the Yukon and Northwest Territories together with a series of reports dealing with major problems of land use on all Indian Reserves except those in British Columbia. A vegetation map suitable for park management was also prepared for the Waterton National Park in southern Alberta, and a similar project was undertaken for the Gatineau Park in Quebec which is administered by the National Capital Commission.

On the Island of Newfoundland and in Labrador, there was continued strong involvement in work on the forest inventory which is being conducted under a special federal-provincial agreement. The Canadian Forestry Service is responsible for the federal side of the administration of the forest inventory aspects of this agreement and for providing technical advice.

In the last annual report, reference was made to a research project concerned with the use of large-scale aerial photography and radar altimetry in forest inventory work. This technique is now finding its first major operational application in the Newfoundland forest inventory mentioned above. In the course of this undertaking, a number of practical problems have inevitably appeared, but these are being solved by continuing research in large-scale aerial photography.

Within the area of research projects, there has been a strong movement to take full advantage of new developments in remote sensing and aerial photography for forest surveys. One recent research program, concentrating on an evaluation of thermal imagery, has indicated that the use of this technique holds promise for fire detection and site evaluation as well as for vegetation appraisal. A preliminary assessment of ultra small-scale photography for forestry purposes was undertaken. Plans are also being drawn up to take advantage of any earth resource satellite program. Continued research emphasis is placed on photography taken with different film and filter combinations and on comparisons of the photogrammetric properties of aerial photographs of different specifications. A major project completed is a practical guide for the recognition and assessment of forest damage through remote sensing and aerial photography.

Timber Harvesting Research

Important research commitments in the field of growth and yield studies and in the appraisal of productivity continued during the year. Quantitative methods of site evaluation were assessed, and a comprehensive review of past research in thinning and spacing is underway to establish a more effective research program in this area. The dimensional and weight-volume relationships of Canadian tree species were investigated partly to substitute weight for volume as a measure of wood quantity and partly in preparation for the development of more efficient methods of assessing tree growth and productivity potential.

The use of computer simulation has permitted new approaches and advances in silvicultural and yield investigations. Dynamic stand models were developed making possible the simulation of stand growth and the evaluation of effects of changes in silvicultural treatments. This is an active and promising field of research from which returns can be expected within the next few years.

In late 1968, the Canadian Forestry Service established a Logging Development Program within the Forest Management Institute. The objective of this program is to work towards an improvement in logging productivity and a reduction in the cost of wood delivered from the standing tree to the consuming mills.

Close cooperation has been established with logging equipment manufacturers and companies using their products, with various government departments, and with individual inventors. A joint study was made with the Woodlands Research Division of the Pulp and Paper Research Institute of Canada on the research and development needs in Canadian logging. This work permitted the establishment of priorities.

A report, based upon a detailed search of the patent literature on tree harvesting, has been published. It is planned to keep this project updated and to issue, periodically, additions listing new patents.

The Forest Management Institute, in cooperation with the Swedish Logging Research Foundation and the Royal College of Forestry, Sweden, completed a study whereby mechanized thinning operations were simulated by computer. The Institute also developed a library of different forest stands by computer simulation. In 1968, the Swedish Logging Research Foundation developed a method for comparing the productivity of different logging systems and machines. A conversion of this method to make it applicable to systems and machines used in Canada has now been completed by the Institute.

An annotated bibliography dealing with aerial logging was published during the year. This includes all available references to the use of helicopters, balloons, and kites in moving logs from the forest. A current project, somewhat allied to aerial harvesting, deals with the feasibility of using air-cushion vehicles in logging.

Basic to the design of any harvesting equipment is a knowledge of the crop to be harvested. As part of a major project on the physical characteristics of trees, detailed studies are in progress on the branching habits of pulpwood species. Field studies on the conifers were completed during the year and studies on the hardwoods will commence in the coming field season.

Forest Protection

Although insects, diseases, and fire play major roles in the cycle of growth, decay, and rejuvenation of forests, they also affect the Canadian forest economy by causing losses estimated to be about 2 billion cubic feet annually, or the equivalent of more than half of the annual industrial utilization of wood. The function of the Canadian Forestry Service in forest protection is to provide information and advice on the most effective methods of safeguarding Canada's forests against depredation by insects, diseases, and fire. This is accomplished through a continuing survey of forest insects and diseases together with extensive research into forest entomology, forest pathology, and forest fire.

FOREST INSECT AND DISEASE SURVEY

The Forest Insect and Disease Survey is a coordinated national program that operates continuously from the regional establishments. Its primary purpose is the surveillance of all forest lands to detect and appraise insect and disease outbreaks, to conduct an annual census of both native and accidentally introduced pests, and to provide technical assistance to industry and the provinces in planning and executing salvage and control operations. Information on the status of important insects and diseases is published annually for Canada as a whole and is made available in more detailed reports to interested agencies on a regional basis.

In 1969, major outbreaks of the spruce budworm were centred in eastern Canada. In Ontario there was a further build-up in populations in the northeastern part of the province, and numerous small areas of balsam fir and white spruce over an area of some 2,800 square miles showed moderate to severe defoliation. Southeastern Ontario also contained a number of small infestations covering a total of 1,200 square miles, mainly in the Ottawa River watershed. Similar conditions extended into southwestern Quebec with infestations occurring as far north as La Vérendrye Provincial Park. In the Maritimes, there was a massive increase in budworm populations and a very large infestation persists throughout central New Brunswick from the Main Southwest Miramichi River south to the Bay of Fundy. Egg surveys conducted through eastern Canada in the fall of 1969 indicate that a further increase in the severity and extent of budworm infestations can be expected in 1970.

Population levels of the jack-pine budworm increased in several parts of eastern Ontario, and moderate to severe defoliation of pines occurred in parts of the Pembroke, Sudbury, and North Bay districts. In contrast, outbreaks in western Ontario and southeastern Manitoba showed a marked decline in 1969.

In Newfoundland, the extensive hemlock looper outbreak declined following a major chemical control operation in 1969 involving some 2 million acres of infested forest. In western Canada, severe outbreaks of the spruce beetle occurred in southwestern Alberta and the interior of British Columbia. In addition, significant increases in numbers of important defoliators, namely, the green-striped forest looper, black-headed budworm, and western hemlock looper were recorded in British Columbia.

The Dutch elm disease was found for the first time in Nova Scotia in 1969, and there were minor extensions of the disease beyond its previously known limits in New Brunswick and Ontario. Mortality from the disease continued to be high, or to increase, in those areas already infected. The smaller European elm bark beetle, a vector of the disease previously known to occur only in Ontario, was found for the first time in Quebec.

The survey gave increased attention to the gathering of quantitative information on the impact of major forest insects and diseases during the year. These data are considered a prerequisite to the development of sound research and management programs, and a further strengthening of this aspect of the survey work can be expected in future years. In Newfoundland, the initial results of a survey indicate that cull in hardwoods is lower than in softwoods and that decay is more important than form defects in all species. Studies of armillaria root rot show that its incidence in balsam fir rises with an increase in damage caused by the balsam woolly aphid. Examinations of balsam fir stands also indicate that trees severely damaged by the balsam woolly aphid and subsequently killed by the eastern hemlock looper in 1968 contain up to 24 per cent sap rot. Stands so affected are receiving high priority in salvage operations. Although defoliation by the eastern hemlock looper is expected to occur in some areas of Newfoundland for at least one more year, salvage work has progressed rapidly, and industry is confident that it can reclaim most of the estimated 3 million cords of balsam fir already killed during the outbreak together with any additional amount that may result from the short-term persistence of the insect. Because of this situation, no major spraying operation is planned for 1970. In the Maritime Provinces, 49 million cubic feet of the standing beech have been killed by the beech bark disease and about 778 million cubic feet are living but cankered. Plot studies in the former Alberta-Northwest Territories-Yukon Region show that 12 per cent of the trembling aspen is infected with hypoxylon canker and that the disease is increasing at the rate of 1 per cent annually. In British Columbia, sampling has been initiated to delimit stands infected by dwarf mistletoes (damage caused

by these parasites ranks second only to decays in economic importance) and to classify them for control purposes. Work has progressed to the point that control through management practices can be demonstrated to forest managers in a series of field workshops that are planned for 1970.

PROTECTION AGAINST FOREST INSECTS

Protection against forest insects demands long-term ecological studies to determine the best control strategy for each pest species. The strategies receiving most attention in 1969 were biological and chemical control.

The effectiveness of parasites, predators, and pathogens in Canadian Forestry Service biological control attempts over the years 1959 to 1968 was the subject of an evaluation started in 1968 and reported in the 1968-69 Annual Report. This work was completed in 1969. Of the 12 trials conducted during the decade under review, four resulted in virtually complete control, two were successful over large areas with occasional local damage, two gave local control with promise of widespread effectiveness when the biotic agent attains its complete distribution, two reduced pest populations but gave only partial control, and two were failures. Besides these broad findings, more detailed evaluations were completed wherever possible. The best documented assessment related to the biological control of the winter moth in Nova Scotia and the costs and benefits of this program. During the 1950's and early 1960's, the winter moth destroyed hardwood forests that today would be worth close to \$2 million. Had the insect persisted unchecked, it is estimated that losses to the forest economy of the region might have reached as high as \$17 million. The cost of research relating to the liberation of the two parasites involved was approximately \$160,000. These figures do not, of course, reflect the value of the continuing protection which arises from self-perpetuation of the biotic control agents concerned.

Two noteworthy field trials using pathogens were carried out in 1969. A virus, only recently developed in pure culture, was applied against the spruce budworm in a ground test. The results were sufficiently promising to warrant multiplication of the virus for a more extensive trial in 1970. An aerial application of an improved strain of *Bacillus thuringiensis* was also tried against the spruce budworm. This proved superior to earlier strains but was not as effective as the best chemical insecticides. However, the company that produces this safe pathogen is prepared to modify the spray formula to improve its effectiveness against forest insects.

To avoid any possibility of undesirable side effects from some commonly used chemical insecticides, laboratory and

field trials were continued in 1969. Ninety-seven laboratory tests of new materials were conducted on 12 species of insects. A total of 11 trials (ground and aerial) were made against two of Canada's most destructive forest insect species: the spruce budworm and the balsam woolly aphid. In these attempts to identify new materials free of undesirable side effects but retaining an effective toxicity to target pests, the insecticides Zectran, Matacil, Lannate, and Dylox proved to be the most promising.

In further tests concerning possible adverse side effects of spray chemicals, an analysis was made of air samples taken following forest spraying with fenitrothion. This revealed that amounts of the insecticide present were well below those which would constitute a hazard to humans. Fenitrothion is effective in the control of spruce budworm.

PROTECTION AGAINST FOREST DISEASES

In the past year, significant progress was made in reducing "corky-root" disease losses sustained by Douglas-fir seedlings in British Columbia nurseries. Soil fumigation has been effective in eliminating both the nematode and fungus responsible for the disease. It was also discovered that fallowing greatly reduces incidence of the disease as well as controlling weed growth. The application of these experimental results permitted the re-opening of one nursery which had been closed because of "corky-root" disease. The techniques developed should largely prevent future losses which, in three nurseries alone in 1969, totalled approximately 660,000 seedlings.

A computerized disease sampling system which can be incorporated into routine nursery operations is now under development. This will provide a continuous record of diseases and their fluctuations which will aid in disease detection and control.

The antibiotic, cryptosporiopsin, received additional testing in the greenhouse this year, and there are further indications that this compound has an important potential in the control of certain agricultural and forest diseases. A possible application in the agricultural field is its use against the potato late blight fungus. In the forestry area, cooperative tests were started with a New Brunswick company to evaluate the effectiveness of the antibiotic in preventing the deterioration of wood chips in outdoor storage piles.

In Quebec, research on hardwood decay led to the development of guidelines useful in establishing the presence of decay and forecasting damage. These were tested jointly with provincial forest management authorities. Two types of de-

fect classification of yellow birch were compared to determine their usefulness in predicting present and future losses. An analysis of sawmill production verified the value of certain external indicators of disease as a basis for achieving the most effective utilization and management of yellow birch stands.

Biological control is an important method used in combating injurious forest insects, but this approach has not been examined adequately regarding possible applications against forest diseases. Departmental researchers, however, have frequently documented such biological control phenomena in nature. This past year, for example, a fungus was detected girdling the cankers of hemlock dwarf mistletoe. Since there was a high incidence of this parasite, inoculation experiments were started to evaluate its control potential and possible application. In addition, studies are in progress on the biological control of soil-borne diseases in forest nurseries, and surveys to identify possible biological control agents are proceeding on other diseases including Dutch elm disease. The department has also taken a leading role, in cooperation with other world agencies, to summarize the information on biological control and to evaluate its potential against forest diseases.

PROTECTION AGAINST FOREST FIRES

Forest fire losses in most regions of Canada during the 1969 fire season were relatively light. The area burned was a little more than 2 million acres which was about the same as for 1968, or some 20 per cent less than the average for the previous 10 years. Among the provinces, British Columbia was the most severely affected, with burns totalling some 400,000 acres. The Yukon Territory had by far the largest area burned; it exceeded 1 million acres, or more than half the total for the country as a whole.

A long-term, cooperative project by fire research officers in Canadian Forestry Service establishments across the country was successfully completed with the production of a new, much-improved system of fire danger rating. The basic tables for the Fire Weather Index (FWI), as the new system is called, were tested in provisional form during the year at approximately 100 fire weather stations operated by provincial and industrial agencies. It was found that only minor modifications were required before proceeding with the printing and distribution of the FWI for use at the start of the 1970 fire season. Federal government fire researchers have provided fire danger rating systems for Canadian forest protection agencies for more than 35 years and Canada is the only country with a widely used, truly national danger rating system.

Research relating to the use of prescribed fire for hazard reduction and silvicultural purposes (preparation of seed beds, reduction or elimination of undesirable species, etc.) continues to receive much attention because of steadily increasing requests from forest managers. Some of the prescribed burning projects will take several years to complete because the effects of fire on such things as soil fertility, for instance, cannot be determined until a few years after the burn. However, concrete results from some phases of the studies are made available to forest operators in the interim.

During 1969, a publication entitled "Planning for Prescribed Burning in Manitoba and Saskatchewan" was issued by the service. This illustrated booklet describes in practical, clear-cut terms the primary purposes of prescribed fires, the use of data on weather and forest fuels in planning the fire, details on conducting burns (including safety precautions), and simple methods for keeping records and appraising results.

Another project completed during the year was the long-term testing of one of Canada's popular types of portable power pumping units. In the absence of highly specialized laboratory facilities, such tests require a minimum of two fire seasons to complete. Distribution of the final reports is limited to individuals in charge of fire protection and to the manufacturer. Not only do the reports inform users about the pump's operating characteristics, fuel consumption rates at various levels of water discharge and pressure, maintenance and overhaul requirements, etc., but they also point out to the manufacturer weaknesses and undesirable features which can be taken into consideration when planning future models.

Forest Products Research

Throughout the year, a high level of cooperation prevailed between forest industry and the Ottawa and Vancouver Forest Products Laboratories. Numerous program advisory committees and project steering committees, made up primarily of industrial representatives, met with the appropriate staff members of the laboratories. This ensured that the research work was directed towards providing practical answers to the industry's major problems. Also, a considerable number of seminars and courses were presented to industry groups to promote the application of new information and technical developments in the wood products field.

Following are some of the highlights from the research and development program.

Harvesting

The potential of balloon logging in currently inaccessible areas of British Columbia was the subject of continued study, and a final report has been prepared which indicates that this technique is believed to have considerable promise.

The splitting damage sustained by the butt log of comparatively large trees felled with shears was examined at the Vancouver laboratory, and work was started on an improved shear blade design to overcome this problem. Similar work at the Ottawa laboratory resulted in the development of special v-shaped shear blades designed to reduce wood damage during shearing operations on the smaller trees found in eastern Canada.

An extensive series of skidding studies has led to the development of equations for predicting the productivity of various types of equipment and methods of operation in the critical "stump-to-landing" transfer. This information, now available to the logging industry, covers both logs and tree lengths of hardwoods and softwoods.

A new technique, employing a video area-evaluator and a closed-circuit television system, was developed to determine quickly and accurately the solid volume of wood contained in a truckload of piled pulpwood. This offers a solution to a problem which has long troubled the logging industry, and two large Canadian companies are now exploring the possibility of using the approach in their scaling operations.

Lumber

Researchers, studying the effect of different log sawing patterns on the yield of lumber and furniture components from logs of varying grades, have produced evidence that the traditional practice of turning a log on the carriage several times during sawing is wasteful of both time and material. This research is being extended to plant operations to verify

these results, and it is gradually being merged with studies aimed at producing more efficient board cut-up processes in the manufacture of furniture components.

Drying

During the year, scientists were successful in developing a rapid two-day drying schedule for white spruce dimension lumber using high air velocity in the initial stages to remove free water.

Structures

Fracture mechanics studies have led to the development of a non-destructive technique for predicting failure in wooden structures, and this has proved reliable in predicting failure loads for commercial stressed-skin panels.

Progress was also made towards establishing the validity of present spacing formulae used in designing stressed-skin panels.

An extensive investigation of the design of glued-laminated structural members was carried out with stiffness-graded eastern spruce lumber. This has identified an improved design procedure which could significantly reduce the variability in strength of such structural members and effect an appreciable increase in the permissible working stresses, thus making this type of construction less costly and more competitive.

Veneer

Besides providing industry with information enabling it to compare the economics of producing different qualities of veneer, laboratory personnel provided technical assistance to several industrial plants which permitted them to reduce wood losses attributable to poor-quality veneer peeling.

A hydrostatic rotary nosebar for commercial veneer lathes was designed and tested. This bar is supported hydrostatically and demands much less maintenance and consequent costly shut-down time than present nosebars. A patent has been obtained for the new nosebar and licensing arrangements are being completed.

Wood Preservation

Because of the impermeable nature of the wood of eastern spruces, they have proved unsuitable for uses where preservative treatment is required. A new technique of transverse compression, which is effective in improving drying rates, was therefore explored for its effect on preservative permeability of eastern spruce. Results have indicated that this simple, inexpensive treatment can greatly increase the uptake of preservative solutions. This development holds promise of opening a new market to the spruces of eastern Canada.

Fire Retardants

During the year, researchers achieved considerable success in producing leach-resistant fire retardants for wood. Two chemical formulations were assessed in the laboratory as to their suitability for treating decorative hardwood plywood and both proved effective. The same formulations were also found to possess potential in the fire retardant treatment of other major wood products. Additional fire-retardant research resulted in development of another promising chemical for which a patent application is being made.

Gluing

A spectrophotometric method, based on the colour-intensity difference of a veneer surface before and after drying, was devised to determine the degree of affinity of a wood surface for adhesives. This technique, initially developed to examine a gluing problem in white spruce, was later found applicable to coast Douglas-fir, Sitka spruce, western white pine, and trembling aspen. A seminar and a workshop were held to demonstrate the method and to sponsor its application in industry.

Particleboard

A patent application has been made for a new pressing technique developed for the manufacture of particleboard. In this approach, the press time required to cure the resin binder is greatly reduced, and the properties of the resulting board are significantly improved. This method could enhance the competitive position of particleboards as it clears the way for weather-proof particleboard manufacture, formerly found impractical because it called for the use of a relatively slow-curing phenolic resin binder.

For testing all of the important physical properties of particleboard, a low-cost (\$50) torque wrench has been produced. Use of the wrench provides, for the first time, an inexpensive quality control procedure for the particleboard manufacturing industry. In addition, the wrench offers a practical solution for small particleboard users who have been deterred from testing by the high cost of the conventional machines required.

Pulping

A laboratory digester involving a new technique was developed for achieving a more precise measurement of yield after pulping. This almost doubled the precision of yield determination when compared with conventional methods.

In collaboration with a British Columbia kraft pulp mill, a detailed study was made of the effect of outside chip storage on pulp yield and quality. The main findings of this study, namely, that storage times should be minimized and that chip

piles should not exceed a certain height, have influenced chip storage decisions in British Columbia.

Other cooperative studies with the pulping industry concerned the prevention of deterioration of hardwood chips stored outside in piles. Of the various chemical preservatives assessed in this work, sodium pentachlorophenate was found to be the most effective.

Additional research in chip deterioration, covering fungal enzyme systems associated with wood decay, led to the discovery that synthetic (non-cellulosic) media could be used for enzyme production and that the isolation of these enzymes was much easier than had they been produced in a cellulosic media. This research has led to the submission of a patent application for a potentially important new enzyme production process.

Chemical Utilization

During 1969, three new extractives from major commercial tree species in British Columbia were isolated and identified as part of a continuing study in wood chemistry aimed at maximum wood utilization.

A simple and inexpensive process for conversion of poplar wood into animal fodder was developed and evaluated in cooperation with the Department of Agriculture. This process holds promise for the utilization of low-quality hardwoods and wood residues as economical sources of livestock feed. A comparison, in terms of growth and meat quality, was made between animals fed on treated wood residues and others fed on hay. No significant differences were found. Considerable interest has been shown by several companies in the possibility of exploiting this process.

Packaging

In a cooperative study with the furniture industry, new packaging concepts were developed and assessed as part of a continuing research program designed to reduce costly damage to packaged furniture in transit. Other concepts resulting from earlier work were under trial by the industry and appreciable reductions in damage are anticipated.

Forest Economics Research

Responsibility for forest economics research in the Canadian Forestry Service is vested in the Forest Economics Research Institute located in Ottawa and with the forest economists in the regional laboratories. In some regional establishments economists have been appointed only recently, and these officers have necessarily been occupied in acquiring a knowledge of their territories. This is particularly true of Newfoundland. The Ontario regional laboratory is the only one currently without an economist.

The broad objectives of the institute include the provision of economic criteria and information that will assist in making policies and decisions respecting forestry, both in the private and public sectors; and the development of economic understanding of forest-based activities through research and analysis on existing and proposed practices.

The institute program is divided into three categories covering forest resources, forest products, and communication and service. Current research in the economics of forest resources includes compilation and assessment, on a national basis, of provincial forest inventories, an investigation concerning the size and seasonal distribution of a mobile airtanker fleet, studies of the supply and demand prospects for Canada's timber, assistance in multiple land use planning, work on the use of linear programming as a macro management tool, and an assessment of the birch resource in Canada.

Continuing research on the economics of forest products covers a survey of lumber and wood-based panel products utilized in residential dwellings together with a study of the possibilities for a futures market for lumber and plywood.

In the field of communication and service there are studies underway on economic indicators in forestry and forest-based industries, on short-term lumber price predictions, and on lumber consumption predictions. A digest of forest management tables and economic data for use by forest managers and scientists is being published.

From time to time, the institute provides economic advice to the Assistant Deputy Minister (Forestry) and the Directorate of Program Coordination of the Canadian Forestry Service. In this area, an important part of the institute's program has been to develop a procedure by which research problems may be identified, assessed, and ranked in terms of economic priority. This is currently being reviewed for its applicability to program planning in the service.

Referring to the program of the regional economists, a problem analysis of the sawmill industry in the Maritime provinces is being undertaken by the economist for the Maritimes Region who has also participated in program planning for the Maritimes regional laboratory.

The economist for the Quebec Region was seconded for most of the year to a study group for forest resources research which operated under the auspices of the Science Council of Canada. Towards the end of the year, this officer was granted leave of absence by the department to work with the World Bank and advise on forestry development in the Cameroons.

In the newly formed Prairies Region, economists have been investigating objectives, procedures, and information needs relative to regional programs. A survey of the Christmas tree market in Winnipeg was concluded together with a study to evaluate criteria for forest fire control expenditures in Manitoba. A paper on the value of water as a forest product in terms of its quantity, quality, and timing of use was presented at a seminar sponsored by the Alberta Forest Service.

Regional economists in British Columbia, in cooperation with other regional economists and the institute, are developing methods for program planning and budgeting for the British Columbia regional laboratory. Work on a framework for rural land use planning in the development of the regional economy is also in progress. Other work in the British Columbia Region involves an investigation of the cost-effectiveness of several reforestation systems with emphasis on the "bullet" container reforestation system.

Forestry Statistics

National Forest Inventory, 1969

Forest Land	Thousands of acres
Softwoods	342,708
Mixedwoods	142,000
Hardwoods	73,304
Unclassified	56,291
Total Productive Forest Land	614,303
Non-productive Forest Land...	480,601
Total Forest Land	1,094,904
Total Land Area of Canada ...	2,278,552
Volume of Merchantable Timber	Millions of cubic feet
Softwoods	609,063
Hardwoods	139,919
Total	748,982
Tenure of Productive Forest Lands	Thousands of acres
Provincial Crown	500,202
Federal Crown	56,749
Privately-owned	57,352
Total	614,303

SOURCE: Forest Economics Research Institute, Department of Fisheries and Forestry.

Annual Forest Depletion

	Average 1957-66	1967	Average 1957-66	1967
	Millions of cubic feet		Percentage	
Utilization				
Logs & Bolts ¹ ..	1,890	2,238	49.1	53.2
Pulpwood ...	1,209	1,330	31.4	31.7
Fuelwood ...	228	170	5.9	4.0
Other Products	57	61	1.4	1.4
Total	3,384	3,799	87.8	90.3
Wastage				
Forest Fires ...	469	409	12.2	9.7
Grand Total ² ...	3,853	4,208	100.0	100.0

¹Since 1963 the data for British Columbia includes wood used in pulp manufacture.

²Does not include wastage caused by agencies other than fire, such as insects, disease, and natural mortality, for which no reliable estimates are available.

SOURCES: Dominion Bureau of Statistics.
Forest Economics Research Institute, Department of Fisheries and Forestry.

Annual Timber Production by Federal Agency

Year	Yukon and Northwest Territories	National Parks	Department of National Defence	Forest Experiment Stations	Indian Reserves	All Species Total
	<i>Thousands of cubic feet</i>					
1960-61	2,383	4,666	729	754	26,885	35,417
1961-62	1,814	4,548	1,354	237	21,446	29,399
1962-63	4,106	3,960	1,312	1,422	33,208	44,008
1963-64	3,965	3,838	1,536	1,147	61,489	71,975
1964-65	3,264	3,706	2,001	926	33,682	43,579
1965-66	3,269	4,628	2,180	659	35,708	46,444
1966-67	3,657	5,464	2,069	1,002	31,460	43,652
1967-68	4,442	4,775	2,503	920	33,212	45,852
1968-69	3,851	4,987	4,387	1,073	32,386	46,684

SOURCE: Forest Management Institute, Department of Fisheries and Forestry.

Annual Timber Production of Federal Agencies by Product

Year	Logs	Pulp-wood	Fuel-wood	Poles, Piling	Mining Timber	Bolts	Other Round-wood	All Species Total
				<i>Thousands of cubic feet</i>				
1960-61.	13,731	8,433	10,323	1,206	531	74	1,119	35,417
1961-62.	12,871	5,576	8,875	382	57	113	1,525	29,399
1962-63.	16,882	6,216	15,149	2,349	1,043	71	2,298	44,008
1963-64.	24,247	7,336	36,752	1,387	574	196	1,483	71,975
1964-65.	22,040	7,327	11,198	629	746	50	1,589	43,579
1965-66.	21,380	8,202	14,035	443	867	121	1,396	46,444
1966-67.	21,957	6,964	13,010	435	570	87	629	43,652
1967-68.	24,408	7,609	12,637	151	289	41	717	45,852
1968-69.	19,486	7,914	17,955	170	2	7	1,150	46,684

SOURCE: Forest Management Institute, Department of Fisheries and Forestry.

Principal Statistics of the Forest Industries, 1967

Industry	Employees	Salaries and Wages	Value Added ¹	Value of Shipments ²
	<i>Number</i>	<i>Millions of dollars</i>		
Logging	58,568	366	627	1,378
Pulp and Paper . .	73,983	517	1,059	2,301
Sawmills.	49,000	250	425	988
Wood Using	82,494	389	655	1,309
Paper Using	39,037	211	400	930
Total	303,082	1,733	3,166	—

¹Gross or sale value less cost of materials, fuel, purchased electricity, and process supplies consumed.

²Shipments of goods of own manufacture.

SOURCE: Dominion Bureau of Statistics.

Production and Exports of Major Forest Products, 1967

Product	Production	Exports	
		Quantity	Value
			<i>\$000,000</i>
Roundwood <i>millions of cubic feet</i>	3,799	237 ¹	67
Lumber <i>millions of board feet</i>	10,329	6,487	509
Plywood <i>millions of square feet 1/4 - inch basis</i>	3,165	680	48
Woodpulp <i>thousands of tons</i>	15,857	4,269	543
Newsprint <i>thousands of tons</i>	8,193	7,464	955
Other Paper and Paperboard <i>thousands of tons</i>	3,156	734	107

¹Includes pulpwood chips.

SOURCE: Dominion Bureau of Statistics.

Created to meet the increased and more complex administrative demands of the department, resulting from the merging of the Fisheries and Forestry components, a Planning and Administration organization went into effective operation in September, 1969, with the appointment of an Assistant Deputy Minister (Planning and Administration).

The following groups provide common services to the department: the Information and Consumer Branch; the Finance and Administration Branch (which includes the Financial Services Division, Materiel Management Division and Management Consulting Service); Biometrics and Computer Science Branch; Personnel Branch; Policy Planning Branch; Facilities Planning Branch; and Emergency Planning Division. Reports of the activities of the individual branches and divisions follow.

Information and Consumer Branch

As a unit of Planning and Administration, the Information and Consumer Branch assumed responsibility during the year for serving the entire department, including the headquarters elements of the Fisheries Service and the Canadian Forestry Service. Information needs of the Fisheries Service are served by the branch's Fisheries Information Section, while the Forestry Information Section provides similar services for the Canadian Forestry Service. Common services are provided by the Central Editorial Section and the Graphic Services unit.

FISHERIES INFORMATION SECTION

Due to a succession of unusual and exceptional pollution crises during the year — phosphorus in Newfoundland's Placentia Bay, oil in Nova Scotia's Chedabucto Bay, and mercury in inland waters — the services of the Fisheries Information Section came under unexpected strain. Both regional chiefs of information and headquarters personnel were diverted from their normal duties to attend to the public relations problems occasioned by these crises.

Media news coverage for various fishery conferences during the year was arranged by the section, notably the FAO International Technical Conference on Fish Inspection and Quality Control, Halifax, N.S., July 15-25, 1969, and the Federal-Provincial Atlantic Fisheries Committee's Conference on Automation and Mechanization in the Fishing Industry, Montreal, Que., Feb. 3-5, 1970.

Publicity measures were taken to promote major departmental changes and programs. These included the establishment of the Freshwater Fish Marketing Corporation, the revamping of the Fisheries Improvement Loans program, the story of the department's vital role in water pollution control, the establishment of the Canadian Saltfish Corporation, the technique of pair seine netting for groundfish, and the rainbow trout farming experiments on the Prairies.

In the implementation of these and other information activities, continuing liaison was maintained with national, regional and local media personnel.

The monthly periodicals "Fisheries of Canada" (circulation 7,000) and its French-language counterpart, "La Pêche au Canada" (3,000), remain the principal general publications on departmental activities and developments in fisheries.

The "Canadian Fisheries Reports" series, which contain conference reports and papers on commercial fisheries, added three volumes. They are: No. 11, "Plant Location and Plant Size in the Fish Processing Industry of Newfound-

land"; No. 12, "Proceedings: Conference on Fishing Vessel Construction Materials"; No. 13, "Proceedings: Meeting on Atlantic Crab Fishery Development".

Publications issued on behalf of the consumer section included: "All About Fish" (teacher's manual, revised) and "Take a Pack of Frozen Fillets", a recipe booklet issued in conjunction with a television film clip distributed to all Canadian TV stations.

An 18-minute colour film "Electronic Fish Finders", in English and French, was released for use primarily in the training of fishermen. In addition, thirteen fisheries films — eight English and five French — are in the National Film Board of Canada distribution system.

Radio tapes were produced for commercial broadcast by both headquarters and regional information officers. Radio and TV interviews were arranged featuring departmental personnel, and background information was provided for various news and feature programs. Good use has been made of the CBC's "Fishermen's Broadcasts" for which the Fisheries Information Section provides tapes and background material on a continuing basis.

National and regional exhibitions, including a week-long careers exposition for Ottawa high-school students, provided opportunities for presentation of fisheries and forestry information.

Marketing of fishery products was the theme at a number of exhibitions. Among these was a successful promotion of Greenland turbot in California by a departmental consumer consultant from Newfoundland.

FORESTRY INFORMATION SECTION

The Forestry Information Section in Ottawa, and the Canadian Forestry Service's regional information offices, conducted a continuing program of news releases, TV and radio interviews publicizing the work of the Canadian Forestry Service.

During the year the section produced a revised bilingual film catalogue, "Canadian Forestry Films", which lists Canadian films on forestry, forest conservation, wildlife and outdoor recreation. Technical details of each film, and the source from which it may be obtained, are included.

A revised edition of one of the section's educational booklets, "Forestry Lessons", was issued in July and two other publications, "Conservation Activities" and "Forest Product Research", were reprinted. "Conservation

Activities" is a companion-piece to "Forestry Lessons", and "Forest Products Research" describes the work of the forest products laboratories in Ottawa and Vancouver.

Exhibits and displays were presented at ten shows and conventions. In addition to exhibiting in Winnipeg, Ottawa, Vancouver, Thunder Bay, Chicoutimi and Rouyn, the Forestry Information Section entered displays at the Canadian Institute of Forestry convention in Prince George, B.C., the Forest Industries Equipment Exhibition in Ottawa, and the International Agricultural Aviation Congress in Kingston.

The Canadian Forestry Service's 1969 television film clip on forest fire prevention was aired throughout the forest fire seasons by TV stations across Canada. The film clip, "Catch a Fisherman", won first prize in both national and international film competitions.

The section's forestry film library at Ottawa, working with the regional offices, made close to 900 film loans during the year, reaching an estimated audience of 43,000.

The National Film Board of Canada continued production on the film "Fires in the Forest" and on the filmstrip series "Forest Regions of Canada".

The audio-visual unit of the Forestry Information Section loaned or supplied some 500 black-and-white photographs and 200 colour slides of forestry items and activities.

FISHERIES CONSUMER SECTION

In the continuing program of consumer education on the preparation of fishery products, more than 10,000 persons were given fish cookery demonstrations by the section's consumer consultants. Cooperation by the media in regional centres made it possible to reach a larger audience through TV demonstrations, TV, radio and newspaper interviews, and radio talks.

Emphasis was on the promotion of seafood and one of the highlights of the year was the introduction of Greenland turbot to California. The Newfoundland-based consumer consultant attended the Fine Food Fair in Los Angeles and served samples of a recipe featuring Greenland turbot to wholesalers and distributors.

Another project was the distribution to TV stations of the four-minute film "Take a Pack of Frozen Fillets" for showing during October's Fish 'n' Seafood Month. This venture resulted in thousands of requests for the recipe booklet made available in conjunction with the film.

A seafood smorgasbord, put on for the media in cooperation with the fishing industry, resulted in extensive newspaper coverage and broadcast interviews.

Continuing and routine activities include participation in regional and national conventions, and development of household and large quantity recipes. Requests for fish recipe booklets, as well as for information, increased during the year.

CENTRAL EDITORIAL SECTION

Central Editorial Section's program for the Canadian Forestry Service produced 73 scientific and technical publications — 57 in English, 15 in French and one in Spanish — as well as other informational material for scientific, technical and general readership.

The year's major project was the revision of "Native Trees of Canada". The new edition — the seventh — was rewritten in a non-technical style and special photography techniques were developed to illustrate the minute detail required for positive tree identification. A French version of the seventh edition is underway.

GRAPHIC SERVICES

Graphic Services — originally set up to handle the needs of the Canadian Forestry Service — extended its services this year to include the Fisheries Research Board and the Fisheries Service.

The increase in responsibility was reflected in a significantly larger output of work. Graphic Services completed 2,160 jobs and filled 643 outside requests for routine work. About 70 per cent of the year's output went to scientific research and 20 per cent was devoted to public relations needs.

The year's main project was the seventh edition of "Native Trees of Canada". All three sections — art, photography and cartography — were involved in this work.

The photographic section took most of the photos for "Native Trees of Canada", carried out photo instrumentation assignments, and produced 16-mm movies of various logging and spray operations.

The cartographic section introduced new techniques to produce large maps at less cost.

Finance and Administration Branch

FINANCIAL SERVICES DIVISION

During the year a financial management reporting system was developed and financial management statements made available to the Fisheries Service and Fisheries Research Board. Planning was completed to convert the Canadian Forestry Service financial management statements, coding and procedures to the new combined departmental standards for 1970-71.

The Financial Services Division assumed full responsibility for pre-audit, allotment control and other accounting matters from the Department of Supply and Services.

MATERIEL MANAGEMENT DIVISION

Major purchasing functions of the department were transferred to the new Department of Supply and Services. This purchasing consolidation had earlier been implemented for the Fisheries Service and was extended on July 1, 1969, to include the Canadian Forestry Service under revised common conditions authorized by the Department of Supply and Services.

MANAGEMENT CONSULTING SERVICE

The Management Consulting Service undertook a number of major studies during the year. One such study was on the Fishermen's Indemnity Plan which resulted in a new method of operating the plan.

The service was expanded during the year to meet a growing need for qualified analysts to engage in systems, organization and procedural studies. The function of the service is to improve managerial methods and organizational structures.

Biometrics and Computer Science Branch

The Biometrics and Computer Science Branch (formerly Biometrics Research Services) was transferred from the Canadian Forestry Service to Planning and Administration during 1969, to serve the whole department in the areas of statistics and data processing.

The largest part of the branch's work in 1969-70 went in support of programs of the Canadian Forestry Service (about 65 per cent) and Planning and Administration (about 30 per cent). Work for the Fisheries Service and the Fisheries Research Board was largely of an advisory and consulting nature. This is expected to change in the next year or two as computing and data processing studies are carried out for the Fisheries Service and computing systems are designed for various administrative programs.

In the last quarter of 1969-70, a study was initiated to determine the effect of new concepts and techniques in statistics and biometrics, operations research, computer science, simulation models, management gaming, program evaluation in relation to the department's activities. This may require changes to the type, quality and level of expertise, activities and services carried on by the branch.

In addition to discussions with senior management within the department, visits were made to universities, government organizations and private companies in the United States and Canada to collect information and opinions.

Personnel Branch

The Personnel Branch worked closely with the Fisheries Research Board in preparation for the changes in employment status when employees of the board came under the jurisdiction of the Public Service Employment Act on April 1, 1970. Two seminars were conducted during the year to acquaint Fisheries Research Board field administrators with their changing roles.

Delegation of classification authority was introduced for the first time and this responsibility is now being carried out by the management staff of the Fisheries Service and the Canadian Forestry Service in British Columbia. Plans for more extensive delegation of classification authority have been made and, as a preparatory step, a number of training sessions were held with line managers to introduce them to job description writing and job evaluation.

Delegation of staffing authority was also extended to regional offices during the year and a portion of staff recruitment is now being carried out at local levels.

A Manpower Planning and Development Officer was appointed and preliminary work started on a total manpower planning and development program.

Policy Planning Branch

The Policy Planning Branch, initiated in January 1970, is concerned with the long-range policies of the whole department. The branch works under the guidance of the Policy Committee of the department, which consists of the Deputy Minister, Chairman of the Fisheries Research Board, and Assistant Deputy Ministers for Fisheries, Forestry, and Planning and Administration.

The branch performs a staff role in advising and making recommendations to the Policy Committee; recommendations are made to senior management of the department only.

Facilities Planning Branch

The primary role of the Facilities Planning Branch is the processing of contracts relating to construction of and modifications to the department's establishments and offices across Canada.

Some consolidation of headquarters' accommodation was effected during the year and an accommodation plan for the total Ministry headquarters was drawn up and approved.

Construction of the Forest Research Laboratory in Edmonton, Alberta, continued on schedule and is expected to be completed by July, 1970.

Emergency Planning Division

The Emergency Planning Division assists line managers in developing procedures to meet disasters — war or peacetime — and to train departmental staff in these procedures.

The division took part in two NATO training exercises during the year. The first was a test of civil wartime logistic agencies, the second was a NATO naval exercise involving, in part, the testing of naval procedures for the control of movement and protection of allied fishing vessels. This test enabled the Fisheries Service to improve its emergency plans for the harvesting and processing of fish on a national and NATO basis.

With the assistance of the Canada Emergency Measures Organization, the division conducted the first three of a continuing series of courses on Fisheries Emergency Operations for Fisheries Service field staff. The policy of training the department's consumer consultants in emergency feeding by attendance at Emergency Welfare Services courses was continued.

In Manitoba and Nova Scotia, emergency planning officers assisted in peacetime disaster exercises.

In Quebec, Ontario, Manitoba, Saskatchewan and Alberta (provinces which have undertaken the responsibilities of Fisheries emergency planning), close cooperation exists between the provincial departments concerned and the division planning staff.

During the year the National Civil Emergency Measures Program was reviewed and reorganized. Considerable work went into the revised fisheries and forestry input for the national program.

The third meeting of the United States/Canada Joint Working Group on Fisheries in War Emergencies was held in Ottawa in May, 1969, and a progress report was sent to the senior United States/Canada Civil Emergency Planning Committee.

The department contributed to a federal-provincial ministerial conference on emergency planning which dealt with proposals for improving civil emergency measures in Canada.

The Emergency Planning Division is involved in work with some 20 departmental, interdepartmental, Canada/United States and NATO committees and working groups.