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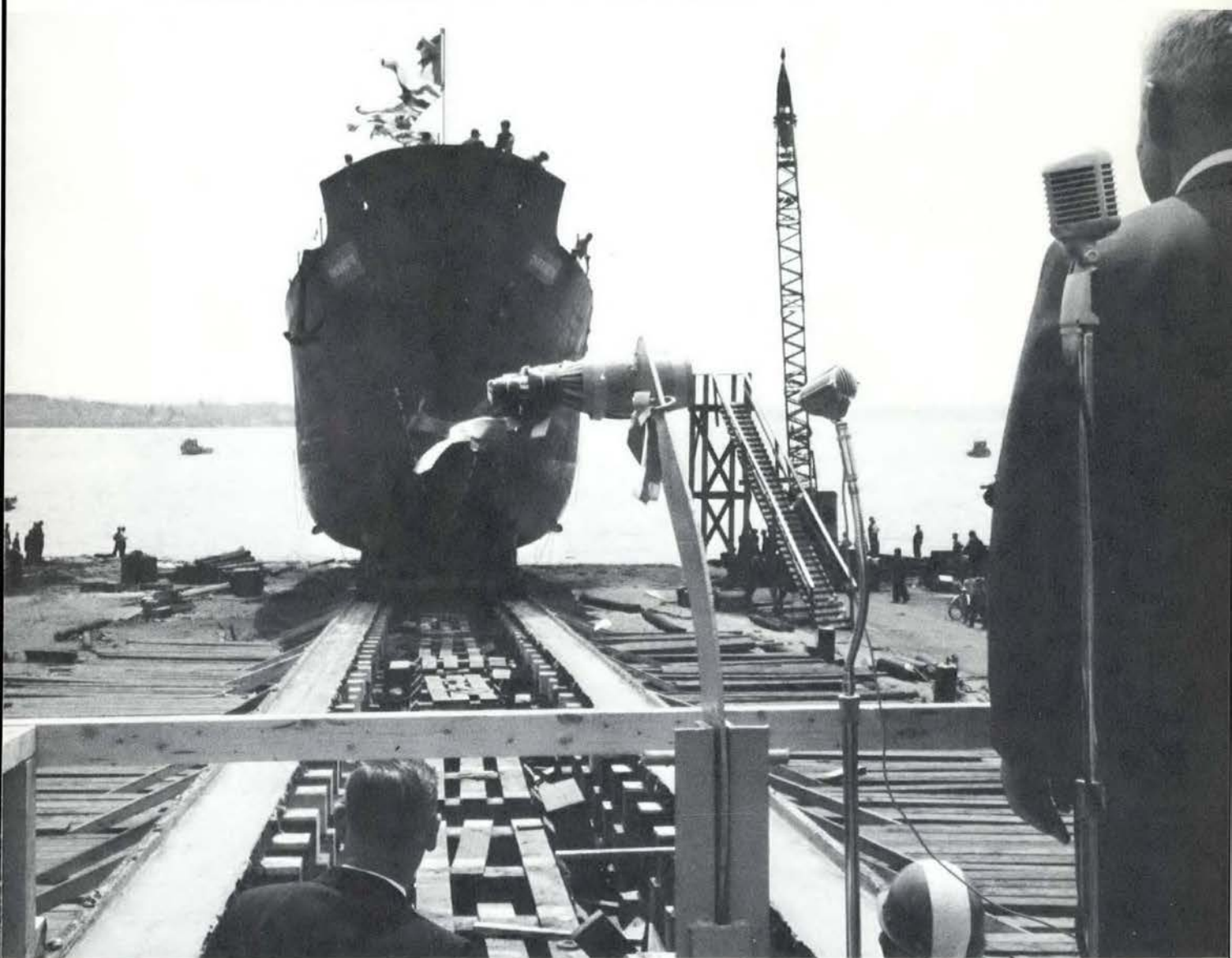

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Department of Fisheries of Canada, Ottawa

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Editor

E. H. HEARNDEN

COVER PHOTOGRAPH - The Department's newest patrol vessel "Chebucto" slides into the water at Pictou, Nova Scotia.

Conference Discusses Expansion of Atlantic Herring Fishery

THE NEED for a better knowledge of Canada's Atlantic herring resource and the manner in which it can be exploited to the greatest advantage of the Canadian people were stressed as prime requisites of the fishing industry at a conference held in Fredericton, N.B., May 5-7.

Expansion of the Atlantic herring fishery is already under way, with millions of dollars either invested in or earmarked for its development. The purpose of the Canadian Atlantic Herring Fishery Conference, which was sponsored by the Federal-Provincial Atlantic Fisheries Committee, was to assess the fishery's potential in the light of improved markets for herring meal, herring oil and herring as food for human consumption, and to assist in the orderly development of this sector of the industry.

The Federal-Provincial Atlantic Fisheries Committee is made up of the deputy ministers responsible for fisheries of the Federal Government and the governments of the five Atlantic Coast provinces. Dr. A.W.H. Needler, Deputy Minister of Fisheries of Canada and Chairman of the Committee, who was also General Chairman of the conference, told the 350 delegates that Canada was not taking full advantage of its Atlantic herring fishery; that there was room for considerable expansion and diversification. Most Canadian Atlantic herring stocks showed by their age composition that a more intensive fishery could be carried on.

ROOM FOR EXPANSION

Dr. Needler pointed out that Canada already had an important herring fishery -- an intensive and efficient purse-seine operation in British Columbia which netted a quarter of a million tons a year for reduction, and the well-known sardine industry of New Brunswick. However, he said it was clear that there was room for further expansion on the Atlantic Coast. "The stocks are here, demand for herring products is increasing, and industry is already extending its efforts."

The purpose of the Conference, the chairman said, was to help lay a basis for sound development of the industry by bringing together knowledge and expert advice on the herring resource, on fishing methods and the best use to be made of the stocks.

Conference delegates examining model of a Pacific coast seine netter.

In addition to representatives from government and the fishing industry, the conference was attended by specialists from the herring industries of the United States, Great Britain and Germany. The operators of fishing vessels and processing plants were able to discuss problems with biologists and technologists specializing in the behaviour, finding and capture of herring as well as with economists, marketing specialists and fishery management authorities.

The more than 300 conference participants were welcomed to New Brunswick by the Minister of Fisheries of that province, Hon. R. Ernest Richard, who expressed gratification that the Atlantic Coast provinces were planning a long-term development program aimed at a better and fuller utilization of the herring resource.

Moderators of the five sessions during the

European and Canadian delegates at the Canadian Atlantic Herring Fishery Conference. Left to right: Alan Glanville, Dunmore East, Ireland; Peter Boot, Holland; Hon. H.J. Robichaud, Minister of Fisheries of Canada; Dr. J. Scharfe and Hans Baasch, Hamburg, Germany; Dr. A.W.H. Needler, Deputy Minister of Fisheries of Canada.

three days of the conference were the other members of the Federal-Provincial Atlantic Fisheries Committee: Brian Meagher, Deputy Minister of Fisheries, Nova Scotia; E.M. Gosse, Deputy Minister of Fisheries, Newfoundland; Eugene M. Gorman, Deputy Minister of Fisheries, Prince Edward Island; Dr. Leonce Chenard, Deputy Minister of Fisheries, New Brunswick, and Maurice Lessard, Associate Deputy Minister, Department of Industry and Commerce, Quebec.

SUMMARY OF RESEARCH

A comprehensive summary of research on the herring of the Atlantic was provided by fisheries scientists S.N. Tibbo and R.D. Humphreys of the St. Andrews, N.B., biological station of the Fisheries Research Board of Canada, V.M. Hodder of the Board's station at St. John's, Nfld., and B.E. Skud, Director of the U.S. Fish and Wildlife Laboratory at Boothbay Harbour, Maine. Dr. W.R. Martin, Assistant Chairman of the Fisheries Research Board, Ottawa, said that the Board was expanding research efforts on herring in response to national and international interest in increased exploitation of the resource.

Adrian Peuvion, a technical adviser to the federal Department of Fisheries, who carried out a three-month study of the winter herring fishery along half of the southeast coast of Newfoundland, said that herring in those waters were likely to die of old age rather than from overfishing. He described the resource there as extraordinary and thought it could be of great value if worked rationally. A fisheries specialist of the federal Department's Industrial Development Service in St. John's, Rupert Prince, told the conference that purse seining was quickly becoming the most popular method for catching herring in almost every fishing country of the world, but he thought that gill-netting for herring in Canadian waters should also be considered. Dr. J. Scharfe, of Hamburg, Germany, presented a paper on progressive herring trawling methods in that country.

VESSEL DESIGN

Improved design and better equipment and gear will be necessary to increase the effectiveness of the Atlantic coast herring fishery, said Jean Frechet, head of the Fishing Operations Branch of the Industrial Development Service of the federal Department of Fisheries. He stressed the fact that the development of this fishery depends to a great extent on the types of fishing boats built in the future. W.W. Johnson of the same branch delivered a paper on Atlantic and Pacific herring seiners of today and Robert F. Allan, a Vancouver, B.C., naval archi-

tect, expressed the hope that the Canadian Atlantic herring industry would develop its own boat designs rather that adapt designs from the Pacific coast or Europe.

Trends in the utilization of herring were dealt with by scientists, technologists and industrial officials. Dr. H. L. A. Tarr, Director of the Vancouver laboratory of the Fisheries Research Board, discussed nutritive values of herring meal and reported on studies made to define the beneficial properties of the Pacific coast product. Dr. B. Weinberg, of the Edible Oils Section of the Food Products Branch of the federal Department of Industry, spoke of the effects of various reduction processes on the quality of herring meal and oil, and said that most Canadian herring oil will probably be produced in the near future on the Atlantic coast. The importance of knowing the oil content of herring and of developing processes for reducing oil in meal were stressed by Dr. D. R. Idler, Director of the Fisheries Research Board's Halifax, N.S., laboratory.

FISH MEAL PRODUCTION

Lawrence I. Clarke, President of Sealife Fisheries Ltd., Nova Scotia and of Atlantic Processing Company, Amagansett, N.Y., speaking of the world supply and consumption of fish meal and oil, predicted that eventually the fish meal reduction business would slowly convert to producing fish protein concentrate, a more valuable and higher quality product than that now turned out as fish meal. He pointed out that it was more economical to feed the fish directly to man rather than to animals and poultry and then to feed the animals and poultry to man.

The technology of herring processing in providing products for human consumption was the subject of a paper by Peter Biegler, a fish consultant and technologist from Cuxhaven-Sahlenberg, Germany, read by a colleague, Hans Baasch. Walter E. Ward, Manager of Research and Quality Control for the Quaker Oats Company of Canada, Ltd., Peterborough Ont., spoke on the utilization of herring for pet food. He said it was the ideal food for cats and dogs, providing them with all essential nutrients.

Current developments in the herring industry of the Atlantic Coast were described as revolutionary by I. S. McArthur, Director-General of Economic Services for the federal Department of Fisheries. He said these developments had arisen from the simultaneous emergence of several factors -- the world food and population problem, the desire of governments to stimulate economic activity, the availability of investment capital and the opportunity for profitable investment in this branch of the industry. A background paper on the Canadian fish meal industry was prepared by Carlyle L. Mitchell of the federal Department's Economics Service.

Industry's approach to the development of the Canadian Atlantic coast herring fishery was dealt with by four executives of fishing companies. D. A. McLean, Jr., of Connors Brothers Limited, Black's Harbour, N.B., while encouraged by the growth of the herring fishery in the Bay of Fundy, expressed concern over the increase in the use of herring for reduction into fish meal and oil, his concern stemming from the possible effect this would have on the supply of sardine size herring.

Laurie Delaney of Gorton-Pew Ltd., Magdalen Islands, said that in order to take full advantage of future prospects, there must be action now to establish standards and goals for the herring industry. A concerted effort by the governments of Canada and the United States to introduce new talent and ability into the herring fishery was advocated by F. K. Spencer, Booth Fisheries Ltd., Chicago, Ill., who presented a paper on the vinegar cured herring industry of eastern Canada. W. R. Murdoch, of B. C. Packers Ltd., Dartmouth, N.S., said it would seem logical to assume that meal and oil plants will form the core of any intensive expansion of the herring industry, adding that food production facilities would follow as demand and product requirements become known.

The Director of the Industrial Development Service of the federal Department of Fisheries, L. S. Bradbury, acted as general secretary of the conference, with his Service providing the secretariat.

We've Changed!

As is obvious from the front cover of this issue, we've had a change in name.

TRADE NEWS, the title that has served this publication for the past 18 years, has been retired in favour of FISHERIES OF CANADA.

We realize some readers may feel they've lost an old and familiar friend. However there appeared almost unanimous agreement that a more appropriate title was needed for the publication in its present form and FISHERIES OF CANADA won out over a host of other name suggestions. Incidentally, our request for name ideas brought replies from such distant points as Sydney, Australia, The Hague, and Beeville, Texas, as well as places from coast to coast in Canada.

To all those who sent us their name suggestions and comments, our sincere thanks. We hope you'll like our new look.

THE EDITOR

Envisage $300 Million Expansion In Canda's Fishing Fleet by 1976

Hon. H.J. Robichaud, federal Minister of Fisheries, addressing the annual meeting of the Fisheries Council of Canada.

AN EXPENDITURE of $300,000,000 on expansion of Canada's fishing fleet is indicated over the next 10 years, federal Fisheries Minister H. J. Robichaud revealed in an address to the Fisheries Council of Canada 1966 annual meeting. This investment will be made for the construction of some 300 modern fishing vessels and the provision of up-to-date mechanical and electronic gear for these vessels.

Mr. Robichaud predicted that within the same 10-year period, about 10,000 men will have to be trained to man the expanding deepsea fleet in Atlantic waters. The indicated requirement is for between 1,000 and 1,200 fully trained men every year.

In his report to the industry, the Minister mentioned programs undertaken to achieve more effective management of the Pacific salmon and Atlantic lobster. It was hoped that measures to be implemented for control of entry of equipment and manpower in these over-crowded fisheries would "not only permit more efficient regulation of the fisheries, in the interest of conserving the stocks, but will also encourage the development of an economically efficient industry."

A control experiment being introduced in the Northumberland Strait lobster fishery this summer represented "the beginning of a planned attack to reduce the concentrated effort on the stocks so there will be better catches and better returns on a sustained basis."

Development programs were currently in progress toward exploitation of Atlantic herring and Pacific groundfish resources. New processing plants were being constructed and a fleet of specialized vessels would be required to fish the available stocks.

Expansion was also the keynote for the Fisheries Research Board of Canada, scientific arm of the department. Facilities were being expanded in Nanaimo, Vancouver and Winnipeg; and new laboratories were planned at St. John's and Dartmouth.

The Minister stated that negotiations were continuing with a number of countries on establishment of proposed baselines for Canada's 12 mile fishing zone. Until these negotiations were completed a 12 mile limit was being enforced against all countries except those with traditional fishing rights.

A record registration of more than 500 persons attended the Fisheries Council's 21st annual meeting held May 7-11 in Halifax. Many delegates attended from the United States, and there were representatives also from England, France, Holland and Northern Ireland. The 1966-67 Executive of the Council is headed by President Guy LeBlanc, of Montreal.

MANPOWER PROBLEM

"The Manpower problem in the fishing industry" was the subject of one of the two major workshop panels featured at the meeting. Mr. Robichaud described the manpower shortage facing the industry as a "critical issue", but the problem was recognized by government and industry. As he pointed out: "Sophisticated technology is being applied on deep-sea fishing vessels so quickly that we shall have to develop a completely new approach to the operation and maintenance of these modern fishing vessels."

Implementation of training programs to produce skilled manpower for fishing vessels depends almost entirely on the co-operation and wholehearted support of industry, the Council was told by Ellery H. Collins, of the Technical and Vocational Training Branch, Department of Citizenship and Immigration.

"Many people from industry," Mr. Collins said, "are guilty of a short-sightedness that prevents them from planning for the future. Immediate operational needs are important and 'crash training' programs can be devised to help overcome special problems, but these are inadequate in themselves." Modern fishing vessels were highly complex craft and navigation and fish finding gear and catching equipment was highly sophisticated; it was no longer possible to learn the necessary skills of the trade by on the job employment.

Schools established in the Atlantic coast region were now, or would be in the near future, in a position to provide training in the basic knowledge and skills required of captains, mates, bosuns, deckhands, engineers and ships cooks. The College of Fisheries, Navigation, Marine Engineering and Electronics in St. John's, Newfoundland, provided both short courses and also post high school training in the fields of nautical science, fishing technology, marine electronics, fish processing technology and naval architecture.

RECRUITMENT IN U.K.

A recruitment system in the British fishing industry which aims to enroll boys at school leaving age was described by A.B. Wilbraham of Hull, England.

The U.K. situation, Mr. Wilbraham said, was radically different from that which prevails on Canada's east coast. With the British fishing industry localized in a relatively small number of ports having a considerable number of trawlers operating out of them, owners worked closely together - usually through a local port association - on such matters as recruitment policy.

At each port a personnel or recruiting officer, usually connected with the local association office, worked full-time finding and training recruits. Young boys started in the galley, then after they got their sea legs, underwent a period as deckhand learners. Mr. Wilbraham said most ports insisted upon a minimum of 100 days at sea before the new apprentice was promoted to a full deckhand.

"In most ports," he added, "it is necessary to complete a fairly simple course at the fishing schools, but this is usually done after the boy has spent at least six months at sea on a trawler."

Payments were made to fishermen while they attended fisheries schools, and in addition some assistance was usually available for accommodation.

But to get the boys to go to sea on trawlers, it was necessary to offer rates of pay substantially higher than what they could earn ashore. Also, it was necessary to show them that the money they could earn "in the foreseeable future" was substantially more than they could earn ashore.

ECONOMIC CONSIDERATIONS

W.C. MacKenzie, Director of Economics Research and Intelligence with the federal Department of Fisheries, Ottawa, dealt with the economics involved in entry control in fishing operations. He discussed a number of proposals which would maximize the returns from fishing effort over time.

The present situation in the Pacific salmon and Atlantic lobster fisheries illustrated what could happen in a "mature fishery with a high level of output and a favourable price-cost ratio." In the lobster fishery for example over the past decade the average dockside price rose by about 30 per cent, but the number of traps in use (indicating the investment) rose only 20 per cent, and the number of fishermen employed increased 45 per cent.

In such situations, measures could be designed for control of input to complement those intended to control output. The difficulty was in framing such measures and their application.

The role of immigration as a potential source of manpower for the fishing industry was not overlooked in the Fisheries Council discussions. C.S. Dwyer, Department of Citizenship and Immigration, Halifax, referred to plans for integration of manpower and immigration activities in the program of the new Department of Manpower which was being established.

Despite world-wide competition for skills, Canada succeeded in attracting 146,000 immigrants

Participants in the "Manpower" discussion at the Fisheries Council annual meeting included, from left, Ellery H. Collins, Ottawa, C.S. Dwyer, Halifax, W.C. MacKenzie, Ottawa, and E.B. Wilbraham, Hull, Eng.

in 1965, an increase of 30 per cent. Of those entering the labor force, 67 per cent were in the "more skilled" categories, compared to 59 per cent in 1964. Total immigration last year was the highest since the post-war peak of 1957.

PACIFIC SITUATION

A move to deeper waters to exploit resources of ocean perch and other groundfish must be taken if Canada is to expand her Pacific fishery, but the move will bring Canadian fishermen into direct competition with the Soviet Union. Dr. K.S. Ketchen of the Fisheries Research Board, Nanaimo, B.C., made this clear in a paper delivered in a Fisheries Council workshop entitled "The Harvest--Crisis or Control". Dr. Ketchen's paper was read in his absence by Dr. John Hart.

Dr. Ketchen pointed out that, in the last two years, production in the Pacific coast groundfish fishery had risen sharply and reached 21,000 tons in 1965 - nearly three times the long-term average. This fishery was still confined largely to the continental shelf and the mainstay of the current effort was the Pacific cod. In contrast, the U.S. for more than a decade had tended to fish more and more in deeper waters along the edge of the shelf - where North American fishermen were now confronted with heavy competition from the Soviet Union.

Should the U.S.S.R. succeed in reducing abundance of ocean perch and other species to an uneconomic level, "we shall have little choice but to remain inshore". Faced with the same obstacle, the U.S. fleet presumably would be forced to retreat from the deep water and become more competitive with the Canadian inshore fishery.

Dr. Ketchen stressed that the crisis of overutilization of a fishery under modern-day methods could emerge very rapidly even before there is sufficient scientific information to establish the magnitude of a resource or the basis for control. In fact, it could be argued that not until a resource was heavily fished could a reliable appraisal be made of sustainable yield.

Referring to the sharp expansion of fishing effort for halibut and other species given impetus by Japan and the Soviet Union, Dr. Ketchen said it was probable that the current level of production from the eastern Pacific was being maintained by an expansion of operations to previously unfished areas, and by turning to species largely ignored in the past.

ATLANTIC SITUATION

Dr. Wilfred Templeman of the Fisheries Research Board at St. John's dealt with the fisheries situation in the Northwest Atlantic. In the rapidly intensifying offshore fishery on that coast, there apparently were no large stocks of commercially acceptable groundfish that were not at present being fished. The greater competition meant that at present a concentration of fish could be found and cleaned up in a few months or in a year or two.

Hence, research efforts had to be more intensive, Dr. Templeman said. Increasing research would be required in the offshore fishery - the only direction in which the industry could expand very significantly. In this fishery, too, Canadian effort and knowledge of ships, gear and fish concentrations would face direct competition from other countries.

Dr. Templeman reviewed the trends in landings for the four chief groundfish species caught by Canadian fishermen in ICNAF subareas. The drop in the Canadian percentage of the total catch of all species in 1958-60 from the previous five years was due largely to the new and large scale landings by Russian and other European entrants in these fisheries. "As a result there were great increases in redfish landings from northern areas where Canadians do not fish and also (1960) in cod and haddock landings by Europeans from ICNAF areas."

Commenting on future expansion of the fisheries, Dr. Templeman said it was apparent that in any further growth of the trawler fleet, cod must receive most attention. Except for sporadic attempts, Canadians at present do not fish offshore cod north of the Grand Bank region, and "in fact there is no significant Canadian catch of offshore cod north of subarea 4."

Canadian fishermen were not yet taking part significantly in the offshore silver hake and herring fisheries. In the Newfoundland area, both inshore and offshore, there were great quantities of capelin which might be used as meal. The spiny dogfish and the porbeagle were beginning to be used. More

squid could be caught in the years of abundance if the additional amounts could be marketed profitably.

RESEARCH

Dr. F.R. Hayes, chairman of the Fisheries Research Board of Canada, in discussing the role of the Board, drew a parallel between the fishermen and the farmer in harvesting the resources of the sea.

Compared with agriculture, however, fisheries scientists were greatly hampered by not being able to see what is happening underwater. Biological oceanography aimed to make the ocean transparent. Much work had been done in this field by defence scientists and there were "good prospects that within five years we may be able to count and even get some measure of sizes and species of fish" as a result of research in the Dartmouth laboratory.

Because defence needs and those of the fisheries are very similar, a joint research effort was possible in "underwater weather" - pattern of currents, cold fronts, stratification, salt barriers and eddy systems.

"Fish tend to accumulate at the boundaries of water masses, and to seek feeding grounds where there is an upwelling of nutrients to support their food organisms. There are more or less temporary lake-like bodies of water within current systems supporting their own fish populations. These can be detected and exploited in the fisheries of the future."

Dr. Hayes said instrumental buoys were being perfected to monitor the underwater weather. These buoys could be placed at various depths and could relay their stored-up observations to a passing aircraft.

Discussing the government's role in new product development, I.S. McArthur, Director-General of Economic Services, Department of Fisheries, Ottawa, noted that close liaison was maintained among the various services of the department and stations of the Fisheries Research Board. Committees at Halifax, Ottawa and Vancouver co-ordinated the work of the board and the Inspection Service laboratories of the department.

RESOLUTIONS

Resolutions on a variety of topics of concern to the industry were debated and approved at the Fisheries Council of Canada annual meeting. They recommended:

* Steps be taken to implement the principle that salmon are the property of the country in which they originate

* Top priority be given by the Government of Canada to an immediate conclusion of negotiations for establishing proposed baselines for a 12-mile exclusive coastal fishing zone.

* Inequities in application of the Unemployment Insurance Act, as recognized in the Gill Committee Report, be remedied as they relate to fishermen.

* Early action to remove the disadvantageous position of the frozen fish industry regarding the Unemployment Insurance Act.

* Inspection be instituted "at the boat level" in order to up-grade the quality of fishery products.

* Removal of discrimination against marine oils in edible fats such as margarine, under existing labelling requirements of the Food and Drug Act.

* Extend the exploratory program for unutilized fish stocks and increase research to improve effectiveness of fishing gear and vessels.

* Legislation to require adequate treatment of industrial or domestic wastes in waterways which may create a pollution problem

* Comprehensive program to ensure an increase in availability of B.C. salmon now threatened by pollution and encroachments of industrialization and urbanization.

* Immediate study of inshore cod fish stocks in the Newfoundland-Labrador area.

* Amendment of ICNAF trawl mesh size regulations.

* Implementation of final report of Fraser River Board. ✔

Fish Protein from Ponds

A week-long symposium on growing fish in ponds held recently in Rome recommended that national departments of agriculture include fish culture in their long-range plans for land and water development.

The symposium, sponsored by the Food and Agriculture Organization, also recommended that FAO form a panel of fish-culture experts to advise on fish culture in fresh and brackish waters as a means of increasing the world supply of badly needed protein.

The symposium was attended by some 120 participants from 40 nations plus a number of international agencies. It urged that countries give high priority to better extension and training services in fish culture.

Canada and U.S. Continue Talks On Salmon Net Fishing Limits

CANADIAN and United States officials met in Seattle May 17-19 to discuss salmon offshore net fishing limits in the area of southeastern Alaska and northern British Columbia.

The Canadian delegation, under the chairmanship of Dr. A.W.H. Needler, Deputy Minister of Fisheries, was comprised of federal government officials from the Department of Fisheries, Department of External Affairs and the Fisheries Research Board of Canada, officials of the Provincial Government of British Columbia, and representatives of the fishing industry of British Columbia including the Fisheries Association of British Columbia, United Fishermen and Allied Workers Union, Prince Rupert Fishermen's Cooperative Association, Pacific Trollers Association, Fishing Vessel Owners Association, and Native Brotherhood of British Columbia.

The United States delegation, chaired by William C. Herrington, Special Assistant for Fisheries and Wildlife to the Under Secretary of State, included Federal, Alaska and Washington fisheries officials and scientists, and representatives of interested fishermen associations and processors.

TWO PREVIOUS ROUNDS

The discussions in Seattle followed two previous rounds of negotiations--one held in Ottawa in April and a prior one held in Washington D.C. in October 1965. These earlier discussions also centered around Pacific Coast salmon problems of mutual concern.

It is the intermingling of salmon en route to their home streams through territorial waters of both countries that has led to disagreement. The Canadian position is that to the extent possible the net fishing lines of each country should be used as a tool to minimize the harvest by one country of salmon bound for the rivers of the other country. The position of the United States is that the two countries must not only consider the origin of the salmon caught by fishermen of the respective countries but that they must respect the historic fisheries of the two countries in seeking an equitable solution to the problem.

CANADIAN SOLUTION

The Canadians suggested that the solution to the problem lay in drawing inward the seaward limits of net fishing off the coast of Alaska and in waters of northern British Columbia. It was their view that this would minimize the capture by fishermen of either country of salmon bound for streams of the other country. The Canadians presented the United States with modified lines designed to accomplish this objective. The United States maintained that their important historic fishery off the west coast of southeastern Alaska would be eliminated by the adjustment of net fishing lines as suggested by Canada. The United States for its part presented net fishing lines which would draw inward the seaward limits of fishing in southeastern Alaska, but would preserve historic fisheries found in that area. Canada was unable to accept these lines because they permitted continued interception of Canadian bound salmon.

Because of these differences, the conference was unable to reach agreement on adjustment of the salmon net fishing lines in the northern area. This led to an understanding that the countries would no longer be bound by the net fishing line agreements reached in 1957.

At the close of the conference the Canadian delegation reserved the right for Canada to extend its fisheries seaward where appropriate in order to seek an equitable solution of the major problem of interception by fishermen of one country of salmon bound for the other which could not be resolved by attempts to reach agreement on the inward adjustment of salmon net fishing limits. Canada gave the assurance

that unrestricted high seas fishing by Canadian fishermen would not be permitted and that due notice of changes in pertinent fishery regulations would be given to the United States.

The United States delegation stated that in view of the Canadian reservation, the United States reserved its right to redefine its seaward salmon net fishing lines as considered appropriate. It also indicated that due notice would be given to the Canadian authorities of any proposed changes.

The conference did agree that a research program designed to provide more information on the movement and intermingling of the stocks originating in southeastern Alaska and northern British Columbia should be initiated as soon as possible. From such research it is hoped that solutions to the unresolved problems can be found which are equitable and mutually advantageous to both countries. W. Kirkness and H. L. Rietze of the U.S. delegation and W.R. Hourston and P.A. Larkin of the Canadian delegation were named as a coordinating committee to initiate the necessary exchange of information and prepare proposals for co-operative research for the consideration of the two governments before October 1, 1966.

Opening Statement By U. S. Delegation

We are meeting for the third time to discuss salmon fishing problems affecting fishermen of our two countries. On our part, we are convinced that the present salmon convention boundaries and the scope of the Salmon Commission Authority are not broad enough to allow for the most effective conservation of sockeye and pink salmon of common concern. Furthermore, we believe the salmon net lines in the Strait of Juan de Fuca are not adequate and should be moved.

Canada on her part has objected to the present net fishing lines in Southeastern Alaska.

At this meeting we are willing to set aside the discussion of the Salmon Commission jurisdiction and some other problems which are of concern to us and to concentrate on the problem of net fishing lines. It should be understood that by so doing we are not departing from our views on the other problems expressed at previous meetings.

At these meetings, both the Canadian and U.S. delegates have set out their positions and proposals regarding net fishing lines. I do not intend to repeat the entire U.S. position but I do believe that it would be useful to review the essentials. The original purpose of the "Lines" as recommended by the International Salmon Commission was to prevent the development of new offshore net fisheries. That was the understanding of the U.S. and it provided the basis for what we agreed to do at the 1957 meeting. We believe that this objective has been met.

A MISUNDERSTANDING

As we understand it, Canada believes that the original agreement in February, 1957 required the United States to draw net fishing lines along the beach in Southeastern Alaska for the purpose of minimizing any interception of mixed stocks and to permit their more effective management closer to their home streams. It is indeed unfortunate that this misunderstanding occurred and we will comment further on this later. On the other hand, our task at this meeting is to resolve our differences to the extent that this is possible as we have so many times in the past.

Canada now proposes that whatever was the intent of the original 1957 agreement it is now desirable to move these lines inward toward the beach wherever their present location permits the taking of salmon from mixed runs headed for rivers of Canada and the United States. Canada justifies this proposal on the grounds of improved fishery management and equity. The United States agrees that the country from whose streams the salmon originate should harvest the returns, provided that appropriate provision is made for historic fisheries.

The provision for historic fisheries is not new or unique. It is an integral part of the North Pacific Fisheries Convention, the North Pacific Fur Seal Convention, the International Salmon Convention, and has been repeatedly recognized in agreements among European fishing nations. Without such a provision these conventions could not have been negotiated nor would they have endured.

We would agree that the country with an historic fishery, which takes salmon spawning in the rivers of another country, has an obligation to cooperate fully in conservation measures to maintain and improve the resource. We can understand Canada's desire for measures by the United States which would limit historic fisheries where the catches include some proportion of salmon originating in waters of Canada. Obviously this would be in Canada's interest. We agree that limitations or regulations should be imposed when needed for conservation purposes. However, we see no equity in Canada's insistence that an historic fishery of the United States be eliminated for the purpose of increasing the catch by Canadian fishermen at the direct expense of United States fishermen. Such a

modification of existing practice obviously is not in the United States interest. It would wipe out a United States fishery which takes salmon predominantly of United States origin, which has been in existence for well over half a century, which provides the principal economic support for a number of canneries and several communities, and which lies in U.S. territorial waters. To meet conservation requirements we have offered the fullest co-operation with Canada in research and conservation measures required to maintain and improve salmon runs originating in Canadian waters where our historic fisheries share in the harvest.

CITE HISTORIC FISHERY

We cannot see any violation of equities or sacrifice of effective conservation management in our position. We are dealing here with an historic fishery in U.S. territorial waters which normally takes mostly salmon of U.S. origin. The Canadian proposal would require that we seek to harvest these salmon in other scattered and less economic localities and severely damage the economy of the dependent canneries and communities. Accordingly, it appears to us that the Canadian proposal is the one which is inequitable and impractical. We believe that this would be the reaction of most neutral observers.

Canadian representatives have referred repeatedly to their conviction that the net fishing lines off Southeastern Alaska were drawn contrary to the understanding reached between our two countries in 1957. Obviously, there was a serious misunderstanding on this issue and we regret exceedingly that it should have occurred. We have referred before to the United States understanding of the purpose of the net fishing lines. We consider that this purpose is being accomplished; we have not permitted nor do we intend to permit the development of any new net fisheries off our coast. If Canada had made it clear at the Conference in 1957 that she considered that the purpose of the net fishing line in Southeastern Alaska and the United States commitment was to reduce the historic Noyes Island fishery, it is obvious that the United States would not have agreed. (The agreement on net lines was made at a meeting in February 1957 before the now famous 1957 salmon season and tagging program.)

Canadian representatives have made a big point of the claim that the net fishing lines off Alaska are drawn on a different basis than those off British Columbia. I would point out that the Canadian net fishing lines on the inner coasts are drawn quite differently than those on the outer coast. In some places these lines permit fishing many miles from the coast. On the mainland shore of Northern British Columbia they are at least as liberal as our present three mile net lines drawn in Southeastern Alaska which follow the sinuosity of the shore. However, the meaningful issue is the effect of the lines, not the precise manner in which they are drawn. We have previously stated that the Alaskan lines have accomplished the intended purpose, they have prevented the development of new net fisheries. If Canada chooses to draw her net fishing lines in some other manner which accomplishes this purpose we could interpose no objection.

EFFECT ON CONSERVATION

Canadian representatives have commented on the serious effect that the Noyes Island fishery has had on the conservation of the Skeena and other salmon runs originating in Canadian rivers. We would point out that although certain scientific evidence suggests that in 1957 substantial numbers of salmon of Canadian origin were taken at Noyes Island other evidence indicates that 1957 was a most unusual year; in fact the most unusual year of recent record. Data for 1958 suggest that in that year few salmon of Canadian origin were taken by the Noyes Island fishery. In fact, a considerable number of salmon destined for U.S. streams in Southeastern Alaska were caught in Northern British Columbia.

The United States has offered to participate fully in a joint research program designed to determine the catch by the U.S. and Canadian fisheries of salmon headed for the waters of the other country and to fully co-operate in any conservation program necessary to maintain and improve the salmon runs from all streams. This seems to us a more reasonable and equitable proposal than that the United States should wipe out an historic fishery in U.S. territorial waters because it may, on apparently unusual occasions, take a substantial number of Canadian bound fish, a move that would require that the United States harvest the salmon of U.S. origin at scattered and less economic locations and severely damage the economies of United States canneries and communities dependent upon this fishery.

POSITION 'CONSISTENT'

Canadian representatives also have claimed that the United States position on Bristol Bay salmon differs completely from the United States position on Noyes Island and the Fraser River. Such commentators have failed to carefully examine the United States position. This position is that the country from whose streams the salmon originate and which has carried out research and management measures to maintain and increase the sustainable yield, and such other countries which have historically participated in the fishery, together are entitled to participate in the fishery. In Bristol Bay no country except the United States has historically participated in the salmon fishery. Thus it is clear that the U.S. position is consistent for all these fisheries.

So much for the past. Out task is to work out a basis of agreement for the future. We are prepared to review all the net fishing lines and conser-

vation problems involved in the United States and Canadian fisheries of the region under discussion with the purpose of seeing what adjustments might be agreed upon and what further research and conservation measures are needed. We believe that such an approach provides the best possibility of resolving our difficulties on a mutually acceptable basis.

Statement by Chairman of Canadian Delegation

Mr. Chairman, as you said in your opening statement, we are setting aside, without prejudice to the views we have expressed at other meetings, a number of salmon problems of mutual concern and are, in this meeting, concentrating on the problem of seaward limits for net fishing. You referred to the misunderstanding during discussion of these limits in 1957 and, because of its importance as background of Canada's position, it seems desirable to explain the nature and seriousness of the misunderstanding. In doing so, we do not wish to, and indeed cannot, place the responsibility for a failure of meeting of minds on either your shoulders or our own. We wish only to lay the basis for a better understanding of our present position.

I am sure by this time we are all quite familiar with the wording of the controversial agreement reached in 1957 as recorded in the official summary of proceedings of that Conference. I refer, of course, to major agreement number four on page seven "the line described in the Alaska fishery regulations was appropriate".

SOUGHT DEFINITIVE LINE

In this connection, it was understood that the closing lines connecting headlands in Alaska, which were discussed and which serve as a baseline in some areas for the measurement of the seaward limits of the "waters of Alaska", as this expression is used in the Alaska fishery regulations, are not definitive. On the request of the Canadian delegation for a chart showing the definitive line, the United States delegation agreed to submit such a chart as soon as possible.

I am also sure we are all familiar with the Canadian and U.S. statements regarding the misunderstanding, recorded in the summary of proceedings of the 1959 conference on co-ordination of fisheries regulations, and in the minutes of the two recent meetings held in Washington and Ottawa. However, I think we should refresh our memories concerning events following the close of the 1957 conference. We expected to receive from the United States, within a short period of time, a chart showing the Alaska line. When more than two months had passed and as the 1957 fishing season was approaching, we wrote asking when we might expect to receive the chart; as you know, the chart was not received for some eight months, and after the 1957 salmon season had passed. After receiving the chart, which made clear to us for the first time that the Alaska seaward net fishing limits had been drawn three miles seaward of the baseline referred to above (which was defined for us after the 1957 meeting), we wrote requesting an early meeting to give consideration to adjustment of the line as provided for in major agreement number five of the 1957 conference. This consideration did not take place until April 1959.

Now let me return to the events which took place during the 1957 conference. We agree with your statements made on several occasions that as a result of concern expressed by the International Pacific Salmon Commission in correspondence directed to our two governments, a decision was reached to convene the 1957 conference to give consideration to ways and means of preventing development of major offshore salmon net fisheries.

At the 1957 meeting, consideration was given to the establishment of lines seaward of which salmon net fishing by nationals of our two countries would be prohibited. The meeting was advised that the State of California was taking action in its legislature to prohibit the taking of salmon by the use of any type of net gear within the territorial waters of the State and by its citizens in international waters of the Pacific Ocean. Obviously, such legislation made it unnecessary to draw a line or define co-ordinates.

CHARTS PRESENTED

Charts showing proposed net fishing limits along the coasts of Oregon, Washington and British Columbia were presented by the respective administrations, critically examined, amended as considered necessary, and accepted. These lines were carefully defined by means of co-ordinates. No similar chart was presented for the Alaska area and no critical examination or consideration of essential amendments was possible. Towards the close of the meeting a map of the Alaska coast was produced and an attempt made by United States delegates to indicate the location of a tentative Alaska baseline. It was made clear, however, that this line was not definitive and that none of the people present were authorized to set its position at that time.

I hope this summary will make clear to all present how the misunderstanding arose. Although, as we finally learned, the territorial water limit off the coast of Alaska formed the proposed net fishing

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Canada to Reassess Salmon Net Fishing Limits

CANADA IS reassessing its seaward net fishing limits for salmon on the Pacific Coast following recent discussions in Seattle with U.S. fishery officials, Fisheries Minister H.J. Robichaud told the Commons Committee on Fisheries May 26 during discussions of his Department's estimates.

Mr. Robichaud stated, however, that he did not expect Canada would be in a position to make any revisions for the 1966 salmon fishing season.

Canada is "to move energetically" with the United States into "a joint research program designed to give both governments more information on the movements and intermingling of salmon stocks originating in Alaskan and Canadian rivers". He said it was hoped "that on the basis of fuller information we can arrive in the future at solutions which are equitable and mutually advantageous".

Mr. Robichaud's complete statement follows:

"After the return of our officials from discussions with the United States representatives in Seattle last week, I have discussed this matter with the Secretary of State for External Affairs.

"The discussions in Seattle last week were concerned with certain seaward limits of fishing for salmon with nets, which were established by the Governments in 1957 on the basis of informal agreements between senior officials. There was some doubt at that time as to the location of these limits off southeastern Alaska and when this was clarified it appeared that the limits there were established on a different basis from that of the limits in British Columbia and along the United States coast south of the border. They were, in fact, farther offshore in Alaska. These limits were discussed again in 1959 when our representatives pointed out that the Alaskan limits gave United States a better opportunity to catch salmon bound for our rivers than if they had been established on the same basis as the limits along the British Columbia coast. At that time Canada reserved the right to move our limits for salmon net fishing seaward where appropriate. In April of this year at a meeting in Ottawa our representatives insisted that these limits be renegotiated and the meetings in Seattle were an attempt to reach an agreement on appropriate limits along both Canadian and United States coasts.

"Unfortunately our representatives considered that the inward adjustments of the Alaskan lines proposed by the United States were not sufficient to remove the inequity, as the new limits would still be less restrictive than corresponding limits in British Columbia and would not affect fisheries in Alaskan waters which take considerable quantities of salmon bound for British Columbia rivers. A Canadian proposal for more extensive inward adjustments of the limits on both sides of the border in order to minimize catches in each country of salmon bound for the other was not accepted by the United States. The Canadian representatives again reserved the right for the Government to extend Canadian net fisheries for salmon seaward where appropriate to achieve an equitable situation.

"Under these circumstances we are determining the extent of Canadian fisheries in existence on any part of our Pacific coast in 1957 which were curtailed by the limits established at that time and also determining what revisions of seaward net fishing limits would make possible their reinstatement in the future. We do not expect, however, to be in a position to make any such revisions in time for the 1966 salmon fishing season.

"At the Seattle meeting our representatives agreed to plan and carry out a joint research program designed to give both Governments more information on the movements and intermingling of salmon stocks originating in Alaskan and Canadian rivers. We intend to move energetically in this direction by carrying out this year in waters off northern British Columbia some research fishing by government or chartered vessels, with associated tagging of salmon. We hope that on the basis of fuller information we can arrive in the future at solutions which are equitable and mutually advantageous."

continued from preceding page

limit, the territorial water limit did not form the net fishing limit proposed for California, Oregon, Washington or British Columbia. The following excerpt from a statement made by the late George Clark, Chairman of the Canadian delegation to the 1957 Conference, towards the end of that meeting may add further clarification regarding the Canadian view at that time. "It is recognized by all concerned that if offshore fishing for salmon, except by trolling gear is allowed to develop, the conservation measures of the two countries will be nullified. Moreover, it is the very strong conviction of the Canadian delegation that in other areas of the Pacific high seas salmon fishing, our case that we are giving adequate and proper protection to the runs of salmon will be materially weakened if the nationals of Canada and the United States are permitted to take salmon in areas where runs are intermingled

and there is no known technique or method to predetermine the various stocks and runs".

MADE GRAVE ERROR

In retrospect it is clear that the Canadian delegation in its efforts to reach agreement regarding restriction of offshore salmon net fishing, which would provide for better conservation and more effective management of the important Pacific coast salmon stocks of our two countries, made a grave error in approving the summary record of the 1957 Conference without having had an opportunity to consider a definitive Alaska net fishing line.

Canada would not have agreed to the seaward net fishing limits in their present form if we had known the definitive location of the Alaska line. Furthermore, as soon as the definitive line was revealed to us we asked for further discussion of the problem which took place in 1959. At that meeting we expressed our disagreement with the line as defined in Alaska and reserved our freedom to adjust our own lines.

We start now, with a clean slate, to reconsider the problem of seaward limits for net fishing and we hope that some measure of agreement can be reached.

Before proceeding with a consideration of actual proposals regarding the definition of lines we must, however, point out our disagreement with some points in your opening statement and reiterate the principle that in the interests of effective management and of equity the taking by one country of salmon bound for the rivers of the other should be minimized. Indeed the increasing demand and value of rivers for other purposes, makes it more necessary year by year for the countries with the rivers to reap the benefits, if they are to continue to bear the high direct and indirect costs of keeping the rivers fit for salmon.

The United States indicated agreement with this principle with the reservation that so-called historic fisheries should be protected. We are not as impressed as you appear to be with the importance of maintaining the status quo. In this connection I would mention only two points at this time. In the first place the seaward net fishing limits defined in 1957 in British Columbia and Washington did not eliminate some fisheries which had existed for some years at that time as well as nipping some others in the bud. Secondly, it is a common place both in domestic and in international fishery regulations to alter existing fisheries. Surely progress in the development of the fisheries everywhere can take place only if such changes are made. Surely, too, the main considerations must be equity and good management.

BASIS FOR DISCUSSION

Mr. Chairman, I suggest that we now ask a smaller group to consider possible actual seaward net fishing limits. We have made a proposal as a basis for discussion and have illustrated the sort of inward adjustment we have in mind with a chart of part of Southeastern Alaska. I wish to repeat my assurance that our aim is to minimize the capture in one country of salmon bound for the other and to that end we are prepared to make adjustments of the seaward net fishing limits in British Columbia which would make a further substantial reduction of our opportunity to catch Alaska bound salmon. ✔

Sport Fishing Survey in B.C.

Tidal sport fishing is continuing to grow in importance and with the increasing participation of many new anglers each year the Department of Fisheries is stepping up its program of obtaining detailed and accurate sport catch and effort information.

The need has also developed for an economic evaluation of the tidal sport fishery. This study will include information on trends in the number of persons participating each year, investment in vessels and equipment, number of moorage facilities available, and the effect of these items on catch and effort.

In order to assemble the catch and effort information and to provide the start of the economic assessment, the Department is employing six University students this season to work along with Departmental Fishery Officers in the major tidal sport fishing areas of British Columbia.

The students will be interviewing fishermen as they come ashore and may ask them to complete questionaires or provide data on their catch and effort for the day. A sample of those interviewed will also be asked to provide information on their monthly and yearly expenditures on tidal sport fishing and information on other related items. In addition, the students will be conducting special surveys of catch and utilization patterns of residents and of tourists.

It is hoped that sport fishermen and operators of sport fishing establishments will co-operate in this study by providing this information when requested by the students.

Technical News

by James Kinloch

The Future Atlantic Herring Fleet

Recent developments in the Canadian Atlantic herring fishery, with promise of greatly increased returns to the Canadian fishing industry from the products and by-products of this fish, have aroused interest in what kind of fishing vessel will be found most suitable for the herring fleet.

Improvements in design, equipment and gear could increase efficiency on most of the boats now catching herring on the Atlantic coast, according to Jean Frechet, Chief of the Fishing Operations Branch of the federal Department of Fisheries' Industrial Development Service.

Factors of greatest concern in the offshore herring vessel of the future, says Mr. Frechet, would be size, type, materials used in construction, machinery required, equipment needed and the methods of fishing to be practised.

Climatic conditions, hold capacity and operational costs would call for a length of 120 feet. From a capital investment point of view, vessels constructed of wood have been profitable on the Atlantic coast, but whether wood is used to keep construction cost at its lowest, or steel to provide a more lasting investment, it would appear that the 120-foot length is indicated for the immediate future.

COMBINATION VESSEL

There would be definite advantages in investing capital in a vessel capable of using various kinds of fishing gear and methods of fishing with minimum changes in machinery and layout. Thus it would be possible to catch fish at peak concentration. A combination vessel such as a stern ramp trawler and purse-seiner is thus indicated. Aluminum could be used for superstructures, and plastic materials for inner surfaces could be easily washed and kept sanitary. In the fish hold a layer of insulation covered with mastic and plywood should be coated with reinforced fibreglass and finished with white epoxy.

The propulsion system should occupy as small a space as possible to allow for greater carrying capacity. In a 120-foot combination vessel, efficient fishing operations would require 900 horsepower.

Aboard a combination vessel, a combination winch is desirable. Hydraulic power gives the necessary flexibility. Such a winch could easily combine the drums and warping heads necessary for seining, trawling, long lining, gillnetting, etc. A desirable addition to the equipment would be a hydraulic side roller which permits the drying out of the bunt or hauling the net with ease. There is a need for a powerful herring pump to empty the bunt as rapidly as possible.

SHIPBOARD FREEZING

Shipboard freezing systems may become mandatory for catches of herring taken for human consumption. A precooling system would be an asset and refrigerated sea water or brine solutions are also indicated. The skiff aboard a herring vessel could be made of aluminum, with a light and compact propulation unit, possibly a free piston gasifier used in conjunction with a water jet turbine.

Modern navigational and fish finding equipment is now well established aboard fishing vessels; a powerful SONAR system is necessary for seining. Light attraction systems could also be used, and experimental work may lead to the introduction of attracting devices using noise or electrical fields or impulses.

A 120-foot vessel with 900 hp would be able to use the largest knotless seine nets known at present, says Mr. Frechet. These are nearly 500 fathoms long and 65 fathoms deep. Similarly, such a boat would have the necessary thrust to tow large herring trawls.

The ability to operate various types of gear and the increased mobility of the herring vessel of the immediate future would easily permit year-round offshore fishing operations. ✔

The Codex Alimentarius Commission

Why it Was Formed

What it Is Doing

EDITOR'S NOTE: The following article is based on a paper delivered at the 21st annual meeting of The Fisheries Council of Canada by H.V. Dempsey, Director of the Inspection Service, federal Department of Fisheries and Vice-chairman, Joint FAO/WHO Codex Alimentarius Commission, Rome, Italy).

By H.V. Dempsey

IN LATIN, "Codex" means a manuscript in the form of a book or a code of laws, and "alimentarius" is the Latin word meaning "relating to nourishment or food". Thus Codex Alimentarius means simply a Food Code. We might refer, therefore, to the Codex Alimentarius Commission as the World Food Standards Organization.

H.V. Dempsey

With the marked increase in world trade in food since the war, exporters grew increasingly frustrated with the multitude of national food laws in respect of quality, workmanship, grade, wholesomeness and labelling which they encountered in international trade. Two examples of this problem which involve fish products might be cited here. In several countries, including the U.K., small herring, packed as sardines in Canada, cannot be sold as sardines but they are quite acceptable on most world markets as sardines. France has passed a law requiring that labels for canned salmon show the drained weight as well as the usual net weight designation. One could mention many such examples of differences in national food laws.

In too many instances it appeared, not without justification, that food inspection regulations were used by some countries or trading blocks as barriers to trade. Canada has been accused of this practice because of our rather rigid quality and labelling requirements for imported fish and shellfish. These have resulted in the rejection of shipments to a value in excess of $1 million in the past ten years. In our case, we can plead innocence and purity of purpose. All accusations have been withdrawn when we demonstrated that the standards applied to imports are precisely the same as those which processors of Canadian fish products are asked to meet.

RESULT OF FAO SURVEY

In 1962, a survey made the FAO (The Food and Agriculture Organization of the United Nations), found that the rather startling number of 135 organizations were engaged in developing international food standards. This included such groups as the Colombo Plan, the International Sugar Council and the European Common Market. Add to this figure the governmental organizations in each country involved in food regulations, such as the Department of Agriculture, the Department of Fisheries and the Food and Drug Directorate in Canada and the frightening complexity of the food standards picture is obvious. What was equally apparent was the need to develop and simplify work on international food standards in order to eliminate duplication, confusion and conflict.

Late in 1962, FAO and WHO (World Health Organization) called a meeting in Geneva of government representatives to consider the problem. It was agreed that a Codex Alimentarius Commission should be formed. Accordingly, the first session of the Codex Alimentarius Commission was called in Rome in the summer of 1963. Most of the time of this session was devoted to developing rules of procedure and in setting up Commodity Committees for standards development. There was much dissension and heated argument over the rules of procedure when France, Austria and the Federal Republic of Germany led an attempt to gain approval for a European Council for the Codex Alimentarius which would be independent from and equal to the main Commission. The proposal was unacceptable to the majority of countries who held firmly to the idea that the main purpose of the Codex Alimentarius Commission was to coordinate development of trading standards on a worldwide basis. The Rules of Procedure, as adopted, reflect the major objectives of the Codex Alimentarius Commission which may be stated briefly as:

1. To promote and strengthen international trade in raw, semi-processed and processed foods.

2. To promote fair trade practices.

3. To ensure that consumers in any country of the world are supplied with safe, wholesome food of acceptable quality.

4. To ensure that all foods are properly labelled and presented and that all elements of fraud, deception and deceit are removed.

Codex Committees have been established to develop trading standards for a broad range of foods including meat and meat products, fish and fish products, processed fruits and vegetables and fats and oils. In addition there are committees formed to deal with general subjects which affect all foods. These include committees for food hygiene, food additives, pesticide residues and food labelling. Canada chairs the Labelling Committee and Norway has the responsibility for convening meetings of the Committee on Fish and Fish Products.

ACCEPTANCE PROCEDURE

Once a standard has been accepted by the Commission as being suitable for publication in the Codex Alimentarius, it may be accepted by a country in one of three ways -

1. in its entirety, without qualification,

2. with an indication of a more stringent national requirement for any part of the standard, or

3. as a target to be accepted after a stated number of years.

Acceptance of a Codex Standard in its entirety or target acceptance constitutes an undertaking by the importing country not to hinder by regulations the distribution of any food which conforms to the standard.

It likely will not be uncommon to see standards accepted by some countries with a footnote indicating a specific legal requirement which must also be met. The first example which comes to mind is canned sardines. I am quite hopeful that agreement can be reached on a Codex Standard for this product which includes definition and requirements for hygiene, weight and measure, quality, labelling and analytical methods for samplying and testing. When published, however, the standard would likely carry a footnote stating that, in the United Kingdom, only fish of the species *Clupea pilchardus Walbaum* may be labelled as sardines. Similarly a general standard for canned tuna might be accepted by the U.S.A. with a proviso that the species *Sarda chilensis* must be labelled as bonito.

What is significant, of course, is the possibility of worldwide acceptance of a standard for food which states requirements for so many factors including quality. If, for example, a British importer wished to buy 10,000 tons of frozen cod fillets of Codex Standard, the factor of quality would be constant in his negotiations and competition between say Iceland, Norway and Canada for the contract would be based, as it should be, on price and service. A parallel example could be given for salted fish, for canned salmon, for unsweetened orange juice, refined white sugar and other food for which a Codex Standard exists.

DRAFT STANDARDS

To date draft standards have been prepared for the following fish products:

Canned brisling	Canned Pacific salmon,	Frozen Pacific salmon,
Canned Sild,	Canned bonito in brine, or oil	Salted herring,
Canned Herring,	Canned Shrimp,	
Canned Sardines,	Frozen fillets of Atlantic Cod, Haddock and Ocean Perch,	

Standards are also under consideration for:

Canned Tuna in brine or oil, Canned Mackerel in brine or oil, Canned Crabmeat,
Frozen tuna as raw material for further processing,
Frozen herring as raw material for further processing,
Frozen crustacea including lobster, shrimp and crab. ✔

Record Groundfish Catch

During the period June 5 - 11, 1,550,000 pounds of trawl-caught fish were landed in Vancouver and Steveston, an all-time record for a week's landing of groundfish at these ports. The previous high figure was 1,250,000 pounds landed in the week of August 29 - September 5, 1965.

The record landing included 768,500 pounds of gray cod, 387,400 pounds of lingcod, 269,200 sole, 98,000 ocean perch and 2,700 pounds of other species. Landings so far this year are about 6 million pounds ahead of 1965.

The Pacific Herring

HERRING were one of the first coastal fishes to be utilized by man. In northern Europe, particularly, they have been a source of food since before written history. In British Columbia herring and herring roe have been an article of food or barter of the coastal Indian tribes for many centuries. They were not fished, however, on a commercial basis until 1877 when 75 tons were caught.

From 1959-1963 the annual catch has averaged about 210,000 tons.

While this fishery is first in landed weight and second to salmon in landed value, it is only worth about one-quarter as much as British Columbia's salmon catch.

Fluctuations in the world price of fish meal and oil cause the market value of about eight million dollars to vary from year to year.

THE FISHERY

The British Columbia herring fishery is a highly organized operation utilizing modern shore plants and efficient fishing vessels. The seventy- to eighty-foot long seine boats are equipped with the very latest electronic fish-detecting equipment, enabling the fishermen to "see" the shoals before setting the net. In some areas the eighty vessel fishing fleet may use powerful blue-tinted lights to attract fish schools.

Purse seining has been the dominant method of harvesting the herring crop since 1910. The 275-fathom long net encircles a school of herring and a purse line closes off the bottom like a draw string to prevent herring from escaping.

Sets average about 70 tons but catches up to 300 tons or about three million herring are not uncommon. The largest catches by a single net ever recorded were 1260 tons from Ogden Channel near Prince Rupert in 1950 and 1150 tons off Comox in 1949. The former was made by the seiner "Maple Leaf C", the latter by the seiner "Western Ranger". The captured herring are scooped two tons at a time with a giant dipnet or brailer into the hold of the fishing vessel and conveyed rapidly to the shore plants. Some herring are also caught by mid-water trawls and a few, to supply the fresh fish market, by gill nets.

The Pacific Herring *(Clupea palasii)*

In southern British Columbia the most prolific fishing grounds are along the Vancouver Island shoreline. On the east coast the best localities are off Campbell River, off Comox and amongst the "Gulf Islands" between Nanaimo and Victoria and on the west coast in Barkley Sound, in Nootka Sound and in Esperanza Inlet. In central British Columbia herring are caught in the channels near Bella Bella and in northern British Columbia around the islands south of Prince Rupert. Considerable catches are sometimes made along the lower east coast of the Queen Charlotte Islands.

Fish caught in southern British Columbia are generally processed at Steveston near Vancouver while those captured in central and northern British Columbia are delivered to shore plants in Prince Rupert and Namu, south of Bella Bella.

At the shore plants herring are unloaded by a giant suction hose into storage bins to await processing into fish meal and oil. The herring harvest of British Columbia is not utilized directly for human consumption but rather forms a protein and mineral rich supplement in the diet of poultry, pigs and mink. The edible fish oil is shipped by rail and truck to markets in Canada and the United States for use in the manufacture of soaps, paints and cooking compounds. Only five per cent of the total herring catch is used for human sustenance either canned, salted, pickled or fresh.

DESCRIPTION

Pacific coast herring are bony fish about nine inches long with blue-green backs shading away to silvery white on the sides. The mouth is large with a slightly projecting lower jaw; the tail is deeply forked. They are graceful but somewhat nervous swimmers, characteristically travelling in large shoals. They are grouped scientifically in the family Clupeidae, to which also belong such other closely related Pacific coast species as the pilchard (Pacific sardine) and the shad.

Iridescent, loosely attached scales, about

one-quarter of an inch broad, are imprinted with annual rings that can be used to tell the age of a herring. In British Columbia the herring catches are composed mainly of fish that are three and four years of age. If there were no fishery some herring would grow to be quite old. The oldest herring on record, caught several years ago near Prince Rupert, was more than fifteen years old.

REPRODUCTION AND GROWTH

To fulfill the instinct to reproduce their species the herring legions undertake long spawning pilgrimages each year. In the fall, they leave the rich offshore feeding grounds above the continental shelf and migrate to inshore waters. Here, they form in dense schools awaiting the ripening of their reproductive organs. It is during this winter resting phase that the fishermen intervene to make their catches. Spawning takes place along the shore in early spring.

Each spring herring leave the ocean depths and crowd onto the beaches in vast numbers to perpetuate their race. Although male and female are present in equal numbers on the spawning ground there is no "pairing off" during the spawning act. Females discharge sticky eggs on green eel grass and brown rockweed, japweed and kelp. The males shed milt into the surrounding water turning it milky and opaque for miles. During the 1964 spawning season, over 220 miles of spawn were deposited along the 17,000 miles of British Columbia shoreline. After spawning, the spent fish return offshore to feed in scattered schools.

An average-sized herring deposits about 20,000 eggs each year. The transparent eggs are less than one-sixteenth of an inch in diameter and one square inch of seaweed may be covered with as many as one thousand eggs. After a sixteen-day incubation period the embryonic fish finally break out of the confining egg membranes and drift away.

During the brief period that they are fastened to moist seaweed many thousands of eggs are destroyed. Storms frequently annihilate whole spawnings. Seagulls and diving ducks are attracted in large flocks to the spawning beaches, first to feed on the spawners and then on the spawn left exposed at low tide. Mortality during the egg stage may amount to as much as 70-80 per cent.

By late April the sea lanes are populated with tremendous numbers of newly hatched, almost invisible herring larvae. These fragile, thread-like one-quarter-inch long infant herring bear little resemblance to the adult fish. They lack scales, the head and black eyes are greatly enlarged and they can barely swim. Two months later when about one and one-half inches long they will have undergone a gradual metamorphosis that changed their outward appearance into that of a miniature adult herring.

After schooling up, the infant herring now known as juveniles can be found frequenting kelp beds for protection during the summer months. These sardine-sized fish are raked by sports fishermen for use as live bait when trolling for salmon. Occasionally, a small fishery for these juveniles takes place but the schools of young herring have never been exploited to the extent of those along the Atlantic seaboard and in the Gulf of Maine.

In October, when about 4 inches long, juvenile herring normally forsake their shallow-water haunts and move seawards into deeper waters. Their survivors will return in the fishable stocks mostly as mature, three-year-old herring. They will continue to return each year in the spawning runs for the remainder of their life span. Little information exists with respect to the distribution and abundance of immature herring between the time they leave shallow water and the time they return as adult fish.

Herring research has shown that two types of herring stocks exist in the coastal waters of British Columbia; major migratory stocks and minor resident stocks, the latter present in local waters all year round. A twenty-year herring tagging program carried out by the Nanaimo Biological Station of the Fisheries Research Board of Canada has indicated that there are at least nine relatively separate migratory herring populations along the coast.

MANAGEMENT PROGRAM

Present day efforts are designed to provide a scientific basis for a management program that will allow the greatest possible catch from all populations. In the continuing program emphasis is placed on compilation of catch statistics, sampling for age, length and maturity, estimating spawn abundance and echo-sounding surveys. The analysis of these data provides information on the level of abundance of each population and on the relationship between the size of the spawning stock (measured by the amount of spawn deposited) and the resulting number of recruits to the fishable schools (year-class strength).

The British Columbia herring fishery is regulated through the Federal Department of Fisheries by a combination of closed areas, closed seasons and catch quotas. The closed season extending from February 5 to May 1 in southern British Columbia is designed to protect the fish at spawning time when they are massed close to shore. By mutual agreement, a 48-hour closure period occurs each weekend as well as a 3-week shut-down over Christmas. However, control of the fishery is provided principally by a system of catch quotas applied to most of the major herring populations. Thus, 40,000 tons of herring may be taken each year from the herring population off the lower east coast of Vancouver Island. If surveys by patrol vessels of the Department of Fisheries and biological evidence indicate

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News Roundup

Patrol Vessel Launched

Latest addition to the federal Department of Fisheries' protection fleet, the patrol vessel "Chebucto", was launched May 25 at Pictou, N.S. Mrs. H.J. Robichaud, wife of the federal Minister of Fisheries, officiated at the naming ceremony.

Built at a cost of a little more than $1,700,000, the "Chebucto" is practically a sister ship to the "Cape Freels" but will incorporate a number of improvements based on experience with the "Freels".

The "Chebucto" is a multi-purpose vessel and can serve in search and rescue operations when needed. There are a number of innovations, such as the ability to refuel other ships at sea. Her steel hull has been strengthened for navigation in ice, and her superstructure is of aluminum. The stability calculations worked out for her also make provision for the formation of ice on the superstructure.

"When completed the vessel will be as efficient a protection vessel as can be devised for service on the North Atlantic" Mr. Robichaud declared at the launching. "Not only my Department but all of Canada can take a pride in her."

RANGE OF 5,000 MILES

The "Chebucto" will serve in the Maritimes region, but with a range of more than 5,000 miles she can go almost anywhere. It is possible that she might be used occasionally for the Newfoundland Bait Service for, like the "Cape Freels", she can carry refrigerated cargo if necessary.

The "Chebucto" will carry a crew of 29 men, who will not only operate the ship but will be able to operate from it, because her two lifeboats are also combination craft. They are, in fact, work-boat-lifeboats, each 27 feet long, made of fibreglass, and powered with diesel engines, so that they can be used at any time in protection duties. Also on board are two outboard-powered lobster patrol boats.

The new vessel is 175 feet long, with a beam of 31 feet. Her engines develop 2,560 horsepower which will give her a speed of 15 knots. Her displacement tonnage is 880 tons.

"Chebucto", incidentally, is the Indian name for the village which once existed where Halifax now stands, which makes the choice of name for her a happy one, as Halifax will be her home port after she goes into service next November.

Mrs. H.J. Robichaud officiating at the naming of the Department's new patrol vessel "Chebucto".

Newfoundland Landings Up

Fish landings in Newfoundland during the first four months of 1966 increased by 44% over landings for the corresponding period last year -- 121 million pounds, compared with 84 million pounds.

In landed value the increase was also significant -- $4 million as against $3.4 million for the first four months of 1965. Cod landings at 52 million pounds represent an increase of more than 16 per cent over last year, while landed value was up by 38 per cent.

Frozen fish production in Newfoundland in April amounted to almost 7,500,000 pounds, bringing in the total output since the beginning of the year to 25,200,000 pounds. Total for the same period last year was 22,100,000 pounds.

Cod alone accounted for two-thirds of the April production, while production of plaice and greysole increased substantially over the 1965 output.

Training Needs Studied

The training needs of Canadian fishermen and the fishing industry generally were considered in Ottawa recently at a conference of officials of the federal Department of Fisheries and university extension departments active in fishing areas. The main topic of discussion was the role to be played by extension services in the over-all fisheries development program.

Dr. A.W.H. Needler, Deputy Minister of Fisheries of Canada who acted as chairman, said that the recommendations of the group would be considered by the appropriate federal-provincial fisheries committees following a survey to determine extension activity requirements in the commercial fisheries. This survey will be undertaken over the next few months by Lloyd J. Crabbe, Vocational Training Officer for the Industrial Development Service of federal fisheries.

Current fisheries extension programs were outlined by Donald Snowdon and E.J. Evans of Memorial University, St. John's, Nfld.; Rev. Fr. J.N. MacNeil and Dr. Remi Chiasson of St. Francis Xavier University, Antogonish, N.S.; Dr. A.J. Boudreau and Donat Lacroix, of the University of Moncton, N.B.; Marc Lemieux of the Quebec Co-operative Council, and Dr. J.K. Friesen and Graham Drew of the University of British Columbia, Vancouver.

Pollution Study

Changes in the plant and animal life of lakes brought about by pollution with domestic and industrial wastes are to be investigated by the Fisheries Research Board of Canada, in a multi-million dollar research program. The investigation will form an important part of a co-ordinated Canadian program organized by the Canadian Section of the International Joint Commission to deal with the increasingly serious problem of pollution in the Great Lakes. Through the International Joint Commission, this program is further co-ordinated with similar ones in the United States so as to avoid duplication of effort.

Domestic sewage and many industrial wastes are extremely rich in plant foods which greatly enrich lake waters. This fertilizing action leads to excessive plant growth which contributes to gradual depletion of oxygen in deeper waters. In turn, this brings about progressive changes in the kinds of fishes and other aquatic organisms that can survive and flourish, and leads to a general deterioration of water quality and usefulness.

This sequence of biological changes caused by increasing enrichment is known as "eutrophication". Similar changes have been observed in many lakes the world over. It is now generally recognized that accelerated eutrophication is the major pollution problem in the Great Lakes. This is particularly evident in Lake Erie where dramatic changes in plant and animal life have occurred.

In order to maintain and improve the condition of the Great Lakes, controls must be applied to halt and reverse the processes of eutrophication. However, these processes are not well enough understood to enable scientists to know what means of pollution control are required. The investigations of the Fisheries Research Board will be aimed at obtaining a fundamental understanding of eutrophication so that effective control measures can be devised.

The Pacific Herring

fish are unusually abundant, extensions to quotas are usually granted.

Pacific herring are almost entirely lacking in either defensive or offensive abilities, consequently, they are more preyed upon than any other species of coastal fish. Their perpetuation is dependent upon their abundance. At all stages of their life span herring form a basic food supply in the economy of the coastal waters of the north-eastern Pacific Ocean. Only one herring from 10,000 eggs is destined to return to spawn. Many fishermen think adequate stocks of herring are necessary to sustain important food fishes such as coho and spring salmon. However, available biological evidence suggests that perhaps these fish could subsist on alternative foods should herring abundance ever reach very low levels.

Herring are eaten by many creatures. Eggs are consumed by many kinds of sea birds, larvae by numerous invertebrates and older herring by sea lions, lingcod, dogfish and salmon. It is truly astonishing that any individuals live long enough to reproduce their kind.

In turn, herring feed on flea-sized organisms, such as copepods, amphipods and the young, free-swimming stages of barnacles and crabs. This diet is supplemented in the summer months with euphausiid shrimps, known locally as red feed. Herring food forms part of the category of ocean life known as zooplankton or animal plankton. The zoo-plankton organisms rise nightly towards the sea surface and descend again at dawn to avoid the intense daylight. Because herring are zoo-plankton feeders they also exhibit a similar up and down movement. The fishing fleets utilize this characteristic upward, nocturnal swim to bring the herring shoals within reach of their nets.

(Prepared by the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.)

Fishery Figures For April

SEAFISH: LANDED WEIGHT AND LANDED VALUE

* (Figures for Quebec available to March 1966 only.)

	May 1964 - April 1965		May 1965 - April 1966*	
	'000 lbs	$'000	'000 lbs	$'000
CANADA - TOTAL	2,222,525	132,097	2,245,666	142,127
ATLANTIC COAST - Total	1,542,994	85,742	1,704,148	96,351
Cod	603,057	23,278	583,570	24,277
Haddock	98,917	5,808	105,256	7,165
Pollock, Hake, Cusk, etc.	95,377	3,078	78,535	2,685
Rosefish	88,247	2,355	125,416	3,291
Catfish	3,350	107	4,456	146
Halibut	4,249	1,355	5,126	1,716
Plaice & Other Flatfish	165,213	5,359	225,008	7,263
Herring & Sardines	323,202	3,359	421,098	4,474
Mackerel	23,897	951	24,856	817
Alewives	10,356	150	12,194	207
Salmon	4,706	2,146	4,808	2,374
Smelts	4,307	311	4,099	293
Swordfish	11,667	3,506	7,807	3,264
Other Fish	15,947	645	14,899	633
Lobsters	41,718	24,561	40,010	26,033
Clams & Quahaugs	3,627	195	3,849	238
Scallops	16,423	7,654	20,605	10,579
Other Shellfish	28,734	924	22,556	896
PACIFIC COAST - Total	679,531	46,355	541,518	45,776
Pacific Cods	19,143	1,415	26,754	1,998
Halibut (1)	31,677	8,039	31,983	10,851
Soles & Other Flatfish	5,750	367	7,096	460
Herring	481,427	6,083	362,726	5,532
Salmon	118,317	28,735	86,385	25,071
Other Fish	5,826	183	8,956	289
Shellfish	17,391	1,533	17,618	1,575
BY PROVINCES				
British Columbia	679,531	46,355	541,518	45,776
Nova Scotia	536,360	42,156	612,952	49,277
New Brunswick	254,818	10,340	285,931	10,398
Prince Edward Island	40,978	5,639	46,810	6,858
Quebec	134,188	5,396	135,222(2)	6,101(2)
Newfoundland	576,650	22,211	623,233	23,717

(1) - Includes halibut landed in U.S. ports by Canadian fishermen.
(2) - Figures to end of April for Quebec not available due to strike.

MID-MONTH WHOLESALE PRICES - APRIL, 1966

		Montreal $	Toronto $
Cod fillets, Atl, fresh, unwrapped	lb.	.382	.450
Cod fillets, Atl, frozen, cello 5's	lb.	.349	.397
Cod fillets, smoked	lb.	.422	.473
Haddock fillets, fresh, unwrapped	lb.	.471	.580
Herring, kippered, Atl.	lb.	.256	.307
Mackerel, frozen, round	lb.	.180	.243
Lobsters, canned, Fancy	case 48-½s	64.947	66.040
Sardines, canned	case 100-¼s	9.364	*9.283
Halibut, frozen, dressed	lb.	.570	.600
Silverbright, frozen, dressed	lb.	.605	.617
Coho, frozen, dressed	lb.	.760	.763
Sockeye, canned, grade A	case 48-½s	25.530	28.457
Pink, canned, grade A	case 48-½s	16.753	17.107
Whitefish, fresh	lb.	(1) .433	.467
Lake trout, frozen	lb.	.422	.517

*Brunswick (1) Dressed

PRICES PER CWT. PAID TO FISHERMEN

Week ending April 16	1965 $	1966 $
Halifax	4.75	5.25
Cod Steak	4.5	5
Cod Market	7.5	8.5
Haddock	4	4.5
Plaice		
Yarmouth		
Haddock	-	-
Black's Harbour		
Sardines	-	-
St. John's Nfld.		
Cod	-	-
Haddock	2.75	2.75-4
Rosefish	2.5	2.5
Vancouver		
Ling Cod	10-12	12-15.5
Gray Cod	6-7	6-7.5
Soles	8-9	8.5
Salmon (Rdspg)	30-65	-

Fishery Figures For April

FROZEN FISH STOCKS AS AT END OF MARCH

	1965 '000 lbs	1966 '000 lbs
TOTAL - Frozen Fish, Canada	43,501	48,895
Frozen - Fresh, Sea Fish - Total	26,088	26,673
Cod, Atlantic, Fillets & Blocks	3,106	3,778
Haddock, fillets & blocks	3,384	2,397
Rosefish, fillets & blocks	1,819	1,609
Flatfish, (excl. halibut), fillets & blocks	2,792	2,557
Halibut, Pacific, dressed & steaks	3,475	2,811
Other Groundfish, dressed & steaks	689	935
Other Groundfish, fillets & blocks	1,949	2,141
Salmon, Pacific, dressed & steaks	4,963	2,598
Herring, Atlantic & Pacific	169	379
All Other Sea Fish, all forms	3,095	3,977
Shellfish	1,747	3,491
Frozen - Fresh, Inland Fish - Total	2,803	4,791
Perch, round or dressed	(1)	239
Pickerel, (Yellow & Blue) fillets	122	128
Sauger, round or dressed	(1)	(1)
Tullibee, round or dressed	107	153
Whitefish, round or dressed	687	1,606
Whitefish, fillets	179	343
Other, all forms	1,708	2,322
Frozen - Smoked Fish - Total	1,555	1,773
Cod Atlantic	850	1,073
Sea Herring, kippers	325	374
Other, all forms	380	326
Frozen for Bait and Animal Feed	13,055	15,658

(1) - Confidential, included with "Other".

SALTED FISH STOCKS AS AT END OF APRIL

Salted and Pickled Fish, Atlantic Coast			
Wet-salted - Total		6,766	3,893
Cod		5,554	2,950
Other		1,212	943
Dried - salted - Total		9,686	3,540
Cod		7,752	3,151
Other		1,934	389
Boneless - Total		839	340
Cod		819	317
Other		20	23
Pickled - Total	(barrels)	8,423	4,066
Herring	"	1,652	3,463
Mackerel	"	5,252	12
Alewives	"	1,519	591
Turbot	"		
Bloaters	(18 lb. boxes)	23,740	30,198
Boneless Herring	(10 lb. boxes)	4,379	-

CANADIAN EXPORT VALUE OF FISHERY PRODUCTS, MAY-JANUARY

(Value in Thousands of Dollars)

		1964-1965		1965-1966
Total Exports		157,995		173,592
By Markets:				
United States		104,612		123,091
Caribbean Area		11,743		13,973
Europe		37,251		31,315
Other Countries		4,389		5,213
By Forms:				
Fresh and Frozen		101,811		120,469
Whole or Dressed	33,678		35,650	
Salmon, Pacific	9,763		9,369	
Halibut, Pacific	4,428		5,890	
Cod, Haddock, Pollock, etc.	324		348	
Swordfish	4,393		3,897	
Other Seafish	4,482		5,297	
Whitefish	4,139		4,220	
Pickerel	2,138		2,603	
Other Freshwater Fish, n.o.p.	4,011		4,026	
Fillets	42,145		54,921	
Cod, Atlantic	16,596		19,893	
Haddock	4,266		3,700	
Rosefish, Hake, Pollock, etc.	3,428		5,342	
Flatfish	6,560		9,009	
Pickerel	2,247		2,425	
Other	9,048		14,552	
Shellfish	25,988		29,898	
Lobster (Alive & Meat)	18,770		20,925	
Other	7,218		8,973	
Cured		17,516		18,479
Smoked	1,389		1,635	
Herring	965		1,036	
Other	424		599	
Salted, Wet & Dried	14,077		14,052	
Cod	11,719		12,008	
Other	2,358		2,044	
Pickled	2,050		2,792	
Herring	1,299		1,703	
Mackerel	360		647	
Other	391		442	
Canned		26,336		20,830
Salmon	19,970		13,581	
Sardines	2,873		3,857	
Lobsters	2,620		2,293	
Other	873		1,099	
Miscellaneous		12,332		13,814
Meal	6,514		7,756	
Oil	1,872		1,558	
Other	3,946		4,500	

Fishery Figures From Abroad—Iceland

ICELANDIC EXPORTS BY COUNTRIES, 1964-1965

Quantity in Thousand Pounds
Value in Thousand Kroners

	Jan.-Sept. 1965		Jan.-Sept. 1964	
	Q.	V.	Q.	V.
GRAND TOTAL	-	3,587,222	-	3,120,513
Canada	6,563	25,301	-	11
Herring Oil				
United States	54,958	661,452	57,450	578,198
Frozen Fish Fillets	49,577	578,536	48,836	494,359
Frozen Lobster	772	56,920	974	50,789
Other Products	4,609	25,996	7,640	33,050
Brazil	3,131	28,613	1,779	17,983
Salt Fish, cured	2,934	27,690	1,345	16,321
United Kingdom	206,959	852,182	150,001	543,153
Salt Fish, uncured	5,534	33,822	5,611	32,584
Fish on Ice	27,785	81,956	28,137	80,055
Frozen Fish, whole	8,662	44,367	4,777	21,183
Frozen Fish, fillets	17,401	158,530	10,342	88,412
Frozen Lobster	357	13,173	838	26,645
Frozen Roes	937	8,921	1,481	15,448
Herring Oil	40,139	151,359	1,517	5,000
Fish Meal	939	2,877	10,721	26,426
Herring and Capelin Meal	97,624	317,077	78,005	211,310
Whale Meat	4,852	19,983	3,642	13,189
Other Products	2,729	20,117	4,930	22,901
Ireland	13,957	45,511	6,493	17,952
Fish Meal	5,831	17,784	5,551	14,920
France	7,313	38,537	8,327	38,990
Roes for Bait	-	-	4,383	16,584
Belgium	6,168	22,789	4,475	15,242
Herring and Capelin Meal	5,763	20,045	2,643	6,907
Spain	17,452	133,662	15,770	113,141
Salt Fish, uncured	16,246	128,463	14,780	109,129
Portugal	12,544	95,144	20,104	140,292
Salt Fish, uncured	12,544	95,144	20,104	140,292
Denmark	45,146	197,947	36,760	122,150
Lumpfish Roes, Salted	831	20,519	494	5,519
Herring Oil	26,916	105,589	3,893	14,043
Herring and Capelin Meal	5,827	19,357	19,766	55,280
Other Products	11,572	52,472	12,607	47,308
Norway	11,120	33,409	51,863	190,140
Herring Oil	4,136	14,709	38,927	137,535
Whale Oil	-	-	4,632	18,675
Other Products	6,982	18,700	8,304	33,930
Sweden	34,643	155,794	39,837	155,436
Cod Roes, salted	3,871	29,412	4,314	30,327
Herring, marinated	10,452	61,322	13,761	70,059
Fish Meal	9,253	27,519	10,794	28,008
Other Products	11,067	37,541	10,968	27,042

Quantity in Thousand Pounds
Value in Thousand Kroners

	Jan.-Sept. 1965		Jan.-Sept. 1964	
	Q.	V.	Q.	V.
Finland	26,347	105,603	27,835	99,947
Herring, marinated	10,333	63,108	10,986	59,301
Herring and Capelin Meal	6,124	21,034	11,129	29,005
Other Products	9,890	21,461	5,720	11,641
Italy	23,023	218,947	12,723	111,439
Salt Fish, uncured	13,702	109,480	7,057	52,409
Wings, salted	3,241	19,870	2,586	14,765
Stockfish	4,866	77,803	2,791	41,842
Other Products	1,214	11,794	289	2,423
Greece	5,624	30,646	4,612	26,159
Salt Fish, uncured	2,167	15,490	1,680	11,014
Holland	22,767	84,284	15,811	55,395
Herring Oil	13,585	50,609	11,336	40,295
Herring and Capelin Meal	7,414	26,223	1,786	4,909
Other Products	1,768	7,452	2,689	10,191
Poland	24,341	82,204	16,702	53,044
Herring, frozen	7,716	22,604	5,512	15,295
Herring and Capelin Meal	5,847	18,898	3,964	11,337
Other Products	10,778	40,702	7,226	26,312
Rumania	8,415	31,747	9,808	31,999
Herring, headless & salted, whole	6,466	24,725	4,888	17,739
West Germany	66,517	235,245	81,647	245,353
Salted Fillets	2,643	20,842	1,614	12,437
Fish on Ice	21,629	54,098	24,244	58,857
Lumpfish Roes, salted	849	20,090	249	3,009
Herring Oil	6,219	24,861	6,413	22,714
Fish Meal	13,444	41,146	17,456	58,141
Herring and Capelin Meal	14,733	47,337	21,138	54,148
Other Products	7,000	26,871	10,533	36,047
East Germany	15,642	50,491	4,372	15,520
Herring & Capelin Meal	9,151	28,987	-	-
U.S.S.R.	34,442	208,471	45,322	308,607
Herring, frozen	13,960	38,965	5,101	12,814
Frozen Fish, fillets	17,165	148,512	32,580	255,645
Other Products	3,317	20,994	7,641	40,148
Czechoslovakia	11,942	57,056	14,714	63,933
Herring, frozen	7,072	21,054	6,984	19,583
Frozen Fish, fillets	2,924	26,102	3,935	31,096
Other Products	1,946	9,900	3,795	13,254
Nigeria	13,042	165,745	12,178	150,267
Stockfish	13,042	165,745	12,057	149,910
All Other Countries	4,142	26,442	4,854	26,162

Iceland

ICELANDIC EXPORTS BY TYPES OF PRODUCTS, 1964-1965

Quantity in Thousand Pounds
Value in Thousand Kroners

	Jan.-Sept. 1965		Jan.-Sept. 1964	
	Q.	V.	Q.	V.
GRAND TOTAL	-	3,587,222	-	3,120,513
Salt Fish, cured	4,700	42,252	1,605	18,425
Brazil	2,934	27,690	1,345	16,321
Salt Fish, uncured	51,112	390,208	50,170	352,316
United Kingdom	5,534	33,822	5,611	32,584
Greece	2,167	15,490	1,680	11,014
Italy	13,702	109,480	7,057	52,409
Portugal	12,544	95,144	20,104	140,292
Spain	16,246	128,463	14,780	109,129
Other Countries	919	7,809	938	6,888
Salted Fillets	3,056	24,463	1,755	13,468
West Germany	2,643	20,842	1,614	12,437
Wings, salted	3,241	19,877	2,586	14,765
Italy	3,241	19,870	2,586	14,765
Stockfish	18,124	246,519	15,439	199,536
Italy	4,866	77,803	2,791	41,842
Nigeria	13,042	165,745	12,057	149,910
Other Countries	216	2,971	591	7,784
Fish on Ice	49,471	136,346	52,544	139,415
United Kingdom	27,785	81,956	28,137	80,055
West Germany	21,629	54,098	24,244	58,857
Other Countries	57	292	163	503
Herring, frozen	35,565	101,604	32,258	85,655
Poland	7,716	22,604	5,512	15,395
U.S.S.R.	13,960	38,965	5,101	12,814
Czechoslovakia	7,072	21,054	6,984	19,583
Other Countries	6,817	18,981	14,661	37,863
Frozen Fish, whole	8,900	46,577	5,851	26,817
United Kingdom	8,662	44,367	4,777	21,183
Frozen Fish, fillets	88,557	927,265	97,796	888,421
United States	49,577	578,536	48,836	494,359
United Kingdom	17,401	158,530	10,342	88,412
U.S.S.R.	17,165	148,512	32,580	255,645
Czechoslovakia	2,924	26,102	3,935	31,096
Other Countries	1,490	15,585	2,103	18,909
Frozen Lobster	1,433	82,573	2,015	84,312
United States	772	56,920	974	50,789
United Kingdom	357	13,173	838	26,645
Other Countries	304	12,480	203	6,878
Frozen Roes	3,702	26,496	3,060	23,775
United Kingdom	937	8,921	1,481	15,448
Canned Fish	926	19,231	454	11,203
Cod-liver Oil, Refined	4,131	20,297	2,393	14,291
Cod-liver Oil, Unrefined	6,362	29,922	15,351	62,296

Quantity in Thousand Pounds
Value in Thousand Kroners

	Jan.-Sept. 1965		Jan.-Sept. 1964	
	Q.	V.	Q.	V.
Lumpfish Roes, Salted	1,865	44,615	926	10,606
Denmark	831	20,519	494	5,519
West Germany	849	20,090	249	3,009
Other Countries	185	4,006	183	2,078
Cod Roes, Salted	4,482	33,530	6,526	43,775
Sweden	3,871	29,412	4,314	30,327
Roes for Bait	1,823	8,749	5,340	20,161
France	-	-	4,383	16,584
Herring, headless and salted, whole	15,234	68,362	24,643	107,010
Rumania	6,466	24,725	4,888	17,739
Herring, marinated	22,227	132,932	26,513	142,033
Finland	10,333	63,108	10,986	59,301
Sweden	10,452	61,322	13,761	70,059
Other Countries	1,442	8,502	1,766	12,673
Herring Oil	106,440	407,847	65,265	231,194
United Kingdom	40,139	151,359	1,517	5,000
Denmark	26,916	105,589	3,893	14,043
Holland	13,585	50,609	11,336	40,295
Canada	6,563	25,270	-	-
Norway	4,138	14,709	38,927	137,535
West Germany	6,219	24,861	6,413	22,714
Other Countries	8,880	35,450	3,179	11,607
Whale Oil	3,979	16,302	6,199	23,944
Norway	-	-	4,632	18,675
Fish Meal	38,457	116,752	55,415	156,172
United Kingdom	939	2,877	10,721	26,426
Ireland	5,831	17,784	5,551	14,920
Sweden	9,253	27,519	10,794	28,008
West Germany	13,444	41,146	17,456	58,141
Other Countries	8,990	27,426	10,893	28,677
Herring and Capelin Meal	166,313	544,86	143,381	386,693
East Germany	9,151	28,987	-	-
Belgium	5,763	20,045	2,643	6,907
United Kingdom	97,624	317,077	78,005	211,310
Denmark	5,827	19,367	19,766	55,280
Finland	6,124	21,034	11,129	29,005
Holland	7,414	26,223	1,786	4,909
Poland	5,847	18,898	3,964	11,337
West Germany	14,733	47,337	21,138	54,148
Other Countries	13,830	45,893	4,950	13,797
Redfish Meal	5,820	19,366	3,525	9,354
Frozen Offal	13,208	23,019	11,105	15,732
Whale Meat	5,441	22,147	3,988	14,395
United Kingdom	4,852	19,983	3,642	13,189
All Other Products	11,629	35,110	6,788	24,749

Current Reading

"Fish Quality at Sea" (Published by Grampian Press Ltd., London, Eng. Price £5 - 5s.)

This is the official record of the "Conference on the Design of Fishing Vessels and their Equipment in Relation to the Improvement of Quality", held in London, Eng. about a year ago under the auspices of the White Fish Authority.

The conference was called to discuss optimum procedure in handling and processing fish on board the deep sea trawler, covering such matters as boxing at sea, icing, superchilling, filleting and freezing. Included in the book are the main papers, supplementary papers and written contributions as well as verbal and written discussions.

Among other things, the book affords a comprehensive coverage of current practice in handling and processing fish at sea as laid down by Britain's Torry Research Station, the Industrial Development Unit of the White Fish Authority and other experts.

Another valuable contribution at the conference came from the catching and processing side of the industry, whose record of experience at sea constituted a summary of hard-earned lessons in what can and cannot be done on a trawler.

Filleting at sea is also well covered, with particular emphasis on the experience gained with Britain's Fairtry factory trawlers. There is also a section devoted to the Russian and East German techniques of transferring at sea. A number of excellent photographs and diagrams add to the value of this well-produced publication.

"Salmon Sport Fishing in the Tidal Waters of British Columbia, 1965" (Department of Fisheries of Canada, Pacific Region).

The growing importance of sport fishing in the tidal waters of British Columbia is reflected in the additional detail contained in this annual bulletin, compared with bulletins issued in previous years.

As well as the usual statistical section with catch highlights and reviews of each major sport fishing area in the province, the bulletin includes reports on a general sport fishing survey and a survey on the bar fisheries of the Fraser River, a summary of Protection regulations in 1965 applicable to tidal sport fishing in B.C., and a review of the biological investigation work carried out by the Department's Resource Development Branch on salmon species normally associated with sport fishing.

Total salmon sport catch in the province in 1965 amounted to 254,200 fish, virtually unchanged from the previous year. However, the total weight of the catch was estimated at 1,260,000 pounds, almost 30 per cent higher than the 1964 figure.

The gradual upward trend in coho sport catches since 1961 continued in 1965, the estimated catch of 105,925 being the second highest for this species in the last 13 years.

Population Dynamics of the Petrale Sole (Eopsetta jordani) in Waters of Western Canada, by K.S. Ketchen and C.R. Forrester (Bulletin No. 153 of the Fisheries Research Board of Canada. Obtainable from the Queen's Printer, Ottawa, price $3.75).

In 1948, the catch of petrale sole (or 'brill', as it is known to many Canadian fishermen) in the region between Juan de Fuca Strait and Dixon Entrance, British Columbia, amounted to 13.7 million pounds and exceeded all other trawl-caught flatfishes combined. A little more than ten years later the catch had declined to 2-3 million pounds annually and now accounts for less than 10 per cent of the trawl landings of flatfish in British Columbia.

The purpose of this paper by K.S. Ketchen and C.R. Forrester, of the Fisheries Research Board of Canada's Biological Station at Nanaimo, B.C., is to critically examine the reason for the drastic decline in the importance of the petrale sole and to obtain some measure of the extent to which the fishery and the environment has been responsible. To do this, the authors have drawn together the results of various types of investigations, much of which has remained unpublished until now.

After outlining the history of the petrale sole fishery, the report deals with tagging programs conducted off the British Columbia and Washington coasts and provides a quantitative evaluation of the changes in abundance which have taken place since the inception of the fishery. Subsequent chapters consider changes in stock size in the light of various biological statistics, such as age, growth, maturity, mortality, recruitment etc., while the concluding chapters deal with the theoretical effects of more intensive fishing and the problem of making practical predictions of these and other effects in designing a policy for rational exploitation of the resource.

The 195-page report is well illustrated.

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OUR DESIGNERS ARE BUSY ON TIME, LABOUR AND COST-SAVING DEVELOPMENTS FOR THE FISHING INDUSTRY.

Throughout the year, the Industrial Development Service of the Department of Fisheries undertakes many projects in an effort to improve and modernize the catching and processing of fish. During the past year, for example, the Department has played an important role in developing the Atlantic herring fishery, the Pacific offshore groundfish fishery, designs of fishing vessels, more efficient catching gear, and a Canadian tuna industry. Currently the Department is investigating such things as the underwater exploration of marine resources by divers, electrical devices for catching fish, automation and mechanization on board fishing vessels and in fish processing plants. In almost every instance the Federal Department co-operates closely with the Provincial fishery departments and the fishing industry in a continuing effort to improve the working conditions and financial returns to the fisherman.

DEPARTMENT OF FISHERIES
Hon. H. J. Robichaud, M.P., Minister — Dr. A. W. H. Needler, Deputy Minister — Ottawa, Canada

ROGER DUHAMEL, F.R.S.C., Queen's Printer and Controller of Stationery, Ottawa, 1966

FISHERIES

(formerly Trade News) OF CANADA

Vol. 19 No.2 August, 1966

In This Issue

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- ★ Sea Lamprey Menace Lessened in Great Lakes
- ★ Expand Deepsea Crab Fishing in Maritimes

Department of Fisheries of Canada, Ottawa

FISHERIES
OF CANADA
(formerly Trade News)

Editor
E. H. HEARNDEN

Vol. 19 No.2 August, 1966

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COVER PHOTOGRAPH: Federal Fisheries Minister H.J. Robichaud takes a close look at a young sea lamprey during a tour of the lamprey control unit at Sault Ste. Marie. G.E. Nixon, M.P. (wearing hat) is an interested onlooker while Dr. J.J. Tibbles, to his immediate right, explains operations to the minister.

Australian Prospects 'Excellent'

Fisheries Mission from Canada Looks at Markets 'Down Under'

(Editor's note: The following article is based on a report on the Canadian Fisheries Reconnaissance Mission to New Zealand and Australia, issued recently by the Department of Trade and Commerce, Ottawa.)

FOUR YEARS ago the Department of Trade and Commerce, in co-operation with the federal and provincial fishery departments and the trade across Canada, launched a systematic examination of fisheries production and markets in leading fish-producing and consuming countries of the world. As part of this program, a Canadian Fisheries Reconnaissance Mission visited New Zealand and Australia, February 26 to March 17, 1966.

Aims and objectives of the mission were:

1. To learn at first hand the kinds and varieties of fisheries products sold in New Zealand and Australia by competitive fish-producing nations;

2. To examine possible outlets for supplies of Canadian fisheries products, particularly of a long-term nature;

3. To investigate fisheries development in both countries and see the methods of production and marketing being used.

Briefly, these were the findings of the mission:

New Zealand - Fish production is currently expanding under the impetus of government encouragement and fishing industry interest. The demand for canned salmon and sardines remains strong with a preference for Canadian products, however unfavourable balance of payments situation has resulted in a reduction in import quotas for canned fish in 1966-67. Restrictions prohibit the import of frozen fish and this is not likely to change for some time.

Australia - The country's fish production falls far short of demand. The industry is growing but largely in the production of tuna, scallops, and prawns. It appears that production of fish for the fresh fish market will not expand significantly, at least in the near future. Prospects for sales of both canned and frozen fish from Canada are excellent. However, unlike New Zealand, preference for Canadian products is not significant. Price is more important. Close attention must be given to quality and type of packaging for frozen fish.

Australia's tuna industry has grown rapidly in recent years. The tuna are caught mostly by the live bait pole method as shown here. (Australian News and Information Bureau).

In both New Zealand and Australia, the

Some of the Auckland, N.Z. fleet of stern trawlers. Registered fishing vessels in New Zealand total about 1,600. (New Zealand Information Service).

mission's itinerary included visits to fish-producing plants, shipyards, retail outlets including supermarkets and chain stores as well as meetings with government fisheries officials, importers, buyers and producers.

New Zealand's imports of all types of fisheries products from all sources in 1965 reached a value of $2.3 million, of which Canada's share was 52 per cent. The principal canned fish imports are salmon, sardines and herring. Sources of supply for canned salmon are Canada, Japan, and Russia while the major suppliers of canned sardines are Norway, Canada and Britain. Britain provides the largest quantity of canned herring.

Because of balance of payment difficulties and the New Zealand government's policy of protecting the local fisheries industry, no licences were being granted for imports of fresh or frozen fish. Further restrictions are being placed on imports of canned fish into New Zealand during the 1966-67 licensing period, representing a reduction of about $190,000 insofar as Canada is concerned.

The Canadian mission reported that while immediate prospects for selling increased supplies of Canadian fisheries products to New Zealand are not encouraging, the products of Canada enjoy a good reputation and are preferred to fish produced by other countries. This is particularly true for canned salmon and sardines. Enquiries were also received for canned herring and mackerel.

Annual consumption of fish in New Zealand is about 14 pounds per capita and the industry faces keen competition from meat and other protein foods. However with increases in population, refrigeration facilities, interest in convenience food packages and an improvement in the balance of payments position, greater quantities of Canadian fisheries products may be sold in New Zealand in the years ahead.

AUSTRALIAN IMPORTS

Statistics show that half of the fresh or frozen fish and the bulk of the canned fish consumed in Australia is imported. Value of these imports exceeded $28 million in 1964-65.

The mission members noted a strong demand for Canadian frozen fish, as well as for canned salmon and sardines. A few enquiries were also

received for salted herring and salt cod.

Apparently lack of adequate supplies from the domestic catch, fewer shipments from European countries, and a steady influx of immigrants from European fish-consuming countries have created a good opportunity for Canadian exporters of frozen fish, particularly flounder, sole and cod. These would be new and continuing outlets. The mission noted, however, that prices must be competitive and quality good. It was recommended that sample packages of fish be sent to prospective customers to test the market. There seemed to be little interest in freshwater fish produced in Canada, particularly because of the relatively high price and unfamiliarity with the species. Frozen mackerel and herring were not of interest.

The report adds: "If Canadian firms are not in a position to supply, they should at least acknowledge the receipt of trade enquiries. It would be preferable for Canadian exporters to make certain that their agents in Australia are not also acting for exporters from competitor countries, such as Japan, Britain, Norway and Denmark."

Representing the federal Department of Fisheries on the mission was Maurice A. Foley, Chief of the Engineering Section, Industrial Development Service. Other members were: Joseph E. Antonelli, general sales manager, Fresh and Frozen Fish Division, Fishermen's Co-Operative Federation, Vancouver, B.C.; Kenneth M. Campbell, secretary-manager, Fisheries Association of British Columbia, Vancouver; Dr. Leonce Chenard, Deputy Minister, New Brunswick Department of Fisheries; Donald A. McLean, vice-president, Connors Bros., Ltd., Black's Harbour, N.B.; William E. Simpson, divisional manager, 40-Fathom Division, National Sea Products, Ltd., Halifax, N.S.; and Ray Kinsella, Assistant Director (Fisheries), Agriculture and Fisheries Branch, Department of Trade and Commerce, Ottawa. ✔

A catch of snapper is unloaded on a New Zealand fishing boat. (New Zealand Information Service.)

A pack of crayfish tails ready for shipment to a freezing plant in Western Australia. Crayfish is Australia's most valuable single species, averaging 85 cents a pound. (Australian News and Information Service).

Ceremony at Sault Ste. Marie

Lamprey Control Unit Officially Opened

By Bruce Woodland

CANADA'S determination to continue its efforts to control and reduce sea lamprey populations in the Great Lakes was strongly emphasized at ceremonies marking the opening of new quarters for the lamprey control program at Sault Ste. Marie, Ontario, in June.

Simultaneously with the opening, there was a transfer of responsibility for lamprey control activities from the Fisheries Research Board of Canada to the Resource Development Service of the Department of Fisheries.

The Hon. H.J. Robichaud, Minister of Fisheries, officially opened the building at a ceremony presided over by Dr. J.J. Tibbles, director of the Lamprey Control Unit. The formal transfer of lamprey control staff and facilities to the Department was symbolized in the hand ing over of a key to Dr. A.W.H. Needler, Deputy Minister of Fisheries, by Dr. F. Ronald Hayes, Chairman of the Fisheries Research Board.

Other distinguished participants in the ceremony included Dr. D.L. McKernan, Director of the Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service of the Department of the Interior and Chairman of the International Great Lakes Fishery Commission; G.E. Nixon, Member of Parliament for Algoma West, who introduced Mr. Robichaud; and Mayor Alexander C. Harry who extended an official welcome to visitors on behalf of the City of Sault Ste. Marie.

The large audience attending the opening ceremony included United States and Canadian delegates to the annual meeting of the International Great Lakes Fishery Commission and members of the Central-Arctic Advisory Committee of the Fisheries Research Board. Both groups held meetings in Sault Ste. Marie during the week of June 20.

CITES CO-OPERATION

The principal speaker, Mr. Robichaud, said that the outstanding achievement of all the efforts to cope with the sea lamprey problem has been the building up of a "truly remarkable" degree of co-operation, internationally and between federal and state and provincial agencies.

Dr. F. Ronald Hayes, (left) Chairman of the Fisheries Research Board, passes a key to Dr. A.W.H. Needler, Deputy Minister of Fisheries for Canada, as a symbol of transfer of responsibility for sea lamprey control operations at the Sault Ste. Marie unit from FRB to the Department.

Mr. Robichaud pointed out that the new building

is strategically located for sea lamprey control operations. It is situated within a 100-mile radius of 16 of a total of 38 Lake Superior lamprey streams and 21 of a total of 38 Lake Huron streams with lamprey populations.

The Fisheries Minister described the transfer of sea lamprey control responsi bility from the FRB to the Resource Development Service of the Department as a step "to employ the research staff and the Department staff to best advantage". He predicted that the important task of lamprey control will continue to be carried out with the same drive and determination that sparked the original researchers.

Mr. Robichaud praised the work of the International Great Lakes Fishery Commission which stands, he said, "as a singularly great example of what can be accomplished through international co-operation".

RECALLS RESEARCH ACTIVITIES

Dr. Hayes traced the scientific activities leading to the discovery of techniques that are effective in reducing sea lamprey populations. That having been accomplished, the Fisheries Research Board was handing over an established laboratory and a competent, trained staff to continue the control operations under the administration of the Department of Fisheries. Dr. Hayes emphasized that the transfer of responsibility from FRB to the Department was a natural, highly desirable development and one that might be expected in other fields as research was completed.

Dr. McKernan said the task of the International Great Lakes Fishery Commission has been com-

The Sea Lamprey

The sea lamprey is an eel-like fish, distinguished by its large suction-like mouth which is lined with sharply piercing teeth, and a rasping tongue. It attacks various other fishes, notably the lake trout, attaching itself to the fish and sucking the body juices.

During its stream life, which lasts from four to seven years, the lamprey is harmless. It begins its parasitic existence once it enters the lake. Each lamprey reaching this stage is estimated to destroy at least 20 pounds of fish in its one to 1 1/2 years in the lake.

The lamprey lives only about two months beyond the parasitic stage, and it is during this period that it returns to the streams to spawn and die. A single female may deposit over 100,000 eggs; the average number is 60,000 plus.

Lampreys entered Lake Erie from Lake Ontario through the Welland Canal which was completed in 1829. Just over a century later (1932) they had reached Lake Huron. They were first located in Lake Michigan in 1936 and in Lake Superior in 1945.

Attempts to control the sea lamprey began in 1946 and eventually the control program came under the jurisdiction of the International Great Lakes Fishery Commission.

The control effort involves the treatment of lamprey spawning streams with lampricide, a chemical compound, and electrical barrier fences and trawls.

Brilliant sunshine greeted the ceremonies marking the opening of the new sea lamprey control laboratory at Sault Ste. Marie. Part of the large crowd is shown in this photograph.

plicated and technical in nature "for it involves the manipulation of natural populations of animals in the Lakes, controlling some forms of natural predators and encouraging the growth of species such as the Great Lakes trout and others of great economic value".

He reported that counts of lamprey in selected streams flowing into Lake Superior indicated the "total success in eliminating the sea lamprey from Lake Superior is likely to exceed 90 per cent this year". He noted that in line with the reductions of lamprey populations, there has been a ten-fold increase in the numbers of Great Lakes trout and other species of economic and recreational value to citizens of the United States and Canada.

Dr. McKernan said that while efforts to control the lamprey have enjoyed successes, the Commission's biggest job remains to be done. That is, the development and conservation of the fishery resources of all the Great Lakes. "Not only must we consider the control of the lamprey ... but pollution, changing environmental conditions in the lakes, changing species composition, and the complexity of administration of our conservation measures all complicate the task tremendously".

Close to 200 people toured the new quarters of the sea lamprey control establishment immediately following the traditional tape-cutting by Fisheries Minister Robichaud. Throughout the buildings and the surrounding grounds, exhibits prepared by

Fisheries Minister H.J. Robichaud (standing next to 'High voltage' sign) and other visitors to the new lamprey control facilities at Sault Ste. Marie inspect an electrical barrier on the Chippewa River.

David G. Denbigh of the Department's Information and Consumer Service effectively portrayed the techniques and equipment used in the battle against the lamprey.

Arousing the animated attention of all the visitors was a number of tanks in which sea lampreys in various stages of development were displayed. In one tank, lampreys had attacked and fastened themselves to the sleek sides of beautiful specimens of lake trout - a dramatic illustration of the depredations of the lamprey!

Later the same day, invited guests were taken on a tour of field operations on the Chippewa River near Sault Ste. Marie. There, actual control operations, involving the use of electrical barriers and chemical treatment techniques were demonstrated.

Commission Reports Reduction in Sea Lamprey

A FURTHER reduction in parasitic sea lamprey in Lake Superior and Lake Michigan was reported at the annual meeting of the Great Lakes Fishery Commission held in Sault Ste. Marie, Ontario in June.

Barrier catches of spawning adult lamprey were down a further 50 per cent from the 1962 to 1965 level on Lake Superior. The overall reduction is now about 90 per cent. In Lake Michigan, where the first round of stream treatments was completed this spring, the steady decline in lamprey catches at barriers continued.

However, in spite of a general improvement in the trout population in Lake Superior there is evidence that lamprey are still present in significant numbers in the western end of the lake as shown by the fresh wounds on lake trout. The Commission asked that its agents investigate possible lamprey escapement principally in Minnesota waters.

Improved survival of lake trout following lamprey reduction has resulted in an increase in natural spawning particularly in Wisconsin waters of Lake Superior. Lake trout living near the shore suffered drastically from lamprey attacks before control was begun and now consist largely of hatchery reared fish planted by federal, provincial and state agencies. These stocks require continued protection offered by present regulations and quotas to encourage their full recovery. Trout stocks on offshore banks appear to be in a healthy condition according to reports of scientists studying them and the Commission has recommended that limits now set on the catch be increased in certain areas.

CHEMICAL TREATMENTS

Chemical treatments have been resumed on Lake Huron and 17 lamprey streams were treated this spring near Sault Ste. Marie and St. Ignace. The Commission recommends that the program on Lake Huron be accelerated to bring the lamprey population under control in this lake as quickly as possible.

The sea lamprey control program in Canada is carried out for the Commission by the federal Department of Fisheries and in the United States by the U.S. Bureau of Commercial Fisheries.

The Commission charged with the responsibilities for sea lamprey control and co-ordination of research to improve the productivity of the Great Lakes fishery reviewed the status of the fishery and problems in each lake. Some of the more important recommendations made concerning the upper lakes were that modest increases be made in fishing offshore stocks of lake trout in Ontario and Michigan waters of Lake Superior and that the rehabilitation of the trout fishery in Lake Huron be undertaken with the selected hybrid splake rather than lake trout.

In the lower lakes, agencies concerned with the Lake Erie fishery were urged to develop a program that will provide information needed to determine if proposed regulations would be effective in improving the strength of walleye stocks. Both Lake Erie and Lake Ontario fishery agencies were encouraged to continue studies to determine the rates of eutrophication and its effects on major species. The Commission will urge agencies concerned with fishery technology and economics to extend their investigations to Lake Ontario. The Commission also expressed interest in extending its sea lamprey control measures to Lake Ontario as soon as possible.

Life History, Migration and Reproduction of Pacific Salmon

THERE are five kinds, or species, of Pacific salmon in British Columbia. Their common and scientific names are:

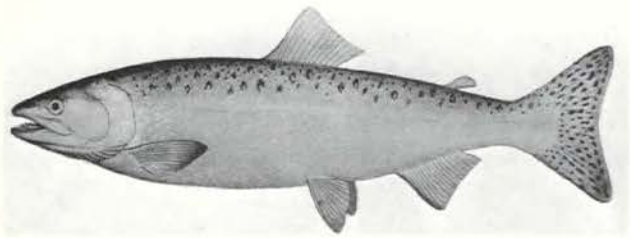
Sockeye *(Oncorhynchus nerka)*
Pink *(Oncorhynchus gorbuscha)*
Chum *(Oncorhynchus keta)*
Coho *(Oncorhynchus kisutch)*
Chinook or
spring *(Oncorhynchus tschawytscha)*

Except for some races of sockeye which remain throughout their life in lakes (known by many names but most commonly as "Kokanees") all salmon are anadromous. That is, they begin their life in fresh water, grow and mature in the ocean and return to fresh water to spawn. More detailed accounts of the life-history of individual species are given in other Fact Sheets forming part of this series.

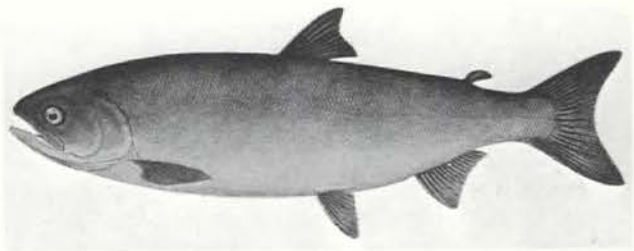
SPAWNING AND DEVELOPMENT

Adult salmon enter rivers and streams from late summer to early winter, the exact time differing between stocks and species. The female, upon choosing a suitable spawning site, digs a nest or "redd" in the streambed. The male, meanwhile, remains in close attendance, courting the female and fending off competing males. When the redd is completed, the female drops into it and releases some of her thousands of eggs, the numbers varying between species and size of individual. At this moment the male moves alongside his mate and releases milt, thus fertilizing the eggs. The female, then with snout, fin and tail covers the eggs while the male returns to his post to resume vigilance. This sequence of redd-building, courting and spawning is repeated until the sex products of both male and female are exhausted, and having spawned once each depart and shortly die.

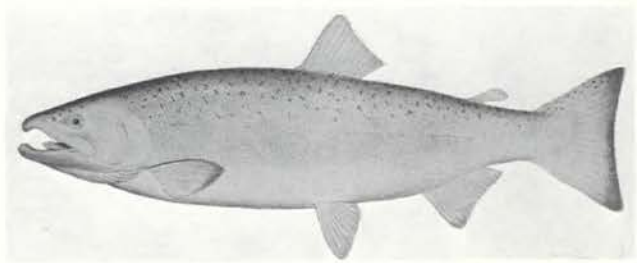
SOCKEYE SALMON



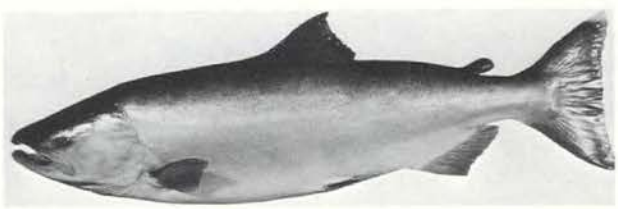
PINK SALMON



CHUM SALMON



COHO SALMON



CHINOOK or SPRING SALMON

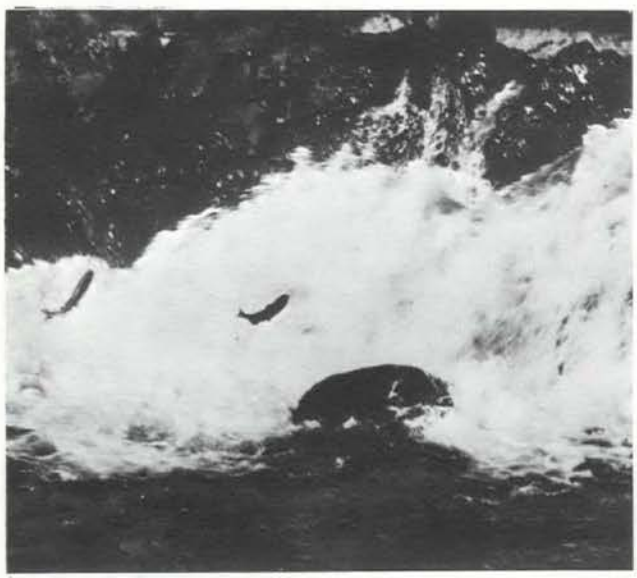
Of the eggs spawned, some hatch while others

are lost as a result of poor stream conditions or predation by trout and other stream fishes. The time required for hatching is influenced by the temperature of the stream. The newborn salmon, or alevin, remains hidden until spring in the gravels forming the streambed. Receiving nourishment from a yolk-sac attached to the underside of its body, the alevin gradually transforms into a miniature salmon, and in the spring emerges from the gravel as a fry. Depending on the species, the fry migrates either immediately to sea, or remains in the stream or river for a few months, or takes up lake-residence for a year, usually, or two, before going to sea. Those living in lakes for a year or more are known as smolts when they leave for the sea.

In the ocean, as in fresh water, the different species as well as stocks of the same species spend varying amounts of time, ranging from about 14 months for pinks to 4 or 5 years for chums and chinooks.

DISTRIBUTION AND MIGRATION

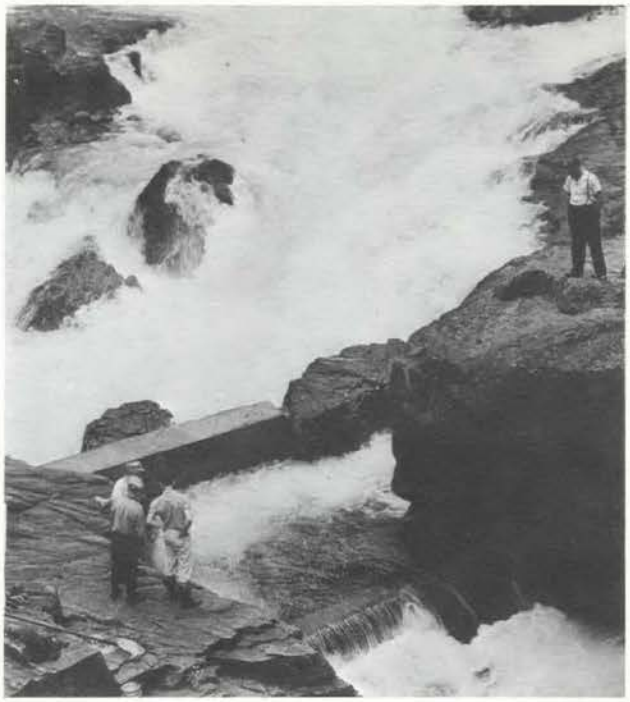
Along the Pacific coast of North America salmon occur from central California northward into the Arctic Ocean as far east as the Mackenzie



Salmon fighting their way upstream to the spawning grounds.

River, but are most abundant between southern British Columbia and western Alaska. Within this length of coastline the geographic range of each species overlaps considerably so that some species at the same time occupy not only the same geographic territory but frequently the same stream.

During their ocean life, salmon range widely throughout the northern North Pacific Ocean and the



Fish ladders such as this one at Stamp Falls, B.C., help salmon move upstream.

Bering Sea, occurring farther south in the winter than in summer. In the spring and summer maturing fish depart the high seas for coastal spawning grounds, travelling at rates which increase as the fish matures. Salmon originating in British Columbia inhabit the eastern North Pacific Ocean where they become intermixed with salmon from Alaska, and to a much lesser extent, with some from Asia.

SIZE AND GROWTH

The size of salmon varies between species, as well as between individuals of the same and different stocks. On the average, chinooks are the largest of the salmons, followed in order of size by chums, coho, sockeye and pinks. While smallest in ultimate size, pinks grow more rapidly than the other species, reaching an average length of 24 inches and an average weight of 4 pounds from the time they leave the streams as fry and return as adults, a period of about 14 months. Chinooks frequently reach a weight of 50 pounds and on occasion 100 pounds.

Maturing salmon, silver and corpulent and belonging to many runs, enter coastal waters during the summer and fall where they are caught by purse-seine, gill net and trolling gear. The average annual catch of salmon in British Columbia amounts to about 180,000,000 pounds and has a landed value of about $25,000,000. *(Prepared by the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.)*

Scientific News

by Bruce Woodland

Studies in the Bay

This summer a new type of visitor will be added to the tourists, yachtsmen, artists and fishermen who frequent the shores and waters of St. Margarets Bay in Nova Scotia, reports the Fisheries Research Board's Atlantic Oceanographic Group at the Bedford Institute of Oceanography.

Marine research scientists have selected the bay for an intensive study of the underlying causes and relationships of biological marine communities. This project is being undertaken by FRB and will be under the general direction of Dr. L. M. Dickie, Director of the Atlantic Oceanographic Group.

The traditional approach taken by marine scientists in their researches has been to select a single species or phenomenon and follow through with an exhaustive study. Because marine communities and their environment are so closely related, however, a comprehensive and concurrent study of the overall marine production in the sea will provide a more efficient means of obtaining knowledge and understanding.

This "new look" in marine research is being tried out in St. Margarets Bay because its physical features provide a large, nearly landlocked deepwater area containing physical and biological conditions duplicated in deeper waters around the Atlantic coast. In other words, St. Margarets Bay provides the nearest approach to a natural aquarium in which scientists can study marine production.

If the investigations this summer prove successful, the same methods may be extended elsewhere.

As the research program develops in St. Margarets Bay, scientists will be afloat collecting samples of fish, plant and animal forms. Water movements will be observed by the use of smoke floats dropped from aircraft or boats while shore based and shipboard instruments will record water movements and temperatures.

FRB investigators will be joined by scientists from the Marine Laboratory of Wood's Hole Oceanographic Institute near Boston, Mass., for some of the research activities.

Draft Tuna Convention

An FAO-sponsored conference held in Rio de Janeiro, Brazil, in May resulted in 17 nations reaffirming their faith in international co-operation to achieve rational exploitation of the tunas of the Atlantic Ocean, a report from FAO states.

Canada was one of the nations represented at the Conference of Plenipotentiaries on the Conservation of Atlantic Tunas. Canada's delegates were S. V. Ozere, Assistant Deputy Minister of Fisheries for International and Jurisdictional Affairs, and Dr. J. C. Stevenson, of the Fisheries Research Board.

Other nations with representation at the conference were: Argentina, Brazil, Cuba, The Congo, France, Japan Portugal, Republic of Korea, South Africa, Senegal, Spain, U.S.S.R., U.K., U.S.A., Uraguay, and Venezuala. Observers from West Germany, Italy, and Poland sat in on the meetings.

Roy I. Jackson, Assistant Director-General (Fisheries) of FAO, and secretary-general of the conference, expressed the hope that the convention, as drafted, will receive favourable treatment during the ratification processes. Most of the articles of the Convention were supported by large majorities at the conference.

Dr. J.C. Stevenson and S.V. Ozere (seated from left) were Canadian delegates at the Atlantic tuna conference in Rio de Janeiro.

Experimental Deepsea Crab Fishing Expanded

EXPERIMENTAL fishing for Atlantic deepsea crabs, initiated last year out of Cheticamp, Nova Scotia, has now been expanded to include the three Maritime provinces. Bearing some similarity to the famous king crab of Pacific waters, the species being fished in the Gulf of St. Lawrence has been named the North Atlantic queen crab.

Three vessels -- one operating out of each of the Maritime provinces -- will be engaged in the experimental fishery which is a joint effort involving the Industrial Development Service of the federal Department of Fisheries and the fisheries agencies of Nova Scotia, New Brunswick and Prince Edward Island.

Louis E. Deveau, Industrial Development Service engineer at Halifax, is general supervisor of the project. "While it is too early to make a proper assessment of this new fishery, the results of our fishing efforts last fall and winter certainly indicated that further expansion is warranted" he says.

U.S. EXPERT EMPLOYED

To assist in the development work, the federal Department has employed an American crab fishing expert, Hiram McAllister, of Puget Sound, Wash., who has fished crabs in the Pacific for many years.

In the initial program, crabs were fished by means of a trawl or net. However, this procedure has been changed. While one boat will continue using trawls, it, along with the other two boats, will use traps. The latter consists of a steel framework with poly netting. Some are round and some rectangular. Larger than the conventional lobster trap, they can hold more than 300 pounds of crabs.

Since the experiment started in the gulf last fall, several large concentrations of crabs have been located. One concentration was estimated to be several miles in length and six miles in width.

Weighing from a half pound to more than two pounds, the queen crab has a body shell of about five inches in diameter and legs up to 10 inches in length. A two-pound crab will yield up to seven ounces of meat, mostly from the legs.

SCIENTIFIC STUDY PLANNED

In contrast to the lobster, the store of biological information on the queen crab is not extensive. This year a Fisheries Research Board of Canada scientist will be making a study of the tasty 10-legged creature.

Co-operating in the experiment is the Inspection Service of the federal Department of Fisheries. Dr. C.M. Blackwood, head of the Inspection Service in the Maritimes, and his staff of fisheries technologists are studying the various methods of which the product can be processed.

The queen crab, known biologically as *chionoecetez opilio*, belongs to the spider crab family and inhabits waters ranging in depth from 200 feet up to 2,000 feet. They are found in waters from Alaska to Siberia and from Greenland to Maine. They are larger and much meatier than the rock crab which abounds in Maritime waters. ✔

Tuesday's a Fish Day, Too

In France it has been estimated that 55 per cent of the population over 20 years of age eat fish at least once a week and 47 per cent eat fish on Friday.

Last fall a campaign was launched to promote a second fish day besides Friday. Seventeen large cities, representing more than a third of the French population, were supplied each Tuesday with fresh fish.

Careful planning was essential, involving some major changes not only in production patterns, such as rescheduling the arrival of fishing boats, but also in distribution methods. A special information network was established in main fishing ports so that on Monday it is known what species will be available in abundance the next day in the various centres.

On Tuesday morning housewives are informed what species are available at the market through special newspaper, television and radio reports. In addition "Tele-pêche", a televised program each Monday evening in the regional news broadcasts, tells the consumer what fish will be plentiful the next morning.

The 'Tuesday Telegram', aimed at the industry, arrives on Monday morning. This gives the tonnage of various species which have just been landed at five large fishing ports and will be auctioned later in the day. Information for compiling the 'Telegram' comes by radio to fish buyers from the fishing grounds.

It is claimed there are now 42 per cent more housewives in fish stores and markets on Tuesday.

FRB Appointments to New Freshwater Institute

Three appointments to the Fisheries Research Board of Canada's recently-established Freshwater Institute in Winnipeg, Man. have been announced.

Dr. W.E. Johnson

Appointed director of the Institute is Dr. W.E. Johnson, 43, of Ottawa. A graduate of the University of Wisconsin, where he received his master's degree of Doctor of Philosophy in 1954, Dr. Johnson worked at the FRB Nanaimo Biological Station in 1954-55 on a post-doctoral Fellowship awarded by the National Science Foundation. He joined the staff of FRB at Nanaimo in 1955, and continued his ecological studies of salmon-producing lakes until 1963.

Dr. W.E. Johnson

He is internationally recognized for his researches on the distribution, growth and migration of young lake-resident sockeye salmon, and the biological productivity of lakes. He was senior author of a paper on the migration of young sockeye which, in 1963, was selected as the year's outstanding paper in fish ecology and management by the North American Wildlife Society.

In 1963, Dr. Johnson was attached to the Nanaimo Station's Pacific Oceanographic Group, where he was in charge of the biological oceanography program. Since August 1965, he has been Special Assistant to the Chairman of the Fisheries Research Board of Canada, working on plans for expanding research on the biological productivity of freshwaters and the effects of pollution.

Dr. E.G. Bligh

Dr. E. Graham Bligh, 37, of Ottawa, has been appointed Scientific Leader of the Technological Section of the Freshwater Institute. A biochemist, Dr. Bligh is a native of Lakeville, N.S. After receiving his master's degree in chemistry at Acadia University, Wolfville, N.S., he joined the FRB Halifax Laboratory. Later he attended McGill University where he obtained his Ph.D in 1956.

Dr. E.G. Bligh

Dr. L. Johnson

Dr. Bligh then returned to the Halifax Laboratory where he continued his researches on frozen fish. In this field of study he has gained international recognition for his work on the extraction of fats from biological tissues, and on the changes that occur in fats in frozen fish.

In 1963 Dr. Bligh was appointed associate editor of FRB scientific publications in Ottawa, continuing in that post until he was named Technological Consultant to the Chairman of FRB in 1965.

Dr. Lionel Johnson

The third appointee to the new Freshwater Institute is Dr. Lionel Johnson, 41, of Ste. Anne de Bellevue, Que., who has been named Scientific Leader of the Fish Population Dynamics Section.

Dr. Johnson is a graduate of the University of Leeds, England, where he obtained his master's degree in Zoology in 1958 and his Ph.D. in 1960. Moving to Canada, he joined the staff of the FRB Arctic Biological Station in January, 1961. Earlier Dr. Johnson had worked as Economic Botanist with the Government of Trinidad and as Senior Agricultural Officer with the Government of Mauritius. He also carried out research at the Windermere Laboratory of the Freshwater Biological Association in England.

While on the staff of the Arctic Biological Station, Dr. Johnson was responsible for extensive limnological and fisheries investigations on Great Bear Lake and other lakes in the Northwest Territories.

News Roundup

Heads FAO Body

Dr. A.W.H. Needler, Deputy Minister of Fisheries of Canada, was elected Chairman of the Food and Agriculture Organization's newly-constituted Committee on Fisheries at its first meeting in Rome in June. Dr. Needler's appointment is for a two-year term.

Establishment of this permanent intergovernmental committee is part of the plan to expand and intensify FAO's work in the field of fisheries. The committee's chief purpose is to bring about closer co-operation between member-nations so as to achieve fuller utilization of the potential of the world's oceans and inland waters. Some 30 countries are represented on the committee.

Addressing the opening session, Dr. B.R. Sen, Director-General of FAO, said most of the fish stocks available for further exploitation are found in international waters, and international agreement to harvest them more rationally is now a necessity.

Machinery for accomplishing this must be created where it does not exist, Dr. Sen said. Nations, above all, must "agree in good time on management measures when the yields are approaching the levels, as ascertained by fishery scientists and economists, that should be maintained indefinitely" he added.

One of the first decisions of the new committee was to agree to set up a working party to study action needed to speed up the development of fisheries in the Indian Ocean. Items scheduled for future consideration include a scientific appraisal of world fishery resources, economic aspects of fisheries management, training for fishermen and fisheries technicians and the promotion of protein concentrates made from fish.

Joins FAO in Ceylon

Ruth G. MacIntosh, assistant chief of the Consumer Branch of the Information and Consumer Service, federal Department of Fisheries, since 1957, has joined the Food and Agriculture Organization of the United Nations as a nutrition education officer. She will be based in Ceylon.

For Miss MacIntosh, a native of Brookfield, N.S., it will be a return to familiar ground. In 1963 she was granted two years' leave of absence to work as a nutrition education officer with the Applied Nutrition Program of FAO in India, working out of New Delhi.

As assistant chief of the Department's Consumer Branch, Miss MacIntosh travelled extensively across Canada, helping to coordinate the national program of the consumer consultants. She is a member of the Canadian Dietetic Association, the Canadian Home Economics Association and the Canadian Institute of Food Technology.

Yellow Perch Fishery

The Fisheries Prices Support Board has been authorized to proceed with a program to stabilize prices to fishermen engaged in the yellow perch fishery of Lake Erie, federal Fisheries Minister H.J. Robichaud announced last month.

Representations were made to the government earlier this year when during the Spring fishing season prices to fishermen fell to as low as 3 cents per pound. It is proposed that the support program will be operative in time for the heavy fall fishery. Officials of the Support Board will work out the details of the program with a small advisory committee representing both fishermen and processors, the Minister said.

Because of wide fluctuations in production from month to month and from year to year, prices to fishermen have varied from a high of 25 cents per pound to a low of 3 cents per pound over the past five years. Such fluctuations make it extremely difficult for both fishermen and processors to plan their operations and merchandizing programs. Annual production of yellow perch ranges from ten to twenty million pounds per year.

The major production is in Lake Erie and measures to stabilize prices in that area will undoubtedly result in stable prices in other producing areas. Most of the production is marketed in the United States in the filleted form although there is a growing market in Canada both as fillets and as breaded and cooked products.

Appointments

R.E. McLaren, 44, of Vancouver, has been appointed Assistant Director, Pacific Region, Department of Fisheries of Canada. Mr. McLaren, formerly chief of the Resource Development Branch, Pacific Region, was the successful candidate in a Civil Service Commission promotional competition open to employees of both the Department of Fisheries and the Fisheries Research Board of Canada.

Mr. McLaren will be responsible for developing and co-ordinating regional programs and also the functions of the Administrative, Economics, Consumer, Personnel and Information Branches.

A native of British Columbia, Mr. McLaren is a graduate in biology from the University of British Columbia. He is a past president of the Board of Governors of the Vancouver Public Aquarium Association.

Joining the Department of Fisheries in Vancouver as a fisheries biologist in 1950, he was promoted to Chief Biologist in 1958. In 1965 he assumed the duties as Chief of the Resource Development Branch. During his service with the Department, Mr. McLaren has been closely associated with the installations at both the Qualicum River and Babine Lake. He has been actively working on industrial problems which are a threat to the resource.

Maurice P. Houghton, of Vancouver, has been appointed Chief of Protection in the Pacific Region, federal Department of Fisheries. In his new position he will be responsible for all phases of the conservation and protection programs in the Region.

He joined the Department in 1947 as a fishery officer serving in succession in the South Queen Charlottes at Rivers and Smith Inlet and at Butedale. In 1956 he was promoted to Senior Officer in District No. 1 moving to Vancouver as Marine Superintendent in 1957. He was promoted to Assistant Chief of Protection in 1963, and assumed the Acting Chief of Protection position in January, 1966.

Food Fairs Abroad

Canadian fishing companies have shown enthusiastic support for international food fairs in 1966-67. Some 42 Canadian exporters of fisheries products will be participating in the international food fair in Paris, France, Nov. 13-21, 1966.

At the Paris fair, Canadian firms from coast to coast will be displaying their individual products. It is also planned to cook and provide samples of inland fish – principally whitefish, pike, trout, smelt and perch – with a view to promoting these freshwater fish products in European countries.

Mrs. Pauline Klosevych a consumer consultant with the federal Department of Fisheries, along with an official from the Fisheries Division, Department of Trade and Commerce, will be present to answer questions. Literature indicating the Canadian exporters participating and a list of their various products will be distributed to prospective buyers.

In addition, seven of the leading Canadian exporters of fish will display their products at the international food fair in Munich, West Germany, September 17-25. Products from both the Atlantic and Pacific coasts will be represented.

The Ideal Home Exhibition, being held next spring at London, Eng., is expected to attract a wide response among Canadian firms that export fish to the British Isles.

Fish With Many Names

Many of the fish in Canadian waters are known by a multiplicity of names, but none comes close to matching the eulachon, the delicate little fish of British Columbia. It claims at least 14 names!

The name "eulachon" actually derives from the Chinook language of British Columbia's coastal Indians. Variations that have appeared in print at one time or another include: hoolakan, hooligan, hoolikan, olachan, ollachan, oolachan, oolichan, oulachan, oulachon, oulacon, ulchen, ulichan, uthlecan and yshuh.

Why so many spellings? W.E. Barraclough, a Fisheries Research Board of Canada scientist at Nanaimo, B.C., explains: "When one considers the various interpretations that the different nationalities of white settlers would give to the Indian pronunciation of their word for eulachon, it is quite understandable how so many variations were recorded."

Mr. Barraclough points out that the eulachon has also been called candlefish because the flesh is so oily that dried fish, when provided with a wick from the inner bark of the cedar tree, burns with a steady flame.

Indians living along the lower Fraser gave it the name 'swavie' or 'chucka', meaning old woman. The English equivalents of other Indian names for the eulachon are 'small fish' and 'salvation fish'. Mr. Barraclough adds that when eulachon were strung on threads in their dried condition, they were sold by the fathom, which gave rise to another name --'fathom fish'.

The scientific name is *(Thaleichtys pacificus)*, the first part of which refers to the oily nature of the fish.

Fishery Figures For May

SEAFISH: LANDED WEIGHT AND LANDED VALUE

	May - 1965		May - 1966	
	000 lbs	$'000	'000 lbs	$'000
CANADA - TOTAL	205,561	15,779	143,065	14,069
ATLANTIC COAST - Total	189,026	12,420	132,839	10,830
Cod	45,353	1,774	31,473	1,406
Haddock	12,438	813	11,942	852
Pollock, Hake, Cusk, etc.	10,812	376	8,514	317
Rosefish	1,812	52	2,713	74
Catfish	723	24	517	18
Halibut	913	267	541	168
Plaice & Other Flatfish	24,407	783	31,697	1,048
Herring & Sardines	76,201	604	30,287	388
Mackerel	207	19	292	23
Alewives	2,023	47	1,851	46
Salmon	110	77	209	124
Smelts	23	3	12	2
Swordfish	368	169	271	164
Other Fish	474	19	186	15
Lobsters	11,084	6,413	10,122	5,467
Clams & Quahaugs	346	22	361	25
Scallops	1,717	957	1,842	692
Other Shellfish	15	1	9	1
PACIFIC COAST - Total	16,535	3,359	15,226	3,239
Pacific Cods	2,910	204	4,745	365
Halibut (1)	7,831	2,259	6,079	2,019
Soles & Other Flatfish	558	35	711	47
Herring	1,854	34	348	19
Salmon	1,272	665	1,126	600
Other Fish	516	21	272	11
Shellfish	1,594	141	1,945	178
BY PROVINCES				
British Columbia	16,535	3,359	15,226	3,239
Nova Scotia	52,472	6,093	50,716	5,709
New Brunswick	45,939	1,504	34,277	1,224
Prince Edward Island	6,283	1,512	8,128	1,709
Quebec	49,173	1,551	(2)	(2)
Newfoundland	35,159	1,760	39,718	2,188

(1) - Includes halibut landed in U.S. ports by Canadian fishermen.
(2) - Figures for Quebec in May 1966 not available.

MID-MONTH WHOLESALE PRICES - May, 1966

		Montreal $	Toronto $
Cod fillets, Atl, fresh, unwrapped	lb.	.384	.450
Cod fillets, Atl, frozen, cello 5's	lb.	.349	.397
Cod fillets, smoked	lb.	.425	.473
Haddock fillets, fresh, unwrapped	lb.	.471	.580
Herring, kippered, Atl.	lb.	.256	.307
Mackerel, frozen, round	lb.	.188	.243
Lobsters, canned, Fancy	Case 48-½s	64.947	66.040
Sardines, canned	Case 100-¼s	9.473	*9.370
Halibut, frozen, dressed	lb.	.570	.600
Silverbright, frozen, dressed	lb.	.608	.617
Coho, frozen, dressed	lb.	.760	.763
Sockeye, canned, grade A	Case 48-½s	28.530	28.833
Pink, canned, grade A	Case 48-½s	16.753	17.107
Whitefish, fresh	lb.	(1) .583	-
Lake trout, frozen	lb.	.438	.517

* - Brunswick (1) Dressed

PRICES PER CWT. PAID TO FISHERMEN

Week ending May 14	1965 $	1966 $
Halifax		
Cod Steak	4.75	5.25
Cod Market	4.5	5
Haddock	7.5	8.5
Plaice	4	4.5
Yarmouth		
Haddock	6	7
Black's Harbour		
Sardines	2	-
St. John's Nfld.		
Cod	3.5	-
Haddock	2.75	2.75
Rosefish	2.5	2.5
Vancouver		
Ling Cod	10-15	12-14
Gray Cod	5.5-7	6-7.5
Soles	6-8	6-9.5
Salmon (Rdspg)	45-80	35-77

Fishery Figures For May

FROZEN FISH STOCKS AS AT END OF APRIL

	1965 '000 lbs	1966(2) '000 lbs
TOTAL - Frozen Fish, Canada	41,653	49,879
Frozen - Fresh, Sea Fish - Total	24,322	27,255
Cod, Atlantic, Fillets & Blocks	4,172	6,537
Haddock, fillets & blocks	3,440	3,810
Rosefish, fillets & blocks	1,661	761
Flatfish, (excl. halibut), fillets & blocks	2,296	2,836
Halibut, Pacific, dressed & steaks	1,940	1,423
Other Groundfish, dressed & steaks	626	984
Other Groundfish, fillets & blocks	1,966	3,117
Salmon, Pacific, dressed & steaks	3,316	1,482
Herring, Atlantic & Pacific	154	340
All Other Sea Fish, all forms	2,926	3,128
Shellfish	1,825	2,837
Frozen - Fresh, Inland Fish - Total	3,010	4,782
Perch, round or dressed	147	641
Pickerel, (Yellow & Blue) fillets	103	118
Sauger, round or dressed	36	(.1)
Tullibee, round or dressed	64	127
Whitefish, round or dressed	535	1,382
Whitefish, fillets	156	277
Other, all forms	1,969	2,237
Frozen - Smoked Fish - Total	2,019	1,844
Cod Atlantic	1,174	1,230
Sea Herring, kippers	300	273
Other, all forms	545	341
Frozen for Bait and Animal Feed	12,302	15,998

(1) - Confidential, included with "Other".
(2) - Does not include Quebec; data not available.

SALTED FISH STOCKS AS AT END OF MAY

		1965	1966(1)
Salted and Pickled Fish, Atlantic Coast			
Wet-salted - Total		7,387	4,779
Cod		5,425	3,063
Other		1,962	1,716
Dried - salted - Total		8,638	2,753
Cod		6,566	2,370
Other		2,072	383
Boneless - Total		538	387
Cod		517	285
Other		21	102
Pickled - Total	(barrels)	8,339	8,288
Herring	"	2,039	6,513
Mackerel	"	4,594	10
Alewives	"	1,706	1,765
Turbot	"	-	-
Bloaters	(18 lb. boxes)	30,313	16,000
Boneless Herring	(10 lb. boxes)	2,198	5,000

(1) - Does not include Quebec; data not available.

CANADIAN EXPORT VALUE OF FISHERY PRODUCTS, May - February

(Value in Thousands of Dollars)

		1964-1965		1965-1966
Total Exports		172,073		188,159
By Markets:				
United States		112,529		132,663
Caribbean Area		13,451		15,514
Europe		41,038		34,401
Other Countries		5,055		5,581
By Forms:				
Fresh and Frozen		109,472		129,819
Whole or Dressed	36,652		39,000	
Salmon, Pacific	10,765		10,434	
Halibut, Pacific	4,968		6,504	
Cod, Haddock, Pollock, etc.	360		423	
Swordfish	4,483		3,969	
Other Seafish	4,767		5,770	
Whitefish	4,596		4,718	
Pickerel	2,337		2,733	
Other Freshwater Fish, n.o.p.	4,376		4,449	
Fillets	44,912		59,131	
Cod, Atlantic	17,407		21,495	
Haddock	4,493		3,979	
Rosefish, Hake, Pollock, etc.	3,563		5,753	
Flatfish	7,102		9,664	
Pickerel	2,354		2,545	
Other	9,993		15,695	
Shellfish	27,908		31,688	
Lobster (Alive & Meat)	20,120		21,712	
Other	7,788		9,976	
Cured		20,008		20,677
Smoked	1,591		1,778	
Herring	1,107		1,108	
Other	484		670	
Salted, Wet & Dried	16,076		15,798	
Cod	13,537		13,646	
Other	2,539		2,152	
Pickled	2,341		3,101	
Herring	1,482		1,923	
Mackerel	411		675	
Other	448		503	
Canned		29,314		22,935
Salmon	22,246		14,863	
Sardines	3,333		4,354	
Lobsters	2,758		2,437	
Other	977		1,281	
Miscellaneous		13,279		14,728
Meal	7,051		8,370	
Oil	2,009		1,673	
Other	4,219		4,685	

Rockfish of British Columbia

THERE are approximately twenty-nine species of fish in British Columbia waters belonging to the genus *Sebastodes* which collectively are called "rockfish". The fishermen give them a variety of common names, some of which are rock-cod, snappers, canaries, black bass, rock salmon, and Pacific Ocean perch. Their nearest relative in the Atlantic is the redfish. The rockfish species of the Pacific coast appear to be very abundant off the British Columbia coast.

DESCRIPTION

The rockfish as a group are distinguished by their stout, heavily constructed bodies. Large broad heads, usually bearing spines and strong ridges, and heavily-spined fins are notable features. The colour patterns vary greatly among species and range from black and drab green through to brilliant orange and crimson. The colour of some species is made even more bizarre by the presence of wide red or black stripes.

HABITS

As a rule the rockfishes are found in the vicinity of reefs and rough bottom. A few species, such as the copper rockfish and the orange-spotted rockfish occur among the kelp patches in shallow water from the intertidal zone to depths of twenty fathoms. These two species are usually termed "rock-cod" by the fishermen Other more brightly coloured species, usually termed "red-cod", such as the red snapper, orange rockfish, and "Spanish flag" occur at depths from thirty to over one hundred fathoms. The majority of the species are inhabitants of deep water off the open coast.

All of the species bear their young alive in prodigious numbers. These young fish are not much more than a quarter of an inch in length when born. During the summer months large schools of fingerling rockfish are encountered in the inlets and bays bordering the open coast. These small fish must also be very abundant in offshore waters for they are frequently found in the stomachs of the albacore tuna.

Pacific Rockfish

The food of the rockfishes consists of herring, sand lance and other small fish, crabs, shrimps and euphausiids.

AGE AND GROWTH

The study of the annulations on scales has revealed that the rockfishes as a group are much slower growing than other groundfish species. It would appear that most of the species do not reach commercial size until they are eight to ten years of age. Some specimens as old as twenty five years have been recorded.

FISHING METHODS

High-opening trawls of light web have proved to be the most effective means of capturing rockfish, since these fish do not congregate so close to the bottom as other groundfish species. Small quantities are caught incidentally in the hand-line fishery for lingcod and the long-line fishery for halibut and blackcod.

HANDLING

Rockfish caught by trawlers are landed in the round while those caught by line vessels are landed dressed with heads off. Most of the catch is filleted and packaged for freezing. A limited amount goes to the fresh fish market and to the "Fish and Chips" trade.

If undelivered return to:
Department of Fisheries of Canada
OTTAWA

CANADA
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It's Fish Barbecue Time!

EACH YEAR between May and October more and more Canadians enjoy the delights of outdoor cooking. Back yards, picnic grounds, and camp sites across the country come alive with outdoor chefs and their equipment.

Nice thing about this type of cooking is that every member of the family can take part in it. Mother usually handles the preliminaries, the children help with the toting, while father superintends the fire and the cooking. Everyone, excepting the very young, can take a turn rotating the food on the grill and drinking in its smoky fragrance.

While barbecuing is a simple art, some foods are more adaptable to it than others. Fish is an excellent choice because it cooks to perfection in a short time. Especially suitable for barbecuing are the species with high fat content such as salmon, shad, black Alaska cod, and mackerel.

Thick, succulent salmon steaks are a treat cooked over the coals. The following tested recipe is recommended by the consumer consultants of the Department of Fisheries of Canada.

Barbecued Salmon Steaks

2 to 3 pounds salmon steaks, 1 to 1½ inches thick
½ cup catsup
¼ cup salad oil
3 tablespoons lemon juice
2 tablespoons vinegar
1 teaspoon Worcestershire sauce
1 teaspoon salt
1/2 teaspoon grated onion
1/2 teaspoon powdered mustard
1/4 teaspoon paprika
1 clove garlic, finely chopped
3 drops Tabasco sauce

Thaw steaks, if frozen. Place in a single layer in a shallow pan or dish. Combine remaining ingredients. Pour sauce over fish and let stand for 30 minutes, turning once. Remove fish, reserving sauce for basting. Place fish in well-greased barbecue basket or hinged wire grills. Cook about 4 inches from moderately hot coals for 10 to 12 minutes. Baste with sauce. Turn and cook for 10 to 12 minutes longer, or until flesh to centre of steaks has lost its translucent look becoming a paler, opaque shade and until it flakes easily when tested with a fork. Makes 4 to 6 servings.

DEPARTMENT OF FISHERIES
Hon. H. J. Robichaud, M.P., Minister
Dr. A. W. H. Needler, Deputy Minister
Ottawa, Canada

ROGER DUHAMEL, F.R.S.C., Queen's Printer and Controller of Stationery, Ottawa, 1966

FISHERIES

(formerly Trade News) OF CANADA

Vol. 19 No. 3 September, 1966

In This Issue

- ★ Fisheries Situation in the N. W. Atlantic
- ★ Latest Facts on the Arctic Char
- ★ Review of Canadian Atlantic Crab Resources

Department of Fisheries of Canada, Ottawa

FISHERIES
OF CANADA
(formerly Trade News)

Editor
E. H. HEARNDEN

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COVER PHOTOGRAPH - Crew of a British Columbia salmon seiner braille a catch of pink salmon from the seine.

The Fisheries Situation in the Northwest Atlantic

By Dr. Wilfred Templeman

Fisheries Research Board of Canada

Biological Station, St. John's, Nfld.

(Editor's note: The following article is based on a paper presented by Dr. Templeman at the annual meeting of the Fisheries Council of Canada, held at Halifax, N.S., May 9-11, 1966).

IN THIS paper I will concentrate on the four chief groundfish species or groups of the Northwest Atlantic and make some more general but not all-inclusive comments toward the end. I shall not deal at all with the tuna fishery which occurs mainly outside the area of the International Commission for the Northwest Atlantic Fisheries (ICNAF).

The statistics used are from ICNAF, and are presented as in the ICNAF publications in metric tons of whole ungutted fish (1 metric ton = 2,204.6 lb), for brevity and according to international usage called tons in this paper. As a sign of maturity in Canadian fisheries it is time to stop talking about pounds of fish and to begin to talk about tons or thousands of tons.

The ICNAF area (Fig.1) is divided for statistical purposes into 5 Subareas: Subarea 1, West Greenland; Subarea 2, Labrador; Subarea 3, the Newfoundland area; Subarea 4, the Nova Scotian Shelf, Bay of Fundy and Gulf of St. Lawrence; and Subarea 5, the Georges Bank and Gulf of Maine areas. Each of these in turn is split into a number of statistical divisions. I shall concern myself only with the recent period 1952-64 for which ICNAF statistics

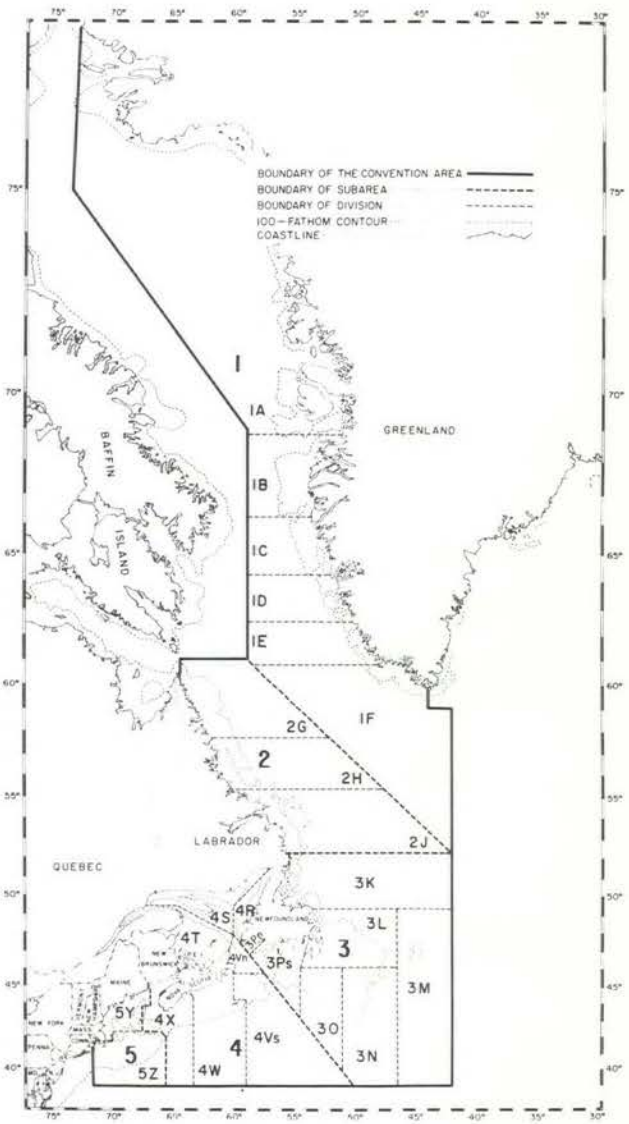

Fig. 1. The ICNAF area, Subareas and Divisions.

are available and during which the great increases in European fishing have taken place.

Traditionally Canadians have fished offshore mainly in the southern part of Subarea 3 and the northern part of Subarea 4. Over the past few years much effort has been directed southward to Subarea 5 and the southern part of Subarea 4. Canadians still do not fish offshore except sporadically with single vessels in the northern half of the ICNAF area, but in the near future this area, from which a large part of the European landings is taken, will have to be fished. Failures in fish supply in any offshore fishery in any ICNAF area bring more fishing pressure on other subareas. I am assuming, therefore, that we have an interest now and in the future in the whole of the ICNAF area.

TOTAL LANDINGS OF ALL SPECIES IN THE ICNAF AREA

Total landings of all species from the ICNAF area (Fig. 2) have increased regularly from 1,847 thousand tons in 1954 to 2,950 thousand tons in 1964. In the same period, total Canadian landings, varying between 634 and 744 thousand tons in 1954-58, have increased in 1963-64 to 801 and 827 thousand tons. Percentage-wise, Canadian landings have declined from 37% of total landings in 1954 to 28% in 1964. The Canadian fishery has had three levels of decreasing percentage landings. In the earlier period 1954-57, landings were fairly stable at 35-37% of the total. The drop in Canadian percentages in 1958-60 was due largely to the new and large scale landings by Russian and other European recent entrants into these fisheries. As a result there were great increases in redfish landings from northern areas where Canadians do not fish and also (in 1960) in cod and haddock landings by Europeans from the ICNAF area. The more recent Canadian percentage decline to 27-29% in 1961-64 has been produced especially by the new European, but not Canadian, offshore fisheries for silver hake and herring in the southern subareas.

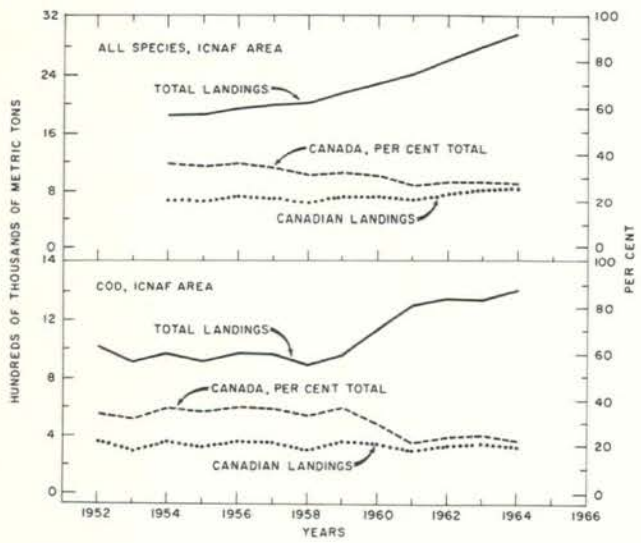

Fig. 2. Total landings, Canadian landings and Canadian percentages of the total landings and all species, 1954-64 and of cod from the ICNAF area, 1952-64.

COD

Total cod landings from the ICNAF area, (Fig. 2) which fluctuated between 884 and 1,017 thousand tons in the period 1952-59, began to increase in 1960 with the development of the great offshore winter-spring fishery off Labrador and N.E. Newfoundland and the intensifying of these northern cod fisheries during the remainder of the year. Total cod landings have been above 1,300 thousand tons since 1961 and were 1,402 thousand tons in 1964. Canadian cod landings have definitely fallen since 1959 from an average of 333 thousand tons in 1952-59 to 318 thousand tons in 1960-64. Percentage-wise, Canadian landings of cod have fallen sharply from a yearly percentage average of 35% of the total cod landings in 1952-59 to 23% in 1961-64. This small total and great relative decline in the Canadian landings coincided with the great development by European countries of the offshore cod fishery off Labrador and Northeast Newfoundland (Fig. 3).

Cod is the dominant fish of the ICNAF area, although of much more importance in the central and

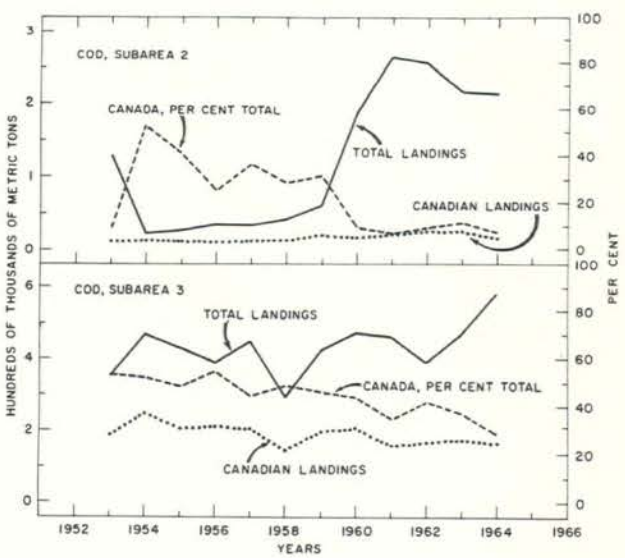

Fig. 3. Total landings, Canadian landings and Canadian percentages of the total landings of cod from ICNAF Subareas 2 and 3, 1953-64.

northern subareas than toward the south. The cod population of the area is divided into many stocks each with its own spawning area and pattern of migration. There is some mixing of stocks but each of these stocks can be overfished separately from the others, especially in the spawning concentrations.

In some years, more than others, there is good survival of recently hatched cod, and the continuing success of the fishery depends on these successful year-classes but the differences in survival between year-classes are usually not so extreme as in the case of the Newfoundland haddock, or of redfish in the Gulf of St. Lawrence.

Cod are abundant where the water is moderately cold, and hence can find food, live and sur-

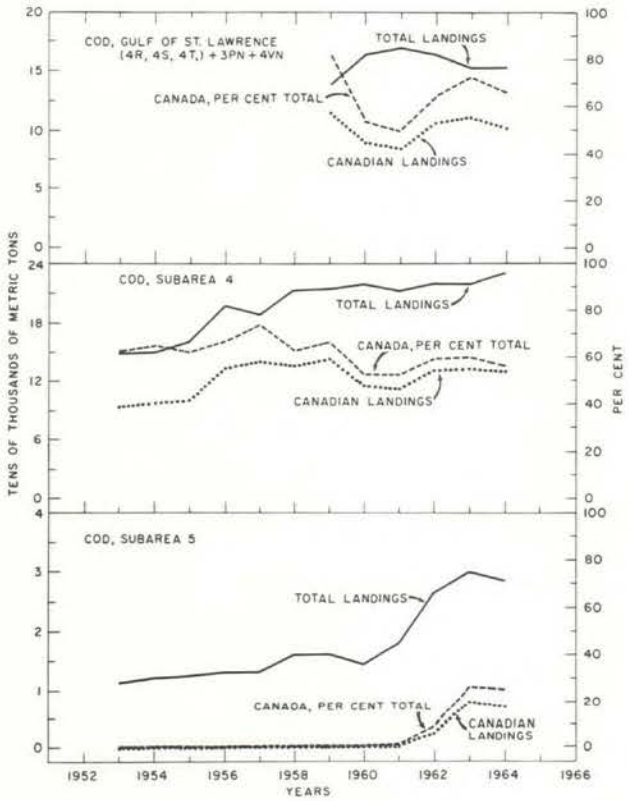

Fig. 4. Total landings, Canadian landings and Canadian percentages of the total landings of cod from the Gulf of St. Lawrence stocks (4R, 4S, 4T) + 3Pn + 4Vn, 1959-64 and from ICNAF subareas 4 and 5, 1953-64.

vive well over a great part of the northern subareas. Considering both its numbers and size it is the dominant fish of the four northern subareas, controlling the numbers of many other fish and invertebrate populations by eating the adults or their young.

In the northern subareas and the northern part of Subarea 4, hydrography and the habits of this fish produce great pre-spawning and spawning concentrations in deep water in winter-spring and feeding concentrations, especially of the younger fish, in shallow water in summer. It is thus heavily attacked, but over centuries of fishing has demonstrated a considerable resilience to the effects of fishing.

Total cod landings from the ICNAF area in 1964 were at their highest level in the history of the fishery. These landings were 450 thousand tons greater than those of 1959, an increase almost 50% higher than the total Canadian landings. Cod landings have declined since 1962 in West Greenland (Subarea 1) and since 1961 in Labrador (Subarea 2) but Subareas 3 and 4 (Fig. 3, 4) in 1964 produced the highest cod landings in the history of the fishery. The 1964 landings from Subarea 3, 120 thousand tons higher than the previous highest landings in 1960, were especially responsible for the increase in the total landings from the ICNAF area.

The total mortality, including both fishing and natural mortality, is now reaching high levels in some areas. The recent catch increases have, however, been so rapid, especially in Subarea 2, that it is too early to be able to judge whether or not the Subarea or the overall ICNAF landings will be sustained at the present or a higher or lower level.

HADDOCK

In contrast to cod, haddock landings, (Fig. 5) which are taken from the 3 southern subareas of ICNAF, rose to peaks of 198 thousand tons in 1955 (191 thousand tons in 1956) and to 179 thousand tons in 1961 (159 thousand tons in 1960) and have been at a lower level of 126-142 thousand tons in 1962-64. Both the peak catches and the recent declines have been largely due to variations in the catches on the Newfoundland banks. The 1955-56 peak in landings was produced especially by the great 1949 year-class of haddock which was so abundant both on the Grand Bank and St. Pierre Bank. (Fig. 6). The increase in 1960 and the peak in 1961 were caused by the large scale entrance of the Russians into the fishery on the Grand Bank, in these two years fishing the last very successful year-class of haddock, that of 1955 (with a smaller 1956 year-class). The recent declines in haddock landings from the ICNAF area have been caused chiefly by scarcity of haddock on the Grand Bank.

After a sharp rise from 23% of the total landings in 1952 to 40% in 1954, Canadian landings have fluctuated between 33 and 48% of the total landings. Beginning in 1962 there have been increasing Canadian landings of haddock from Subarea 5 (Georges Bank), from which previously Canadian landings had been negligible. (Fig. 6).

The abundance of all fish is dependent on the success of survival of year-classes and the differ-

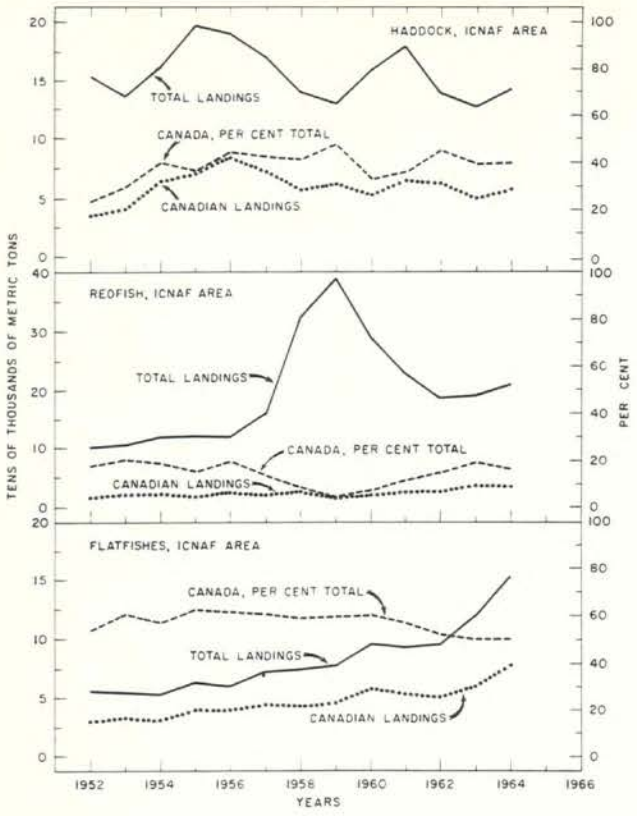

Fig. 5. Total landings, Canadian landings and Canadian percentages of the total landings of haddock, redfish and flatfishes from the ICNAF area, 1952-64.

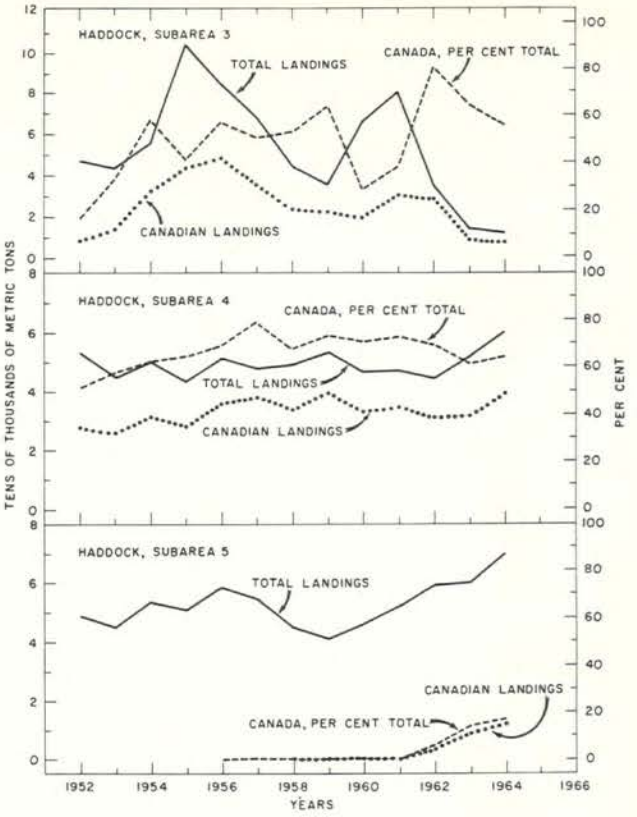

Fig. 6. Total landings, Canadian landings and Canadian percentages of the total landings of haddock from ICNAF Subareas 3, 4 and 5, 1952-64.

ences in survival of young from year to year are noteworthy in the haddock. These differences in survival of different year-classes of young are especially great in the northern haddock populations on the Grand Bank and St. Pierre Bank. The Grand Bank fishery since its inception in 1946 has depended on successful year-classes which appeared every 3 or 4 years - 1942, 1946, 1949, 1952 -53, 1955-56 - with almost no survival of young hatched in the intervening years. Of these no year-class since 1949 has been successful on St. Pierre Bank. This 1949 year-class was fished heavily in 1955-56. The Grand Bank has not had a good survival of young haddock since 1955 with a smaller one in 1956. These year-classes sustained the fishery at a high level in 1960 and 1961 and are only now passing out of the fishery.

The failure of a significant year-class to appear on St. Pierre Bank since 1949 must be attributed to conditions over this bank being in almost all years generally unsuited to survival and retention of young haddock in large numbers. The causes of the relative failures of year-class survival on the Grand Bank since 1955-56 are doubtful. Since 1951 there has been on the average some decline in sea temperature in the Newfoundland area but there have been some warm as well as cold years. The Russian entry into the fishery on a large scale in 1960-61 together with the Canadian efforts in 1960-62 rapidly reduced the last big year-class, that of 1955, to very low numbers. The highly fluctuating haddock fishery of the Newfoundland area (Subarea 3) is now at a low level and is expected to remain low for at least four years as no very successful year-class is in sight. In research vessel surveys of the southern Grand Bank in May and June 1960, 1962-65, the average numbers of haddock of all sizes per half-hour drag were respectively 579, 79, 72, 32, and 29. At present the numbers of mature haddock on the Grand Bank are so low - probably less than 5% of their former abundance - that it will take very favourable environmental conditions to produce a year-class of significant commercial importance.

In the period 1952-64, landings of haddock from the Nova Scotian area and from Georges Bank did not vary so much as those from the Newfoundland banks, but there have been considerable differences between yearly landings. In this period, haddock landings from Subarea 4 were between 43 and 60 thousand tons and from Subarea 5 between 41 and 70 thousand tons. (Fig. 6). In both cases, the highest landings during the period were in 1964. On Georges

Bank and on the western Nova Scotian banks, good and moderate year-classes are appearing with enough regularity to keep the fishery at a high level and the year-class of 1963 was particularly large. This year-class entered the fishery in the latter part of 1965 on Georges Bank and should contribute heavily to the fishery in 1966-68. The 1963 year-class will make its contribution to the fishery on Browns Bank somewhat later than on Georges Bank because of the slower growth rate on Browns Bank. The 1964 year-class on these banks has a relatively low abundance. The fishing effort for haddock on Georges Bank in 1964 exceeded by 35% that calculated by United States scientists to produce the maximum sustainable annual yield of about 45,000 tons. On the northeastern Nova Scotian banks the 1963 year-class is the largest since that of 1961 but is not as abundant as on the more southern banks.

REDFISH

In the period 1952-56, effort on redfish was concentrated mainly on the small redfish of the southern half of the ICNAF area and by far the greatest landings were taken by the United States. From 1957 to 1959, European and especially the Russian landings, mainly of the larger redfish from the northern half of the area, increased rapidly. Total redfish landings from the ICNAF area (Fig. 5) increased to 389 thousand tons in 1959 from 102 thousand tons in 1952. After 1959, the northern redfish stocks of Subareas 2 and 3 had been considerably reduced in abundance (Fig. 7) and much of the Russian effort for redfish was transferred to haddock of Subarea 3 in 1960-61 and southward in 1961 to the herring of Subarea 5 and in 1962 to the silver hake of Subareas 5 and 4. The Icelandic fishery for redfish in the ICNAF area also declined greatly. Consequently, total redfish landings fell to 187 thousand tons in 1962, less than half the peak landings of 1959. Since that time there has been a slight increase in landings to 213 thousand tons in 1964. Canadian redfish landings fluctuated between 18 and 28 thousand tons from 1952 to 1962 but in 1963-64 there was an increase to 36-38 thousand tons and there was apparently a considerable further increase in 1965. In terms of percentages of the total landings, Canadian landings decreased rapidly from 16-21% in 1952-56 to 5% in 1959 and have since risen to 17-20% in 1963-64.

Redfish are very slow growing fish. In the southern part of the area they are about 15 years of age at 12 inches in length and the largest sizes of fish may be 25-50 years of age but only grow about an inch in length in the last half of their life. Female redfish liberate living young instead of eggs and in some places such as the Gulf of St. Lawrence there can be many years between successful year-classes. In these areas, therefore, the fishery will fluctuate greatly between periods of years.

In West Greenland and off the Baffin Island coast female redfish do not mature. Consequently

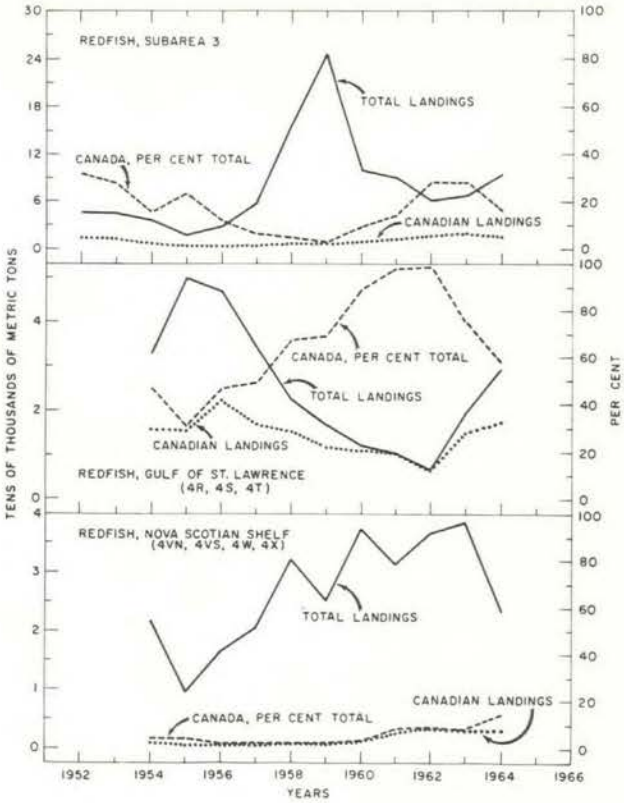

Fig. 7. Total landings, Canadian landings and Canadian percentages of the total landings of redfish from ICNAF Subarea 3, 1952-64 and from Subarea 4 - Gulf of St. Lawrence (4R, 4S, 4T), and from Subarea 4 - Nova Scotian Shelf and Bay of Fundy (4Vn, 4Vs, 4W, 4X), 1954-64.

the redfish population of these areas depends on larval drift and the migration of some very large *marinus* redfish from Denmark Strait between Iceland and East Greenland. The redfish fishery in West Greenland has been relatively large but is now declining and this area cannot be expected to maintain a large redfish fishery indefinitely.

As an example of local changes in the redfish fishery we shall consider the Gulf of St. Lawrence. When the fishery began in the Gulf in the early 1950's the population was made up mainly of large redfish 12-16 inches long with few fish below 10 inches in length. This fishery on a virgin stock reached a peak of 50 thousand tons in 1955 and declined to a low of 6.6 thousand tons in 1962 as the fishery depleted the redfish population of the Gulf (Fig. 7). In 1963-65, redfish landings from the Gulf have increased rapidly, due to the entry into the fishery of a new group of small redfish apparently produced in 1956 and followed in surveys by the St. John's Station from 1959 until these redfish grew large enough to produce a significant fishery for them beginning in 1963.

There was a period of about 10 years of year-

class failure between the group of small redfish which has recently produced a temporary renewal of the fishery in the Gulf of St. Lawrence and the previous successful year-class in this area.

The increases in the redfish fishery of the ICNAF area up to 1959 came by fishing the accumulated virgin populations of old fish and by moving northward to new virgin populations as the old accumulations were reduced. This process has now come to an end as it is not likely that there are any great new populations of redfish, or in fact of any other commercial groundfish, remaining near the continental shelf of the Northwest Atlantic. The slow growth and in some areas lack of adequate recruitment will not permit a continually expanding fishery, and the maximum sustainable yearly yield is likely to be less than the peak yield of 389 thousand tons in 1959 although it may well be at least 200 thousand tons. Only time, increased research, and the resilience of the fish to the fishery will give us the answer. In the northern areas, however, in the Gulf of St. Lawrence and Subareas 3, 2 and 1, this is the most plentiful groundfish after the cod. As the Canadian fleet grows larger Canadians must take part in the fishery for the large redfish in the northern half of the ICNAF area.

FLATFISHES

Under flatfishes I have included all the flounders, the halibut and the Greenland halibut or Newfoundland turbot. In terms of weight the most important of the flatfishes is the American plaice (53 thousand tons in 1964), whose greatest abundance is in Subarea 3 (73% of total ICNAF landings of this species in 1964) and the yellowtail flounder (42 thousand tons in 1964), whose greatest abundance is farther south in Subarea 5 (87% of total ICNAF landings of this species in 1964). The witch flounder or greysole is important to Canada, especially in Subarea 4. Canada landed 13 thousand of the 15 thousand tons of this species reported from the ICNAF area in 1964. The winter flounder or blackback (18 thousand tons in 1964) is mainly caught in Subarea 5 and to a minor degree in Subarea 4. Halibut, (5.1 thousand tons in 1964) with greatest landings in Subareas 3 and 4, is important for its value, especially to Canada which caught a little more than half (2.6 thousand tons) in 1964. In recent years Canada's Atlantic halibut landings have been declining both in quantity and in percentage of the total. Newfoundland Greenland halibut (turbot) landings from the deeper Newfoundland bays increased greatly in 1965 to 8.2 thousand tons from 1.8 thousand in 1964. This was due to their increasing use as frozen fillets rather than pickled fish.

Total flatfish landings (Fig. 5) increased almost three times, from 55-57 thousand tons in 1952-54 to 153 thousand tons in 1964. Canadian landings in this period increased from 30-34 thousand tons in 1952-54 to 78 thousand tons in 1964. Canadian

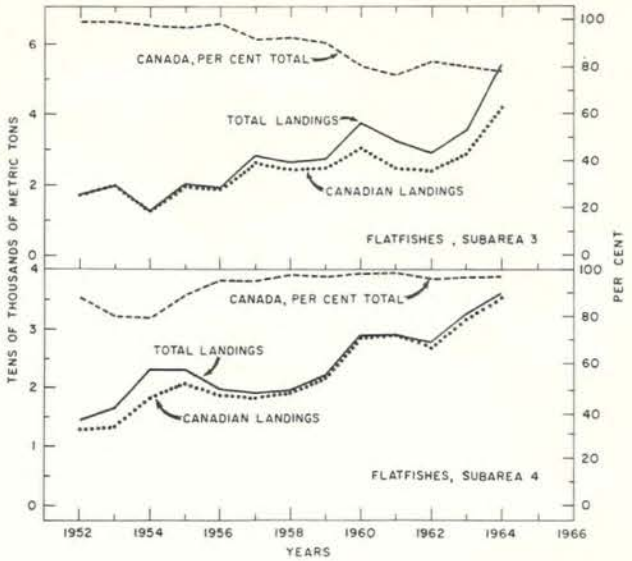

Fig. 8. Total landings, Canadian landings and Canadian percentages of the total landings of flatfishes from ICNAF Subareas 3 and 4, 1952-64.

flatfish landings, although rising rapidly in quantity, fell from an average (of yearly percentages) of 59% in 1952-61 to 50% in 1963-64. Canada lands a great share of the flatfish of the area, especially in Subarea 3, 78% in 1964, and Subarea 4, 97% in 1964 (Fig. 8). It may be inevitable that our landings as a percentage of the total landings will decline if other countries take more interest in catching these fish.

COMPARATIVE LANDINGS, INCLUDING OTHER SPECIES THAN GROUNDFISH

In 1964, 2,950 thousand tons of all species were landed from the ICNAF area. In this year the most important species were landed in the following percentages of the total landings (Canadian landings in terms of percentage of the species total, not the overall total, in parentheses): cod, 48 (23); herring, 10 (47); silver hake, 10 (0); redfish, 7 (17); flatfishes, 5 (51); haddock, 5 (41); sea scallop, 4 (54); remainder, 11 (43). Cod are caught chiefly in Subareas 1 (25%), 2 (15%), 3 (41%), and 4 (16%); herring in Subarea 4 (46%) and Subarea 5 (53%); silver hake in Subareas 4 (27%) and 5 (73%); redfish chiefly in Subareas 3 (44%) and 4 (25%); haddock chiefly in Subareas 4 (42%) and 5 (49%); and flatfishes chiefly in Subareas 3 (35%), 4 (24%) and 5 (38%).

It is apparent that in any future expansion of the trawler fleet the cod must receive most attention. Except for sporadic attempts, Canadians at present do not fish offshore cod north of the Grand Bank region and in fact there is no significant Canadian catch of offshore cod north of Subarea 4. This means that cod are caught offshore in quantity by Canadians only

in Subarea 4 (Fig. 4) which accounts for only 16% of the total cod catch of the ICNAF area.

For redfish we are fishing only Subarea 4 and the southern fringe of Subarea 3. This is another field for expansion.

We are not yet taking part significantly in the offshore silver hake and herring fisheries. The low prices for these fish offer difficulties for trawler catches. As fish prices rise it may be possible to increase the area fished for flatfishes but we are already taking a great share of these fishes and it may be difficult enough to maintain our present percentage share of the landings. In the Newfoundland area, both inshore and offshore, there are great quantities of capelin which will presumably be used as meal but which like the herring will not attain their full value until they are used as human food. The spiny dogfish and the porbeagle are beginning to be used. More squid could be caught in the years of abundance if the additional amounts could be marketed profitably.

There are other fishes, not discussed here, which have become more important in the catches in recent years - pollock mainly in Subarea 4 and white and red hake chiefly in Subarea 5 and many minor species are contributing to the landings in increasing amounts instead of being thrown overboard. The ultimate aim must be to use all fish and as far as possible invertebrates for human food and otherwise for fish meal.

Inshore since 1952, Canadian lobster landings have varied between 19 and 24 thousand tons. Landings have declined since 1960, and the 1964 landings were 4 thousand tons below the 23 thousand tons caught in 1960. At least in the colder parts of the lobster area, both short- and long-term lobster landings are likely to be unfavourably affected by lower temperatures, and sea temperatures in the Maritime and Newfoundland areas have been falling on the average since the early 1950's.

Some of the coastal molluscan resources have suffered greatly, from disease in the oyster and presumably from overexploitation in the clam.

Total landings of sea scallops from Georges Bank (Division 5Z) reached a peak of 15 thousand tons of shucked meats in 1962 and fell to 12 thousand tons in 1964 in spite of increasing effort. Canadian landings from this bank have increased steadily from 1.6% of total landings in 1955 to 48% in 1964. In this year, 90% of the Canadian offshore scallop landings came from Georges Bank. Year-class success is important for scallops and difficult to estimate at early ages because very small scallops cannot be caught efficiently. Long-term prediction of fishing success is therefore difficult.

The fishery for Atlantic salmon has recovered a little in recent years but the effects on the Canadian landings of the large new salmon fishery in West Greenland are yet to be assessed.

Swordfish landings increased with the introduction of the longline method of fishing but showed a decline in 1965.

The coastal herring fishery is showing new life with the higher prices for fish meal and the successful purse-seining ventures off southern Newfoundland, the Gulf of St. Lawrence and southwestern Nova Scotia. There can be no assurance, at least in the Newfoundland area, that large herring populations will always be present in any single area. The history of the Newfoundland fishery shows great fluctuations in area abundance of herring with rapid disappearances and appearances of large local populations. The assessment of the effects of nature and of the fishery on these herring stocks will be a major field of research matching the importance of the industry.

The great inshore cod fisheries of Newfoundland are showing the effects of the increasing offshore fishery, particularly that of winter and spring on the cod spawning schools. These effects are showing up in the reduction in fish size and in catch per man and, especially on the northeast coast of Newfoundland, in the reduction of the overall total inshore catch in spite of increases in men and gear.

The general outlook for major expansion of the offshore fishery can be one of pessimism or optimism, with the balance between these two attitudes dependent on Canadian ability to compete with high efficiency in the offshore fisheries.

It may be significant that the fields where North Americans dominate, such as the flatfishes and scallops, are those where the catch per hour's fishing is relatively low. In the international fisheries, Canada will need to decide whether its interest lies in the maintenance of larger or smaller standing stocks or of larger or smaller fish in these areas. In cod, where the offshore in our interest at present to maintain large standing stocks, but this may not be the case for some other fishes.

RESEARCH

Research indicates fields for fisheries development and the resulting increases in fishing effort produce corresponding decreases in the standing stocks and sizes of fish. The greater exploitation of the fishery in turn increases the need for research on fish populations to supply up-to-date information for policy decisions by the fishing industry, the Department of Fisheries and ICNAF.

In the rapidly intensifying offshore fishery, there are apparently no large stocks of commercially

acceptable groundfish that are not at present being fished and there is increasing competition. Whereas 10-15 years ago we could discover a fish concentration - redfish for example - and confidently expect it to be in approximately the same quantities in the same place at the same season 5 years later, at the present time a concentration can be discovered and cleaned up in a few months or in a year or two.

Under these conditions, research efforts also need to be more intensive. If many of the questions the industry, Government, and ICNAF are asking are to be answered, there will need to be increasing research effort in the offshore fishery, the only direction in which the industry can expand very significantly and where Canadian effort and knowledge of ships, gear and fish concentrations will be directly competing with those of other countries. It is also important for Canada, with her great coastal as well as offshore fisheries interests, to have more knowledge than any other country at the ICNAF conference table. The questions of fish supply are becoming increasingly of paramount importance to the fishing industry. To supply the required information on the offshore fishery there is a pressing need for more, larger, and much better equipped research vessels, with accompanying scientific and technical staffs and increased laboratory space and facilities on shore. ✔

Seek Uniform System of Food Labelling

AIMED at reaching international accord in establishing a uniform system of food labelling, a committee of the United Nations-sponsored Codex Alimentarius Commission convened in Ottawa recently. Delegates and observers from eleven nations met to study specific problems assigned to it by the commission.

Recalling the failure of international efforts in the past to set up a uniform labelling program, Dr. S.C. Barry, Canada's Deputy Minister of Agriculture, said the Codex committee provided a vehicle by which this might be done. Food labelling was one area, he added, where "it should be possible to make progress and see our way clear to sort out our difficulties".

Jointly sponsored by the Food and Agriculture Organization of the United Nations and the World Health Organization, the Codex Alimentarius Commission was established in 1962. Meeting in Geneva two years ago, the commission accepted the offer that Canada take the responsibility for the committee on food labelling. The commitee met for the first time last year.

General chairman of the recent Ottawa meeting was Dr. R.A. Chapman, Director-General, Food and Drugs, Department of National Health and Welfare.

Chief Canadian delegate to the Ottawa meeting was Andrew Hollett of the Health and Welfare Department. Other Canadian delegates and observers were H.V. Dempsey, Director, Inspection Service, Department of Fisheries, and R.M. McKay, R.M. Haney and Clair Merkley, Department of Trade and Commerce. Canada's food industry was represented by representatives of the Meat Packers' Council, the Fisheries Council of Canada, the Canadian Food Processors Association and the Canadian Confectionery Association. Representing the FAO and WHO were respectively, G.O. Kermode, Rome, and Dr. Claus Agthe, Geneva.

Nations represented at the meeting included Australia, Belgium, Canada, Denmark, Federal Republic of Germany, Israel, Netherlands, Poland, Switzerland, United Kingdom and the United States.

Briefly, the objectives of the Codex commission are: to promote and strengthen international trade in raw, semi-processed and processed foods; to promote fair trade practices, to ensure that consumers in any country of the world are supplied with safe, wholesome food of acceptable quality, and to ensure that all foods are properly labelled and presented so that all elements of fraud and deception are removed.

Codex committees have been established to develop trading standards for a broad range of foods including meat and meat products, fish and fish products, processed fruits and vegetables and fats and oils. Committees have also been set up to study problems associated with food hygiene, food additives, pesticide residues and food labelling.

Hatchery Survey

A survey to determine future needs for hatchery fish to help manage sport fishing has been announced in the United States.

The survey will be made by the U.S. Bureau of Sport Fisheries and Wildlife in co-operation with State fish and game departments. It will be used to estimate the water now suitable for sport fishes, how much of this is or should be stocked, fisherman numbers, future stocking needs, and capabilities of national, state, and private hatcheries. The survey is also expected to be helpful in deciding the future roles of public and private hatcheries.

Data gathered will be projected to cover needs for "hatchery fish" in 1973, 1980, and 2000.

Fisheries Research Board of Canada
Biological Station, St. Andrews, N. B.
General Series Circular No. 50, Sept. 1966

Canadian Atlantic Crab Resources

By D.G. Wilder

RECENT developments in the fisheries for rock crabs and spider crabs in the Gulf of St. Lawrence have stimulated interest in these and other crab species. Since relatively little is known about Canadian Atlantic crabs it is timely to summarize available information, consider needs for further research, and examine possibilities for expanding the existing fisheries or developing new ones.

Fig. 1. Rock crab - Cancer irroratus. Nine shallow smooth-edged teeth on margin of carapace; surface of carapace and claws smooth; carapace width about 1½ times carapace length; light-coloured background with purple or crimson spots.

ROCK CRAB - *Cancer irroratus (Fig. 1)*

LIFE HISTORY

There is virtually no published information on the life history of the rock crab. Its mating, moulting, egg laying and hatching periods, its rate of growth, feeding habits and movements are largely unknown.

DISTRIBUTION AND ABUNDANCE

The rock crab occurs from Labrador to South Carolina from the low-water mark to depths of 300 fathoms. It appears to be most abundant in the southern Gulf of St. Lawrence and in the New England States. It is present in fair numbers along the outer coast of Cape Breton Island but seems to be quite scarce in the Bay of Fundy and south-western Nova Scotia. However, our impressions as to the abundance of this species depend to a large extent on catches by lobster fishermen. Since the lobster fishing seasons vary from place to place, differences in the catchability of crabs in relation to water temperature could give a very distorted picture of their abundance.

SIZE

Samples of rock crabs caught in lobster traps were measured at four ports in the northern half of Northumberland Strait. The males ranged from 3 to 5 inches in carapace width, averaging about 4 inches. The females ranged from 2 to 4 inches, most being too small for commercial use. The average live weight of both sexes as landed was 6 ounces. Rock crabs examined at two ports on the outer coast of Cape Breton Island were appreciably smaller. From the commercial point of view of rock crab is relatively small. The Dungeness crab, *Cancer magister*, of British Columbia reaches a maximum carapace width of 9 inches and a maximum weight of 4 pounds. Those above the $6\frac{1}{2}$ inch minimum legal size average about $7\frac{1}{2}$ inches and 1 3/4 pounds. Similarly, the edible crab of Europe, *Cancer pagurus*, reaches a maximum width of $8\frac{1}{4}$ inches and varies regionally in average weight from 1 to 1 7/8 pounds.

THE FISHERY

A commercial fishery for rock crabs started

in Massachusetts about 1900 and gradually spread to other New England States. By 1962 the United States catch totalled nearly 2,000,000 pounds with a landed value of $91,000. Nearly 90% of this catch was landed in Maine.

Up to 20 years ago rock crabs were canned on a small scale at Victoria and Summerside, P.E.I. These operations did not continue for long, perhaps mainly because of the excessive labour costs for processing the small crabs. The crab meat, although tasty, was usually quite broken up and tended to darken in the can making it much less attractive than canned lobster meat.

More recently new interest in the processing of rock crabs developed in the Shediac, N.B., area. This was stimulated in part by the desire to extend canning operations which were curtailed to some extent by the 2-month lobster seasons in the Gulf of St. Lawrence. This interest led to experiments by the Industrial Development Service of the Department of Fisheries to develop a trap that would retain crabs but not lobsters and so could be fished when the lobster seasons were closed. These experiments had some success but the ease with which a crab trap could be altered at sea to catch lobsters illegally cast doubt on their use. In any case, special traps for crabs have not yet come into use on the Canadian Atlantic coast.

Since 1962 when 22,000 pounds of rock crabs were landed, the fishery has expanded rapidly. By 1965 several hundred fishermen fished crabs principally in conjunction with their lobster fishing and landed 527,000 pounds valued at $11,800. To date, the fishery is restricted almost entirely to the northern half of Northumberland Strait where the lobster fishing season is from August 10 to October 10. In 1963 the daily crab catch per boat varied from 150 to 4,000 pounds. One boat in the Pugwash, N.S., area was reported to average 1,900 pounds a day from September 5 to October 10. The price to fishermen has averaged 2.3 cents per pound live weight. In 1964, 3,600 cases of 48 five-ounce cans were packed and interest in fresh-frozen crab meat was developing. In December 1965, a five-ounce can retailed for 65¢ to 79¢ in the Halifax, N.S. area.

MEAT YIELD

To determine the potential meat yield some of the larger crabs caught off Summerside, P.E.I., in October were boiled and the meat carefully removed from the claws, legs and body. The yield averaged 21% of the live weight. Since all parts of the crab are not used commercially and since many of the smaller crabs are undoubtedly discarded after landing, the present commercial meat yield is much lower, probably averaging about 10%.

RELATION TO THE LOBSTER FISHERY

The effect that fishing crabs has on the much more valuable lobster stocks is not known. In many areas crabs and lobsters occupy different kinds of bottom but at times their distribution appears to overlap considerably. Under such conditions crabs and lobsters probably compete for a common food supply and probably prey on each other. Certainly lobsters are known to eat crabs and its seems likely that hard-shelled crabs would attack the smaller lobsters at least when they are soft. The net effect of these relations is unknown but it seems possible that reducing the crab stocks through fishing could increase the lobster production.

POTENTIAL

It is difficult from the available information to estimate the commercial potential of this species. Present production is essentially a by-product of an intense warm-water lobster fishery in one region. Whether satisfactory trap catches can be made in other lobster districts during cold-water seasons remains to be seen. The small size of the crabs, the high labour costs of processing and the low meat yields necessitate low prices for the raw product. This in turn means that a dense stock of crabs, readily catchable at low costs, must be available to the fishermen. These conditions are now met in the northern half of Northumberland Strait but as the fishery continues stock densities, sizes of crabs and individual profits are expected to decline. Rock crabs probably could be caught commercially in some areas with otter trawls. Another possible fishing method is the trotline such as is used to catch blue crabs *(Callinectes sapidus)* in the Chesapeake Bay area. With this method a long line baited at frequent intervals is set on bottom and crabs that cling to the bait are caught as the line is raised. Results of one small-scale trial of this method in Northumberland Strait by an inexperienced operator were not too encouraging but the method should not yet be ruled out.

JONAH CRAB - *Cancer borealis (Fig. 2)*

The Jonah crab is very similar to the rock crab with which it is often confused. It occurs from Nova Scotia to South Carolina at depths to 400 fathoms. It is the dominant crab species in southern Nova Scotia and the Bay of Fundy but we have no definite knowledge of its occurrence in the southern Gulf of St. Lawrence. Jonah crabs caught off southern Nova Scotia in lobster traps from December to May are somewhat larger than trap-caught rock crabs in the Gulf of St. Lawrence but this could result in part from differences in the lobster traps. In contrast to the rock crabs, female Jonah crabs greatly outnumber the males in trap catches. The sexes do not differ appreciably in size. Winter and early spring catches from lobster traps suggest that Jonah crabs are much scarcer off southern

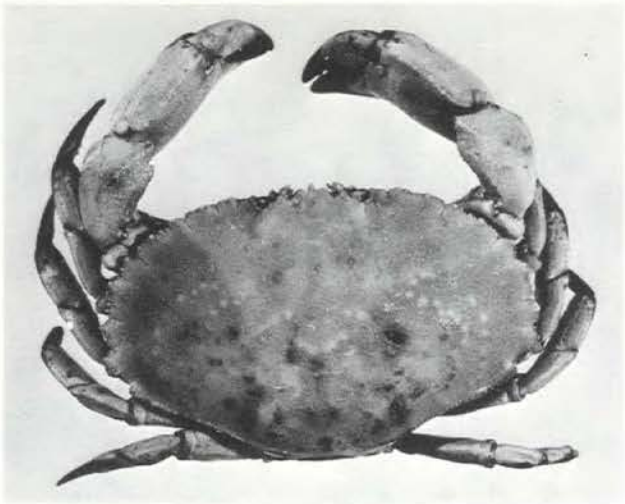

Fig. 2. Jonah crab - Cancer borealis. Similar to rock crab; 9 teeth on margin of carapace have rough edges; surface of carapace and claws rough; margin of carapace more rounded; carapace width about 1½ times carapace length; usually reddish above, yellowish below.

Fig. 3. Spider crab - Chionoecetes opilio. Walking legs 2-3 times as long as carapace and flattened; carapace with scattered, unequal, wartlike tubercles; carapace width and carapace length about equal; light brick-red above, yellowish below. (Photo courtesy J.S. MacPhail)

Nova Scotia than rock crabs in the Gulf of St. Lawrence. This could, however, simply reflect the effect of water temperature on the crabs' activity and catchability. Jonah crabs were quite abundant off southern Nova Scotia during the summer of 1965 at depths of 25 to 50 fathoms and were well represented in Yarmouth County lobster fishermen's catches during December 1965.

Although the meat of the Jonah crab has a good flavour the species has had only limited commercial use. This may be because of its more restricted distribution, its lesser abundance or possibly its harder shell which makes extraction of the meat more difficult and reduces the yield.

SPIDER CRAB *Chionoecetes opilio (Fig. 3)*

LIFE HISTORY

Knowledge of the biology of this species in the Canadian Atlantic is based almost entirely on the observations of Mr. Pierre Brunel formerly of the Marine Biological Station at Grand River, P.Q. In the Gaspe region the crabs appear to be scarce in June, possibly because they are buried in the mud during moulting and mating. The smaller male crabs and the females appear to moult earlier (May-June) than the larger males (May-mid July). The proportion of soft-shelled, slack-meated crabs declines from June to October. Newly laid eggs are orange and vary in number from 7,000 for a 2-inch carapace length female to 80,000 for a 3-inch female. During embryonic development the individual eggs more than double in size but many are lost, a 3-inch female carrying only 20,000 ripe eggs on the average. The greyish, eyed eggs start hatching in May-June.

DISTRIBUTION AND ABUNDANCE

The spider crab occurs to depths of 350 fathoms from West Greenland to Maine and from Alaska to Siberia. Our knowledge of it in the Canadian Atlantic is limited mainly to the Gulf of St. Lawrence where it is known to occur off Anticosti Island, along the Gaspe coast and between Cape Breton Island and the Magdalen Islands. It is associated with cold water (30-40°F) and is most abundant on mud bottom. Too little information is available to describe its distribution accurately or estimate actual stock densities. It is, however, quite widely distributed in the Gulf at depths of 30-100 fathoms and abundant enough in places to yield catches of 300 pounds or more per hour with a standard #41 Yankee trawl.

SIZE

The males attain a carapace length of 6 inches, or with legs fully extended, a maximum spread of 36 inches. In the Gulf they reach a maximum weight of 2 3/4 pounds averaging about 1½ pounds. The females are much smaller, seldom exceeding a pound and are rarely used commercially.

THE FISHERY

The Canadian Atlantic commercial fishery apparently started in November 1960 when Quebec

United Fishermen operating groundfish draggers in the Anticosti Island area landed 12,000 pounds of spider crabs. Since that time small quantities, not exceeding 18,000 pounds, have been landed annually in Gaspé and marketed fresh or frozen mainly in Montreal.

EXPLORATORY FISHING

Spider crabs have been caught off Gaspé during experimental fishing with beam trawls and 5- to 6-inch mesh gill nets set on bottom. To our knowledge they are not caught in lobster traps. During experimental bottom trawling two to three times as many crabs were caught at night as in the daytime.

In September and October 1965 Danish seiners were chartered in a joint project by the Industrial Development Service of the Department of Fisheries of Canada and the Nova Scotia Department of Fisheries. From 136 sets at 20 to 75 fathoms between Cape Breton Island and the Magdalen Islands over 19,000 pounds of spider crabs were landed with best catches at 50 to 75 fathoms. From December 1965 to February 1966 the Industrial Development Service explored essentially the same area with a chartered medium dragger using a standard #41 Yankee trawl. In 124 1½ to 2-hour tows in 35 to 135 fathoms, 12,141 crabs weighing 18,195 pounds were caught. This program of exploratory fishing is being continued and expanded to cover more extensive areas in the Gulf of St. Lawrence.

MEAT YIELD

The meat, most of which is obtained from the legs, is tender, pleasantly flavoured and has been well received in marketing trials. The yield has varied from 15% of the live weight in commercial plants to 18% in small-scale laboratory trials. Studies of processing methods and storage qualities are being conducted by the Department of Fisheries, Fish Inspection Laboratory in Halifax, N.S.

POTENTIAL

Too little is known of the distribution, abundance, behaviour, reproduction, survival and growth of spider crabs or of efficient fishing methods and market demand to estimate the potential value of this species. Exploratory trawl catches and fishermen's reports have suggested dense stocks in some areas but the extent of these grounds and their annual productive capacity are not yet known. There are suggestions that spider crabs grow slowly. If so, an intensive fishery would be expected to reduce the abundance of the more desirable large crabs rather quickly. Since crabs and groundfish are often caught together, it is probably that a spider crab fishery can be developed as a worthwhile supplement to existing groundfish fisheries.

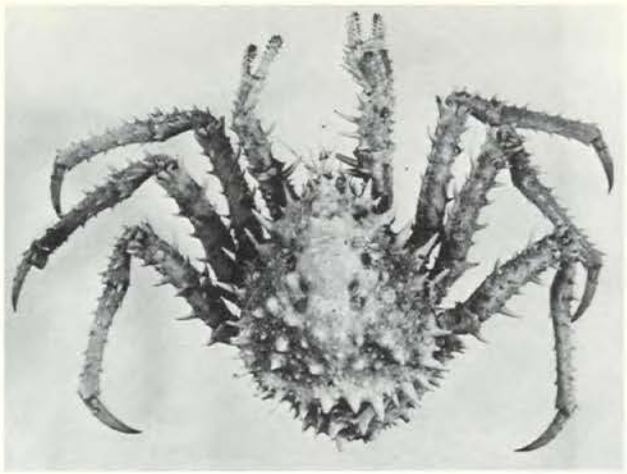

Fig. 4. Northern stone crab - Lithodes maia. Numerous prominent spines on carapace and legs; 8 spines on rostrum; carapace slightly longer than wide; brownish in colour with legs obscurely banded; last pair of legs very small and folded under carapace.

NORTHERN STONE CRAB - *Lithodes maia (Fig. 4)*

This species reaches a carapace length of 7 inches. It resembles the spider crab, *Chionoecetes opilio*, in size and general shape but can be readily identified by the numerous spines on its carapace and legs. It occurs at depths of 35 to 300 fathoms from Newfoundland to New Jersey and in northwestern Europe. In the Gulf of St. Lawrence it appears to live in deeper, warmer water than the spider crab. There is so little information on its abundance, distribution and quality that we cannot hazard a guess as to its commercial potential.

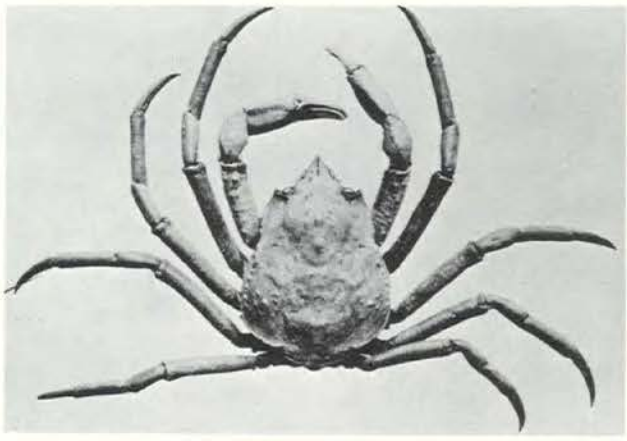

Fig. 5. Toad crab - Hyas araneus. Carapace subtriangular in shape, about 1 1/3 times as long as wide; two rostral horns touching; surface of carapace uneven with blunt tubercles; dull purplish-red above, buff below.

TOAD CRAB - *Hyas araneus (Fig. 5)*

This member of the spider crab family is found from shallow water to depths of 275 fathoms from Labrador to Rhode Island, in Greenland, Iceland, northern Europe and Spitsbergen. This and closely related smaller species are unlikely to be of commercial significance but will probably be caught from time to time during exploratory and commercial fishing for spider crabs.

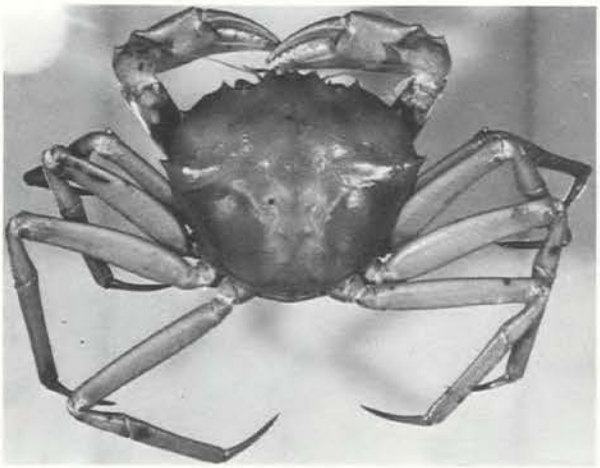

Fig. 6. Deep sea red crab - Geryon quinquedens. Fiveteeth on margin of carapace; carapace width about 1½ times carapace length; carapace smooth with a rounded transverse ridge at widest part; posterior half of carapace with nearly straight margins; dark red.

DEEP SEA RED CRAB

Geryon quinquedens (Fig. 6)

This dark red crab occurs at depths of 100 to 1,000 fathoms from Nova Scotia to Cuba. In exploratory fishing along the continental slope between Nova Scotia and Virginia by the Woods Hole Oceanographic Institution it was found most abundant at depths of 200 to 600 fathoms. Here the catch per hour's trawling with nets having 35- to 60-ft ground ropes averaged 48 crabs. The crabs were abundant on muddy bottom but good catches were also taken on hard bottom. Bottom water temperatures ranged from 38 to 42°F. This crab reaches a carapace width of 7 inches, a leg spread of over 2 feet and a weight of more than 2½ pounds. The meat is excellent. The crab dies quickly in air or water at temperatures above 45°F but will live several days buried in ice.

SUMMARY

Of the various crab species that occur off the Canadian Atlantic coast, the spider crab *(Chionoecetes opilio)* and the rock crab *(Cancer irroratus)* show most promise for increased commercial use in the near future. The spider crab is larger, of higher quality and easier to process but is probably much less abundant and less widely distributed than the rock crab. It may make significant contributions to dragger catches in the Gulf of St. Lawrence but seems unlikely to form the basis of an independent fishery. Similarly the rock crab may become a valuable supplement to lobster catches particularly if more efficient processing methods would permit higher prices to the fishermen. The small size of rock crabs, low meat yield, high processing costs, low prices and the difficulties in regulating a trap fishery for this species during closed lobster seasons tend to rule out an independent fishery. The Jonah crab *(Cancer borealis)* does not seem to be caught in lobster traps in sufficient quantities to warrant appreciable commercial use but information on seasonal and geographic variations in abundance is scarce. The red crab *(Geryon quinquedens)* shows real promise, particularly in conjunction with a deep-water trawl fishery for lobsters.

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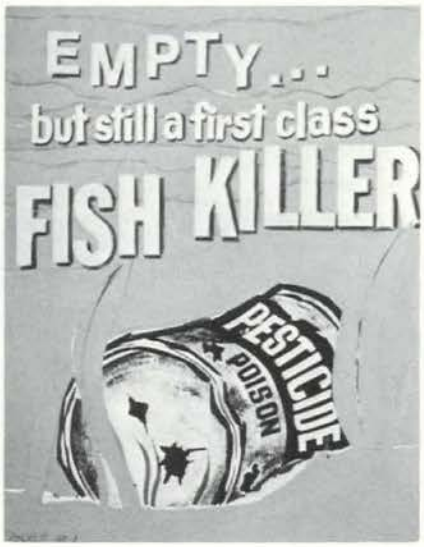
Posters Carry Anti-Pollution Message to Farmers



These three posters will soon become familiar in farming communities throughout Canada, carrying a message of warning on the dangers of agricultural pesticides when used near fish-bearing streams and rivers. The posters, printed in vivid colours in both English and French, are part of an anti-pollution campaign currently under way by the Resource Development Service of the federal Department of Fisheries.

(continued from previous page)

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Correction

A dropped line of text in last month's issue of "Fisheries of Canada" resulted in a garbled sentence in the biography of Dr. W.E. Johnson, recently appointed director of the Fishery Research Board of Canada's Freshwater Institute in Winnipeg.

The sentence should have read: "A graduate of the University of Wisconsin, where he received his master's degree in Biology in 1952 and the degree of Doctor of Philosophy in 1954, Dr. Johnson worked at the FRB Nanaimo Biological Station in 1954-55 on a post-doctoral Fellowship awarded by the National Science Foundation".

The Arctic Char

By J.G.Hunter

Fisheries Research Board of Canada Arctic Biological Station,

St. Anne de Bellevue, Que.

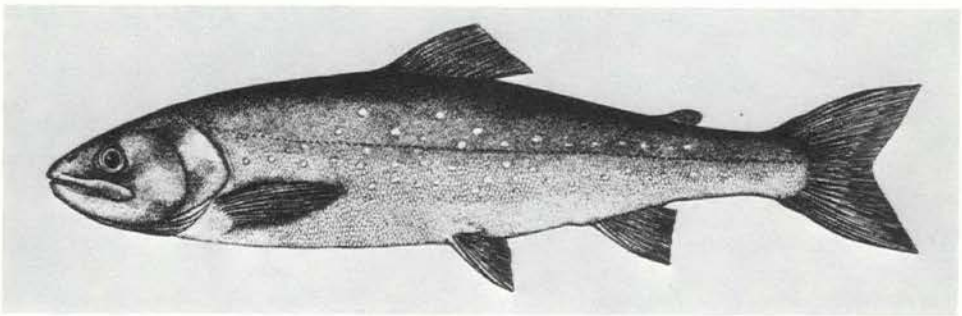


Figure 1. Arctic char *(Salvelinus alpinus)*.
Courtesy of W.B. Scott.

THE ARCTIC CHAR *(Salvelinus alpinus)* is known by a number of vernacular names depending upon its geographic location, habitat, size, colouration and body proportions. The Eskimo people, who are at home throughout a large part of the char's range in North America generally refer to the species as irkalukpik, but they also use a number of other names which convey information about size, colouration and breeding condition. The chars as a group are represented by three other species: the dollyvarden *S. malma*, which occurs in both eastern Asian and western North American waters: the lake, grey or bull trout *S. namaycush*, and the eastern brook or speckled trout *S. fontinalis*, both of which are endemic to North America.

The arctic char occurs in two principal forms. One migrates into the sea in the summer to feed but returns to fresh water to pass the winter. This is the anadromous form. The other remains in fresh water throughout its entire life and is often, though not necessarily, prevented from migrating by physical barriers. This is the so-called landlocked form.

DESCRIPTION

The arctic char has an elongate body typical of salmon and trout and in the sea-run condition is silvery with a deep blue or greenish-blue on the back and upper sides. Sometimes a series of small pink spots is noticeable along and below the lateral line.

As char approach spawning condition body colouration changes from a silvery sheen, through orange, to a range of reddish hues from bright red to deep vermilion. The leading edges of the pectoral, pelvic and anal fins, and the fold of skin lying under the maxillary bones of the upper jaw become conspicuously white. Jaws are equal in size except at spawning time, when males frequently develop a kype or hook on the lower jaw, the point of which fits into a notch in the upper jaw.

In the spawning condition landlocked char normally show the same colouration as the sea-run form, and at other times continue to exhibit a pink to red colouration of the belly. When sexually immature, both landlocked and anadromous char are silvery. The flesh is usually red, but occasionally may be pink or white.

DISTRIBUTION AND ECONOMIC IMPORTANCE

The arctic char has a circumpolar range, the southern limits of the anadromous form roughly

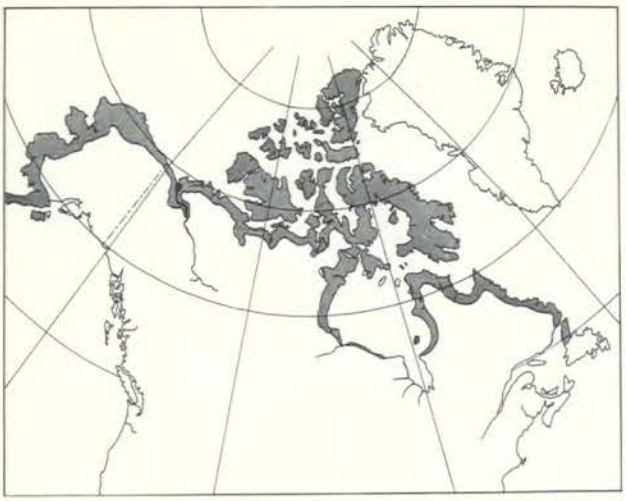


Figure 2. Distribution of anadromous arctic char in North America.

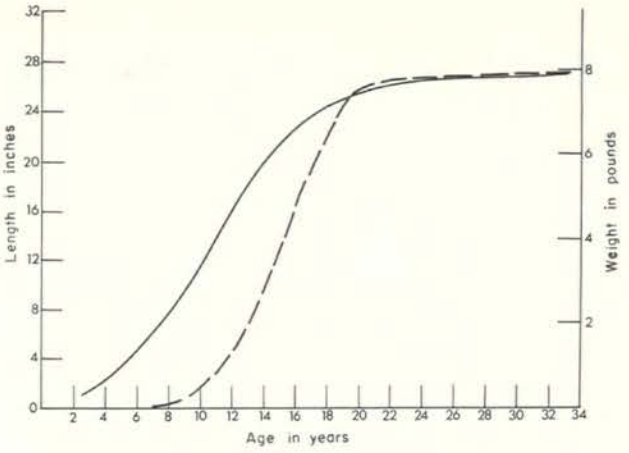


Figure 3. Length, weight and age of arctic char from Frobisher Bay.

following a mean summer sea temperature of 50°F.

Landlocked char occur throughout the entire range of the migratory form, as well as in many lakes in southern latitudes where they have remained as glacial relicts.

The importance of the species in North America has been confined, in the past, to its use as food for local use. In the past 10 years it has achieved status on the market as a luxury food item and renown as an excellent sports fish.

Commercial exploitation began on the Labrador coast in the early 1940's and has reached a peak annual production of 200,000 pounds. Smaller commercial catches, totalling approximately 100,000 pounds annually, now also originate from Ungava, Frobisher and Cambridge Bays and the rivers to the west of the Mackenzie. These catches are shipped frozen to southern markets and are primarily sea-run fish. Landlocked char are of minor importance in North America.

The sports fishery for arctic char has been expanding rapidly and at present total catches are estimated to exceed 50,000 pounds annually.

LIFE HISTORY AND HABITS

SPAWNING

In the Arctic, char spawn during the months of September and October on areas of lake bottom or river bed where suitable gravel and small rocks occur and where winter ice does not become a problem. The female provides a nest or redd by scooping out a shallow depression in the loose bottom. Eggs and milt are released simultaneously into the nest, then the female lightly covers the fertilized eggs by fanning gravel over them. Each female deposits from 3000 to 5000 eggs averaging about 5.0 mm in diameter. Water temperatures at spawning time may range over several degrees but are generally less than 39°F.

Mortality of the eggs occurs when water temperatures exceed about 46°F. However this is not usually a problem within the distributional area of anadromous char where winter temperatures are usually between 32° and 36°F. Observations on hatching time are not available, but samples of alevins, which are the young char with yolk sac attached, have been collected as early as mid April, giving the char a probably birth date of April 1. Emergence of the young free-swimming fish, known as "fry" at this stage, probably coincides with ice disappearance in mid July when food in the form of plankton becomes available. Fry collected around the shore at this time are about one inch in length.

Little is known about the factors affecting survival of eggs. Since anadromous char are frequently the only species of fish to occur in a lake or river system (although nine-spined sticklebacks are common), predatory action on the eggs is probably nil. It is known that spawning char will eat any eggs improperly covered in the nest, but no deliberate excavation of nests has ever been observed. Apart from egg losses resulting from multiple nest building in the same area, and poor physical conditions of oxygen and temperature, no factors contributing to egg mortality have been discovered. The greatest mortality of char probably occurs after emergence as fry, through competition for available food supplies and cannibalism.

MATURATION AND MIGRATION

Young char start feeding on minute plants and animals. As they increase in size, larger food items such as insects and their larvae, small bivalve molluscs, gastropods, crustaceans and fish are eaten. When anadromous char reach a length of six to eight inches they migrate to sea for the first time, usually in early spring as soon as the frozen rivers open. Return to fresh water occurs from mid August to late September. Overwintering in the sea is unknown. While in the sea char feed voraciously on the abundant small crustaceans, and on small fish if they are available.

Sexual maturity generally occurs at a length of 18 inches, after which spawning occurs every second or third year. In these reproductive years the char remains in fresh water and does not emigrate to sea.

The mechanisms controlling migratory behaviour are not well known, but are presumably initiated by changing light intensities and controlled by hormonal balance. Once char have migrated to sea, movement may be controlled by food availability, since they frequently remain close to the mouths of their rivers of origin when food is abundant but disappear into offshore waters when food is scarce. Tagged specimens have been recovered as far as 80 miles from their river of origin. While in the sea, char from distant rivers mingle, but later segregate and return to their parent stream. In some instances they even return to the exact spawning sites of previous spawning years.

GROWTH

The general productivity of cold northern waters is low but the arctic char is adapted to low temperatures and can take advantage of a wide range of feeding circumstances. Despite this adaptability growth is slow and the length of one-year-old char is often under two inches, the size at which scale development begins. Growth rates vary between individual fish in a given habitat and between fish in different habitat areas, but on the average, full size is reached at an age of 20 years. Some char may live as long as 40 years but may not be appreciably larger than fish 20 years of age. Large or trophy-sized char have been caught ranging a few ounces in excess of 27 pounds in North America and 34 pounds in Novaya Zemlya, USSR. Such char need not be of great age but may simply have an inherent ability to respond to particularly good growing conditions.

Apart from the expected increase of weight with increase in length, differences as great as 15% in weight,may occur between spring- and fall-caught fish of equal lengths. During the winter, char feed little or not at all but use large fat reserves stored during the previous summer to take care of their metabolic needs.

PREDATION AND COMPETITION

The char has relatively few predators. In many systems it may be the only fish-eating species present. Birds such as gulls and loons may take numbers of the small fish but their depredations seem to be low. In the sea a few char are taken by seals and possibly white whales but again the concentration of these predators is usually so light as to be only a minor factor. Cannibalism may account for large numbers of the younger and smaller fish but such predation is virtually complete by the time char have reached a length of six inches.

Competition probably plays a much greater role in the regulation of numbers of char in a system. Food availability restricts all sizes of fish within a lake and may be particularly damaging to survival of the early age groups. These young fish may, in fact, act as a potential food supply for larger char in times of adversity and thus constitute a method of conserving energy for the surviving population in the lake.

Observations on char in aquaria show that some fish maintain territories and dominate other fish. This may result in lower survival and slower growth in the less dominant fish. Such territorial behaviour might well restrict both the number and total weight of fish that a lake is able to support. Where char live in rivers instead of lakes, the productive capacity per unit surface area of the river is greater than in the lake. This may result from territorial requirements of individual fish being reduced by some function of the speed of the current or discharge rate of the river. Also,feeding conditions may be better in the river, thus reducing the space requirements for adequate searching.

PRODUCTION

The size of char populations is controlled by the availability of suitable fresh water. The slow rate of growth coupled with limited population size results in low production of the species. Where an anadromous population is exploited and the stock density is reduced, no recognizable increase in productive capacity has been observed. This is because most feeding is done in the sea, once migratory size has been reached, and no increase in rate of growth results from a lower population density of large fish. In all probability no decrease in the pre-migratory stock occurs through removal of larger individuals, and competition within the lake remains high.

Present studies indicate a lake production of about one pound of char per acre per annum, which is about 10% of the standing stock of fishable-sized fish. River populations, though maintaining the same percentage yield, are capable of producing char at rates as high as 60 pounds per acre per annum. ✔

Technical News

by James Kinloch

European Herring Trawling

During the past year much emphasis has been placed by both industry and government on the desirability of making fuller use of the great herring stocks off the coasts of Canada's Atlantic provinces.

Expansion of the Atlantic herring fishery is already under way, and at the herring fishery conference held in Fredericton, N.B., last May, under the auspices of the Federal-Provincial Atlantic Fisheries Committee, the need was stressed for further information on the manner in which this resource can best be exploited.

W.W. Johnson, a fishing gear specialist with the Industrial Development Service of the federal Department of Fisheries, recently spent several weeks in Europe with the herring fleets of the North Sea. His interest was mainly in herring trawling, and his observations led him to the conclusion that so far the West Germans have been extremely successful in this operation. Most of the catch, 90 per cent or more, is processed in canned or cured form for human consumption. One plant alone uses more than 200,000 tons a year for this purpose.

Mr. Johnson found that the first successful catches using this method were made by a 180-foot side trawler with 1,200 horsepower engines. Stern ramp trawlers ranging from 160 to 210 feet were next adapted for midwater trawling for herring. The catches were quite heavy, with 50-ton tows being quite common. As examples, he reports that one German processing stern trawler produced 250 tons of herring fillets from 11 drags during a single trip; another vessel, a fresh fishing stern trawler, iced between 250 and 300 tons in two days of fishing.

Midwater herring trawling has been intensively developed in Germany in the past two years, and at present is a fall, winter and early spring fishery. Mr. Johnson states that the method became quite firmly established during the 1965-66 season and as a result, virtually every stern trawler in West Germany will be engaged in midwater trawling late this summer and early in the fall. All these vessels have been or are being equipped with Asdic and net sounding equipment.

The German skippers told Mr. Johnson that they had no difficulty in catching herring consistently but that a vessel should have at least 1,000 horsepower to do the job properly. This power is necessary to provide a reserve to increase trawling speed and lift the trawl when the need arises.

A considerable amount of one-boat bottom trawling and mid-water pair trawling is carried out by the lugger-drifters of the German fleet. These are from 100 to 120 feet in length, over-all, with from 400 to 700 horsepower. Bottom trawling is also carried out by cutters, 75-85 feet over-all, with from 150 to 300 horsepower. The luggers remain at sea for long periods and salt their catches in barrels, while the cutters ice their herring in boxes during trips of short duration.

Divers Study Codtraps

The traditional Newfoundland cod trap, always an effective type of fishing gear, should become even more efficient in future as a result of observations made during the past two months by a team of scuba divers operating under contract to the Industrial Development Service of the federal Department of Fisheries.

The diving team, working from the tender "St. Brandan", first surveyed typical cod traps at Carbonear, in Conception Bay, where its members took underwater photographs showing the physical condition of the netting and the berths, and the activities of fish both inside and outside the traps. One result of their efforts was the discovery of the manner in which large numbers of fish are able to escape after they have entered the net, of which fishermen previously had little knowledge.

At St. John's the divers made further surveys of the traditional cod traps and were also able to observe the functioning of new traps made entirely of synthetic fibres. At Calvert, on the southern shore of Newfoundland, the investigators not only observed the traps to report on their efficiency, but guided fishermen to new and better cod trap berths.

The diving team has now left Newfoundland waters for Prince Edward Island and will continue underwater fishery investigations in other Atlantic provinces.

News Roundup

FRB Chief Scientist

Dr. W.E. Ricker, 57, of Nanaimo, B.C., has been appointed Chief Scientist of the Fisheries Research Board of Canada.

DR. W.E. RICKER

Dr. Ricker is the first in the history of FRB to be named Chief Scientist, an appointment that reflects his outstanding contribution to Canadian and international fisheries research and his responsibility as a leader in scientific programming for FRB establishments across Canada. His notable achievements in science were recognized in 1965 when he was awarded the Gold Medal in Pure and Applied Science by the Professional Institute of the Public Service of Canada.

Born at Waterdown, Ont., Dr. Ricker attended elementary and secondary schools in North Bay. He subsequently studied at the University of Toronto where he received his B.A. degree in 1930, M.A. in 1931 and Ph. D. in 1936.

Dr. Ricker served with the FRB from 1931 to 1938 as scientist in the sockeye salmon investigations. He was with the International Pacific Salmon Fisheries Commission 1938-39 and from 1939 to 1950 was Professor of Zoology at Indiana University.

Rejoining FRB in 1950, Dr. Ricker served in the dual capacity of editor of publications and biological consultant, later devoting full time to the latter responsibility. In 1963, he was appointed Acting Chairman of the Fisheries Research Board continuing in the post for approximately one year. He has remained on the staff of FRB headquarters as adviser to the Chairman and consultant to scientists, although working out of the FRB Biological Station, Nanaimo.

Dr. Ricker has served as senior scientific adviser to the Canadian Commissioners for the International Pacific Halibut Commission, the International North Pacific Fur Seal Commission and the International Whaling Commission.

Author of more than 130 research publications, he is a member of numerous scientific societies, including the Royal Society of Canada.

Fish 'n' Seafood Month

October is Fish 'n' Seafood Month in Canada and Fisheries Minister H.J. Robichaud, in endorsing the industry's aims in promoting the greater use of fish and shellfish in family and group feeding has urged all Canadians to buy, try and enjoy Canada's excellent seafood products.

Canada is singularly blessed in the variety and abundance of fish and shellfish in her coastal and inland waters. Last year for the first time the marketed value of all fishery products went over the $300,000,000 mark.

The products of Canada's fisheries are justly famed and favoured in world markets. Their attractive form, consistent quality and unrivalled taste keep them in constant demand. Canada outranks all countries but one in the value of her fishery exports which reached $213,000,000 last year.

Production is on the march, with many millions of dollars invested in efficient vessels, catching gear and processing facilities. The fishing industry employs close to 100,000 persons either on ships at sea or in plants on shore. Increased production means additional employment and more food for all, at home and abroad, said Mr. Robichaud.

Lobster Regulations

Further changes in fishing regulations in lobster district No. 8 in the Northumberland Strait have been announced.

The latest change prohibits any lobster fisherman from having in his possession lobster claws or tails that have been separated from the thorax or body shell of the lobster.

Also included in the new regulations is a section that limits the number of traps to 250 per fishing boat regardless of the number of men employed in that boat. The regulations also specify that each boat must be registered or licensed by the Department of Transport, and each lobster trap fished must bear a tag issued by the federal Department of Fisheries.

The new regulations are aimed at further protecting the valuable lobster stocks in the Maritimes

which last year put more than $22,000,000 into the pockets of fishermen. The clause respecting lobster claws and tails would strengthen the department's efforts to stamp out the illegal traffic in under-sized lobsters. In district eight the legal size is two-and-a-half inches. The minimum length is measured from the rear of either eye socket along a parallel line to the centre line of body shell, to the rear of the body shell.

Lobster fishing opened in the Northumberland Strait on August 10. The area comprises the west side of Prince County, P.E.I., and along the mainland shoreline from Eel River Bridge, Kent County, N.B., to Bergman's Point, Cumberland County, N.S.

Bait Service Improved

Measures for further improvement of the Newfoundland Bait Service have been announced by Fisheries Minister H.J. Robichaud. These measures include the extension of refrigerated bait storage facilities to serve areas requiring this service, the consolidation of existing storage units, and a revision in buying prices.

Facilities are to be extended by construction of a storage depot in Labrador, and establishment of additional bait holding units in selected communities. The Bait Service is provided by the federal department, under terms of Newfoundland's 1949 union with Canada, to supply bait to fishermen in areas not adequately served by private enterprise.

The improvements to be implemented this season are based upon recommendations by a five-man committee appointed by the Minister to make a thorough study of the province's bait requirements and facilities. The service supplies Newfoundland and Labrador fishermen with close to 5,000,000 pounds of bait annually through 19 depots and 38 holding units, eight of which are going into operation for the first time this year. The department also operates the C.G.S. "Arctica", which delivers bait supplies from depots to units in fishing areas. Some refrigerated cargo space on the Department's patrol vessel "Cape Freels" is also utilized for bait deliveries.

"The federal Department of Fisheries has greatly extended and improved bait storage capacity since taking over this service, and it is determined to continue to provide good coverage in the future," Mr. Robichaud stated. In order to ensure a steady supply for the depots and holding units, new prices are being put into effect for the purchase of bait by the federally-operated plants.

Effective August 1, the price paid for squid supplied to the Bait Service is to be raised to a minimum of 2½ cents per pound to the fisherman. In previous years, the price ranged from 1½ to 2 cents per pound. In years of short supply, the service may have to follow the market above the 2½ cent price to ensure adequate squid supplies. No change is to be made in the buying price for herring, which will remain on a competitive basis. Capelin, the third bait fish handled by the service, will be purchased from fishermen at a minimum price of $1.50 per barrel.

All new purchase price levels went into effect August 1, but are subject to review early in 1967. Changes, if any, in prices to be charged by the service will be announced at a later date.

The committee which carried out the study of the Newfoundland Bait Service was headed by I.S. McArthur, Director-General of Economics Services with the federal Department of Fisheries.

Appointment

Dr. Chesley M. Blackwood, 36, of Halifax, has been appointed Assistant Regional Director of the Maritimes Region of the federal Department of Fisheries, it was announced by the Deputy Minister of Fisheries, Dr. A.W.H. Needler. He was the successful candidate in a public service promotional competition.

He succeeds R.E.S. Homans, who was recently appointed Regional Director for the Maritimes Region.

DR. C.M. BLACKWOOD

A native of Brookfield, Bonavista Bay, Newfoundland, Dr. Blackwood graduated from Dalhousie University, Halifax, with a Bachelor of Science degree and a Food Technology diploma. He received his Master's degree in Food Chemistry from the University of Toronto, and in 1961 received the degree of Doctor of Philosophy from the University of Washington.

He joined the Technological Unit of the Fisheries Research Board of Canada at St. John's, Newfoundland, in 1952, and two years later was seconded to the Department of Fisheries Inspection Laboratory in that city. At the conclusion of his university studies, Dr. Blackwood rejoined the St. John's Technological Unit as Associate Scientist. He moved to Halifax early in 1962 upon appointment as Chief of the Inspection Branch of the Department of Fisheries for the Maritimes Region.

The Pacific Halibut

THE HALIBUT ranks as Canada's eighth most important food fish (in terms of value of products) and is found on both coasts of the Dominion. The Pacific halibut is distinguished from the Atlantic species by certain scale characteristics which have given it the specific name, *Hippoglossus stenolepis* Halibut are found both in shallow waters and in depths of at least 600 fathoms, but for the most part range from 30 to 225 fathoms. British Columbia fishermen take halibut from within the whole area of the continental shelf extending from the Strait of Juan de Fuca to the eastern Bering Sea. The principal fishery, however, is centered in the waters off northern British Columbia and in the Gulf of Alaska. Of the 35 to 40 million pounds caught annually by Canadians in Atlantic and Pacific waters, the British Columbia catch makes up 85 to 90 per cent of Canada's total. The marketed value of West Coast halibut amounts to more than $10 million annually.

DESCRIPTION

The halibut, a member of the flatfish family, is dark brown on the upper side, with lighter irregular blotches. The lower side is white, and rarely blotched. It has a mouth extending to a point below the eye. The eyes are large, with the upper eye slightly behind the lower. The scales are very small and smooth and the lateral line is arched.

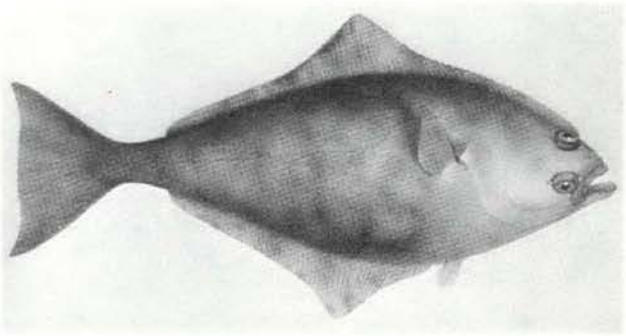
HABITS AND MOVEMENTS

The eggs and larvae are heavier than surface sea water and lighter than the deep water. For this reason, they drift passively with the currents at depths down to 375 fathoms. They gradually rise to the surface as development proceeds, and drift into shallow water with the inshore surface currents.

When six or seven months old, the young fish settle to the bottom in the shallow waters of sandy bays and inshore banks. With advancing size and age they move into deeper waters. Tagging operations have shown that the immature halibut move within very restricted areas. Mature fish, however, migrate extensively to and from the spawning grounds. A few West Coast halibut have travelled as much as 2,000 miles.

FOOD

The halibut are ground feeders, but occasionally will swim near the surface in quest of food, which consists of fishes, crabs, clams, squid, worms, etc.



THE PACIFIC HALIBUT (HIPPOGLOSSUS STENOLEPIS)

SPAWNING

Spawning takes place from November to January in well defined areas of depths from 150 to 225 fathoms. Halibut do not spawn until they are 10 to 12 years old. At that time, a large female of 140 pounds may have as many as 2,700,000 eggs.

GROWTH

The larvae like those of other members of the flatfish family, begin life in an upright position with eyes on each side of the head, and both sides of the body the same colour. However, after the young halibut is about an inch long, an extraordinary transformation takes place. It proceeds to the bottom, from the near-surface depths of the ocean in which it has lived since birth, and acquires the habit of resting and swimming on its left side. Gradually, as the young halibut grows, the left eye migrates or twists over towards the right side of the head. Simultaneously the left or underside of the fish changes colour and becomes white or grayish, while the right or upper side is a varying slate brown, often mottled and sometimes almost black. By early spring the transformation is complete and the young fish settles to the bottom in the shallow waters near shore. The female halibut is faster growing than the male. However, she does not reach maturity until she is from eight to 16 years old, averaging around 12 years, while males mature considerably earlier. Males have been known to attain an age of 25 years and a weight of 40 pounds. They have been known to reach 4 feet, 7 inches in length. Female halibut may weigh as much as 470 pounds, and reach a length of over eight feet. They are known to live for 35 years or more.

FISHING AREAS AND THE FISHERY

British Columbia is close to the world's greatest halibut fishing grounds. Some of the principal ones are off the north coast of Vancouver Island, off the Queen Charlotte Islands, in Hecate Strait and in Dixon Entrance. Others, farther away, but commercially accessible to British Columbia vessels, lie off Alaska. All told, these areas yield more than 60 per cent of the world's annual halibut catch.

The fishery is regulated by the International Pacific Halibut Commission, consisting of representatives of Canada and the United States, which operates under a treaty between the two countries. The work of the Commission is one of the world's outstanding examples of successful international action in fisheries conservation.

The Canadian Pacific halibut fishery is a primary industry, and as such a specialized fleet is engaged in its prosecution. The halibut is caught on set-lines, the unit of line being the "skate". These are run out on relatively shallow bank areas, ranging in depth from 10 to 150 fathoms. Frozen herring, cod or octopus is usually used for bait, and the bait, and the baited long lines are paid out directly from the power-boats. In early days of the fishery, however, the gear was set from dories.

Among the West Coast companies, the following categories are used to ensure uniformity in the commercial handling of halibut.

Chicken	5 - 10 lbs.
Small Medium	10 - 40 lbs.
Large Medium	40 - 60 lbs.
Large	60 - 125 lbs.
Whales 125 and over.	

Practically all the five million pounds landed on the Atlantic Coast are marketed as fresh, of which about half is exported to the United States. On the Pacific Coast, about 25 per cent of the catch is landed directly by fishermen at U.S. ports and most of what is landed in Canada is sold as frozen dressed. About two-thirds of B.C. production of frozen dressed halibut is sold to foreign markets, mainly to the United States and United Kingdom.

(Prepared by the Fisheries Research Board of Canada Biological Station, Nanaimo, B.C.)

Perch Price Support

The federal government program designed to stabilize the price of perch produced from Lake Erie went into effect on August 15.

Under the program the Fisheries Prices Support Board will stand ready to purchase from processors of perch surplus supplies of frozen round or filleted perch at prices sufficient to ensure that all fishermen receive a minimum of 10 cents per pound at point of landing. It is expected that processors will continue to sell maximum quantities into domestic and export channels and only rely on sales to the Board when production exceeds the capacity of the markets to absorb current production.

During recent weeks prices to fishermen have been sustained by the market at or above 10 cents per pound and it is quite possible that market demand will keep the price above the minimum established by the government.

This is the first time a price support measure has been carried out in any of the fisheries of the Great Lakes and Fisheries Minister Robichaud indicated that he was relying on full co-operation from fishermen and processors in making the operation successful.

Sea-Water Evaporators

Two small sea-water evaporators specially designed by a British firm for the needs of vessels of 40 ft. or more, will produce 100 and 200 gallons of distilled water every 24 hours. Both versions are only 22 inches high, 21 inches long and nine inches wide, and weigh 100 pounds.

Raw sea water is boiled at low temperature under deep vacuum, giving freedom from scaling and fouling. The vacuum is introduced by two water-jet operated extractors. One, operated by the sea water which cools the condenser and provides feed for the evaporator, removes excess sea water from the shell and automatically maintains the correct water level. The other, operated by fresh distilled water, removes the made water and air from the condenser. The made water is led off to storage tanks. The vapour produced passes through a separator, thus preventing any droplets of sea water entering the condenser.

The heat is provided by hot water which can be taken from the jacket cooling system of a diesel engine working up to 25 B.H.P. or more. After passing through the evaporator it is returned to the engine system. This gives cost-free supplies of fresh water since only waste heat is used.

Fishery Figures For June

SEAFISH: LANDED WEIGHT AND LANDED VALUE

	May-June 1965 '000 lbs	May-June 1965 $'000	May-June 1966(2) '000 lbs	May-June 1966(2) $'000
CANADA - TOTAL	459,528	36,299	386,746	32,559
ATLANTIC COAST - Total	407,937	28,641	331,460	23,170
Cod	138,357	5,428	118,473	5,108
Haddock	18,591	1,232	18,885	1,340
Pollock, Hake, Cusk, etc.	19,217	644	14,171	531
Rosefish	9,551	253	13,209	361
Catfish	1,378	47	1,074	37
Halibut	1,451	412	1,073	335
Plaice & Other Flatfish	55,693	1,789	61,764	2,001
Herring & Sardines	105,216	960	58,938	856
Mackerel	9,330	319	6,139	247
Alewives	11,642	198	6,427	125
Salmon	1,857	1,035	1,876	920
Smelts	51	5	12	2
Swordfish	1,196	516	473	273
Other Fish	6,616	88	7,181	87
Lobsters	23,345	13,721	17,442	9,618
Clams & Quahaugs	903	54	925	58
Scallops	3,488	1,938	3,370	1,270
Other Shellfish	55	2	28	1
PACIFIC COAST - Total	51,591	7,658	55,286	9,389
Pacific Cods	6,105	435	8,314	670
Halibut (1)	14,343	4,374	14,288	4,909
Soles & Other Flatfish	1,431	93	1,951	125
Herring	21,293	294	18,928	326
Salmon	4,719	2,170	6,844	2,983
Other Fish	1,064	40	1,630	54
Shellfish	2,636	252	3,331	322
BY PROVINCES				
British Columbia	51,591	7,658	55,286	9,389
Nova Scotia	118,902	12,262	111,482	9,993
New Brunswick	81,085	3,246	59,258	2,751
Prince Edward Island	13,983	3,824	13,706	3,019
Quebec	66,761	3,007	(2)	(2)
Newfoundland	127,206	6,302	147,014	7,407

(1) - Includes halibut landed in U.S. ports by Canadian fishermen.
(2) - Figures for Quebec for May - June 1966 not available.

MID-MONTH WHOLESALE PRICES - JUNE 1966

		Montreal $	Toronto $
Cod fillets, Atl, fresh, unwrapped	lb.	.378	.450
Cod fillets, Atl, frozen, cello 5's	lb.	.351	.397
Cod fillets, smoked	lb.	.425	.473
Haddock fillets, fresh, unwrapped	lb.	.471	.580
Herring, kippered, Atl.	lb.	.256	.307
Mackerel, frozen, round	lb.	.202	.243
Lobsters, canned, Fancy	Case 48-$\frac{1}{2}$s	61 .513	64 .033
Sardines, canned	Case 100-$\frac{1}{4}$s	9 .693	9 .487
Halibut, frozen, dressed	lb.	.554	.600
Silverbright, frozen, dressed	lb.	.625	.617
Coho, frozen, dressed	lb.	.754	.763
Sockeye, canned, grade A	Case 48-$\frac{1}{2}$s	28 .530	28 .833
Pink, canned, grade A	Case 48-$\frac{1}{2}$s	16 .753	17 .107
Whitefish, fresh	lb.	(1).483	.460
Lake trout, frozen	lb.	.430	.517

(1) - Dressed

PRICES PER CWT. PAID TO FISHERMEN

(Week ending June 11)	1965 $	1966 $
Halifax		
Cod Steak	4.75	5.25
Cod Market	4.5	5
Haddock	7.5	8.5
Plaice	4	5
Yarmouth		
Haddock	-	-
Black's Harbour		
Sardines	-	-
St. John's Nfld.		
Cod	3.5	-
Haddock	2.75	2.75-3.5
Rosefish	2.5	2.5
Vancouver		
Ling Cod	10-12	10-12
Gray Cod	6-7	5-7.5
Soles	6-9	6-9.5
Salmon (Rdspg)	45-73	45-77

Fishery Figures For June

FROZEN FISH STOCKS AS AT END OF MAY

	1965 '000 lbs	1966(2) '000 lbs
TOTAL - Frozen Fish, Canada	55,888	56,221
Frozen - Fresh, Sea Fish - Total	36,589	34,788
Cod, Atlantic, Fillets & Blocks	7,477	8,307
Haddock, fillets & blocks	3,907	3,446
Rosefish, fillets & blocks	1,310	669
Flatfish, (excl. halibut), fillets & blocks	3,674	3,417
Halibut, Pacific, dressed & steaks	5,059	5,120
Other Groundfish, dressed & steaks	1,063	1,249
Other Groundfish, fillets & blocks	4,818	4,657
Salmon, Pacific, dressed & steaks	2,896	1,091
Herring, Atlantic & Pacific	373	478
All Other Sea Fish, all forms	3,437	3,127
Shellfish	2,575	3,227
Frozen - Fresh, Inland Fish - Total	2,686	4,657
Perch, round or dressed	178	553
Pickerel, (Yellow & Blue) fillets	84	59
Sauger, round or dressed	(1)	(1)
Tullibee, round or dressed	(1)	(1)
Whitefish, round or dressed	375	1,130
Whitefish, fillets	164	243
Other, all forms	1,885	2,672
Frozen - Smoked Fish - Total	2,019	1,740
Cod Atlantic	1,280	1,207
Sea Herring, kippers	(1)	234
Other, all forms	739	299
Frozen for Bait and Animal Feed	14,594	15,036

(1) - Confidential, included with "Other".
(2) - Does not include Quebec, data not available.

SALTED FISH STOCKS AS AT END OF JUNE

Salted and Pickled Fish, Atlantic Coast		1965 '000 lb.	1966 (1) '000 lb.
Wet-salted - Total		8,997	7,667
Cod		6,639	5,130
Other		2,358	2,537
Dried - salted - Total		8,919	1,945
Cod		6,960	1,436
Other		1,959	509
Boneless - Total		590	306
Cod		534	285
Other		56	21
Pickled - Total	(barrels)	16,001	17,042
Herring	"	3,492	3,811
Mackerel	"	6,858	5,613
Alewives	"	5,651	7,618
Turbot	"	-	-
Bloaters	(18 lb. boxes)	126,210	70,949
Boneless Herring	(10 lb. boxes)	1,403	6,000

(1) - Does not include Quebec, data not available

CANADIAN EXPORT VALUE OF FISHERY PRODUCTS, MAY-MARCH

(Value in Thousands of Dollars)

	1964 - 1965		1964 - 1965	
Total Exports		187,609		203,020
By Markets:				
United States		122,595		143,286
Caribbean Area		15,451		17,110
Europe		44,154		36,759
Other Countries		5,409		5,865
By Forms:				
Fresh and Frozen		119,618		140,725
Whole or Dressed	40,414		42,956	
Salmon, Pacific	12,103		11,726	
Halibut, Pacific	5,648		7,075	
Cod, Haddock, Pollock, etc.	399		469	
Swordfish	4,602		4,073	
Other Seafish	5,131		6,266	
Whitefish	5,179		5,282	
Pickerel	2,534		3,089	
Other Freshwater Fish, n.o.p.	4,818		4,976	
Fillets	49,000		63,866	
Cod, Atlantic	18,894		23,284	
Haddock	5,071		4,709	
Rosefish, Hake, Pollock, etc.	3,852		6,232	
Flatfish	7,658		10,252	
Pickerel	2,501		2,616	
Other	11,024		16,773	
Shellfish	30,204		33,903	
Lobster (Alive & Meat)	21,594		23,347	
Other	8,610		10,556	
Cured		22,417		22,421
Smoked	1,773		1,935	
Herring	1,189		1,192	
Other	584		743	
Salted, Wet & Dried	18,097		17,264	
Cod	15,255		14,947	
Other	2,842		2,317	
Pickled	2,547		3,222	
Herring	1,546		1,979	
Mackerel	485		699	
Other	516		544	
Canned		31,543		24,173
Salmon	23,829		15,489	
Sardines	3,779		4,845	
Lobsters	2,827		2,455	
Other	1,108		1,384	
Miscellaneous		14,031		15,701
Meal	7,690		9,169	
Oil	2,042		1,730	
Other	4,299		4,802	

Norway

NORWEGIAN EXPORTS BY COUNTRIES, 1964-1965

Quantity in Thousand Pounds
Value in Thousand Kroners

	Jan.-Dec. 1965 Q.	Jan.-Dec. 1965 V.	Jan.-Dec. 1964 Q.	Jan.-Dec. 1964 V.
GRAND TOTAL	-	1,354,775	-	1,064,933
Fresh or Iced Fish, n.o.p.	43,095	57,060	45,831	61,251
Sweden	11,045	17,735	10,536	19,573
United Kingdom	14,698	16,141	17,214	17,721
Other Countries	17,352	23,184	18,081	23,957
Frozen Herring & Sprat (brisling) except fillets	28,223	11,132	33,208	12,662
Frozen Fish, n.o.p. - except fillets	50,776	72,525	45,005	63,088
Italy	10,342	20,629	11,115	16,387
United Kingdom	7,928	17,750	5,900	16,425
West Germany	9,323	10,633	9,189	9,902
Other Countries	23,183	23,513	16,801	20,374
Frozen Fillets of Fish	156,789	247,728	114,372	161,365
Finland	7,418	11,989	4,486	7,183
Sweden	16,316	33,875	11,252	20,550
France	6,252	13,640	7,015	14,387
United Kingdom	37,606	67,871	19,434	31,092
Czechoslovakia	12,348	14,280	8,730	9,423
West Germany	17,853	25,462	6,129	7,663
U.S.S.R.	22,302	25,179	19,218	20,944
United States	13,730	20,574	14,469	20,473
Other Countries	22,964	34,858	23,639	29,650
Salted Herring and Sprat (brisling)	14,861	15,022	17,681	15,136
Salted Fish, n.o.p.	23,073	29,376	10,295	12,990
Italy	10,578	16,419	4,541	6,811
Dried Fish (stockfish)	56,614	137,721	51,636	125,098
Italy	10,161	35,578	8,814	31,488
Nigeria	37,591	75,243	32,902	65,987
Other Countries	8,862	26,900	9,920	27,623
Salted and Dried Fish (klipfish)	68,570	135,019	58,380	115,193
Italy	7,209	12,602	7,123	11,990
Portugal	11,468	25,359	5,348	11,207
Brazil	17,214	33,859	11,541	22,897
Cuba	-	-	7,690	15,062
Other Countries	32,679	63,199	26,678	54,037
Crustacean and Molluscs, not canned	11,453	76,746	13,431	71,209
Sweden	3,395	22,149	3,876	19,532
United Kingdom	6,349	39,036	6,790	38,345
Other Countries	1,709	15,561	2,765	13,332
Other Fish Oils, excluding waste & brown oils	31,938	24,937	33,259	24,425
Fish, Prepared or Preserved - In Airtight Containers	63,510	141,610	64,857	140,254
United Kingdom	10,298	23,427	14,608	32,243
United States	24,795	62,957	23,102	56,021
Other Countries	28,417	55,226	27,147	51,990
Fish, Prep. or Pres. - In non-airtight containers	17,767	34,210	20,644	36,948
France	6,537	13,559	4,921	10,056
Crustaceans and Molluscs, Prep. or Pres.	2,795	12,831	3,572	16,656
United Kingdom	1,949	8,314	2,346	10,255
Herring Meal	537,772	314,152	365,496	169,406
Denmark	20,115	11,982	8,331	4,015
Sweden	38,744	21,136	23,093	10,686
Belgium	32,070	19,442	19,852	9,193
France	69,427	38,703	65,422	30,051
Netherlands	55,108	35,180	10,736	5,111
United Kingdom	172,272	96,855	159,194	72,987
West Germany	31,281	19,054	16,828	7,667
East Germany	24,376	15,088	8,115	3,902
Other Countries	94,379	56,712	53,925	25,794
Other Meals	43,256	23,437	49,180	21,834
All Other Products	31,170	21,268	24,212	17,418

NORWEGIAN EXPORTS BY TYPES OF PRODUCTS, 1964-1965

Quantity in Thousand Pounds
Value in Thousand Kroners

	Jan.-Dec. 1965 Q.	Jan.-Dec. 1965 V.	Jan.-Dec. 1964 Q.	Jan.-Dec. 1964 V.
GRAND TOTAL	-	1,354,774	-	1,064,933
United States	49,926	95,050	48,562	91,264
Frozen Fillets of Fish	13,730	20,574	14,469	20,473
Fish, Prep. or Pres. - In airtight containers	24,795	62,957	23,102	56,021
Other Products	8,401	11,519	10,991	14,770
Brazil	17,214	33,859	11,541	22,897
Salted and Dried Fish (klipfish)	17,214	33,859	11,541	22,897
Cuba	-	-	7,690	15,062
Salted and Dried Fish (klipfish)				
United Kingdom	263,554	279,801	233,100	226,077
Fresh or Iced Fish, n.o.p.	14,698	16,141	17,214	17,721
Frozen Fish, n.o.p. - except fillets	7,928	17,750	5,900	16,425
Frozen Fillets of Fish	37,606	67,871	19,434	31,092
Crustaceans and Molluscs, not canned	1,949	8,314	2,346	10,255
Fish, Prep. or Pres. In airtight containers	10,298	23,427	14,608	32,243
Crustaceans and Molluscs, Prep. or Pres.	1,949	8,314	2,346	10,255
Herring Meal	172,272	96,855	159,194	72,987
Other Products	12,454	10,407	7,614	7,009
France	86,032	75,435	85,485	68,729
Frozen Fillets of Fish	6,252	13,640	7,015	14,387
Fish, Prep. or Pres. - In non-airtight containers	6,537	13,559	4,921	10,056
Herring Meal	69,427	38,703	65,422	30,051
Other Products	3,816	9,533	8,127	14,235
Belgium	46,694	38,063	26,076	19,349
Herring Meal	32,070	19,442	19,852	9,193
Portugal	11,468	25,359	5,348	11,207
Salted and Dried Fish (klipfish)	11,468	25,359	5,348	11,207
Sweden	91,990	133,726	71,400	103,990
Fresh or Iced Fish n.o.p.	11,045	17,735	10,536	19,573
Frozen Fillets of Fish	16,316	33,875	11,252	20,550
Crustaceans and Molluscs, not canned	3,395	22,149	3,876	19,532
Herring Meal	38,744	21,136	23,093	10,686
Other Products	22,490	38,831	22,643	33,649
Denmark	32,974	33,579	21,233	21,540
Herring Meal	20,115	11,982	8,331	4,015
Finland	17,061	21,227	17,058	16,530
Frozen Fillets of Fish	7,418	11,989	4,486	7,183
Italy	62,325	104,660	46,069	77,141
Frozen Fish, n.o.p. - except fillets	10,342	20,629	11,115	16,387
Salted Fish, n.o.p.	10,578	16,419	4,541	6,811
Dried Fish (stockfish)	10,161	35,578	8,814	31,488
Salted and Dried Fish (klipfish)	7,209	12,602	7,123	11,990
Other Products				
Netherlands	61,757	50,886	16,425	16,593
Herring Meal	55,108	35,180	10,736	5,111
West Germany	94,839	80,652	54,715	48,509
Frozen Fish, n.o.p. except fillets	9,323	10,633	9,189	9,902
Frozen fillets of Fish	17,853	25,462	6,129	7,663
Herring Meal	31,281	19,054	16,828	7,667
Other Products	36,382	25,503	22,569	23,277
East Germany	42,591	30,955	34,455	23,973
Herring Meal	24,376	15,088	8,115	3,902
Czechoslovakia	31,147	28,395	30,212	24,618
Frozen Fillets of Fish	12,348	14,280	8,730	9,423
U.S.S.R.	41,339	35,011	41,471	30,494
Frozen Fillets of Fish	22,302	25,179	19,218	20,944
Nigeria	37,591	75,243	32,902	65,987
Dried Fish (stockfish)	37,591	75,243	32,902	65,987
All Other Countries	196,360	212,873	165,317	180,973

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DEVELOPMENT OF SPAWNING CHANNELS HELPS MAINTAIN SALMON RUNS. On both coasts the Federal Department of Fisheries is vitally concerned with the maintenance of salmon stocks. One of the most important activities is the construction and supervision of spawning channels. In addition, the Department is engaged in construction of "fishways" and the clearing of obstructions to allow salmon access to headwater spawning grounds. Investigation and correction of pollution problems is also a continuing activity.

DEPARTMENT OF FISHERIES
Hon. H. J. Robichaud, M.P., Minister — Dr. A. W. H. Needler, Deputy Minister

Ottawa, Canada

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In This Issue

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- ★ Fish Inspection in Retail Stores
- ★ The Pacific Blackcod

Department of Fisheries of Canada, Ottawa

FISHERIES OF CANADA

(formerly Trade News)

Editor

E. H. HEARNDEN

Vol. 19 No. 4 October, 1966

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COVER PHOTOGRAPH - Operating like a vacuum cleaner, a pumper boat loads thousands of sardine-sized herring from a weir near Digby, N.S., in the Bay of Fundy.

Resource Development in the Pacific Region

Report for 1965

THE PRINCIPAL responsibilities of the Resource Development Branch of the federal Department of Fisheries in the Pacific Area are:

(1) to protect the fisheries resource from the harmful effects of industrial and other water-use projects,

(2) to expand the resource by the application of techniques developed through research, and

(3) to undertake scientific studies and assessments, as required, to ascertain the status of various salmon stocks with a view to advancing recommendations for their effective management. The activities of the Branch continued to expand in all three fields in 1965, maintaining the trend of recent years.

Major undertakings in the field of salmon development projects were initiated in 1965 when contracts were let for the construction of a $700,000 fishway at Meziadin Falls on the Nass River system, and a $500,000 spawning channel on Fulton River, tributary to Babine Lake. The latter is the first stage of a proposed five-year $5,000,000 program aimed at developing the potential of Babine Lake as a sockeye salmon nursery area.

Operation and assessment of the Big Qualicum River salmon development project constituted an important part of the 1965 program. Results obtained to date have been most encouraging.

Several unforeseeable developments of an emergency nature occurred during the year which required the immediate attention of the Branch. An extensive landslide on the Tahltan River, the major sockeye producer in the Stikine watershed, created an impassable obstruction which called for a helicopter airlift to pass the 1965 spawning migration. Moreover, a major change in the course of the Phillips River in mid-October cut off the direct flow to heavily-seeded pink salmon spawning grounds and it was necessary for the Branch to excavate a $40,000 channel to divert the river back to its natural bed. A similar problem was alleviated at the Teaquahan River by the construction of a dyke.

Surveys and investigations of spawning streams, particularly those in the lower Fraser Valley, Vancouver Island, and the Queen Charlotte Islands were continued during the year and certain watersheds have been selected for more intensive study as possible development projects for the future. Similarly, a number of reported obstructions were surveyed and several of these received immediate attention.

During 1965, the salmon management activities of the Branch included: test-fishing and sockeye salmon enumeration studies on the Nass River; an exploratory test-fishing operation on the Stikine River; adult sockeye enumeration studies at Rivers Inlet, complemented by a study to measure juvenile sockeye abundance in Owikeno Lake; regulatory studies on the Johnstone Strait pink and chum salmon; tagging of coho as part of a distribution study in the Strait of Georgia; regulatory studies on the Fraser River chinook and chum salmon; and the assumption by the Branch of regulatory responsibilities on the Skeena River Management Committee.

Development

Big Qualicum River Project

The program initiated in 1959 to assess the effects of flow control on the freshwater survival of chum, coho, and chinook salmon in the Big Qualicum River was continued in 1965, and interesting

comparisons can now be drawn from available data. For instance, in the four years immediately prior to implementation of flow control, chum salmon egg-to-fry survival rates averaged 11.2 percent, with a range of 5-17 percent; whereas figures of 25.2 percent and 24.5 percent have been recorded in the two succeeding years (1963-64 and 1964-65) when river flows were being controlled.

Similarly, the magnitude of the seaward migration of coho fry at the enumeration site, which is regarded as a measure of the abundance of emergent fry, has increased from a maximum of the 64,000 recorded under natural conditions, to approximately 500,000 under the controlled-flow conditions which prevailed over the winter of 1964-65.

It is of interest to note also that fry emigrations produced by coho spawning stocks of comparable size have been recorded as 0.6 percent of the potential egg deposition, under natural conditions, as compared with 9.6 percent with flow control. On the other hand, the output of coho smolts, migrating after one year of stream residence, has been relatively steady, with no significant increase being noted during the first summer of flow control.

It should be pointed out, however, that although the average river discharge during the two low-flow months of August and September was above normal in 1964, it did not exceed the minimum daily discharge which occurred in some study years prior to implementation of the flow control project.

The magnitude of the 1965 seaward migration stemming from the 1964 brood of chinook salmon represented 12 percent of the estimated potential egg deposition, which is substantially less than the 19.8 percent survival rate of the eggs deposited by the 1963 brood, but it is still in excess of all those recorded under natural conditions. Year-to-year variations which have been observed in the quality of chinook fry migrants, particularly with regard to their sizes and their dates of entry into saltwater, are such that their actual numbers may not be indicative of the potential adult production.

In the spring of 1965 the adipose fins of approximately 750,000 seaward-migrating chum salmon fry were removed so that the adult returns would be readily identifiable, providing the basis for measuring the Big Qualicum's contribution to a commercial fishery involving a number of different races.

The 6.4 million pink salmon eggs taken from the Bear River stock and transplanted in the Qualicum spawning channel in 1964, in an effort to establish a self-perpetuating run, resulted in an emigration of 3.0 million fry in the spring of 1965. This represents an egg-to-fry survival rate of 47 per cent, which is a substantial improvement over the 20 percent recorded in the previous year, when prior to implementation of the flow control program, the 6.3 million eggs transplated from the Cheakamus River stocks were subjected to heavy siltation during freshets.

The 1965 escapements to the Big Qualicum River were 19,000 chums, 3,700 coho, and 1,300 chinooks. The returns of chums and coho were down from the 35,000 and 5,200 recorded in 1964, but the chinook return was up by 800. The six-year average escapements over the 1959-64 period have been 50,000 chums, 3,700 coho, and 1,150 chinooks. Only 75 adult pink salmon returned to the Big Qualicum River in 1965 and all of these are presumed to have originated from the 1963 transplant because the numbers of "strays" from other systems have not been significant in previous years.

In the summer of 1965 the spawning channel was reconstructed to eliminate defects which had developed as a result of bank erosion caused by salmon spawning along the margins. In this connection the channel width had been increased in some local areas by as much as 30 percent, causing substantial changes in the flow patterns within the channel and siltation of the spawning gravel.

After removal of the existing spawning gravel the channel sub-base was re-formed to a uniform cross-section and the banks were lined with sheets of corrugated asbestos board. The channel was then re-lined with new high-quality gravel.

The gravel extracted from the channel was distributed over approximately 8,000 square yards of river bed in an area which had not previously been utilized for spawning purposes. In 1965, however, significant numbers of chum salmon spawned in this area, giving reason to believe that improvements of this type might be a worthwhile means of increasing salmon production in the natural river.

Runoff from the Big Qualicum watershed in 1965 was about average, and near-optimum flows were maintained in the lower river without having the reservoir approach critical levels.

Babine Lake Development Program

This is a proposed five-year $5,000,000 construction program looking to the development of the potential of the main basin of Babine Lake as a nursery area for sockeye salmon - this potential being restricted under natural conditions by the lack of spawning grounds adjacent to the lake, as is indicated by data obtained from the Fisheries Research Board of Canada.

The first phase of the program was completed on schedule in October, 1965, when water was

turned into a newly-constructed spawning channel adjacent to the Fulton River. This installation, which was completed at a cost of approximately $500,000 will accommodate 24,000 sockeye spawners in its 4800-foot length. Although the channel was not completed in time to accommodate spawners in 1965, approximately 1,200,000 eyed sockeye eggs were planted in the channel in late November to provide valuable experience in connection with operating problems caused by severe climatic conditions; to measure the efficiency of the channel in terms of egg-to-fry survival; and to facilitate tests of gear and techniques which will be employed for fry enumeration when the channel is brought into full production.

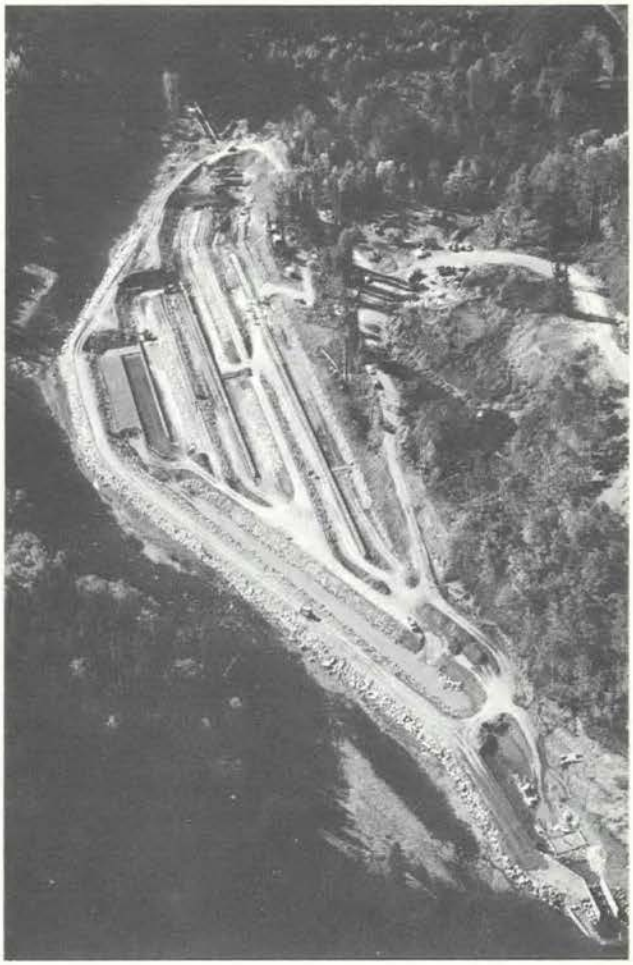
ENGINEERING SURVEYS

While construction of the Fulton River spawning channel was underway, engineering surveys and design studies were being pursued concurrently in preparation for the 1966 construction program, which calls for the expenditure of approximately $1,100,000 for part of the flow-control works at Fulton and Taltapin Lakes and for a start on the spawning channel proposed for Pinkut (15-Mile) Creek.

During 1965, surveys of the Morrison River watershed were completed, and the data so obtained will be evaluated to determine whether or not a development project would be warranted at this location. The biological studies which were initiated at Fulton River in 1961 and at Pinkut Creek in 1964, were continued in 1965 to provide additional background information with respect to the sockeye runs and their natural environments. The data so obtained provides the basis for the design of the salmon development projects and will serve in future as a means of evaluating the worth of such projects.

The 1965 fry outputs from Fulton River and Pinkut Creek, as estimated by sampling of migrants at the former, and pre-emergent fry at the latter, were: 24-25 million fry at Fulton, which represents 12-13 percent of the potential egg deposition (187 million), and 4-5 million fry at Pinkut, which represents approximately two percent of the potential egg deposition (228 million).

Comparison with results obtained in previous years reveals that the 1965 survival rates were low in both rivers. It should be noted, however, that unusually high discharges which occurred in the fall of 1964 resulted in above-normal marginal spawning, and that very severe winter conditions, with air temperatures dropping to as low as -45°F during the last half of December, probably contributed to the reduced survival. Furthermore, overcrowding on the Pinkut Creek spawning grounds resulted in abnormal losses of eggs during the spawning period.



Aerial view of Fulton River spawning channel under construction, August, 1965. Fish entrance at lower right, water intake at upper left.

On the basis of visual counts taken from towers overlooking each of the two rivers the 1965 sockeye spawning population to the Fulton River was estimated at 139,000 (11 per cent jacks), with an estimated potential egg deposition of 182 million; while that at Pinkut Creek was 34,000 (30 percent jacks), with an estimated potential egg deposition of 59 million. Post-spawning hydraulic samplings undertaken at Pinkut Creek indicated that the actual deposition was 19.7 million eggs, or 33.4 percent of the potential, and that the actual live deposition at the time of sampling was 13.5 million eggs, or 23 per cent of the potential.

The Fulton River spawning population was close to the optimum of 120,000, but the low flows and relatively high water temperatures which prevailed throughout August and September reduced the areas available for spawning, delayed spawning activity, and substantially altered the normal distribution of spawners. On the other hand, above-normal discharges occurring in October and November

resulted in relatively high water temperatures, and the accompanying enhancement of incubation rates tended to offset the rather late deposition of ova.

Low flows which prevailed in Pinkut Creek throughout the spawning- and early-incubation periods, did not delay spawning, but they did reduce the area available for spawning, and the accompanying low water temperatures retarded development during the early incubation period.

Meziadin River Fishway

In June, 1965, a contract was awarded for the construction of a fishway and barrier dam at Meziadin Falls on the Meziadin River, approximately 125 miles northeast of the city of Prince Rupert. When completed, these facilities will eliminate the serious losses and delays sustained at certain water levels by important stocks of sockeye salmon which spawn in Meziadin Lake and its tributaries.

The barrier dam is essentially a concrete sill mounted on the crest of the lower falls to create a minimum water surface drop of eight feet, which will be impassable to sockeye. The entire structure is angled across the river in such a way that upstream-migrant fish, on encountering the sheet of water falling from the 280-foot crest, will be directed naturally to the fishway entrance located on the left (north) bank. The 670-foot-long concrete fishway with 35 baffles of the vertical-slot type, will provide the means by which all fish can surmount the 35-foot obstruction posed by the upper and lower falls.

Good progress was made on the construction of these works in 1965 before the contractor had to close down the operation in mid-December because of severe winter conditions. The expected cost of the completed works is approximately $700,000.

Robertson Creek Experimental and Development Project

The 1964 transplant of 10.1 million pink salmon eggs taken from the Atnarko and Bear River runs, resulted in an emigration of 6.5 million fry from Robertson Creek in 1965, which represents a mean egg-to-fry survival of 64 percent. While incubation survival of the Bear River eggs was relatively high (89 percent), that of the Atnarko eggs was low (51.4 percent), continuing the high-mortality trend observed in the hatchery eyeing station (25 percent), which was the highest recorded during the six years in which the hatchery has been operating. This high rate of mortality is believed to be attributable to the long transit time for the green eggs or to the high temperature at Robertson Creek. The Bear River transplant was made to compare survivals and returns from this late spawning stock with those of the Atnarko stocks and possibly determine the reason for poor survivals and returns.

The 1963 deposition of 13 million pink salmon eggs (9.7 million by transplant, and 3.3 million by the adult returns from the 1961 transplant) produced a 1965 return of approximately 2,000 adults. Of these, 1,646 returned to the spawning channel, while approximately 352 spawned elsewhere in the Somass River system, chiefly in the upper Stamp River. An additional 55 fish were reported to have been taken in the commercial and sport fisheries. There were no reports of fish straying to other streams discharging into Alberni Inlet.

The 1965 return of 2,000 fish falls far short of the 13,000 required to replace the parent stock of 13 million eggs. Nevertheless, it was encouraging to note from a preliminary comparison of redd locations charted in 1963 and 1965 that the 1965 spawning distribution was more uniform and that superimposition was minimal. Moreover, prespawning mortality was less than two percent in 1965, as compared with 30 percent in 1963.

The calculated egg deposition of the 1965 pink salmon return was 1.7 million, of which 0.7 million were located in the experimental sub-channels. Spawning efficiencies in the sub-channels were studied, using density, water velocity, and proximity to riffles as experimental variables.

EXAMINED FOR COLUMNARIS

A Fisheries Research Board pathologist examined 43 moribund pink salmon for columnaris and other bacterial fish diseases. Microscopic examinations of gill filaments and media cultures were all negative for columnaris. This disease has been suspected as one of the major causes of high prespawning mortality recorded with pink salmon in 1963. It is probable that the marked improvement in the pre-spawning mortality rate is directly associated with the fact that the mean daily stream temperature was 3-5 degrees colder than that in 1963.

A total of 415 coho were transported by truck to a discrete section of the channel, where their spawning success and distribution were observed. Observations were made on the effect of a longitudinal centre gravel berm, riffles, and a subsurface percolation bed on the spawning distribution of these coho.

To determine the causes of the high prespawning mortality of this species in the channel approximately one-half of the spawners (200) were placed in the channel during the early period of upstream migration (September 1 to 21). The remainder were placed in the channel during the late period of migration approximately a month later. Fifty percent of the females in the early group and 11 percent of the females in the late group died be-

fore spawning. It is believed that the major portion of the early run normally enters Great Central Lake and spawns in tributaries to the lake while the later running coho spawn chiefly in the river below the lake. These later fish are probably the only coho that can be used in experimental studies in Robertson Creek.

The temporary eyeing station, installed in the test flume, was dismantled, and the flume was turned over, on loan, to the Institute of Oceanography and the Fisheries Research Board to facilitate their joint study of a high-velocity test conduit.

During the year the Robertson Creek facilities were used to provide data and tests for the design of the large-scale downstream migrant traps required at the Fulton River spawning channel.

Constricted reaches of the Boot Lagoon flowage, upstream of the spawning channel, were dredged to reduce the high headlosses which threatened to restrict the availability of flows to the channel during low-water periods.

Nanika River Rehabilitation Program

The Nanika River hatchery which was constructed by the Department in 1960 to rehabilitate the severely depleted Nanika River sockeye run was operated as a production unit for the fourth consecutive year during the 1964-65 season.

In September of 1964, 13.6 million sockeye eggs were transferred from 15-Mile Creek on Babine Lake to the hatchery. A total of 12.1 million eggs were held in the hatchery to the fry stage while 1.5 million eggs were incubated to the eyed stage in the hatchery and then subsequently transferred to a small experimental incubation channel associated with the hatchery. Egg-to-fry survival in the hatchery and channel totalled 65 percent and 80 percent respectively.

With regard to fry quality, the channel-incubated fry were much larger than the hatchery-produced fry but were slightly smaller than the naturally-produced 15-Mile Creek fry. A comparative study, conducted on the sizes of pre-emergent fry from the incubation channel and from 15-Mile Creek, indicated that the naturally-produced 15-Mile Creek fry were larger because of pre-emergent feeding which occurred only in that system.

In recent years the Nanika River sockeye stock has shown definite signs of recovering and concern with respect to its future status has eased considerably. For this reason, as well as the fact that hatchery-incubated fry have been of inferior size, the hatchery operation was limited in 1965 to the incubation of 3.4 million eyed eggs for transplantation to the Nanika incubation channel pending evaluation of the past four years production. This channel has been kept in operation for the current year as a means of assessing the operation of this type of facility under extreme winter conditions.

An adult return of age-4 sockeye, incubated in the hatchery during its first year of operation, was expected in 1965, but there were only a calculated 400 age-4 fish in the total return of 9,700. Since a return of this magnitude could have been expected

Estimating fry survival at Pinkut Creek by means of hydraulic sampler technique, 1965.

from the 1961 Nanika River native stock, the contribution of the hatchery-produced fish probably was not significant.

A biological program, initiated in 1961 to assess the contribution of the artificial transplants and the status of the native sockeye population, is being continued.

Tahltan River Slide

In April, 1965, a report was received that a large landslide had created an impassable obstruction in the lower reaches of the Tahltan River, the major sockeye-salmon-producing tributary of the Stikine River, which is approximately 300 miles north of the city of Prince Rupert.

Subsequent air and ground surveys confirmed this report, noting that the slide had engulfed the natural river bed for a substantial distance, with the result that the river was displaced several hundred feet from its former course. Several falls located along the new stretch of the river were obviously impassable to salmon.

When preliminary surveys clearly revealed that the slide was of such gigantic proportions that the cost of its removal would be prohibitive, studies were initiated to develop an alternative solution. It was obvious, however, that a permanent solution could not be undertaken in time to assist the 1965 migration because of the problems of access and the very short time available to develop and implement plans. Accordingly, steps were taken to effect a temporary solution by blasting channels through the obstructions, and, when these proved to be of little value, a helicopter airlift was implemented to convey salmon around the slide area.

Nets were employed to trap and hold salmon in a quiet reach of the river, from which they were transferred manually to a 45-gallon drum (half-full of water) suspended from a helicopter in such a way that the machine was able to hover for loading and unloading of the fish. A total of 10,914 salmon, most of which were sockeye, was transported by this means.

Unfortunately, the extremely low discharges which occurred in 1965 resulted in another complete obstruction at Descheeka Falls, some 20 miles upstream from the slide. A hastily-contrived dipnetting program finally resulted in 2,000 salmon being passed around this obstruction.

Further attention will be directed toward the slide and Descheeka Falls in the spring of 1966, looking to developing permanent solutions to the fisheries problems they present.

River Diversions

The heavy rains which caused floods in many coastal streams in mid-October resulted in the Teaquahan and Phillips Rivers changing courses, cutting off the flow to important spawning grounds which had been heavily seeded by the 1965 spawning stocks.

Inspections of both sites revealed that local drainage, coupled with continuing wet weather, was keeping the eggs moist, and that there was every reason to believe that substantial numbers could survive if the normal water supply was resumed as quickly as possible.

The Teaquahan River (Eva Creek), which is situated at the head of Bute Inlet, was diverted back to its original channel by means of a dyke constructed at the point of break-through. The cost of this project was borne jointly by the Department and a local logging firm, the Department's share amounting to approximately $2,000.

At Phillips River, near Bute Inlet, the entire outflow from Phillips Lake was being discharged via an abandoned logging channel which roughly parallels the river bed in the reach where spawning occurs. In order to re-divert these flows onto the spawning grounds a new channel, some 2,800 feet long, is being excavated to a depth of several feet below the invert of the logging channel to connect the lake with the upper reaches of the spawning grounds. Total cost of the project, scheduled for completion in late January, 1966, is estimated to be $40,000.

Kakweiken River

The pre-fabricated steep-pass fishway installed at a falls on the Kakweiken River in 1964 performed well in 1965, as evidenced by "spot" counts which showed that pink salmon were moving through the structure at rates of up to 600 per hour. It is estimated that more than 30,000 adult pink salmon utilized this facility in 1965.

Investigations and Assessments

The Branch's long-range program to catalogue and define all salmon obstructions in the Pacific Area was continued in 1965, when surveys were undertaken at obstructions on the Kispiox, Cranberry, Kiteen, Bulkley, Bear, Marble, Zeballos, Mahatta, Waukass, and Tzoonie Rivers. On the basis of recommendations stemming from these surveys, remedial measures, involving the use of explosives, have since been undertaken on the Tzoonie, Waukass, and Marble Rivers.

Surveys initiated in 1964 for the purpose of formulating plans for rehabilitation of the declining stocks of chum salmon native to the lower Fraser River culminated in 1965 with the recommendation

that attention be directed specifically toward increasing the fry output from the Vedder, Harrison-Chehalis, and Stave Rivers. Preliminary studies are now underway to develop plans for spawning channels on one or more of these systems.

In 1965, also, the Branch continued to pursue its study of the Yakoun River, Queen Charlotte Islands, in an effort to ascertain the reasons underlying the decline of a pink salmon run which was once one of the largest on the Pacific coast. The returns since 1960 have fallen to as low as ten percent of those recorded a decade or two ago, and in view of this continuing trend studies have been initiated to determine whether or not freshwater survival is a major factor. The 1964 spawning population of 325,000 pink salmon was one of the best escapements recorded in recent years. The 1965 seaward migration was enumerated at 31,000,000 fry, which represents an egg-to-fry survival rate of 12.4 percent.

The Branch initiated a program on the Cowichan River system in 1965 to determine more precisely the magnitude of the salmon spawning stocks and to measure their freshwater survival rates. While the system supports substantial numbers of chum, coho, and chinook salmon, the latter were selected for the initial study because of a reported decline in the numbers of this species. The 1965 chinook spawning population was estimated by means of a tower count to be 8,600. The program will continue with a study of the progeny of this chinook run during their downstream migration next spring.

In an effort to develop a full understanding of the factors which limit the abundance and availability of chinook salmon the Branch is undertaking salmon-tagging programs in the Strait of Georgia; measuring the freshwater survival rates of different groups of seaward-migrating fry, and relating these to the adult returns; and recording water temperatures and other physical data in a number of watersheds with a view to determining their relative effects on freshwater survival. In addition, Branch personnel are maintaining a close liaison with their counterparts in the United States to keep abreast of the results being obtained in a comprehensive assessment of the value of hatcheries and rearing ponds as a means of enhancing the production of chinook salmon. In due course, it is expected that these various studies will add valuable data to provide a firm basis for the formulation of a development program for chinook salmon in the Pacific Area.

Industrial Projects

Hydroelectric

The Branch's activities in 1965 with respect to hydro-electric developments were again confined mostly to operational problems arising at existing developments. One aspect of the long-standing fish-power problem at the Puntledge River hydro development was resolved however, when discussions initiated by B.C. Hydro and Power Authority in mid-1964, culminated in an agreement in January, 1965 whereby the Authority would construct a spawning channel to accommodate the severely-depleted up-river run of early chinook salmon.

Clearing of the site commenced in early February and water was turned into the channel on June 14 - the exact date on which chinooks were first sighted in the upper river. The channel is approximately 800 feet long, providing a spawning area capable of accommodating some 800 spawners, which is far in excess of spawning escapements recorded in recent years. The channel has been designed for expansion to accommodate 2,500 spawners whenever such action is warranted. Notable features of the channel are its pumped water supply and four deep (8' 6") holding pools.

Operation of the channel in 1965 proved to be most encouraging. The total escapement was enumerated at 270 chinooks, of which 236 (91 females) were distributed evenly throughout the channel while 34 remained in the river downstream of the channel entrance. Only 12 of those in the channel died without spawning, despite the fact that they were required to hold for up to four months in water temperatures which frequently exceeded 70°F. Egg deposition by the remainder was virtually complete.

During the year, also, liaison was established with representatives of a consulting engineering firm undertaking hydro-electric power investigations of the Nass, Stikine, Iskut, and other rivers in northwestern British Columbia.

Jones Creek

The pink salmon return to Jones Creek numbered approximately 3,000. Approximately 2,100 of these spawned in the channel and the remainder spawned in the unimproved stream below. This seeding is considered sufficient to maintain the run at the capacity of the spawning channel.

Water Supply

The development of fisheries protective measures at water diversions was again an important phase of the Branch's activities in 1965. In addition to a substantial number of small- to medium-sized diversions for mining, irrigation, and domestic purposes, the Branch was associated with the development of screening facilities to exclude salmon fry from several major diversions. In this connection designs were developed for self-cleaning travelling screens at two new pulp mills being constructed at Prince George, and for a major addition to the existing pulp mill at Prince Rupert. Further discussions were held with representatives of the

Tahsis Company Ltd. with regard to fisheries flow requirements in the Gold River downstream of the Company's planned diversion for its proposed pulp mill. At the year's end, negotiations were progressing well in connection with Granisle Mines Ltd. proposal to divert water from Babine Lake. Similarly, plans were being developed for a screened intake and fishway at a combined storage and diversion scheme planned by Wesfrob Mines Ltd. for diversion of water from Wright Lake, Tasu Sound, Queen Charlotte Islands.

Marine Seismic Explorations

Seismic explorations being undertaken in coastal waters by various oil companies continued to require the careful attention of Branch personnel in 1965. The British American Oil Company conducted a gas-exploder program in the Strait of Georgia; the Socony-Mobil Oil Company undertook preliminary conventional seismic programs in the offshore waters of Vancouver Island, Queen Charlotte Sound, and Hecate Strait; and Shell Canada Ltd. carried out their third major seismic survey using both the conventional seismic technique and the gas-exploder technique in offshore waters extending from Barkley Sound, on the west coast of Vancouver Island, to north-central Hecate Strait. In each instance technical discussions with representatives of the companies led to the acceptance of a number of conditions which were designed to afford maximum protection to the fisheries.

In 1963 to 1965 inclusive, Shell Canada Limited detonated 32,885 seismic explosions, of which only 2,214 resulted in observed fish kills, amounting to a total of 152,716 of all species. The fish killed were chiefly herring and rockfish with salmon of all age groups representing less than one percent. Fisheries recommendations, which resulted in the suspension of 3,778 proposed shot points during this three-year program, illustrates the value of having a Departmental observer accompany the survey ships.

Further technical meetings were convened with representatives of Shell Canada Limited in late 1965 to discuss a seismic program proposed for January-March, 1966.

Logging

During the year two Ministerial Orders were issued to provide for regulation of log dumping, log towing and log driving in the Stellako and Tachie-Middle Rivers.

Observation of the 1965 log-driving operations in the Stellako River revealed that spawning areas were being damaged extensively as a result of flow diversions in the vicinity of log jams. Moreover, samples taken by the International Pacific Salmon Fisheries Commission before and after the drive showed the wood-fibre content of the spawning gravel had been increased.

With the completion in August of the Forest Service access road linking Rivers Inlet with Owikeno Lake, regulated log-towing operations in the Whannock River were authorized, pending installation of loading and dumping facilities.

Satisfactory results are being obtained in connection with the incorporation of stream-protection clauses in timber sale contracts and cutting permits in the Prince George, Prince Rupert and Vancouver Forest Districts, and a request for extension of this arrangement to the Kamloops Forest District has been favorably received by the Forest Service.

Discussions have been arranged with representatives of a major logging operator in the Owikeno Lake watershed with a view to developing procedures to secure the protection of salmon-producing streams encompassed by or adjoining Timber Licences, which are exempt from the jurisdiction of the Forest Service.

As a result of site investigations, river development plans associated with log driving in the Nass River watershed were conditionally approved under the authority of a Ministerial Logging Order. Similarly, regulations for log-driving operations, and agreements with respect to river development proposals, on the Quesnel and Cariboo Rivers were achieved through the co-operation of the local logging company.

Liaison has been established with the B.C. Forest Service and several major logging operators in connection with the proposed construction of forest access roads adjacent to salmon-producing streams.

Discussions with officials of the B.C. Forest Service have been initiated with a view to undertaking experimental cutting practices to determine whether or not the potentially deleterious effects which removal of forest cover can have on the stability of stream beds and runoff patterns can be eased.

Gravel Removal

In 1965 Ministerial Orders were issued to provide for the regulation of gravel removal from between the high water margins of the Vedder-Chilliwack, Homathko, Teaquahan, Nanaimo and Chemainus Rivers.

Through the co-operation of the Provincial Lands Branch, all applications to quarry gravel on Crown Lands, directly administered by the Lands Branch and lying in or adjacent to salmon-producing streams are now referred to the Department. Control over gravel removal within the high water wet-

Meziadin fishway and barrier dam under construction, December, 1965.

ted perimeter of salmon streams on Crown lands administered by the B.C. Forest Service may soon be achieved through a forthcoming revision of the Stream Protection Clauses.

A study designed to assess the gravel replacement potential of the Yakoun and Mamin Rivers, Queen Charlotte Island was initiated in 1964 and is continuing. To date the data shows that the Yakoun River which is characterized by a headwater lake and relatively poor bankside deposits has a low replacement potential. The Mamin which is devoid of headwater lakes, has fairly extensive areas with good bankside deposits and a higher average gradient has a considerably higher replacement potential. However, rehabilitation of spawning areas in the lower Mamin River which were destroyed by past gravel removal operations is not proceeding rapidly.

Pollution

Pulp Mills

Lengthy negotiations with representatives of pulp mills under construction in the Fraser River watershed were successfully concluded in 1965 when agreement was reached with regard to the facilities to be provided to reduce losses of toxic chemicals and for the treatment of non-recoverable wastes.

Bio-assays of the treated effluent issuing from the newly-completed pulp mill at Kamloops show that the effluent is being rendered harmless to fish.

Negotiations concerning the type and extent of the facilities to be employed at a new pulp mill on Muchalat Arm (Gold River) to reduce losses of toxic chemicals and particulate material are progressing well, and the owners have agreed to install an outfall diffuser which will dilute untreatable wastes to levels which will not be toxic to fish.

Pesticides

A good liaison has been established between the Branch and most major users of pesticides in British Columbia. These include: insecticides for the control of mosquitoes and forest-defoliating insects; herbicides for the control of brush alongside roads, railways, and power line rights-of-way; sodium arsenite for the control of marine borers;

and copper sulfate for the control of snails which transmit swimmer's itch. Fish-protective measures required by the Department in connection with the application of pesticides impose such restrictions as: (1) application must precede the appearance of fish in the spray area; (2) untreated buffer swaths must be maintained between the spray areas and waters frequented by fish; (3) insecticides which are non-toxic to fish at concentrations which are effective for the control of the pest in question must be employed wherever possible; and (4) the mixing of chemicals, cleaning of spray equipment, and disposal of surplus spray materials near any water course are strictly prohibited.

To facilitate field measurements, the Branch has recently developed a technique by means of which concentrations of insecticides can be measured rapidly in the field. This technique involves the addition of the insecticide of a fixed proportion of a fluorescent dye which is detectable with a fluorometer, so that the pesticide concentration may be calculated.

Industrial Pollution

At the Department's request, effluent disposal facilities have been provided at a number of new industrial plants, involving wastes from mine-mill operations, plating shops, a steel plant, and a chlorine and caustic soda manufacturing plant.

Applied Research

The applicability of electronic counters as a means of enumerating salmon escapements to the spawning grounds was investigated in some detail during the year. An excellent unit has been developed by the U. S. Fish and Wildlife Service in co-operation with an electronics firm, and while production models are not available it is believed that plans could be obtained on loan for assembly of such a unit if the need arises here. Tests of a counter, designed and manufactured by Irish interests, proved that this instrument was too slow for registering the passage of large numbers of fish in a short period of time, and that it could not be modified readily to do so. Investigations into the possibilities of employing a sonar system for enumeration of adults ascending large rivers were undertaken during the year, and in view of the encouraging results these will be continued in future.

Tests of low-cost probes which were developed during the year for measurement of dissolved oxygen concentrations in any type of spawning gravel proved that these instruments were reliable, and it is now felt that they can be used successfully as fixed sampling points for measurement of dissolved oxygen levels in the field. Tests were also undertaken in connection with a technique for measuring water velocity through spawning gravel, and apparatus which will simplify the field procedure has now been ordered. A device which can accurately measure increments of sediment in spawning gravel at the depths of egg deposition was developed and is now in the final stages of calibration.

A B. C. Hydro and Power Authority proposal to provide a high-voltage direct-current interconnection of Vancouver Island and the mainland, with a saltwater return, introduced a threat to the salmon stocks which frequent the areas in the vicinity of the terminals; and tests were initiated in 1965 to determine the sensitivities of various species of salmon to the voltage gradients which can be expected. These tests will be continued in early 1966 with a view to developing recommendations for fisheries protective measures.

Miscellaneous

In recent years the Branch has kept abreast of all applications for water licences and placer leases in the Province in order to ensure that suitable fish-protective facilities are provided at those sites where such are required. These responsibilities were transferred to the Conservation and Protection Branch in 1965, although this Branch is still called upon for advice in connection with those of a technical nature.

Engineering advice and assistance was given to the Fisheries Research Board in connection with the design of facilities to accommodate a proposed experimental transplant of lobsters from the Atlantic coast.

The major landslide which occurred on the Chilcotin River on August 19, 1964 was inspected by the Branch and the International Pacific Salmon Fisheries Commission in the late spring and again in late July to ensure that the 1965 salmon migrations would not be impeded. On both occasions prevailing conditions were regarded as satisfactory, and salmon subsequently passed through this reach without difficulty. It appears that the slide area and the river channel are now reasonably stable, so no further action is contemplated at this time.

Salmon Management

Rivers Inlet

As in the past six years, tow-netting was conducted on Owikeno Lake during 1965, to provide an index of juvenile sockeye abundance. Moreover, an enumeration of the Rivers Inlet adult sockeye salmon stocks was conducted through the use of a "dichotomous technique" which is based on measurements of changes in size and age composition of the stock resulting from selective removal by the gill-

net fishery. The enumeration studies indicate that a relatively poor escapement to Owikeno Lake of less than 250,000 sockeye salmon occurred in 1965.

Strait of Georgia Chinook and Coho Investigation

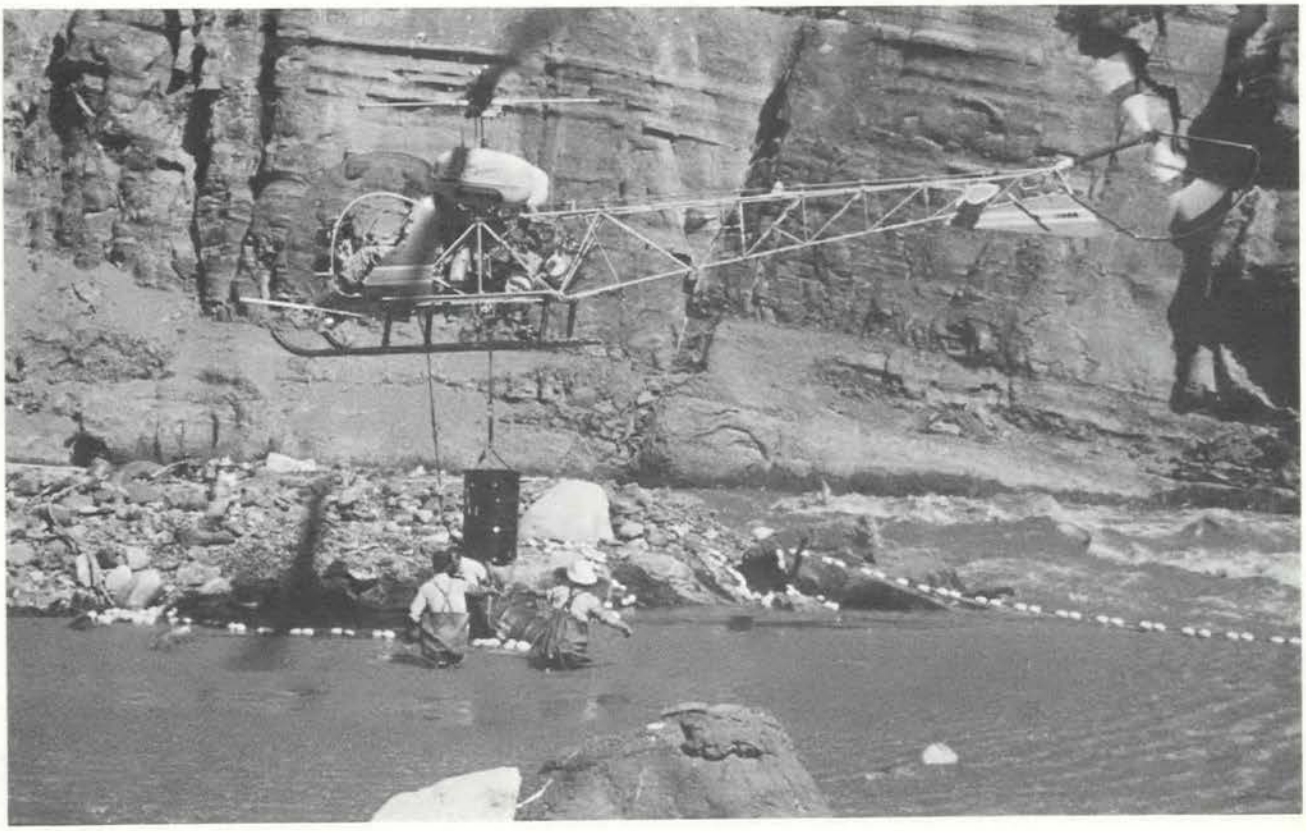
As a result of biological studies conducted during 1963 and 1964, several regulation changes were implemented in the Strait of Georgia during the 1965 season to correct a trend which had developed in the sport and commercial fisheries toward the harvest of chinook and coho salmon at a younger age and therefore smaller size. These included a reduction in the commercial troll season from ten months to four and one-half months, beginning April 15; a postponement of the commercial troll opening date for coho salmon from June 15 to July 1; and a reduction in the sports bag limit from four salmon or eight grilse or an aggregate of eight salmon and grilse to an aggregate of four salmon over twelve inches in length.

The 1965 field program included: (1) a study to measure the susceptibility of maturing coho to hook and line gear in the Juan de Fuca - Sooke area; (2) a tagging program in Discovery Passage to determine the ultimate distribution of coho grilse which demonstrate a mass movement northward each fall through lower Johnstone Strait; and (3) a study, based on sampling by commercial troller, to define overwintering areas for coho grilse in the extreme northern and southern regions of the Strait of Georgia.

Johnstone Strait

The 1965 pink salmon returns to all regions of the British Columbia coast were much lower than expected and the Johnstone Strait return approximated only one-third of that expected on the basis of pre-season studies. As a result of this low return a very stringent fishing pattern was applied throughout the period of the pink salmon migration. The 1965 commercial catch totalled only 674,000 which constitutes only one-third of the average catch recorded over the previous seven odd-year cycles. Assessment of the 1965 escapement is not complete at this time but indications are that it will be only a fraction of the 1.4 million goal set for the region.

On the basis of pre-season studies on the status of the Johnstone Strait - Fraser River study area stocks, a 1965 return of 680,000 chum salmon was predicted. Such a return would have constituted in total, less than one-half the escapement level recorded during the pre-1956 period of high production. Because of the low return anticipated for 1965, no commercial fishing for the purpose of exploiting chum salmon was permitted in the entire Johnstone Strait - Fraser River region.



Helicopter air-lift of sockeye salmon at the Tahltan River Slide, 1965.

A typical catch, Stikine River exploratory test-fishing program, 1965.

In order both to obtain a measure of the strength of the run as it developed and also to acquire pertinent age composition data, fishing by chartered purse-seine vessel was conducted in Blackfish Sound, located in the upper straits region, throughout the chum salmon migration period.

Fraser River Chum Salmon Investigation

In 1965, the Branch continued the investigation which was initiated in 1960 to assess the condition of the Fraser River chum salmon stock; to determine the factors responsible for a decline in both the escapement and commercial catch since the mid-1950's; and to acquire the additional information required for management and rehabilitation of the stock. The Fraser River study has been closely integrated with an overall assessment presently being conducted on the chum salmon stocks indigenous to the Johnstone Strait - Fraser River region. As a result of studies conducted to date, it has been possible to design fishing patterns that provide a maximum degree of protection to the peak of the major Fraser River stock, not only during its period of passage through Area 29, but also through the Johnstone Strait and Strait of Georgia fishing areas. The 1965 Fraser River program included: enumeration of both system and tributary spawning; test-fishing in the lower river; test-fishing and tagging in the estuary; and enumeration of the total system chum salmon fry output from the 1964 escapement.

Although virtually no exploitation was permitted on the Fraser River in 1965, the system spawning escapement totalled only 185,000 fish which constitutes a very slight improvement over the brood escapement of 1961 and 1962.

With regard to downstream fry enumeration, the 1965 studies indicated that the total fry output from the 1964 spawning was considerably greater than that measured during the previous three years.

Fraser River Chinook Salmon

In 1964, a chinook salmon test-fishing program was initiated on the Fraser River and this program was continued in 1965. Analysis of the results of the 1965 program, which extended from April 1 to late September, has shown that the test-fishing procedure has provided a reliable measure of escapement.

Stikine River

An exploratory fishing program was conducted in the Canadian waters of the Stikine River with two chartered "mosquito"-type commercial gill-net boats

in an effort to determine the feasibility of conducting a self-supporting commercial fishery in the area. Although a 25-mile segment of the river was explored, an eight-mile area of the main Stikine was considered to be the only region where drift-gillnets could be operated.

Nass River

A test-fishing program, which was initiated in 1963 to provide a daily index of sockeye escapement from the commercial fishing area and thereby to assist in the management of the Nass River sockeye stocks, was continued in 1965. In addition to the test-fishing operation, the 1965 program included: (1) enumeration of the sockeye escapement to Meziadin Lake as part of an assessment of sockeye production; and (3) sampling of the escapements to Meziadin, Bowser, Damdochax and Kwinageese Lakes for racial characteristics.

Skeena River Salmon Management Committee

The first phase in the transfer of operational duties associated with management of the Skeena River salmon stocks, from technical staff of the Fisheries Research Board to that of the Resource Development Branch was completed in 1965, when the latter assumed responsibility for the development of the 1965 regulations.

The 1965 season was characterized by returns of both sockeye and pink salmon at lower levels than anticipated. Commercial catches of these species totalled 291,000 and 143,000 respectively. Chinook and chum salmon catches were also among the lowest on record. The coho catch was moderate, but probably did not reflect the actual magnitude of the stock as fishing was curtailed during the peak of the coho migration to provide for necessary sockeye and pink salmon escapements.

The sockeye escapement to the Skeena system totalled 660,000, of which 580,000 entered the Babine system. The Bulkley - Morice and Lakelse Lake sockeye escapements of 20,000 and 33,000 respectively were the best in recent years. Pink escapements to early streams and to the main stem of the Skeena were generally light. The escapement to Lakelse River, however, totalled 835,000 pinks, which is considered to be within the optimum range. The coho escapement, as indicated by test-fishing catches, was the best on record, while the chinook escapement was moderate, and the chum escapement poor. ✔

National Conference to Study Pollution Problems

Past and present problems of air, water and soil pollution in Canada and the drawing up of guidelines for the future will be subjects for four days of extensive scrutiny at a national conference on "Pollution and Our Environment" at Montreal, October 31 - November 4.

Representatives from the federal Department of Fisheries and the Fisheries Research Board of Canada will be among the 600 persons attending the conference, which is being sponsored by the Canadian Council of Resource Ministers. The delegates will represent all levels of government in Canada, business and industry, private and semi-private groups and associations, as well as experts in related scientific and technical fields. There will also be a number of experts from abroad.

In preparation for the conference, the experience of Canadian scientists, engineers and administrators with the problems of pollution has been assembled in a series of background papers.

Delegates will be divided into two sets of small groups -- the first set will examine the problems in depth; the second set will have the task of formulating guidelines to support decisions that must be made to improve the quality of our environment.

Work and responsibilities of the Department of Fisheries in the field of pollution control will be incorporated in a background paper entitled: "Participation of the Government of Canada in the Investigation and Abatement of Water Pollution".

Other background papers include: "Impact of Water Pollution on Fisheries in the Atlantic Provinces" by Dr. J. B. Sprague, St. Andrew's Biological Station, FRB, and C. P. Ruggles, Resource Development Branch, Department of Fisheries, Halifax; "Impact of Water Pollution on the Uses for Water--Fisheries" by R. E. McLaren and K. J. Jackson, Resource Development Branch, Vancouver; "The Detection and Measurement of Water Pollution" (Chemical Analysis and Biological Assays) by Dr. Michael Waldichuk and Dr. D. F. Alderdice, Nanaimo Biological Station, FRB.

Among those attending the conference are the Hon. H. J. Robichaud, federal Minister of Fisheries, Dr. A. W. H. Needler, Deputy Minister; Dr. R. R. Logie, Assistant Deputy Minister (Operations); S. V. Ozere, Assistant Deputy Minister (International and Jurisdictional); K. C. Lucas, Director, Resource Development Service; W. C. MacKenzie, Director, Resource Management Economics; and Regional Directors H. R. Bradley, G. L. Grant, R. E. S. Homans, and W. R. Hourston. Dr. F. R. Hayes, Chairman will head a contingent from the Fisheries Research Board. ✔

Technical News

by James Kinloch

Moncton University Courses

Through the University of Moncton, New Brunswick has joined the provinces in which extension services are operated for the benefit of fishermen.

Educational upgrading and leadership training will be offered to New Brunswick fishermen by the university's Extension Service, director of which is Professor A.J. Boudreau, with Donat Lacroix, of his staff, specifically in charge of fisheries training activities. These courses will be held at the university's Memramcook Institute.

This expansion of Moncton University's extension work is encouraged by an annual grant from the federal Department of Fisheries, which provides financial aid for educational work in fisheries techniques and co-operative producing and selling among fishermen.

Other institutions receiving assistance to provide extension services for the benefit of fishermen are St. Francis Xavier University, Antigonish, N.S., Memorial University, St. John's, Newfoundland, the University of British Columbia, Vancouver, B.C., and the Quebec Co-operative Council.

Gulf of St. Lawrence Herring

Large catches of herring in the Gulf of St. Lawrence, made by a British Columbia purse seiner during the summer, have demonstrated the feasibility of taking enough herring in this manner to establish an expanded fish meal industry in New Brunswick.

The vessel is the 80-foot "Western Ranger", chartered by the New Brunswick Department of Fisheries under a cost-sharing agreement with the federal Department of Fisheries, and skippered by Captain George Seter of Vancouver. Between July 17 and August 17, it landed 1,600 tons of herring at Caraquet, N.B., for reduction to meal. The catches were made off Mackerel Point in the Gaspé area, with some individual sets yielding up to 150 tons. On one occasion 50 tons had to be left in the sea because the catch was beyond the capacity of the vessel and its gear.

This joint federal-provincial project has aroused great interest among fishermen of the area, whose herring operations until the present have been carried out with gillnets and small purse seines. The limited catch had been utilized for bait and human consumption, with a relatively small quantity going into fish meal.

The seine net used on the "Western Ranger" is 325 fathoms long and 36 fathoms deep. In the catches off Mackerel Point the depth of the net had to be reduced, as the herring were found there in 30 fathoms of water.

In addition to the skeleton crew which sailed the vessel to New Brunswick from Vancouver, the "Western Ranger" employs five local fishermen. Exploratory work elsewhere in the Gulf will be carried out during the balance of the charter, and it is thought that the vessel, owned by the Vancouver company of Nelson Brothers, may continue fishing out of Caraquet after the termination of the charter.

Underwater Studies

A new type of echo-sounding equipment, using triple transducers which scan upwards, downwards and sideways so quickly that they can give an almost instantaneous presentation of underwater conditions, has been developed by the Lowestoft Fisheries Laboratory in England.

Twin sets of the echo-sounder and underwater television cameras have been mounted on the laboratory's research ship "Clione" and used in the open sea off the Scottish Shetland Islands to study the movements of fish in the vicinity of a pelagic trawl and to explore and identify echo traces.

The laboratory team hope, with the equipment, to study shoal behaviour, determine how fish evade a trawl, and discover if there is a consistent pattern in their tactics. They also hope to study the shapes the trawl net assumes under water and to watch the whole trawl function as it is carried out.

An outsize net, about 50 ft. square and four times the length of the trawl normally used by Lowestoft trawlers, is being used.

The scientists have been experimenting with "aimed" fishing from a single boat, an exercise in which the vessel passes over the shoal to make the trawl, as distinct from pair-trawling where two boats share the net and pass either side of the shoal.

Starts in Montreal

FISH INSPECTION IN RETAIL STORES

MONTREAL is the first city in Canada to have retail store fish inspection on a continuous basis. According to H. V. Dempsey, Director of the federal Department of Fisheries Inspection Service, this type of inspection will be provided soon in other major Canadian cities. This is but another phase of the Department's long-term quality control program which was begun at the processing plant level in 1959.

At present, almost all of the fresh and frozen fish produced in Canada is of Grade 1 quality when it leaves the processing plants. Unfortunately, the careful quality control maintained by the processors is sometimes nullified by improper handling and storage at the retail level. The need for educational work with the store managers is evident.

Retail inspection, presently confined to fish imported from other provinces and countries, began in Montreal on March 1 of this year. Montreal, Canada's largest city has some 50 stores which sell fish exclusively, as well as about 500 chain stores and about 450 independent stores, including some butchers, which retail fish.

Cans of fish on the shelves of a retail store are examined for any swollen or leaking cans and for labelling which does not comply with federal government specifications.

Inspection Officer Paul G. Houle checks the internal temperature of fresh fish in a Montreal fish market with a resistance thermometer.

Briefly, retail inspection consists of:

- Advising retailers of recommended temperature control levels, rotation procedures, and other information which will aid in preserving the quality of fresh and frozen fishery products.
- Surveying the sanitation of the store with special attention to counters, display cases, cutting equipment, storage rooms, and waste disposal facilities.
- Examination of fresh, frozen, and canned fish on display for signs of spoilage.
- Checking labels for evidence of fraud or deception.
- Investigation of consumer complaints.

Should any unwholesome imported fishery products be found in a retail store, action can be taken under the Fish Inspection Act to prevent their sale for human consumption. To date, detention and seizure of merchandise has not been a common occurrence. On the contrary, most of the store managers are very co-operative, and pleased to receive suggestions from the Department's representative.

News Roundup

Appointments

The appointment of J.N. Lewis of Ottawa as Chairman of the Fisheries Prices Support Board and of Richard I. Nelson, Jr. of Vancouver as a board member was announced in August by Fisheries Minister H.J. Robichaud.

Mr. Lewis, 56, is Chief of the Economic Intelligence branch of the Department of Fisheries. A native of Saint John, N.B., he graduated from Acadia University with a Bachelor of Science degree

J.N. Lewis

Richard I. Nelson

and received a Master's degree in Economics and Sociology from McGill University. He joined the Department of Agriculture in 1937 and in 1943 moved to Washington, D.C. as deputy executive officer with the wartime Combined Food Board, later serving as assistant secretary-general of the International Emergency Food Council. Following a further two years service in Ottawa with the Agriculture Department, he joined the Department of Fisheries in 1950.

Mr. Nelson, 37, succeeds Francis Millerd, Sr. of Vancouver, who resigned earlier this year. Associated with Nelson Brothers Fisheries Ltd. for many years, the new board member became company president on January 1, 1966. He graduated from the University of British Columbia in 1953 with a B.Sc. degree in mechanical engineering, and received a Master's degree in Business Administration from Harvard University in 1955. He is a member of the Fisheries Council of Canada.

Now in its twentieth year of operation, the Fisheries Prices Support Board is responsible for the implementation of price support measures when severe price declines are experienced in any branch of the fisheries. The Board reports directly to the Minister of Fisheries and, in addition to the Chairman, comprises five members chosen from the fishing industry. Other members with Mr. Lewis and Mr. Nelson are: K.F. Harding (Vice-Chairman) of Prince Rupert, B.C., Bernard Blais, Quebec, P.Q., H.I. Mifflin, Catalina, Nfld, and W.R. Ritcey, Riverport, N.S.

Mr. Lewis replaces Ian S. McArthur as Chairman of the Fisheries Prices Support Board. Mr. McArthur, who is now Director-General of Economics Services with the Department of Fisheries, had been Chairman since 1953.

Perch Support Extended

The program of the federal government to stabilize the price of yellow perch caught in Lake Erie, announced August 11, will be extended to perch caught in other areas of Ontario.

The original program was to ensure that Canadian fishermen on Lake Erie receive a minimum of 10 cents per pound for number one round yellow perch at point of landing. The program will now apply to yellow perch caught by Ontario fishermen in waters other than Lake Erie where such fish are purchased by Canadian packers or processors. Perch landings in Ontario, other than from Lake Erie, come mainly from Lake Ontario, Lake Huron, Georgian Bay and the North Channel.

New Coastal Chart

A new chart of Nova Scotia's southeast coast, from Yarmouth to Halifax, has just been published by the Canadian Hydrographic Service.

Chart 4012, drawn to a scale of 1:300,000 (about four miles to the inch), replaces Chart 4350, Halifax to Cape Sable and is the second in a series that eventually will cover the Maritimes coastal area. The first in the series was Chart 4010, Bay of Fundy, published in 1965.

The charts are designed for both offshore navigation and for use by the fishing industry. They show the shape of the ocean floor by means of closely-spaced blue contour lines.

Chart 4012 is also available in two latticed versions: L(D7)4012, which shows the Decca lattice for Nova Scotia Chain 7; and 4012-L, which shows the three Loran-A rates covering the area.

FRB Appointments

Dr. W.E. Ricker, Chief Scientist of the Fisheries Research Board of Canada, has been appointed Acting Director of the FRB Biological Station, Nanaimo, B.C.

Dr. Ricker, who is on the staff of FRB headquarters but resident in Nanaimo, assumes his new responsibilities in October. His appointment to the temporary directorship of the Nanaimo Biological Station follows the resignation of Dr. P.A. Larkin, station director since June, 1963, who leaves the Fisheries Research Board to return to university life.

In announcing the resignation, Dr. F.R. Hayes, FRB Chairman, expressed regrets that the Board would be losing the services of Dr. Larkin. "Dr. Larkin is an outstanding fisheries scientist and educator and his enthusiastic leadership at Nanaimo has been greatly appreciated", Dr. Hayes said. "It is gratifying to know that he is returning to the academic sphere where continuation of his impact upon Canadian fisheries research is assured."

Two senior appointments at the Fisheries Research Board of Canada's Biological Station at Nanaimo, B.C., have been announced. Dr. Michael Waldichuk has been named head of the station's Pacific Oceanographic Group and Dr. Robert R. Parker, head of Salmon Investigations.

A native of Roumania, Dr. Waldichuk obtained his B.A. in 1948 and his M.A. in 1950 from the University of British Columbia. In 1955 he obtained his Ph.D. from the University of Washington. He joined the FRB in 1952, initially serving on the staff of the Pacific Oceanographic Group. Subsequently he was appointed scientist-in-charge of water pollution studies at Nanaimo and his work in this field has gained him international recognition.

Dr. Parker, 45, was born in Seattle, Wash., and obtained his B.Sc. in 1942 from the University of Washington. Later he attended the University of British Columbia where he obtained his M.A. in 1947 and his Ph. D. in 1959. Dr. Parker worked for several years as a fisheries scientist in the United States before joining the FRB staff in 1960. He is best known for his work on the growth of fishes and the early life history of the pink salmon.

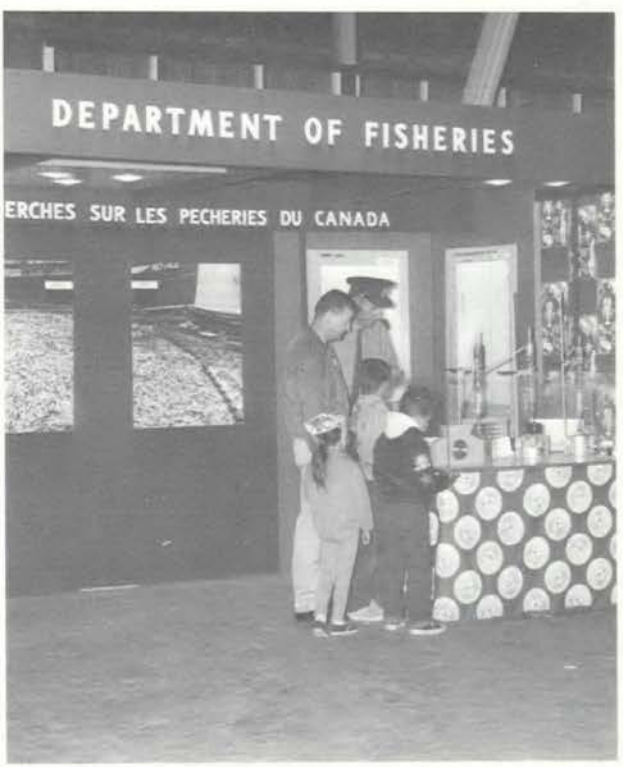
Department's Exhibition Program Concluded for 1966

With the conclusion of the St. John's, Nfl'd, Fisheries Festival, the Department of Fisheries wound up its exhibition program for 1966. The exhibits were designed and arranged by the display branch of the Department's Information and Consumer Service. In some of the displays there was participation by the Fisheries Research Board of Canada.

Largest of the west coast exhibits was the 140-foot display at the Pacific National Exhibition in Vancouver. On the Atlantic coast the Information service sponsored two 40-foot displays at Shippegan, N.B., Yarmouth, Lunenburg and Summerside. The herring fishery and lobster conservation were the themes of these exhibits. Also in the Maritimes smaller displays were shown at Shediac and Ellerslie, P.E.I. The latter was billed as the Tyne Valley Oyster Festival.

In addition the department's consumer consultants had displays at conventions of home economists, restaurant operators and dietitians in various parts of Canada.

Picture, right shows a section of the exhibit featuring the herring fishery at the Summerside Lobster Carnival.



The Pacific Blackcod

(Prepared by the Nanaimo Biological Station of the Fisheries Research Board of Canada.)

THE blackcod *(Anoplopoma fimbria)* like several other species of Pacific coast fish is misnamed in that it is not a true cod. Active fisheries for this species occur from California to Alaska. The total annual production for the Pacific coast has been maintained at a level of 14 to 18 million pounds in recent years, with Alaska taking between 40 and 50 percent. The Canadian catch, which has averaged over two million pounds per year, has had an average landed value of over a quarter of a million dollars. Over 60 percent of this catch comes from the waters off the Queen Charlotte Islands and off the coast of Alaska during the summer months.

DESCRIPTION

The blackcod or sablefish is a member of the skilfish family. It is distinguished by its green to bluish black colour, two widely separated dorsal fins, a slender caudal peduncle and a smooth, streamlined body.

HABITS

The adults of this species inhabit much greater depths than most other groundfish species, being commonly taken in waters of 70 to 250 fathoms. Spawning takes place in the late winter months and is believed to occur in deep water off the west coast of Vancouver Island and off the Queen Charlotte Islands. The eggs are pelagic. Very young stages have been captured near the surface several hundred miles off the continental shelf. Large schools of immature fish between one and two feet in length are frequently seen in the surface waters close to land in the straits and inlets. On the fishing banks the smaller fish are encountered at shallower depths than the larger fish.

The food of the blackcod consists mainly of herring, sand lance and crustaceans.

AGE AND GROWTH

From a study of the rings on the scales of the blackcod it has been found that commercial size is reached at an age of approximately five years and maturity is reached at about six to eight years. At that age the fish are about 28 inches in length. Very old fish may reach a length of three and a half feet and a weight of forty pounds.

BLACKCOD *(Anoplopoma fimbria)*

FISHING METHODS

Almost all of the Canadian catch of blackcod is landed by longline vessels. The main landings usually occur after the halibut season has closed. Since otter-trawlers usually do not fish as deep as the longliners they seldom encounter fish which are much over the legal size.

HANDLING

The major part of the catch is put through the smoking process, the finished product often appearing on the market as "smoked Alaska cod". Small quantities are dry-salted. Because of the high oil content in the flesh, blackcod is seldom marketed fresh.

The liver oil, like that of the lingcod, halibut and dogfish, is high in vitamins A and D. The heavy demand for this product during the war years contributed greatly to the expansion of the fishery.

Japan Sets Catch Record

Japan's total catch from ocean and inland fishing in 1965 amounted to 6,879 thousand metric tons (not including whales), according to preliminary figures issued by Japanese Government sources.

The catch was 8 per cent higher than the previous year, and exceeded the record high set in 1962 by some 15,000 tons.

The increase in the total catch was due mainly to heavier landings by purse seiners (up 26 per cent) and the squid angling fishery (up 63 per cent).

Number of whales caught was 27,200, an 11 per cent increase over 1964 but representing a decrease of 6 per cent when converted to blue whale units.

Fishery Figures For July

SEAFISH: LANDED WEIGHT AND LANDED VALUE

	May-July 1965		May-July 1966 [2]	
	'000 lbs	$'000	'000 lbs	$'000
CANADA - TOTAL	800,293	63,790	760,727	65,368
ATLANTIC COAST - Total	677,322	42,180	605,853	37,894
Cod	282,824	11,277	240,456	10,221
Haddock	26,232	1,709	27,705	1,969
Pollock, Hake, Cusk, etc.	26,241	870	25,405	938
Rosefish	26,973	700	36,960	1,032
Catfish	2,129	72	1,920	64
Halibut	2,008	587	1,673	528
Plaice & Other Flatfish	80,748	2,576	93,200	3,014
Herring & Sardines	151,033	1,503	111,445	1,672
Mackerel	14,058	471	11,830	443
Alewives	12,058	202	7,521	137
Salmon	4,000	1,889	3,836	1,954
Smelts	91	9	13	2
Swordfish	1,844	814	2,257	1,119
Other Fish	11,829	191	10,902	150
Lobsters	26,999	16,048	22,166	12,100
Clams & Quahaugs	1,657	96	1,845	114
Scallops	5,668	3,147	6,389	2,424
Other Shellfish	930	19	330	13
PACIFIC COAST - Total	122,971	21,610	154,874	27,474
Pacific Cods	10,825	763	12,922	1,067
Halibut (1)	22,360	7,220	22,474	7,859
Soles & Other Flatfish	2,275	149	4,010	255
Herring	45,246	605	42,873	721
Salmon	37,276	12,469	65,649	17,041
Other Fish	1,457	52	2,495	73
Shellfish	3,532	352	4,451	453
BY PROVINCES				
British Columbia	122,971	21,610	154,874	27,474
Nova Scotia	186,264	16,707	193,397	15,629
New Brunswick	117,830	4,334	93,577	4,444
Prince Edward Island	20,226	4,851	23,344	3,974
Quebec	86,722	3,986	24,018 [2]	1,173 [2]
Newfoundland	266,280	12,302	271,517	12,674

(1) - Includes halibut landed in U.S. ports by Canadian fishermen.
(2) - Figures for Quebec available for May 1966 only.

MID-MONTH WHOLESALE PRICES - JULY 1966

		Montreal $	Toronto $
Cod fillets, Atl, fresh, unwrapped	lb.	.378	.450
Cod fillets, Atl, frozen, cello 5's	lb.	.351	.397
Cod fillets, smoked	lb.	.425	.473
Haddock fillets, fresh, unwrapped	lb.	.471	.580
Herring, kippered, Atl.	lb.	.256	.307
Mackerel, frozen, round	lb.	.202	.243
Lobsters, canned, Fancy	case 48-1/2s	59.680	62.367
Sardines, canned	case 100-1/4s	9.693	9.487
Halibut, frozen, dressed	lb.	.558	.600
Silverbright, frozen, dressed	lb.	.625	.633
Coho, frozen, dressed	lb.	.758	.763
Sockeye, canned, grade A	case 48-1/2s	28.437	28.833
Pink, canned, grade A	case 48-1/2s	16.753	17.107
Whitefish, fresh	lb.	.483 [1]	.417
Lake trout, frozen	lb.	.434	.493

PRICES PER CWT. PAID TO FISHERMEN

(Week ending July 16th)	1965 $	1966 $
Halifax		
Cod Steak	4.75	5.25
Cod Market	4.5	5
Haddock	7.5	8.5
Plaice	4	5
Yarmouth		
Haddock	6	-
Black's Harbour		
Sardines	2	2
St. John's Nfld.		
Cod	3	3
Haddock	-	2.75-4
Rosefish	2.5	2.5
Vancouver		
Ling Cod	10-12	10-12
Gray Cod	5.5-7	6-7.5
Soles	8-9	8.5
Salmon (Rdspg)	42-73	45-75

Fishery Figures For July

FROZEN FISH STOCKS AS AT END OF JUNE

	1965 '000 lbs	1966 2/ '000 lbs
TOTAL - Frozen Fish, Canada	71,537	76,668
Frozen - Fresh, Sea Fish - Total	50,076	53,138
Cod, Atlantic, Fillets & Blocks	13,777	16,760
Haddock, fillets & blocks	3,843	3,118
Rosefish, fillets & blocks	2,102	2,827
Flatfish, (excl. halibut), fillets & blocks	4,365	4,140
Halibut, Pacific, dressed & steaks	7,296	8,077
Other Groundfish, dressed & steaks	2,013	2,334
Other Groundfish, fillets & blocks	5,167	6,905
Salmon, Pacific, dressed & steaks	3,277	1,047
Herring, Atlantic & Pacific	(1)	263
All Other Sea Fish, all forms	5,371	4,237
Shellfish	2,865	3,430
Frozen - Fresh, Inland Fish - Total	2,912	4,939
Perch, round or dressed	41	494
Pickerel, (Yellow & Blue) fillets	174	146
Sauger, round or dressed	20	(1)
Tullibee, round or dressed	101	109
Whitefish, round or dressed	815	1,453
Whitefish, fillets	151	(1)
Other, all forms	1,610	2,737
Frozen - Smoked Fish - Total	2,043	1,814
Cod Atlantic	1,217	1,284
Sea Herring, kippers	324	269
Other, all forms	502	261
Frozen for Bait and Animal Feed	16,506	16,777

1/ - Confidential, included with "Other"
2/ - Does not include Quebec, data not available.

SALTED FISH STOCKS AS AT END OF JULY

Salted and Pickled Fish, Atlantic Coast			
Wet-salted - Total		16,782	13,439
Cod		13,293	9,585
Other		3,489	3,854
Dried - salted - Total		8,519	2,373
Cod		6,560	1,777
Other		1,959	596
Boneless - Total		591	408
Cod		510	380
Other		81	28
Pickled - Total	(barrels)	22,242	26,598
Herring	"	5,590	9,742
Mackerel	"	9,561	7,338
Alewives	"	7,091	9,518
Turbot	"	-	-
Bloaters	(18 lb. boxes)	184,050	126,321
Boneless Herring	(10 lb. boxes)	14,389	106,500

1/ - Does not include Quebec, data not available.

CANADIAN EXPORT VALUE OF FISHERY PRODUCTS, MAY-APRIL

(Value in Thousands of Dollars)

	1964-1965		1965-1966	
Total Exports		200,202		215,143
By Markets:				
United States		132,396		152,664
Caribbean Area		16,228		18,411
Europe		45,852		38,023
Other Countries		5,726		6,045
By Forms:		128,922		149,576
Fresh and Frozen				
Whole or Dressed	43,012		45,421	
Salmon, Pacific	12,651		12,151	
Halibut, Pacific	5,979		7,324	
Cod, Haddock, Pollock, etc.	413		509	
Swordfish	4,670		4,161	
Other Seafish	5,448		6,772	
Whitefish	5,751		5,743	
Pickerel	2,875		3,361	
Other Freshwater Fish, n.o.p.	5,225		5,400	
Fillets	52,971		67,865	
Cod, Atlantic	20,305		24,388	
Haddock	5,798		5,769	
Rosefish, Hake, Pollock, etc.	4,302		6,451	
Flatfish	8,174		10,829	
Pickerel	2,522		2,683	
Other	11,870		17,745	
Shellfish	32,939		36,290	
Lobster (Alive & Meat)	23,492		25,026	
Other	9,447		11,264	
Cured		23,406		23,800
Smoked	1,862		2,165	
Herring	1,215		1,324	
Other	647		841	
Salted, Wet & Dried	18,903		18,300	
Cod	15,964		15,858	
Other	2,939		2,442	
Pickled	2,641		3,335	
Herring	1,577		2,042	
Mackerel	498		713	
Other	566		580	
Canned		32,909		25,108
Salmon	24,866		16,028	
Sardines	4,035		5,168	
Lobsters	2,853		2,479	
Other	1,155		1,433	
Miscellaneous		14,965		16,659
Meal	8,329		),888	
Oil	2,217		1,756	
Other	4,419		5,015	

Current Reading

SEA STARS *(Echinodermata: Asteroidea)* OF ARCTIC NORTH AMERICA.

By E.H. Grainger, (Bulletin 152 of the Fisheries Research Board of Canada. Available from the Queen's Printer, Ottawa. Price $2.50).

The area of this study by Dr. Grainger, of the Arctic Biological Station of the Fisheries Research Board of Canada, covers northern North American waters between the Strait of Belle Isle and Point Barrow, Alaska. The known sea star fauna of this region consists at present of 24 species, although it is probably that at least five other species from adjacent areas also occur.

This well-illustrated bulletin contains a key for identification and morphological descriptions of all the recorded species, as well as of several others of probable occurrence. Details are given on geographical distribution and on depth, substrate, temperature and salinity conditions.

On the basis of sea star distribution, Dr. Grainger concludes that the arctic-subarctic waters surrounding the Arctic Ocean appear to comprise two major zoogeographical regions -- Atlantic-arctic, embracing all of northern North America except the western portion, Greenland and the waters east of there to eastern Siberia, and Pacific, including the Chukchi and south Beaufort seas and possibly extending to the Western Canadian arctic islands.

INLAND FISHERIES MANAGEMENT

Edited by Alex Calhoun. State of California Department of Fish and Game (Obtainable from the Office of Procurement, Documents Section, P.O. Box 1612, Sacramento, Calif. Price $3.84).

This 546-page publication is aimed primarily at the field men responsible for California's inland fisheries -- the biologists, fish hatchery operators and the wardens. Its purpose is to provide a ready reference to the wealth of fact and theory that has been recorded over the years relating to management of inland fisheries.

The subject matter is dealt with in a total of 76 chapters, ranging from population dynamics and fish marking to economic evaluation of sport fisheries and fisheries-oriented computer programs. The main freshwater species to be found in California are covered in some detail and there are also sections devoted to such matters as echo-sounders, fishways, net repairing and aquatic plant control.

ICNAF SPECIAL PUBLICATION NO. 6.

(Issued from the headquarters of the International Commission for the Northwest Atlantic Fisheries at Dartmouth, Nova Scotia.)

Representing the latest in the series of ICNAF Special Publications, this 914-page volume is a comprehensive report of the lectures presented at the ICNAF Environmental Symposium held at Rome in 1964.

The book, like the symposium, is divided into nine sections, each dealing with a specific aspect of fisheries environmental problems. These cover: The effect of physical environmental conditions on the distribution of adult fish; effect of the environment on pelagic and early demersal stages of groundfish; effect of the biological environment (including parasites) on the distribution of adult fish; effect of the environment on the growth, survival and age and size at first maturity; herring and the environment in the ICNAF area; physiological reactions to changes in the environment; effect of the environment on the process of fishing; effects of long-term trends; and forecasting environmental conditions.

These subjects are dealt with in a total of 91 papers. Each section has been summarized separately and includes a precis of the discussion. In addition there are four review papers dealing with new hydrographical aspects of the Northwest Atlantic and effects of environment on the tuna, herring and Pacific sardine.

In a foreword, Dr. C.E. Lucas points out that the symposium, among other things, attracted from the archives masses of data which might otherwise have taken long to see the light of day, and led to valuable discussions of present problems and future needs. It also pointed up the fact that no longer can hydrographers be content with merely measuring temperatures and salinities but in conjunction with their biological collegues they should also be measuring water movements, both large and small scale, the nature and intensity of light at different times and places, and investigating their effects, along with more chemical aspects of the environment.

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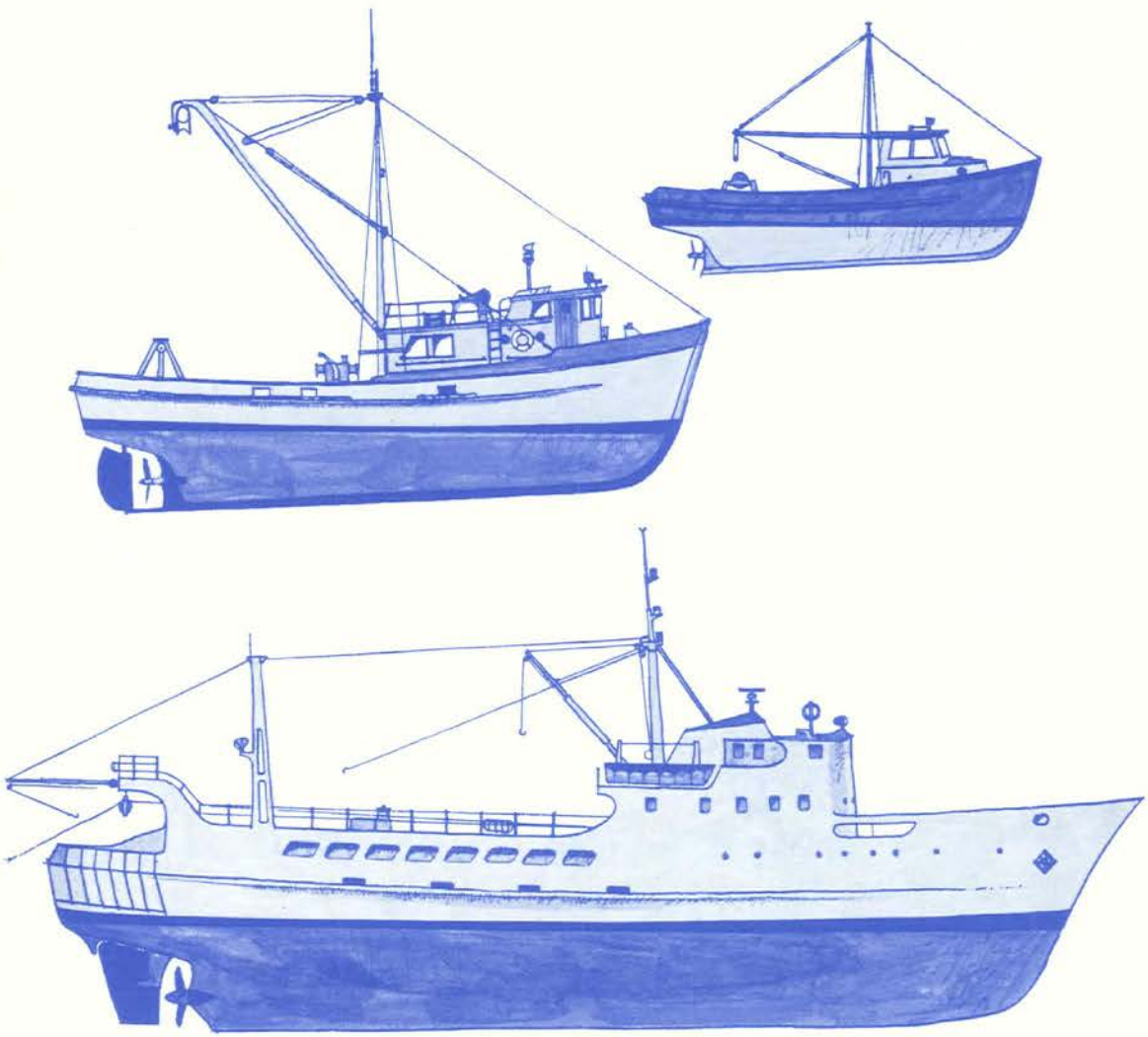

DEPARTMENT OF FISHERIES
Hon. H. J. Robichaud, M.P., Minister
Dr. A. W. H. Needler, Deputy Minister
Ottawa, Canada

ROGER DUHAMEL, F.R.S.C., Queen's Printer and Controller of Stationery, Ottawa, 1966

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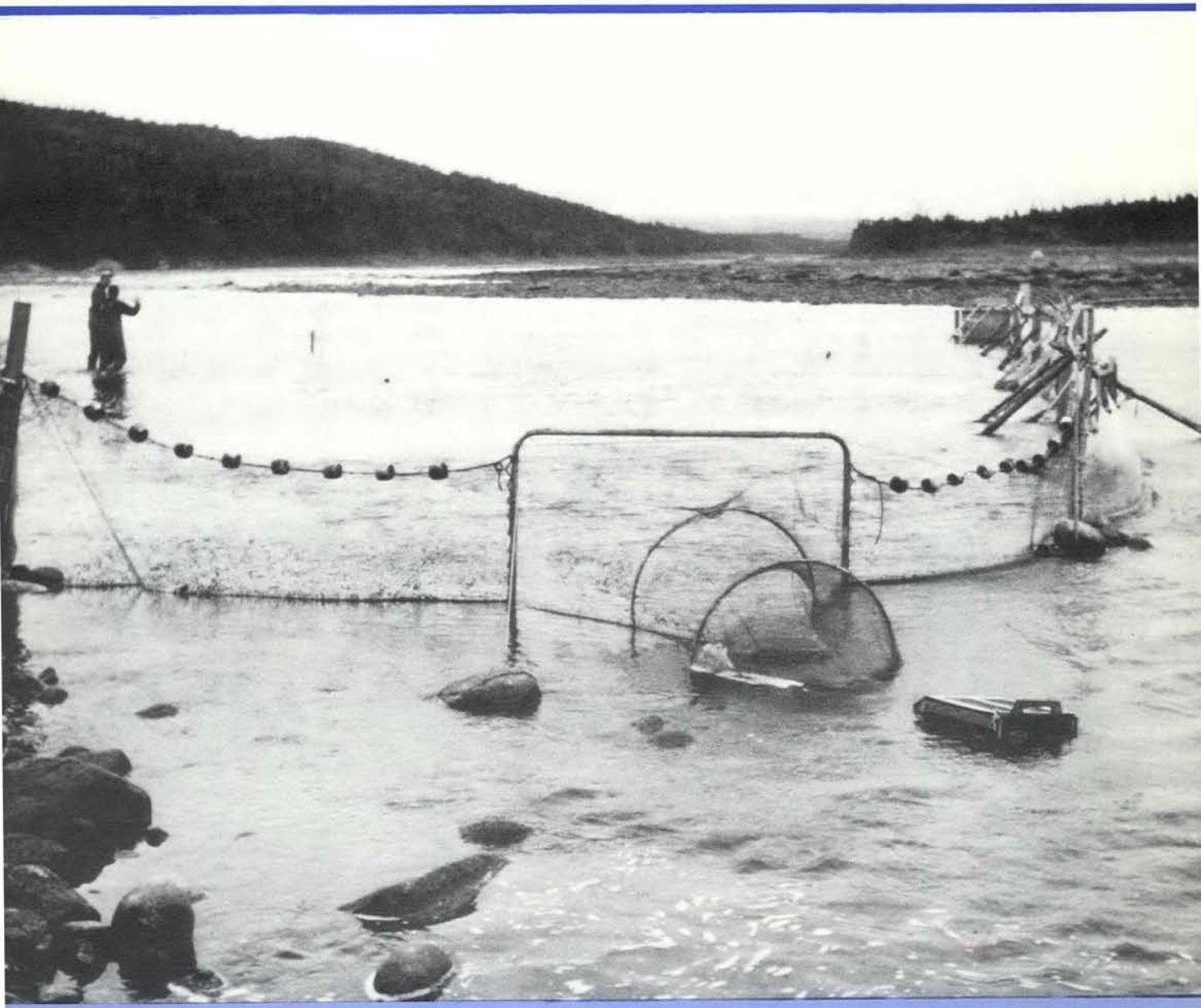

In This Issue

- Report on Atlantic Salmon and 'Trout
- Reaction of Fish to Otter Trawls
- Latest Fisheries Research Vessel Named

Department of Fisheries of Canada, Ottawa

FISHERIES
OF CANADA
(formerly Trade News)

Editor
E. H. HEARNDEN

Vol. 19 No. 5 November, 1966

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COVER PHOTOGRAPH - Salmon smolt and adult counting fence operated by the Resource Development Service of the Department of Fisheries at Long Harbour River, Fortune Bay, Nfld.

Investigation and Management of Atlantic Salmon and Trout

IT HAS BECOME customary in recent years to publish annually a summary of some of the principal advances in research and management in relation to Atlantic salmon and trout in eastern Canada. These summaries have dealt principally with the research work of the Fisheries Research Board based on its Biological Stations at St. Andrews, N.B. and St. John's, Nfld., and on the management activities of the Department of Fisheries based on their Regional Offices in Halifax, N.S., and St. John's, Nfld. These activities have continued to be co-ordinated through the Program Working Party on Atlantic Anadromous Fish. This Working Party which consists of senior members of the staffs engaged on salmon work at the Research Board's Stations at St. Andrews, N.B. and St. John's, Nfld., and at the Regional Offices of the Department of Fisheries at Halifax, N.S., and St. John's, Nfld., met at St. Andrews, N.B., on March 2-3, 1966. At this meeting the members of the Working Party had the assistance of representatives of most of the Provincial Fisheries Departments concerned and of a number of the scientific officers of the Board and Department in the area.

Part I of this summary deals with research and is based on investigations by Messrs. K.R. Allen, A.A. Blair, P.F. Elson, A.R. Murray, J.W. Saunders, R.L. Saunders, M.W. Smith, J.B. Sprague and P.E.K. Symons of the Biological Stations of the Research Board at St. Andrews and St. John's.

Part II deals with the management program and was assembled by the Department of Fisheries, Ottawa, from reports submitted by the Department's regional headquarters in St. John's, Nfld., and Halifax, N.S. The Regional chiefs of the Resource Development Branches, V.R. Taylor and J.P. Parkinson (acting chief), and their staffs were responsible for conducting the field programs and preparing the reviews appearing in Part II.

As in previous summaries, an outline of the typical life history of Atlantic salmon and brook trout is given as an aid to readers.

Adult salmon spawn in the autumn, burying their eggs wherever suitable gravel occurs between head of tide and the uppermost reaches of rivers. In spring the young emerge from the gravel as fry and are called underyearlings during their first year. Older young salmon are called parr. The young fish usually stay in the river for two to four years but sometimes longer, after which they migrate to sea in spring as silvery smolts after growing to a length of usually five to six inches. The adults may return to fresh water as grilse weighing up to six pounds after one winter at sea, or as larger salmon weighing about eight pounds or more after an additional year or longer at sea. Some adults enter fresh water in the spring, others do not enter until autumn, but all spawn in October or later. Only a small fraction, usually under 10%, of fish that have spawned once survive to return and spawn again. In the Maritime provinces salmon commonly complete a cycle in four to six years, but there is considerable variation among different areas.

The brook trout, like the Atlantic salmon, spawns in the autumn. The eggs are buried in gravel, usually in streams but on occasion in shallow gravel areas of lakes. The young emerge from the gravel in early spring. During their first year of life, the young are referred to as underyearlings (age 0), and during their second year as yearlings (age 1). Few brook trout live beyond age 4.

PART 1 --

The Research Program

Summary of 1965-66 Reports

RESEARCH IN MARITIME PROVINCES

Fisheries Research Board of Canada, Biological Station, St. Andrews, N.B.

RESEARCH has continued to be concerned mainly with the maintenance and development of Atlantic salmon and brook trout stocks. Projects have been concentrated on various aspects of the freshwater life and on physiological studies of some of the problems associated with the transfer from a freshwater to a marine environment.

During the year the work of maintaining a continuing watch on the effect of forest spraying on salmon stocks in the Maritimes was transferred from the Research Board to the Fisheries Department. This has allowed the Board staff to concentrate to a somewhat greater extent on the more fundamental problems determining salmon production and management and to follow the policy which prevailed before widespread forest spraying was begun.

The continuation of the Greenland fishery for Atlantic salmon at a high level has emphasized the need for a thorough study of its effect on Canadian salmon stocks and catches. Preparations have therefore been made during the year to develop new research projects aimed at dealing with these problems.

SALMON STOCKS AND CATCHES

The generally increasing trend of salmon catches in the Maritimes area which has been apparent in the last few years has continued in both commercial and angling catches as is shown in Table I. The catch for Northumberland County, N. B. is of particular interest to the Board's studies since a large proportion of these fish are drawn from the Miramichi River where research on the salmon population has been in progress for many years.

In the Miramichi system itself, the angling catch was well maintained in 1965 (Table II). In this system there has been in recent years a steady increase in the proportion of grilse in the catch and correspondingly a decrease in the average size of fish caught. On the Northwest Miramichi River where the Board maintains a counting fence at Curventon, this change in the composition of the run has been shown in a steady decline in the number of large salmon returning to the river (Table III).

Table 1. Angling and commercial catches in in the Maritimes area in pounds.

	Commercial Catch		Angling Catch
	Total Maritimes	Northumberland County	Maritimes
1962	1,029,000	364,000	211,000
1963	1,010,000	375,000	371,500
1964	1,310,000	627,600	296,900
1965	1,567,000	635,900	325,000

Table II. Angling catches in the Miramichi River system.

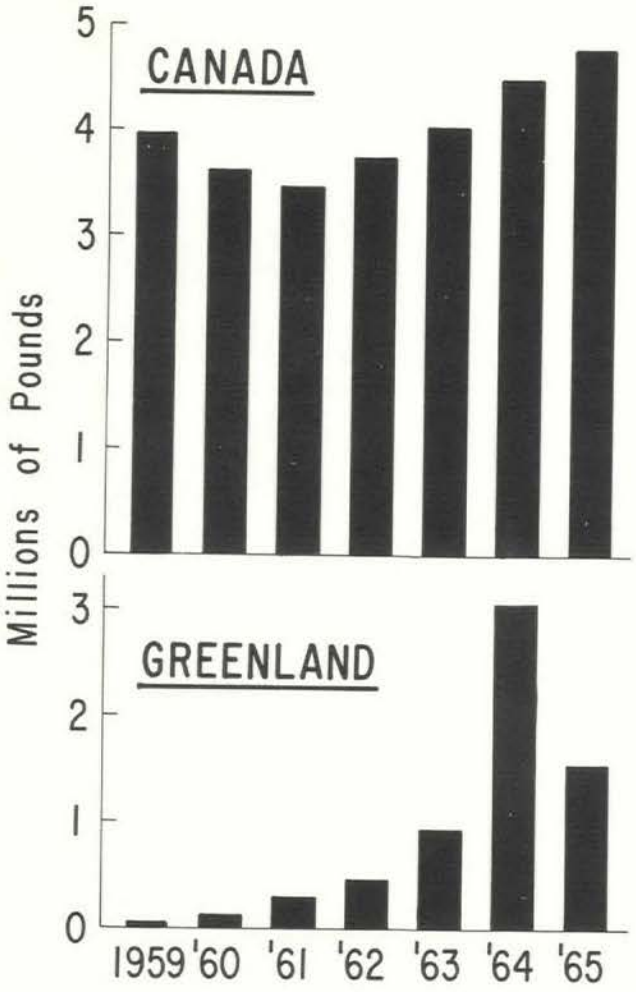
	Number of fish	Average weight (lb)	Catch per rod-day	% grilse
1962	19,784	5.68	0.4	72
1963	58,182	4.56	1.2	88
1964	40,352	4.37	0.6	-
1965	50,328	4.00	0.8	92

Table III. Catches in the Curventon counting fence, Northwest Miramichi River.

	Grilse	Large salmon	% grilse
1962	2285	224	91
1963	6088	309	95
1964	5127	146	97
1965	1689	120	93

Greenland salmon fishery

The fishery for Atlantic salmon on the Greenland coast which developed about 1959 continued at a high level in 1965, although the catch of about 700 tons was only about half that of 1964 (Figure 1). Twelve more captures of salmon tagged in Canada



Comparison of annual commercial catches of Atlantic salmon in Canada and in Greenland for 1959 to 1965.

were reported from Greenland, bringing the total to 32. Of these, 9 were caught in 1965. In addition, over 50 salmon tagged in Europe have now been recaptured in Greenland, as well as 2 tagged in Maine, U.S.A.

Most of the fish caught in Greenland are in their second sea year, and those of Canadian origin would, if not caught in Greenland, be most likely to be taken as two- or three-sea-year salmon in the commercial fishery here in the following years. The large Maritimes commercial catch of 1965 is therefore drawn at least in part from the same group of fish which yielded the record Greenland catch in 1964. It does not appear therefore that up to the present the Greenland fishery is having any disastrous effect on Canadian catches, at least in the Maritimes area.

The International Council for the Exploration of the Sea and the International Council for the Northwest Atlantic Fisheries have set up a joint scientific Working Party to pool information and coordinate research programs on the effects of the Greenland fishery. Canadian scientists will be taking an active part in the work of this group.

A scientist from the St. Andrews Station of the Research Board, Dr. R.L. Saunders, paid a brief visit to the Greenland fishery in 1965 to obtain first-hand information. This will prove of great value in planning further work which it is hoped to undertake in the area.

Biology of Miramichi smolts

Detailed studies were made of the size and age distribution of the smolts during the progress of the Miramichi run. These showed that the largest smolts occurred at the beginning and end of the run, although all those descending after early June had already made some growth in that summer. The proportion of three-year-olds was nearly 88%, most of the remainder being two-year-olds. This is in striking contrast with 1962 when nearly half the run were two-year-olds. About two-thirds of the run were females and there was a slight tendency for these to run earlier than the males.

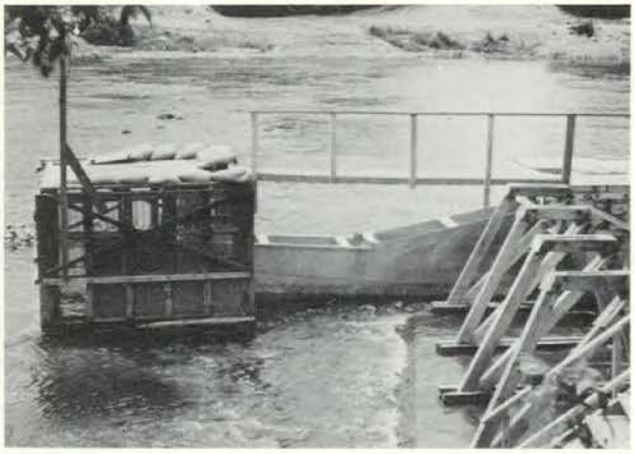
Estuarial planting of trout and salmon

The results of experiments to assess the possible advantages of planting trout and salmon in estuaries rather than up stream are now becoming available. Experimental plantings of trout were made on Prince Edward Island in 1961-64. At Ellerslie Brook, returns from estuarial planting of fingerlings ranged from 6% to 28% while upstream plantings in the same year ranged from 2% to 6%. Thus the estuarine plantings showed better returns although the proportion of fish running upstream and entering the fishery seemed to depend greatly on the size of the spring run-off. At Cains Brook no clear-cut difference in the returns from estuarine and stream plantings was obtained.

Similar experiments have been started with Atlantic salmon in the Miramichi, N.B., and the Margaree, N.S.

Late-run versus early-run

Further results became available in 1965 from some of the experiments designed to find out the effect of parentage on the time of return of salmon. In these experiments batches of 1000 smolts each, derived from early-run Miramichi grilse and from late-run Miramichi salmon, and reared in hatcheries, were liberated in the Margaree and Miramichi in 1963 and in the Margaree and Big Salmon Rivers in 1964. Of the fish of early-run parentage which have been recaptured, 92% were caught either



An improved smolt trap on the Miramichi River; screens in the bottom of the flume from the fence to the trap divert most of the water and prevent damage to the smolts from excessive turbulence.

at the counting fence or in the fishery before the end of July. In contrast, of the fish of late-run parentage only 45% were recaptured before the end of July and a significant number entered the counting fence as late as October.

A similar experiment was attempted using smolts of Bay of Chaleur parentage and reputedly of large late-run stock. These, unfortunately, gave a comparatively poor return but they tended to be relatively late running.

For the fish of early-run parentage, about one-third of those known to have returned were caught in commercial fisheries in the sea on their way to the rivers. For fish of late-run parentage, the proportion caught in the sea was much higher (59%).

The results of these experiments have also tended to confirm previous conclusions that higher returns are obtained from large smolts than from small smolts. Further experiments using batches of smolts of known parentage were begun in 1965, and should yield valuable results in coming years as the adult fish return.

Effect of salinity on young salmon

Smolts were again raised in water of differing salinities, batches being kept in fresh water and 7, 15, 22 and 30-32‰. All groups survived satisfactorily but certain differences in growth rate emerged. All groups grew equally well until about July 8 when the temperature rose to about 16°C (61°F). From then till September 23 the freshwater group grew more rapidly than the fish in salt water. During most of this time the temperature was 16-18°C (61-64°F). After September 23 the fish in salt water again grew as fast or faster than those in fresh water and the temperature remained below 16°C. These results seem to indicate that the critical temperature above which the growth of salmon is adversely affected is rather lower when fish are in salt water than when they are in fresh water.

Somewhat similar changes occurred in the amount of food consumed by the fish. This decreased for the fish in salt water when the temperature rose above 15°C (59°F), while for fish in fresh water it did not decrease till the temperature rose above 17°C (63°F), and then to a lesser extent.

Fairly low oxygen levels (4-5 ppm) occurred at times during these experiments but seemed to have much less effect on growth than did the high temperatures.

In similar experiments with salmon fry, batches were held in fresh water and in water of 6‰ and 12‰ salinity. In fish at this stage, evidence was again found that salinity affected the rate of survival, this being significantly better in the saline water than in the fresh water.

In the growth observations there appeared to be some tendency for the fish in more saline water to grow better than those in fresh water.

Herring as a hatchery diet

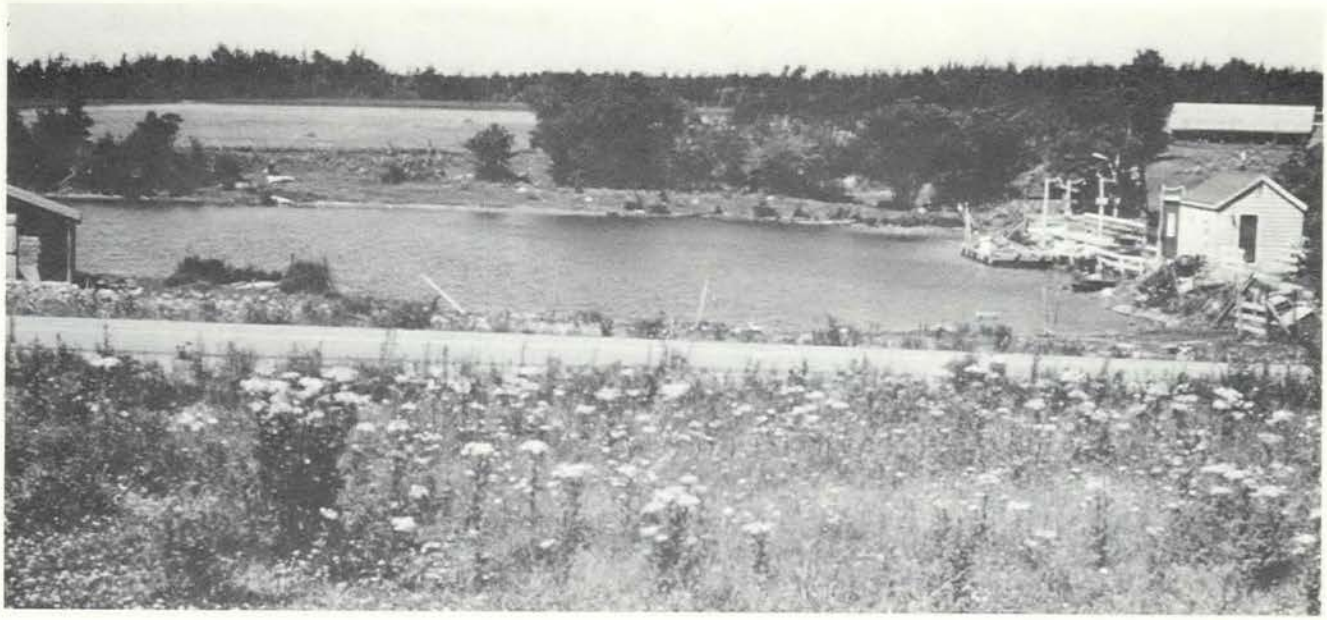
Further work has confirmed the 1964 observation that the prolonged inclusion of herring in the diet of salmon causes considerable mortality. This is probably due to the high content of thiaminase which breaks down vitamin B_1 during digestion.

In the smolt experiments referred to above, one additional group of fish in water of salinity of 7‰ was fed on a diet containing 42.5% herring while all others were fed the same diet except that it contained 42.5% cod instead of herring. The herring-fed fish survived and grew as well as the others from April till September but they then became sick and eventually died.

In the fry experiments the alternative diets were liver only and liver and herring. Both diets were fed to fish in fresh water and water of 6‰ and 12‰ salinity. The experiments were begun in August and the difference in diet produced no effect till late October. From then till January when the experiments were discontinued, the liver-fed fish continued to survive and grow well but the herring-fed fish showed poorer growth and had many more fatalities.

Merganser control and salmon production

Further observations in 1965 on the numbers of young salmon in the Margaree River have supported the conclusion that the rate of survival has



The pond at the mouth of Ellerslie Brook, P.E.I., construction of which in 1952 caused great changes in the behaviour of the trout in the brook.

increased since merganser control was begun there in 1962.

Smolts liberated in 1963 and 1964, after control was in operation, have also given a higher rate of return as adult fish than smolts liberated in 1961 and 1962, prior to merganser control. There has not yet been time for sufficient evidence to accumlate regarding any effect for improved survival of naturally-produced young salmon may have on angling and commercial catches.

Effect of stream modification on brook trout yields

These experiments are being carried out in Ellerslie Brook, P.E.I. The initial modification was the construction of a pond at the mouth of the stream in 1952. Accumulation of fish in this pond where they can be exposed to heavy angling has led to the gradual disappearance of sea-run fish. Before construction of the pond there was an average seaward movement of 1,800 fish and a return of 800 fish but these have now declined to negligible numbers.

In the first few years after construction of the pond, large catches were obtained from it but by 1961 these had declined to about half the original level.

In 1961 the lowest one mile of the stream was improved by the installation of low dams and other structures. This has led to a substantial increase in the angling yield from the stream itself which has about doubled since improvement. The total catch of fish from the Ellerslie Brook system is now approximately the same as in the years immediately before construction of the pond.

Pollution

Observations have been continued on the pollution from a base metal mine entering the lower part of the Northwest Miramichi River. Pollution here is of particular importance to the Research Board since, in addition to its adverse effect on the salmon stock, it complicates the interpretation of the results of the experimental studies which have been carried out on this river for a considerable number of years.

The estuary of Ellerslie Brook; anglers now catch many fewer trout in this area than they did before construction of the pond.

The main poisonous elements involved are copper and zinc and a means has now been developed of expressing their combined effect as "toxic unit," a value of 1.0 toxic units being just lethal for fish at summer temperatures. The results of previous studies have now been converted to these units and the monthly averages are shown in Table IV. It is apparent that the overall conditions in 1965 were little if any better than in preceding years. It should be realized that a monthly average of 1.0 as occurred in April 1965 implies that for some part of the month, toxic levels considerably higher than this occurred and must have caused mortality in the fish. In other months having high average levels, lethal conditions probably existed for limited periods. Under winter conditions, toxic levels rather less than 1.0 would probably be generally lethal.

Table IV. Monthly averages of toxic units for mining pollution of the Northwest Miramichi River at Curventon. A value of 1.0 toxic units is just lethal for fish at summer temperature.

	1960	1961	1962	1963	1964	1965	All years
Jan.	-	.20	.77	.85	.54	.82	.73
Feb.	-	.39	.53	.70	.48	.69	.59
Mar.	-	.31	.63	.44	.59	.82	.61
Apr.	-	.36	.59	.95	.82	1.0	.78
May	-	.36	.74	1.2	1.0	.57	.85
June	.88	.40	.33	.54	.43	.32	.41
July	.63	.14	.44	.38	.24	.28	.31
Aug.	.22	.11	.56	.61	.29	.42	.39
Sept.	.50	.14	.37	.81	.32	.34	.40
Oct.	1.8	.28	.26	.52	.45	.53	.46
Nov.	1.0	.25	.49	.74	.63	.62	.54
Dec.	.41	.30	.57	.57	1.2	.44	.61
Year	.77	.24	.49	.67	.54	.51	.51

Tests have been made of the toxicity of the insecticide Phosphamidon which is now being used in areas adjacent to streams in spraying for spruce budworm control. The lethal threshold for a one-hour exposure was found to be about 220 milligrams per litre. This is much higher than the concentrations of about 0.1 milligram per litre which might be expected in streams following aerial spraying operations. Compared with such insecticides as DDT, therefore, this insecticide is, under usual operating conditions, relatively safe "from the point of view of damage to young salmon."

Research in Newfoundland

FISHERIES RESEARCH BOARD OF CANADA,
BIOLOGICAL STATION, ST. JOHN'S, NFLD.

Atlantic salmon of the Little Codroy River

The purpose of this work was to study the life history of Atlantic salmon in a small river and to measure the populations at various stages of the life cycle. The most important aspect was the study of the survival of the smolts and the utilization of the adults. Each spring the seaward migrating smolts were distinctively finclipped. About 1.4% were estimated to have been taken by the commercial fishery in Newfoundland and Labrador and about 0.8% survived to return to Little Codroy River.

Another aspect of the program was the tagging of the seaward migrating spent salmon to follow their movements in the sea. About 5% of them were captured by the commercial fishery. Most were taken along the west coast of the island of Newfoundland. One was caught on the west coast of Greenland just north of the Arctic Circle in November 1961.

Two other aspects concerned the smolts and the parr. The smolt runs varied between approximately 7,000 and 15,000. This suggests that between 0.9 and 1.7 smolts were produced from every 100 square yards of stream. The larger runs had heavier smolts. Information on the number and distribution of parr was collected by means of electrofishing on a catch per effort basis. Estimates averaged about 15 parr per 100 square yards of stream bottom.

Introduction of pink salmon to Newfoundland

A third transfer consisting of 3.4 million eggs was obtained from Lakelse River, B. C., and planted in a prepared channel in North Harbour River, St. Mary's Bay. About 2.9 million fry (83%) were estimated to pass through the counting fence at the channel. The fry left the river about the beginning of June and were observed in the sea for some time afterwards, the last observation being on July 13 about 30 miles from the mouth of the river.

The Management Program

Biological Section's Annual Summary

PART 2 --

SALMON INVESTIGATIONS

CONSTRUCTION of the Mactaquac power development project on the St. John River reached the active stage in 1965. Branch personnel maintained a close liaison with the New Brunswick Electric Power Commission in their efforts to provide adequate facilities to safeguard the salmon run to the St. John River. With the completion of the project in 1967, a management program designed to replace lost salmon production from the river above Mactaquac will be phased into operation. Work continued in 1965 to determine the timing and distribution of the salmon run to the system.

A total of 2,829 salmon and grilse were tagged and released in the lower St. John River, 761 were obtained from the commercially operated weirs in the harbour and the remaining 2,068 fish were tagged about ten miles above the harbour at Westfield. During the year there was a total of 740 tag returns from this tagging operation. The large number of tagged harbour fish checked through the Beechwood fish facilities, indicates the important contribution of this upper river to the commercial fishery. Elapsed time for tagged salmon to travel from the St. John harbour to Beechwood varied from 15 to 142 days with the majority covering the distance in three to six weeks.

Salmon runs through the Kennebecasis and Salmon River fences were relatively small and these runs did not enter the rivers until late in the season. Tag recoveries at both fences were mostly from the Westfield tagging site, indicating that late run fish utilize these streams and contribute relatively little to the commercial fishery. A similar pattern was observed on some of the smaller tributary streams above Mactaquac.

Commercial salmon catch in the St. John Harbour and Bay of Fundy was at a record level. Salmon were plentiful in the upriver angling area but angling was poor because of extremely low summer water levels.

To study genetic influence on seasonal return of adult salmon, tagged hatchery-reared smolts from both early and late run stocks have been released annually at Big Salmon River since 1959. Observations on the time these fish return to fresh water at Big Salmon River commenced in 1960 and continued up to the present. Tagged adult returns from the early run stock have been so low that no conclusions regarding the effect of heredity on the time of return of the progeny can be made. Tagged returns from the late run stock, although low, showed a pattern for entry during September and October, thus indicating that heredity plays a part on the time of entry to the river of this late run stock.

A carlin-type tag is attached to an Atlantic salmon during tagging operations on the St. John River near Westfield, N.B.

Salmon brood stock collected in the Bay of Chaleur are captured during the spring in salt water, and the time of entry of these fish to freshwater is not known. To determine if the progeny of these fish moved into freshwater early in the season, tagged hatchery reared smolts of this stock origin were planted in River Philip in 1964, and the time of return of the tagged grilse was checked in 1965. The returning tagged grilse exhibited timing characteristics similar to the pattern found in the Miramichi and Restigouche rivers where the greater portion of grilse run enters freshwater during the panded in 1966 and a start will be made on collecting

summer followed by a smaller run in the fall. Observation on the timing of returns of two-sea-year fish will be made in 1966.

Pollution

Studies on Atlantic salmon juveniles in streams of the 1965 New Brunswick forest spray area indicated that about one half of the fry were killed while parr were not seriously affected. Fish mortality, under the present system of spraying where Phosphamidon is sprayed along rivers instead of DDT, has been reduced to less than 50 percent of the level observed when DDT was sprayed directly over streams. No extensive fall mortality was observed in 1965, but survival of 1964 yearling parr to 1965 two-year parr was found to be about 10 percent indicating the severity of the 1964 fall mortality.

Agriculture crop sprays continue to cause fish kills particularly in the potato growing areas of New Brunswick and Prince Edward Island. Speckled trout populations of the streams which flow through these farming areas are the most seriously depleted species. A loss of part of the stock at Florenceville Fish Culture Station was attributed to agricultural spray poisoning.

Mine wastes caused mortality to caged salmon parr in the Tomogonops River below Heath Steele Mine and in the Little River below Brunswick Mine. No mortality occurred to caged parr in the Nipisiguit below the Wedge Mine. Opening of new mines in the area may bring more pollution problems, particullarly on the Upsalquitch-Restigouche drainage area. The problem of freshwater supply and waste disposal for the steel-chemical-fertilizer complex at Belledune is currently being studied.

Pulp mill developments at Miramichi River, N.B., Saint Croix River, N.B. and New Glasgow, N.S. have created new mill waste disposal problems. Fraser Companies have conducted a series of bio-assay tests in co-operation with Department of Fisheries and Fisheries Research Board to study the effect of mill effluent on young salmon. Caged fish tests at the St. Croix River below the Georgia Pacific Sulphite Mill resulted in young salmon dying within a few minutes of being placed in the water. Dissolved oxygen concentration was almost zero in the river during these tests in July. Wastes from the new kraft mill will have to be treated to prevent this situation from recurring. Effluent from the Scott Mill at New Glasgow, N.S. will probably be treated in the Boat Harbour Lagoon.

Waste water from the new Deuterium of Canada heavy water plant at Glace Bay, N.S. will be discharged into Big Glace Bay Lake. Controlled release of chlorine and hydrogen sulphide in the effluent, along with tidal exchange are expected to prevent fish mortality.

Trout Investigations

Lakes and streams in the provinces of Nova Scotia and New Brunswick are found mainly in ingenous rock formations where waters are soft and basic productivity is low. In addition to this, spawning conditions for trout in these waters are frequently lacking and often conditions favour the production of the so-called coarse or unwanted species of fish such as perch and pickerel. Under such conditions the task of meeting the demands of an annually increasing angling public becomes more difficult every year.

In 1965 the Resource Development Branch started a new program of trout development which will result in more efficient use of artificially raised trout stocks in selected environments. The object is to provide more trout in the anglers' creels. Initially the program plans to manage selected lakes in areas of high angling pressures. Four lake surveys carried out in western Nova Scotia during 1965 gave both valuable experience and data. These four surveys provided information on the lakes' morphometry, water chemistry, temperature, fish populations, trout spawning grounds, and the fate of hatchery planted trout in these lakes.

Resource Development

One of the first projects undertaken in the development field is the rehabilitation of East River Sheet Harbour, Halifax County, Nova Scotia. On this river three main stem dams block upriver salmon migration. It is planned to collect adult fish below the lowermost dam and transport them by tank truck to the upper reaches. Downstream migrating smolts will be protected by louver deflector screens installed in the power canals. Initial smolt production will come from hatchery-produced stock and from natural spawning of transplanted adult stock from an adjacent donor stream.

Stream Surveys

Inspections and short-term surveys were made on the following rivers during 1965 in order to check on obstruction or the results of remedial work carried out by the Service in 1964: (1) MacAskill Brook, Cape Breton Co., N.S.; (2) Avon River, Hants Co., N.S.; (3) Shepody River, Albert Co., N.B.; and (4) Big Salmon River, Saint John Co., N.B. A brief survey was conducted on Salmon River, Guysborough Co., N.S., to determine the feasibility of initiating any development work.

Preliminary work was started on a stream inventory system for the Maritimes Region. This has involved a cataloguing of information gathered from departmental files and river survey reports, and in 1965 this phase was completed for all river systems in Nova Scotia. This project will be ex-

current physical and biological data on waters in the Maritimes Region.

Fish Culture Stations, 1965

Production

Sixteen fish culture stations were in operation in 1965, and produced a total of 23,610,000 fish of all species for distribution. This figure represents a decrease of one and one-half-million fish from 1964; but total weight of fish produced rose to 204,000 pounds--an increase of 12%. The increase in weight indicates the trend to greater salmon smolt production, and to distribution of larger fish. Below normal water conditions posed a major problem during 1965.

Total egg collections for all species in 1965 were slightly less than 44½ million--a decrease of 10% from 1964. Transfers of eggs were made to the New England States, Jasper National Park in Alberta and New South Wales, Australia. Landlocked salmon eggs (eyed) were received from the State of Maine. Experimental breeding of hybrids was continued at Lindloff station where a cross between rainbow and brown trout was attempted.

Experimental stocking of tagged speckled trout was done in Prince Edward Island waters, with satisfactory results. This project will be continued in 1966, and a creel census will be made.

In 1965, live fish were supplied for research programs in the Maritime Provinces, central Canada, and the State of Maine.

Public interest in activities at the fish culture stations is increasing each year. Last year more than 4,000 visitors signed the guest book at Kejimkujik station. Live fish displays at sportsmen's shows in the Maritime Provinces received the greatest attention.

Feeding Experiments

Dry food experiments were conducted in eight fish culture stations during 1965, and 160,000 pounds of dry food were fed to 560,000 young fish. Three species--Atlantic salmon, brown trout and speckled trout were involved in the test. This is the first time that a completely dry diet has been fed to young salmon in the area. Results of the dry feed test were varied, ranging from poor to highly encouraging. The benefits of low food cost, elimination of equipment, reduced labour costs and generally greater efficiency justify continuing dry feed tests in 1966.

Feeding tests were made, using cod napes and Newfoundland capelin for feeding speckled trout. Results indicate that continued use of cod napes is satisfactory only when certain supplements are added. The benefit of feeding capelin will be determined in 1966, when the experiment has been completed.

Facilities

Maintenance and repairs to the fish culture stations were carried out by the Engineering Section. Two projects which were undertaken will be completed in 1966--a summer holding pond for parent salmon on the Miramichi station, and a new type of salmon smolt rearing facility at Margaree station. If the latter installation is successful, the technique will be recommended for the Mactaquac power development project.

Newer types of equipment are being tested, in order to reduce production costs. In 1965, three types of dry-feed pond feeders were tested at St. John station, and five types of dry-feed dispensers for use on troughs were under test at Cobequid station. Jar culture and stacked egg tray incubators are being tested at Kejimkujik and St. John stations respectively. The problem of transporting live fish in cold weather may be overcome when a compressed air unit is used to aerate the water. This unit is now being perfected. The value of using anti-fouling paint to simplify the cleaning of ponds has been proved and this paint will be used in all fish culture stations.

Engineering

MARITIMES REGION

The rapid industrial expansion experienced in the Region during the past year, with the ever-increasing demand for usable fresh water, has created several industrial water intake screening problems. Negotiations were concluded for acceptable intake works for the Fraser Companies expansion program at Newcastle, N.B., and negotiations are nearing completion for the protective water intake works in the Jacquet River for the industrial complex at Belledune Point, N.B.

The problems associated with the Mactaquac development are of concern to the Branch and have accounted for a large portion of staff effort during 1965. Actual construction commenced during the year and liaison was maintained with the New Brunswick Electric Power Commission and their consultants with respect to the design of adequate fish facilities to maintain the salmon runs to the St. John River. Functional layouts were provided for the temporary and permanent facilities including tentative designs for the proposed smolt rearing station.

Considerable staff effort was directed towards the East River Sheet Harbour rehabilitation program and related problems. Due to the construction of hydro plants and numerous storage dams over the past number of years, the anadromous species of fish have been virtually eliminated in this river system. Engineering surveys, paralleling the biol-

ogical surveys, were conducted to acquire information to determine the best solution to the existing problems of re-establishing the runs of anadromous fish to the East River.

The rehabilitation program of the East River calls for a barrier structure immediately above Ruth Falls power house, the lowermost hydro plant, to prevent anadromous fish from entering the river section below the dam and being trapped during low water, and the construction of a mechanical trapping-and-trucking works to capture and transport adult fish to spawning and nursery grounds in the upper sections of the system. To provide protection for downstream migrants, a louver deflector system of the type developed on the West Coast is proposed in the Ruth Falls power canal to deflect fish back into the main river and thus protect them from any possible turbine mutilation and mortality. This louver installation will be the first practical installation of its kind in Canada.

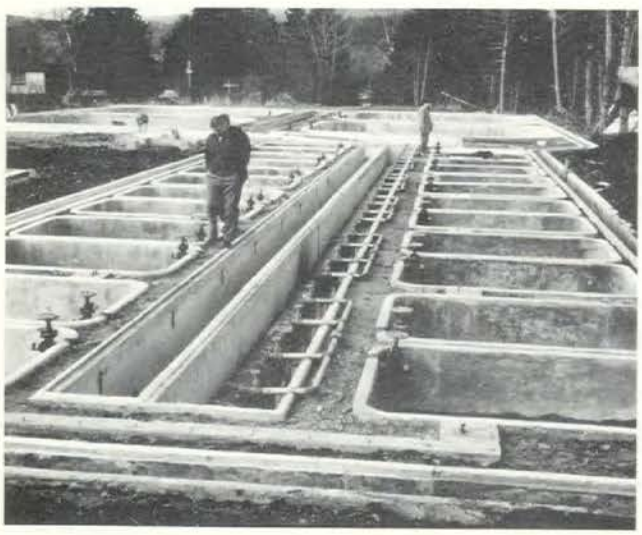
Utilizing departmental forces, the first phase of the rehabilitation program, the construction of the barrier dam at Ruth Falls, was virtually completed during the year. Installation of steel barrier racks is to take place prior to the 1966 runs. Reconnaissance surveys were made to evaluate necessity and feasibility of constructing storage facilities on the upper reaches of the Fifteen Mile Stream to provide adequate operational flow for the louver system and limited flow control to certain spawning and nursery areas.

One of the major contracts let during the year was for the construction of a modified Swedish-type hatchery at the Margaree station. Although the contract entailed intake works, supply lines, pond system and buildings, the main concern was the operational features of the ponds, piping and automatic feeding. The Margaree installation will be evaluated and recommended with improvements for construction at the Mactaquac project.

The mechanical equipment necessary to effectively demonstrate the capabilities of this arrangement is to be installed early in 1966. Evaluation of the installation and equipment will follow with suitable recommendations being made in time for the construction of the Mactaquac smolt rearing station in 1967.

Active construction accounted for a large portion of engineering staff time during 1965. The larger undertakings in connection with the upkeep and improvement of departmental fish culture stations were let out to contract and entailed the construction of a salmon holding pond at Miramichi; construction of a new residence at Mersey; workshop and storage facilities at Ellerslie; heating installation at Grand Falls and Coldbrook; domestic water supply at Coldbrook and Cardigan; renewal of lower wall sections of the Antigonish sub-hatchery; reconstruction of thirteen long ponds and refacing the storage dam at Yarmouth. In cooperation with the federal Department of Public Works, construction got underway on a concrete seawall at Ellerslie to provide better protection of existing works from the sea.

Negotiations are continuing with the Nova Scotia Power Commission and their consultants regarding adequate fish facilities for the Middle River and Pictou Harbour causeway crossings. The former undertaking is in response to demands for adequate fresh water supply for the Scott Paper mill at Abercrombie Point, and the latter is an effort to



Pond arrangement built at Margaree Fish Culture Station, Cape Breton, to test a Swedish method of rearing Atlantic salmon.

A fishway on Bernard Brook in the Bay D'Espoir area of Newfoundland.

improve highway approach facilities in the immediate area of Pictou.

Negotiations are also underway regarding suitable fish facilities to be incorporated into the Petitcodiac River causeway at Moncton, N. B. This project is particularly interesting and difficult because of the magnitude of the tides at the site.

Discussions carried out in co-operative efforts with the Nova Scotia Power Commission resulted in a fishway being designed for the MacAskill Brook dam in Cape Breton. This dam is being constructed to fulfil the fresh water requirements for the heavy water plant at Glace Bay, N.S.

Other fish culture problems which were investigated and assessed included screening intake works for McCain's fresh water requirements, Florenceville, N.B., Newcastle Creek causeway, Minto, N.B.; Bartholomew River fishway, Blackville, N.B.; facilities developed for the purpose of transporting fish over Hargrove Dam, Bath, N.B., fishway requirements, Flemming and Gibson Company dam, Juniper, N.B.

For a number of years the Branch has been concerned with the lack of sufficient information about the major rivers in the Maritimes upon which to base decisions. During 1965, a physical survey was started on the Medway River, Queens County, N.S. Field data collected will provide information neccesary to accurately decide what advantages, if any, may be derived from any one of the several possible activities directed at improving fish habitat and fishing conditions on the stream.

In co-operation with the Department of Northern Affairs and National Resources staff, gauging stations were installed on the Gold River and St. Mary's River during the year. Information that will be collected from these installations will be invaluable in determining additional development possibilities of these two rivers.

NEWFOUNDLAND REGION

Exploits River Development Program

The Exploits is the largest river on the Island of Newfoundland. The system supports Atlantic salmon in tributaries below Grand Falls. The number of fish has, in the past, been depressed due to less than 20 per cent of the watershed being accessible. A proposed development program is directed toward establishing Atlantic salmon in the 1300 sq. miles between Grand Falls and Red Indian Lake. This development is to be given biological impetus by construction of spawning channels and adult transfers. If this proves successful, major remedial work will be carried out at several existing obstructions.

Major engineering investigations associated with this project were directed towards the design of fishways, a spawning channel at Noel Paul Brook, and other such work.

Pollution studies on the Exploits River system consisted of the analysis of mine wastes from Buchans mining operation and pulp and paper mill wastes from Grand Falls. Results indicate little doubt that wastes in the river may have an adverse effect on salmon populations during years of low flow and high temperatures. Also, results of water analysis from Red Indian Lake show concentrations of copper and zinc in certain areas to be at serious levels as far as fish life is concerned. The development program envisages control of all of these wastes to acceptable levels.

Little Rattling Brook Hydro Development Adult Salmon Transfer

In 1958, a hydro-electric development on Little Rattling Brook, a stream draining into Bay of Exploits, made it impossible for the Atlantic salmon population to maintain itself in that stream. After investigation, the Department decided to relocate the run in Great Rattling Brook. The transfer continued to 1965. An evaluation based on (1) Tagging data, (2) Redd counts, (3) Smolt migrations, (4) Numbers of adult salmon returning to the recipient stream (5) Marked smolts recovered as adults, and (6) Statistical analysis, suggests that the transfer was successful in relocating a run of fish in a stream not formerly utilized by salmon.

Indian River Spawning Channel

A controlled flow spawning channel was constructed in 1962 and 1963 on Upper Indian River to maintain an Atlantic salmon run which would otherwise be adversely affected by hydro-electric water diversion.

In 1963, 113 salmon entered the channel and spawned successfully, producing more than 45,000 fry - an egg-to-fry survival of 25%. In that year, survival was adversely affected by flood conditions resulting in widespread silting and subsequent egg mortality.

In 1964, 284 salmon spawned and produced about 168,000 fry - an egg-to-fry survival of 32.6%. Again silting, due this time to highway construction, resulted in a reduction of the expected survival rate.

In 1965,, 142 salmon entered the channel and deposited 268,000 eggs.

A program is now underway to obtain information on the movement and survival of fry together with determining the effect channel fry production may have on Indian River's salmon population.

Spawning area assessment, Indian River spawning channel, Newfoundland.

Pollution Investigations

Pollution problems during 1965 were many and varied. In addition to investigations on the effects of mining and pulp and paper mill operations on the Exploits River and Red Indian Lake, investigations were also conducted at Wabush Lake, Labrador; Rambler Watershed, Baie Verte; and Whalesback Pond Watershed, Little Bay, Notre Dame Bay. Investigations on two fish kills were made in the St. John's area. While the cause of one of the kills was not definitely determined, the other was attributed to oil pollution.

Discussions and negotiations continued with several industrial concerns to (a) in case of existing pollution, find ways of reducing or eliminating it, or (b) in case of new developments, prevent them from becoming problems.

Lake Investigations

Several projects undertaken by Memorial University of Newfoundland and Waterloo University in financial co-operation with the Department, were completed during 1965. These included: (1) a study of the parasites of freshwater fish throughout the province, and (2) a study of the landlocked salmon populations of the Gambo Lakes. Studies on aquatic plants, and brook trout populations, are continuing at Memorial University. Discussions are underway to implement further such co-operative projects during 1966.

A limited biological survey was carried out on Victoria Lake in South-central Newfoundland. Three species of game fish were collected: landlocked salmon, brook trout, and landlocked Arctic char. The oldest landlocked salmon collected was seven years old while the majority were in the 4 or 5 year classes. Arctic char were distributed in deeper water than the other species. Spawning grounds of landlocked salmon were located in one major tributary. Many larger landlocked salmon were found to be heavily infected with a parasitic nematode, *Philonema agubernaculum*.

A review of the distinguishing morphological characteristics of Newfoundland's landlocked Arctic char was completed. This study indicated that differences in coloration in different populations is probably a function of size rather than indicating basic intra-specific differences.

Hydro-electric and Industrial Development

Scheduled development of White Bear, Grey, and Salmon Rivers, necessitated biological surveys of these streams (part of the large Bay D'Espoir Power Project) on Newfoundland's South coast. White Bear and Grey Rivers were found to support significant runs of salmon and sea trout. Less than 100 adults were estimated to be using Salmon River. The Department's concern, in 1965, focused on Grey River, where damage to salmon stocks, without special provision made for them, could be disastrous in low water years. An agreement was

reached with the Newfoundland and Labrador Power Commission whereby the Commission will guarantee release of sufficient water at Pudop's Dam, Grey River, to maintain flow at not less than 600 cfs. at the confluence of Grey River and Salmon Brook, the last upstream spawning tributary.

In anticipation of Newfoundland's third paper mill, proposed to be located on the Come by Chance River, with additional water supply from Black River, North Harbour River was surveyed to determine the feasibility of developing it to compensate for loss of fish stocks from the other two rivers if this project becomes a reality.

River Reconnaissance

In addition to biological surveys of rivers scheduled for hydro-electric possible industrial development, reconnaissance surveys were also conducted on several other rivers in the South Newfoundland coast drainage. These were: Grandy's Brook, Northwest Arm River, Couteau Brook, Cinq Cerf Brook, and LaPoile River. Information from these, and other past and future surveys, will be used in constructing a stream catalogue for the Island of Newfoundland.

Engineering Construction and Surveys

A new adult-smolt counting fence to be used in the evaluation of the effectiveness of the spawning channel at Indian River was designed for a site on the lower reaches of Indian River.

A vertical slot, reinforced concrete fishway, which will open up approximately 200 sq. miles of watershed to Atlantic salmon, was completed over a falls on Torrent River.

Remedial work, in the form of rock removal and construction of notched weirs in the river channel, was carried out on North East Placentia River on the Avalon Peninsula.

A large tank for the transportion of live fish was designed by the Branch and constructed under tender. The tank will be capable of handling 70 to 100 fish depending on their size.

Investigations continued on the various facilities required in connection with the Exploits River Development Program. Design of fishways for Grand Falls, Exploits River, was continued. Design of a controlled flow spawning channel to be built on Noel Paul Brook, Exploits River, should be completed in early 1966. ✔

New Plant Opened *The new Imperial plant of British Columbia Packers Ltd., built at a cost of $4,000,000 at Steveston, B.C., was officially opened by Federal Fisheries Minister H.J. Robichaud on Sept. 20. Although fully equipped for the freezing and storage of salmon and halibut, the new plant has been built principally to process groundfish species such as cod, sole and ocean perch and the wide variety of partially prepared or fully cooked fish products now on the market. Shown watching a conveyor belt at the plant are, left to right, K.F. Fraser, President of B.C. Packers Ltd.; Hon. H.J. Robichaud; Hon. James Sinclair, a former Minister of Fisheries; and J.N. Hyland, Chairman of B.C. Packers Ltd.*

Christening Ceremony

Research Vessel Honours Dr. E.E. Prince

by Bruce Woodland

Canada's latest fisheries research vessel, the "E.E. Prince".

MEMORIES of fisheries research in its infancy and of the dedicated men who sparked this nation's interest in and support of the aquatic sciences were revived at the christening of Canada's latest ocean-going research vessel on September 17.

The *E.E. Prince*, honouring the first head of fisheries research in Canada, was named by Mrs. A.W.H. Needler, wife of the Deputy Minister of Fisheries for Canada. Dr. Needler was the principal speaker at the christening ceremony at Port Weller Dry Docks Limited, St. Catharines, Ont.

The Fisheries Research Board's newest vessel, specially designed and equipped for fisheries investigations on the high seas, will operate out of St. Andrews, New Brunswick. She will be commissioned and put in service soon.

Dr. Needler recalled that, as a student marine biologist, he was associated with Professor Prince at St. Andrews in 1924. At that time, he said, the fisheries of the Atlantic coast had depended upon primitive methods and sparse information. Research in biology and technology had altered the entire framework of the industry, and now makes it possible for Canada to maintain and improve its fisheries in the face of greatly expanded competition.

Dr. Needler described the new *E.E. Prince* as "a research instrument dedicated to imaginative investigations on which to base larger and more prosperous fisheries on the east coast". He noted that the *E.E. Prince* was the second Canadian deep-sea vessel to be built for marine research on the Atlantic. The C.G.S. *A.T. Cameron* already was serving to broaden and extend Canada's knowledge of the Atlantic and its resources. The *E.E. Prince* will be used primarily in investigations on the pelagic species such as herring, tuna and swordfish.

A DISTINGUISHED SCIENTIST

Dr. W.R. Martin, Assistant Chairman of the Fisheries Research Board, told the 400 guests at the christening ceremony that the ship honours a distinguished scientist and fisheries administrator, Professor Edward Ernest Prince.

Dr. Prince came to Canada from Scotland in 1893 to take the post of Dominion Commissioner and General Inspector of Fisheries. Already a recog-

The 'E.E. Prince' - Fishing Craft and Scientific Tool

Canada's newest fisheries research vessel, the *E.E. Prince*, is an impressive combination of fishing craft and scientific tool.

She is capable of stern trawling at various depths, scallop dragging and longlining, and she has shipboard laboratories. Specialized instrumentation for fish finding, weather and oceanographic observations and navigational aids complete the vessel as a modern instrument of fisheries research.

The vessel has many unique features among which is a flume stabilization system that gives the ship stability at sea. The stabilizer system will ensure that seamen and scientists will have an unusually steady platform, essential to many of the research operations at sea.

The *E.E. Prince* will operate on a year-round basis on the Atlantic coast, out of St. Andrews, N.B., and has a welded steel hull strengthened for navigation in ice; she has a maximum range of 3,000 miles at a cruising speed of 11 knots.

The new research vessel has an overall length of 130 feet. The superstructure is of aluminum and the vessel's appearance is enhanced by an extended forecastle, raked stem and reverse transom. Fish pounds and fishing equipment are located on the main deck aft which is wood sheathed. Specially designed hinged gallows have been installed for lowering and retrieving trawls.

Two hydraulic trawl winches, each capable of exerting a pull of four tons at 240 feet per minute have been fitted to operate in synchronization or independently. A separate winch has been installed to permit taking of oceanographic samples.

The propulsion machinery, located amidships, is a non-reversing direct drive diesel engine rated at 600 B.H.P., coupled to a four-bladed, controllable pitch propellor. Electric power is provided by three diesel-driven generators.

The steering gear is of the electro-hydraulic rotary vane type with emergency hand-hydraulic operation. Navigational aids include two radars, gyro compass, automatic pilot, Loran, Decca navigator and radio-telephones.

The most modern fish-finding equipment includes three echo sounders and a horizontal ranging device.

Initially, the *E.E. Prince* will carry out deep-sea programs involving the pelagic species such as herring, tuna and swordfish, but she is equipped to perform in many fields of marine research.

nized authority in marine biology, he had cherished the idea of establishing a fisheries research program in Canada. He won scientific and governmental support for this by 1898 when a "portable" laboratory was constructed for the Atlantic coast. This was based at fishing ports in New Brunswick, Nova Scotia, Prince Edward Island and Quebec before the first permanent biological station was located at St. Andrews in 1908. Dr. Prince continued as senior officer and member of fisheries research boards for a total of 38 years, a record of service that still stands.

Dr. Martin referred to the fact that the new research vessel was the second to be named in honour of Dr. Prince. In 1913, the Biological Station at St. Andrews purchased a 50-foot vessel which was called the *Edward E. Prince*. That vessel had served well in fisheries investigations stretching from the Strait of Belle Isle south to the Bay of Fundy.

Dr. Martin had the additional but pleasurable task of introducing the two daughters and grandson of Professor Prince. Mrs. John Barkley Mason and her son, Edward Prince Mason, of Toronto, and Mrs. Reginald C. Wilson of Ottawa were honoured guests at the christening.

Other speakers were Mayor Robert M. Johnston of St. Catharines, Robert S.K. Welch, M.P.P. for Lincoln County, and Jan Furst, Vice-President and General Manager of Port Weller Dry Docks Limited. ✔

Technical News

by James Kinloch

Scottish Seine Netter in Canada

Canadian Atlantic fishermen will see an unfamiliar vessel from time to time during the next twelve months as a conventional black hulled Scottish seine netter, the *Guiding Star*, moves from one Atlantic coast province to another to demonstrate her method of catching various species of fish.

The *Guiding Star*, a 70-foot wooden vessel powered by a 152 hp diesel engine, is shown in the accompanying photo just before leaving her home port of Aberdeen for the Atlantic crossing to Newfoundland. She is under a one-year charter to the Industrial Development Service of the federal Department of Fisheries to determine whether Scottish seine netting can be adopted profitably by the Canadian fishing industry, and also to engage in exploratory activity.

The skipper is Captain Alex Hay of Peterhead, Scotland. He and his Scottish crew of six will operate first from ports in Newfoundland and later will move to Nova Scotia, New Brunswick, Prince Edward Island and Quebec.

The *Guiding Star* will engage in full scale commercial fishing operations which will enable fisheries authorities to assess the potential of the Scottish seine netting technique in Canada.

The Scottish seine netter "Guiding Star" in her home port of Aberdeen.

The decision to charter the Scottish vessel and her crew was made following a survey carried out last year by experienced Scottish skippers, under contract to the federal Government, to determine the possibilities for the development in the Atlantic of Scottish-style seining. The decision to conduct a full-scale, year-long trial was made following an assessment of their findings.

Demonstration Vessel

The "Straight Shore" of Newfoundland - a section of the northeast coast extending from Cape Freels to Musgrave Harbour - and long a mecca for inshore fishermen, has been perpetuated in the naming and launching of a 37-foot demonstration fishing vessel.

Built for the Industrial Development Service of the federal Department of Fisheries, the *Straight Shore* is being fitted for snap-gear longlining and gill-netting with a powered drum. The combination vessel was designed by the well-known naval architect, William Reid, of Vancouver.

It is basically a British Columbia type vessel specifically adapted to East Coast fishing. The vessel will be able to haul gillnets over the stern or over the starboard side, as conditions dictate. She will also be fitted with a small combination trawl winch and be rigged with a modified Atlantic Western Trawl which was designed by W. W. Johnson of the Department of Fisheries, Ottawa.

The *Straight Shore*, built near the site of the Department's Valleyfield Experimental Fish Plant, will be utilized to demonstrate not only existing fishing methods, but any new methods within the scope of her capabilities.

Initially, the vessel will be operated by the Department from the Valleyfield plant, but will also travel to various areas of Newfoundland where she will demonstrate the advantage of mechanization to interested fishermen.

Specialists and high line fishermen under contract to the Department have been responsible for the various special installations, catching gear, layout and assembly aboard.

Reaction of Fish to Otter Trawls

By F. W. H. Beamish

HOW DO fish behave ahead of an otter trawl? Are they herded by the wings, warps, or doors? Do they attempt to swim around the wings or dart upwards out of the trawl's reach. Is behaviour the same by day and night?

These are among the many questions uppermost in the minds of fishermen and fishery scientists. Answers are difficult to obtain. High towing speeds, three to over four knots, and depth are forbidding to scuba divers. Movie cameras and television require continuous light which undoubtedly influences behaviour of fish.

The method used by the Fisheries Research Board's Biological Station at St. Andrews is a multi-exposure underwater camera and electronic flash (Fig. 1) which are attached to the trawl. To reduce distortion to the net when towing, the two units are housed in an aluminum case designed for this purpose by P.J.G. Carrothers of the St. Andrews Station (Fig. 2).

The unit is shackled to the headrope and square of an otter trawl as illustrated in Fig. 3. Mounted in this way, the camera takes pictures of the bottom immediately ahead of the footrope through clear, plastic windows located on the lower side of the case (Fig. 2).

Each frame covers an area of about 15 square feet. Pictures are taken at regular 12 sec. intervals. About 300 pictures are taken in a one hour tow. A record of time, depth, area, frame number, are included in each picture of bottom (Fig. 4).

Behaviour studies were carried out mainly in two areas, Miscou Island in the Bay of Chaleur and Passamaquoddy Bay in the Bay of Fundy. Photographs were taken for about 40 tows. Slightly over half of the tows were made by day, the remainder after dark. In all, about 10,000 frames were taken. Cod were the most abundant fish in photographs. Indeed, almost 600 were observed. Fewer pictures were taken of haddock, flatfish (winter flounder and American plaice), skate, long-horn sculpin, and eelpout.

Figure 1: Preparation of multi-exposure camera (A) and electronic flash (B) before the case (C) is attached to headline of an otter trawl. Buoyancy tubes (D) reduce weight of unit in water.

In general, fish ahead of the footrope swam near the bottom. There was no suggestion of attempted escape over the headline. Although the camera was not in the best position to estimate movements in this direction, it is believed that extensive movements would have been recorded.

During daylight hours most cod were observed swimming ahead of the moving net in the same direction as the tow. The greater the number of cod observed at one time, the more consistent was their

direction of swimming. Of the cod observed in groups (Fig. 4), 90% swam in the direction of tow. When swimming alone, 74% were photographed moving in the same direction as the tow. Escape thus seems unlikely. Rather, it would appear as though cod swim ahead of a trawl until fatigued, and then drift back into the net.

The number of cod photographed in night tows was appreciably less than by day. Groups or grouping was less common at night. This agrees with echo sounder observations and otter trawl catches. Over much of the year, echo traces of cod are recorded on or near bottom by day. With the onset of darkness, traces move off bottom sometimes as much as several hundred feet. When echo traces are on bottom, otter-trawl catches are greater than when the traces show up in mid water.

DAY AND NIGHT REACTION

Instances of cod swimming in the direction of tow were less frequent in night tows. Rather, a comparatively high percentage were headed towards the wings (Fig. 5) or into the mouth of the trawl. The difference in reaction to the towed gear by day and night may relate to vision of cod. By day, when vision is best, cod are herded in front of the net and swim in the direction of tow. After dark, vision is reduced, and fish swim in all directions. As mentioned previously, cod were not often photographed swimming in groups at night. Thus it may be that by day cod are herded by some visual stimulus such as the wings or footrope. At night when vision is reduced, cod are no longer able to set their course by some part of the gear, or indeed other cod, and hence swim alone in various directions. Of course, the fact that fewer groups were observed at night may mean that most cod were off bottom after dark.

Comparatively few haddock were photographed. Of those observed the majority swam in the direction of tow by day and night. During the daylight hours, 45 of the 50 haddock observed were swimming in the direction of tow. After dark, 24 of the 30 observations were headed the same way. Groups of haddock were not recorded in sufficient numbers to make an adequate comparison. On the basis of observations on single fish, it appears that once haddock are in the vicinity of the footrope they have little chance of escape, since they consistently swim in the direction of tow.

BEHAVIOUR OF FLATFISH

Contrary to behaviour of cod and haddock, flatfish were most frequently observed swimming towards the wings (Fig. 6). Of 60 observations, 36 were headed towards the wings, 12 in direction of tow and 12 into the mouth of the trawl. There was no obvious difference in behaviour by day and night. Escape in the direction of the wings is possible. Evidence from experimental laboratory studies suggests flatfish and many other fish can escape from any position between the wings of an otter trawl towed at 3 knots. However, they must put together the correct combination of direction and swimming speed. The shortest route of escape is around the wings. For most nets towed at 3 knots, fish must swim at top speeds; otherwise they will be trapped in the wings. If, on the other hand, they take a longer route, perhaps towards the otter doors, they must swim fast but below top speeds to escape. The distance a fish can swim is related to swimming speeds. Hence fish taking the long route must swim below maximum speeds if not to tire before escaping. Of course, the photographs do not shed any light on whether flatfish actually escape. Perhaps with the camera mounted on the wings

Figure 2: Underwater case containing camera and flash units designed to reduce distortion to the net. Pictures are taken through clear plastic windows (A) in the case.

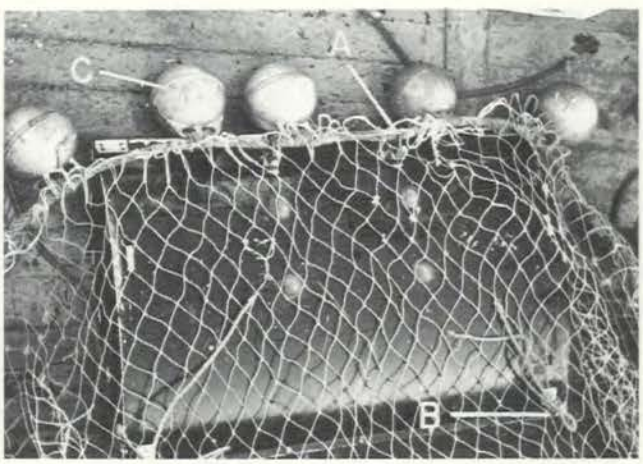


Figure 3: Underwater case shackled to headline (A) and square (B) of an otter trawl. The floats (C) attached to the headline are a normal part of the trawl.

some estimate of escape will be possible.

Most of the long horn sculpins and eelpout photographed appeared to be resting on bottom rather than swimming from the gear (Fig. 7).

Figure 4: Day tow illustrating a group of cod ahead of footrope swimming in direction of tow. Important data such as time (A), depth (B), area (C), and frame number (D), are recorded on the right. The arrow indicates the direction of tow.

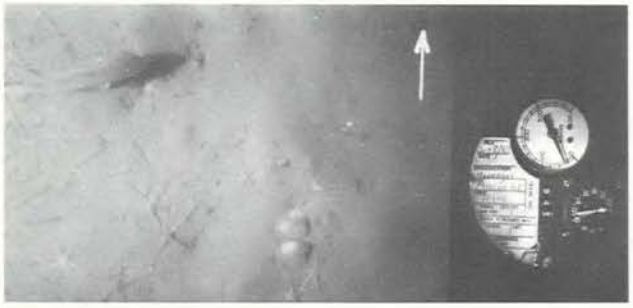


Figure 5: Single cod swimming toward wing of an otter trawl. Photograph was taken in a night tow off Miscou Island. Again, the arrow indicates the direction of tow. Brittlestars can be seen on bottom.

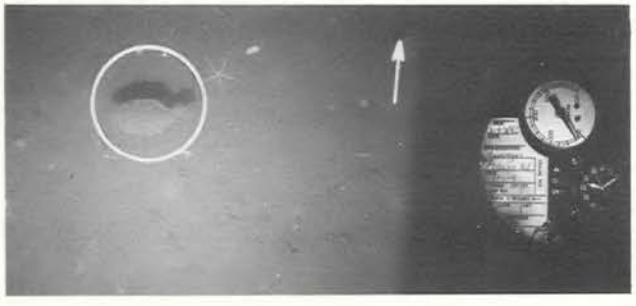


Figure 6: Flatfish (circled) swimming toward wing of an otter trawl during a daylight tow off Miscou Island. Numerous brittlestars are on the soft bottom.

Skates swam ahead of the net but did not follow a regular pattern. In some cases they swam towards the wings, in others away from footrope, or even into the mouth of the net (Fig. 8).

Knowledge of fish behaviour ahead of an otter trawl is essential for the design of more efficient gear. Only when it is clearly understood how fish behave can engineers make the necessary changes to the gear to improve catches. The results reported above are a start. More information is needed about behaviour along the whole mouth of the trawl and as far ahead as the otter doors. The problem of suspending cameras between the otter doors so that they will photograph bottom is indeed a difficult one. However, this problem is presently under consideration at the St. Andrews Station.

* This article was prepared by Dr. F. W. H. Beamish at the Fisheries Research Board of Canada's Biological Station, St. Andrews, N. B. Dr. Beamish is now associated with the Department of Zoology at the University of Guelph, Guelph, Ont.

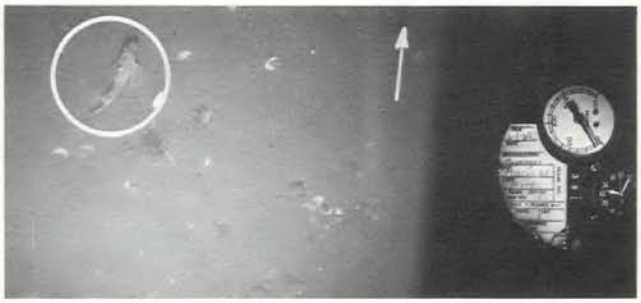


Figure 7: Long horn sculpin (circled) on bottom ahead of otter trawl during a daylight tow. A few dead clams can be seen on bottom along with the brittlestars.

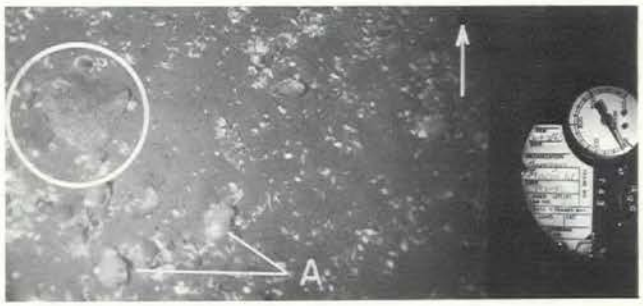


Figure 8: Skate (circled) swimming into the mouth of an otter trawl during a daylight tow. Many broken clam shells are scattered over the bottom. Several sea anemone (A) also appear in the photograph.

News Roundup

Salmon Fishery Talks

Preliminary discussions were held in Vancouver on September 26 between representatives of the Department of Fisheries led by the Deputy Minister, Dr. A. W. H. Needler, and of the United Fishermen & Allied Workers' Union, Native Brotherhood of B.C., Pacific Trollers' Association, Fishing Vessel Owners' Association, Prince Rupert Fishermen's Co-operative Association, and the Fisheries Association of British Columbia, on tentative proposals put forward by the Department regarding the licensing of vessels to engage in the salmon fishery.

The fishing effort for salmon has increased in recent years so much that it impairs the effectiveness of regulations to maintain the salmon catch at its maximum long-term level. As a step towards reversing this dangerous trend, the Department put forward for discussion proposals which would prevent an increase in the number of vessels engaged in the salmon fishery above the present level. Among these proposals was the suggestion that licences to engage in the salmon fishery in 1967 would be issued only for vessels which had been licensed to fish salmon in 1966 or which replaced such vessels.

The discussions led to no agreement on the steps which should be taken to reduce the catching power of the salmon fleet and no decision on a restrictive vessel licensing policy has yet been made pending further discussions later this autumn, federal Fisheries Minister H. J. Robichaud stated.

However, he added, fishermen and others are warned that no assurance can be given at this time that a licence will be issued for a vessel to engage in the salmon fishery in 1967 unless the applicant has a vessel licensed for the salmon fishery in 1966 or unless arrangements for acquiring the vessel to be licensed had been completed prior to this annoucement. Special consideration, would, of course, have to be given to salmon fishermen who for some valid reason did not engage in the fishery in 1966.

It was recognized by all those taking part in the meeting that special provisions must be made to assure the opportunity for as many Indian fishermen to engage in the salmon fishery as now do so. This and other problems will receive fuller consideration at a further meeting planned later this year.

Conservation Award

Dr. A. L. Pritchard, of Ottawa, who retired earlier this year as Director of the federal Department of Fisheries' Conservation and Development Service, has been named joint winner of the Julian T. Crandall conservation trophy, awarded annually by the Canadian Tourist Association.

Dr. Pritchard

Presentation of the trophy was made during the CTA convention at Vancouver, Oct. 10. Sharing the honor with Dr. Pritchard of being named "Conservationist of the Year" was Alan B. Beaven, of Winnipeg.

The trophy is awarded by the tourist association to the Canadian citizen considered to have contributed most to the conservation of renewable resources of forest, field and stream in Canada.

Dr. Pritchard, a graduate of the University of Toronto, began his career as a fisheries biologist with the Biological Board of Canada (now the Fisheries Research Board) at the Nanaimo, B.C. biological station in 1938. He made a particular study of the life and history of Pacific salmon and his publications on this topic have brought him world recognition as an authority on Canadian salmon.

In 1948 he headed the then newly-formed Fish Culture Development Branch of the Department of Fisheries and when the Conservation and Development Service was organized two years later, he was appointed Director of that service.

Dr. Pritchard participated in the establishment of the International Great Lakes Fisheries Convention and has served as Commissioner for Canada since the inception of this convention. He is presently chairman of the Great Lakes Fisheries Commission. With almost 40 years spent in the realm of fisheries resource conservation and management, Dr. Pritchard has made a notable contribution in these fields both nationally and internationally.

Oyster Fishery Control

A recent survey of the Richibucto River system in New Brunswick by the federal Department of Fisheries has indicated that, if properly controlled, it is capable of supporting an economically important oyster fishery.

Fisheries Minister H. J. Robichaud, as a re-

sult of the survey, will implement measures next year to achieve maximum oyster production in this area.

Previously the fishery in the public area of the river had been allowed from October 1 to December 31 each year. However, this year the season was closed to the public fishery on October 21, as a grave danger that the area could be overfished had been indicated by the survey.

These new controls will allow for the protection of section of the upper portions of the river system as spat producing areas. The survey indicated that the oysters in the upper sections were poorly flavoured, and had poor quality shells. However it was pointed out that if these were transferred downstream to areas of higher salinity they would improve in flavour and shell quality.

Mr. Robichaud said that he would also implement the report's recommendation for a spring fishery in the upper reaches of the river system next year, as it was indicated that such a fishery was better able to maintain oyster production than a fall oyster harvest. Also a two-month fishery will be allowed downstream from the Main River bridge in the main Richibucto River in the open fishing areas.

"Through these new measures," said Mr. Robichaud, "we hope to effect the full oyster production of the Richibucto system. Also we hope to bring this about by encouraging the leasing of sections of the river to experienced oyster fishermen who recognize the value of such long-term programs to bring about a sustained yield from year to year."

The Minister said new legislation covering the control of oyster fishing in the entire river system is now being drafted and will be in force next year. Fishermen will be advised of the new regulations by the Department's fishery officers in the area.

Codex Committee Holds First Session

The first session of the Codex Committee on Fish and Fishery Products met in Bergen, Norway, from Aug. 29 to Sept. 2. Some 15 countries and six international organizations were represented at the meeting.

The standards for frozen gutted Pacific salmon and canned Pacific salmon, drafted by Canada, and a standard for frozen fillets of cod and haddock, drafted by the United Kingdom, were discussed in detail. The committee agreed on revised texts for these standards which will now be circulated by the secretariat of the Joint FAO/WHO Food Standards Program to member governments of the Codex Alimentarius Commission for comment as to the next step in the procedure established for the elaboration of world-wide food standards.

Other standards of interest to Canada as a producing country included those for canned sardines, canned sild, canned brisling, salted cod and salted herring. The discussion on canned sardines, canned sild and canned brisling centered around the question of the use of the designation "sardine" to describe a number of different species of fish in various countries of the world. Agreement could not be reached on the matter of designation and the United States was requested to gather additional information and, if necessary, to revise the proposed standards for consideration by the committee at its next meeting.

The standards for salted cod and salted herring were referred to Canada and the Netherlands, respectively, for redrafting. The salted cod standard is to be revised to cover wet salted cod only and the salted herring standard will be revised to cover salted herring and sugar-cured and spiced herring as separate products.

New work to be undertaken on behalf of the committee for consideration at its next session includes standards for frozen fillets of ocean perch, frozen blocks of cod and haddock, frozen fillets of plaice, frozen tuna, frozen herring, canned anchovies and canned mackerel in brine or oil. The task of drafting standards for ocean perch and for cod and haddock blocks was assigned to Canada. The Federal Republic of Germany and Norway are to assist in the preparation of the standard on ocean perch and Norway is to assist in the drafting of the standard for cod and haddock blocks.

Representing the federal Department of Fisheries at the session were: H.V. Dempsey, Director of the Inspection Service, Ottawa; R.M. Bond, Chief of Inspection, Ottawa; R.S. Bolton, Chief of the Inspection Branch, Pacific Region; Dr. C.M. Blackwood, Assistant Director, Maritimes Region; and J.P. Hennessey, Chief of the Inspection Branch, Newfoundland Region. Also with the Canadian delegation were: T.R. Kinsella, Assistant Director (Fisheries), Agriculture and Fisheries Branch, Department of Trade and Commerce; J.N. Hyland, B.C. Packers, Vancouver; D.A. McLean and J.A. Stewart, Connors Bros. Ltd., Black's Harbour, N.B.; H.D. Pyke, Lunenburg Sea Products Ltd., Lunenburg, N.S.; and F.A.J. Laws, Newfoundland Associates Fish Exporters Ltd., St. John's, Nfld.

Fisheries Scientists Pay Tribute to NRC

In tribute to the National Research Council of Canada on its 50th anniversary, the Fisheries Research Board of Canada has published a commemorative volume of reports on aquatic pollution covering studies by Board scientists from 1902 to 1966. A suitably bound copy was presented to NRC President Dr. B.G. Ballard by Dr. W.R. Martin, Assistant Chairman of the Fisheries Research Board, representing Board Chairman Dr. F. Ronald Hayes.

Dr. Ballard, in thanking FRB for its gift, commented that the acquatic environment with its grave problem of pollution "is a timely subject, not only for fisheries but for all of us."

The NRC president told Dr. Martin that his agency had followed the work of Canada's fisheries scientists with keenest interest.

Dr. Martin said the Fisheries Research Board had great appreciation for the co-operation received from NRC, particularly with respect to its support program for scientific research in universities.

In the preface to the publication, Dr. Hayes wrote that "the National Research Council of Canada had contributed much to the cause of science in observing its Golden Anniversary in a way that attracts attention -- not only of the biased onlookers of the world of science, but that of the general public..."

He also observed that "today, no single area of aquatic research is of greater concern to the general public than that of adverse changes in the environment. The word 'pollution' has become a household term but there is little appreciation of the total phenomena involved. Even in science we are moving into new concepts of what pollution is all about".

The presentation volume opens with a paper on the effects of polluted waters on fish life, written in 1902 by the late Dr. A.P. Knight. Dr. Knight, one of the earliest proponents of fisheries research in Canada, was Chairman of the Marine Biological Board of Canada from 1920-1926.

Dr. B.G. Ballard, (left) President of the National Research Council of Canada, examines a volume of reports on aquatic pollution presented to the NRC by the Fisheries Research Board of Canada to mark the Council's 50th anniversary. Looking on is Dr. W.R. Martin, Assistant Chairman of FRB, who who made the presentation.

The concluding paper is one by Dr. Hayes on the biological aspects of the water problem. It was a contribution to the symposium on "Water Resources" conducted by the Royal Society of Canada in June 1966.

Additional copies of "Aquatic Pollution Studies 1902-1966" are being printed by FRB for distribution to universities and other research agencies as a valuable reference work on pollution problems and research in Canada.

Record Landings in British Columbia

The value of all fish landed by British Columbia fishermen during July and August, the peak months of the year, was the highest ever reported.

Based on preliminary reports, landed value reached $18,100,000 in July and $16,900,000 in August. The total value of all fish landings to the end of September, according to estimates from the Economics Branch of the Department, already exceeds $55,000,000 compared to the previous record value of landings for the entire year of $52,000,000 in 1958.

The value of salmon landings this year will approximate that of the record year of 1958 and might even exceed it.

Based on the anticipated landings, the wholesale value of fish production in B.C. this year will probably exceed $115,000,000, compared to $85,000,000 in 1965 and $98,000,000 in the record year of 1958.

Fishery Figures For August

SEAFISH: LANDED WEIGHT AND LANDED VALUE

	May-August 1965		May-August 1966(2)	
	'000 lbs	$'000	'000 lbs	$'000
CANADA - TOTAL	1,118,808	86,900	1,066,299	92,954
ATLANTIC COAST - Total	949,488	54,083	833,064	48,626
Cod	371,487	14,968	328,315	13,955
Haddock	36,737	2,337	35,358	2,507
Pollock, Hake, Cusk, etc.	35,214	1,140	32,548	1,171
Rosefish	53,878	1,411	76,811	2,123
Catfish	2,705	91	3,148	102
Halibut	2,421	784	2,003	629
Plaice & Other Flatfish	104,278	3,307	116,299	3,771
Herring & Sardines (3)	243,210	2,471	155,555	2,199
Mackerel	18,088	581	15,270	537
Alewives	12,084	202	7,901	140
Salmon	4,559	2,184	4,760	2,501
Smelts	135	14	189	17
Swordfish	4,111	1,676	2,976	1,404
Other Fish	12,940	265	11,828	171
Lobsters	29,962	17,736	25,940	14,059
Clams & Quahaugs	2,364	137	2,719	162
Scallops	8,420	4,661	8,105	3,091
Other Shellfish	6,795	118	3,339	87
PACIFIC COAST - Total	169,320	32,817	233,235	44,328
Pacific Cods	13,352	944	14,885	1,255
Halibut (1)	27,864	9,292	29,693	10,623
Soles & Other Flatfish	3,057	200	5,367	342
Herring	46,466	621	46,206	776
Salmon	72,089	21,257	128,437	30,712
Other Fish	2,281	75	3,642	113
Shellfish	4,211	428	5,005	507
BY PROVINCES				
British Columbia	169,320	32,817	233,235	44,328
Nova Scotia	296,742	21,869	240,062	18,371
New Brunswick	164,562	6,437	139,012	6,069
Prince Edward Island	29,737	5,620	31,750	4,421
Quebec	104,511	4,652	64,810(2)	3,909(2)
Newfoundland	353,936	15,505	357,430	15.856

(1) - Includes halibut landed in U.S. ports by Canadian fishermen. (2) - Figures for Quebec available to the end of July 1966 only. (3) - Incomplete - total reported does not include all herring landed for the month of August 1966.

MID-MONTH WHOLESALE PRICES - August, 1966

			Montreal $	Toronto $
Cod fillets, Atl, fresh, unwrapped		lb.	.380	.453
Cod fillets, Atl, frozen, cello 5's		lb.	.354	.397
Cod fillets, smoked		lb.	.422	.473
Haddock fillets, fresh, unwrapped		lb.	.471	.580
Herring, kippered, Atl.		lb.	.256	.307
Mackerel, frozen, round		lb.	.190	.243
Lobsters, canned, Fancy	case	48-½s	59.680	60.660
Sardines, canned	case	100-1/4s	9.693	9.567
Halibut, frozen, dressed		lb.	.564	.600
Silverbright, frozen, dressed		lb.	.618	.640
Coho, frozen, dressed		lb.	.788	.763
Sockeye, canned, grade A	case	48-½s	28.437	29.140
Pink, canned, grade A	case	48-½s	16.753	17.067
Whitefish, fresh		lb.	(1) .483	.417
Lake trout, frozen		lb.	.428	.517

(1) - Dressed.

PRICES PER CWT. PAID TO FISHERMEN

(Week ending Aug. 13).	1965 $	1966 $
Halifax		
Cod Steak	4.75	5.25
Cod Market	4.5	5
Haddock	7.5	8.5
Plaice	4	5
Yarmouth		
Haddock	6	8
Black's Harbour		
Sardines	2	2
St. John's Nfld.		
Cod	3.25-4	3.50-4
Haddock	-	2.75-4
Rosefish	2.5	2.5
Vancouver		
Ling Cod	10-12	8-10
Gray Cod	5.5-7	6-7.5
Soles	6-9	7-9.5
Salmon (Rdspg)	41-75	47-75

Fishery Figures For August

FROZEN FISH STOCKS AS AT END OF JULY

	1965 '000 lbs	1966 '000 lbs
TOTAL - Frozen Fish, Canada	87,808	99,443
Frozen - Fresh, Sea Fish - Total	66,834	73,596
Cod, Atlantic, Fillets & Blocks	18,512	24,181
Haddock, fillets & blocks	3,313	3,086
Rosefish, fillets & blocks	4,051	5,081
Flatfish, (excl. halibut), fillets & blocks	5,473	5,359
Halibut, Pacific, dressed & steaks	8,726	9,998
Other Groundfish, dressed & steaks	2,224	2,709
Other Groundfish, fillets & blocks	6,534	7,112
Salmon, Pacific, dressed & steaks	8,297	7,733
Herring, Atlantic & Pacific	676	363
All Other Sea Fish, all forms	5,540	4,038
Shellfish	3,488	3,936
Frozen - Fresh, Inland Fish - Total	3,994	6,085
Perch, round or dressed	14	460
Pickerel, (Yellow & Blue) fillets	132	138
Sauger, round or dressed	14	32
Tullibee, round or dressed	99	110
Whitefish, round or dressed	1,596	1,945
Whitefish, fillets	207	307
Other, all forms	1,932	3,093
Frozen - Smoked Fish - Total	2,215	2,077
Cod Atlantic	1,235	1,301
Sea Herring, kippers	588	445
Other, all forms	392	331
Frozen for Bait and Animal Feed	14,765	17,685

SALTED FISH STOCKS AS AT END OF AUGUST

Salted and Pickled Fish, Atlantic Coast			
Wet-salted - Total		22,597	28,142
Cod		17,989	22,904
Other		4,608	5,238
Dried - salted - Total		4,849	7,170
Cod		4,325	6,507
Other		524	663
Boneless - Total		862	608
Cod		769	553
Other		93	55
Pickled - Total	(barrels)	25,951	30,333
Herring	"	8,322	11,195
Mackerel	"	10,391	10,306
Alewives	"	7,238	8,832
Turbot	"	-	-
Bloaters	(18 lb. boxes)	202,677	206,295
Boneless Herring	(10 lb. boxes)	5,403	7,952

CANADIAN EXPORT VALUE OF FISHERY PRODUCTS, MAY

(Value in Thousands of Dollars)

	1965		1966
Total Exports	15,147		15,620
By Markets:			
United States	11,592		10,920
Caribbean Area	1,488		2,189
Europe	1,691		2,211
Other Countries	376		300
By Forms:			
Fresh and Frozen	11,042		10,944
Whole or Dressed	2,751	3,148	
Salmon, Pacific	839	1,179	
Halibut, Pacific	656	620	
Cod, Haddock, Pollock, etc.	26	33	
Swordfish	221	158	
Other Seafish	277	362	
Whitefish	191	211	
Pickerel	202	189	
Other Freshwater Fish, n.o.p.	339	396	
Fillets	4,437	4,615	
Cod, Atlantic	2,056	1,321	
Haddock	544	829	
Rosefish, Hake, Pollock, etc.	203	312	
Flatfish	571	1,077	
Pickerel	39	40	
Other	1,024	1,036	
Shellfish	3,854	3,181	
Lobster (Alive & Meat)	3,031	2,269	
Other	823	912	
Cured	1,607		2,343
Smoked	132	140	
Herring	100	81	
Other	32	59	
Salted, Wet & Dried	1,245	2,012	
Cod	1,068	1,756	
Other	177	256	
Pickled	230	190	
Herring	136	152	
Mackerel	36	8	
Other	58	30	
Canned	1,340		646
Salmon	817	139	
Sardines	283	365	
Lobsters	164	105	
Other	76	37	
Miscellaneous	1,158		1,688
Meal	828	1,023	
Oil	39	37	
Other	291	628	

ICELANDIC EXPORTS BY COUNTRIES, 1964-1965

	Jan.-Dec. 1965 Q.	Jan.-Dec. 1965 V.	Jan.-Dec. 1964 Q.	Jan.-Dec. 1964 V.
GRAND TOTAL	-	5,256,859	-	4,384,339
Canada	6,629	25,765	Ø	11
Herring Oil	6,563	25,270	-	-
United States	71,863	863,765	71,409	739,931
Frozen Fish, fillets	62,123	732,766	61,328	628,133
Frozen Lobster	1,065	80,362	1,193	63,502
Herring, Head & Headless, salted	4,200	25,157	6,021	35,410
Other Products	4,475	25,480	2,867	12,886
Brazil	4,081	38,249	2,383	24,661
Salt Fish, cured	3,558	34,323	1,911	22,827
United Kingdom	262,947	1,089,855	208,026	767,545
Salt Fish, uncured	5,736	34,933	5,783	33,469
Fish on Ice	34,123	105,224	36,122	109,902
Frozen Fish, whole	15,086	84,608	9,460	45,759
Frozen Fish, fillets	18,885	173,196	14,268	122,772
Frozen Lobster	397	15,739	974	31,783
Herring Oil	40,139	151,359	3,287	11,419
Fish Meal	939	2,877	11,426	28,418
Herring and Capelin Meal	138,129	461,582	113,826	318,484
Whale Meat, frozen	5,066	20,940	4,455	16,191
Other Products	4,447	39,397	8,425	49,348
France	17,361	74,209	11,669	54,434
Roes for Bait	1,682	5,878	5,765	21,703
Belgium	16,243	59,374	7,736	23,630
Herring and Capelin Meal	13,807	49,546	6,171	17,162
Spain	17,458	134,049	15,769	113,123
Salt Fish, uncured	16,246	128,463	14,780	109,129
Portugal	12,544	95,144	20,104	140,292
Salt Fish, uncured	12,544	95,144	20,104	140,292
Denmark	86,420	363,095	58,492	208,072
Lumpfish Roes, salted	842	20,802	494	5,519
Herring, Marinated	4,718	28,269	5,767	30,995
Herring Oil	46,424	177,714	18,629	67,855
Herring and Capelin Meal	21,030	77,675	20,752	58,130
Other Products	13,406	58,635	12,850	45,573
Norway	17,013	68,438	76,499	286,432
Herring, Marinated	4,277	25,899	3,296	18,024
Herring Oil	4,590	15,991	61,475	222,186
Other Products	8,146	26,548	11,728	46,222
Sweden	70,067	343,967	64,066	278,437
Cod Roes, salted	3,871	29,412	4,334	30,478
Herring, Head & Headless, salted	6,113	35,258	5,400	28,100
Herring, Marinated	32,644	189,879	30,844	159,458
Fish Meal	11,016	34,424	11,338	29,590
Herring and Capelin Meal	7,374	27,898	772	2,188
Other Products	9,049	27,096	11,378	28,623
Finland	43,096	171,825	42,705	153,280
Herring, Marinated	16,155	100,432	15,866	86,407
Herring and Capelin Meal	10,392	36,266	17,299	47,247
Frozen Offal	13,228	20,500	7,507	9,142
Other Products	3,321	14,627	2,033	10,484
Italy	31,543	307,581	19,601	186,448
Salt Fish, uncured	16,548	134,135	8,161	60,718
Wings, salted	3,276	20,102	2,586	14,756
Stockfish	7,630	127,284	6,603	99,648
Other Products	4,089	26,060	2,251	11,326
Greece	8,192	48,465	6,459	37,234
Salt Fish, uncured	3,946	30,247	2,934	19,897
Holland	52,333	192,756	24,030	86,224
Herring Oil	35,309	128,590	17,249	61,925
Herring and Capelin Meal	12,205	43,962	1,786	4,909
Other Products	4,819	20,204	4,995	19,390
Poland	32,912	116,691	29,222	93,963
Herring, frozen	7,716	22,604	8,818	24,574
Herring and Capelin Meal	14,198	52,523	9,528	29,148
Other Products	10,998	41,564	10,876	40,241
Rumania	8,635	32,865	10,421	33,643
Herring, Head & Headless, salted	6,466	24,725	4,888	17,739
West Germany	120,395	426,905	109,864	334,559
Salted Fillets	3,415	27,939	2,000	15,635
Fish on Ice	31,973	82,383	39,802	104,634
Lumpfish Roes, salted	884	20,973	251	3,012
Herring Oil	29,676	109,152	6,413	22,714
Fish Meal	14,418	44,530	18,799	62,115
Herring and Capelin Meal	25,274	83,226	28,267	73,939
Other Products	14,755	58,702	14,332	52,510
East Germany	22,791	72,584	2,608	8,032
Herring, frozen	8,790	25,716	1,828	4,502
Herring and Capelin Meal	9,151	28,987	-	-
Other Products	4,850	17,881	780	3,530
U.S.S.R.	40,970	268,631	68,345	414,036
Herring, frozen	13,960	38,965	13,882	34,792
Frozen Fish, fillets	21,832	190,791	36,839	288,411
Other Products	5,178	38,875	17,624	90,833
Czechoslovakia	27,088	116,804	22,106	90,179
Herring, frozen	13,486	39,537	7,421	20,831
Frozen Fish, Fillets	3,959	35,544	3,935	31,096
Herring and Capelin Meal	7,974	31,698	8,801	27,634
Other Products	1,669	10,025	1,949	10,618
Nigeria	19,054	244,500	18,250	277,093
Stockfish	19,052	244,373	18,104	226,667
All Other Countries	23,843	101,342	21,736	83,080

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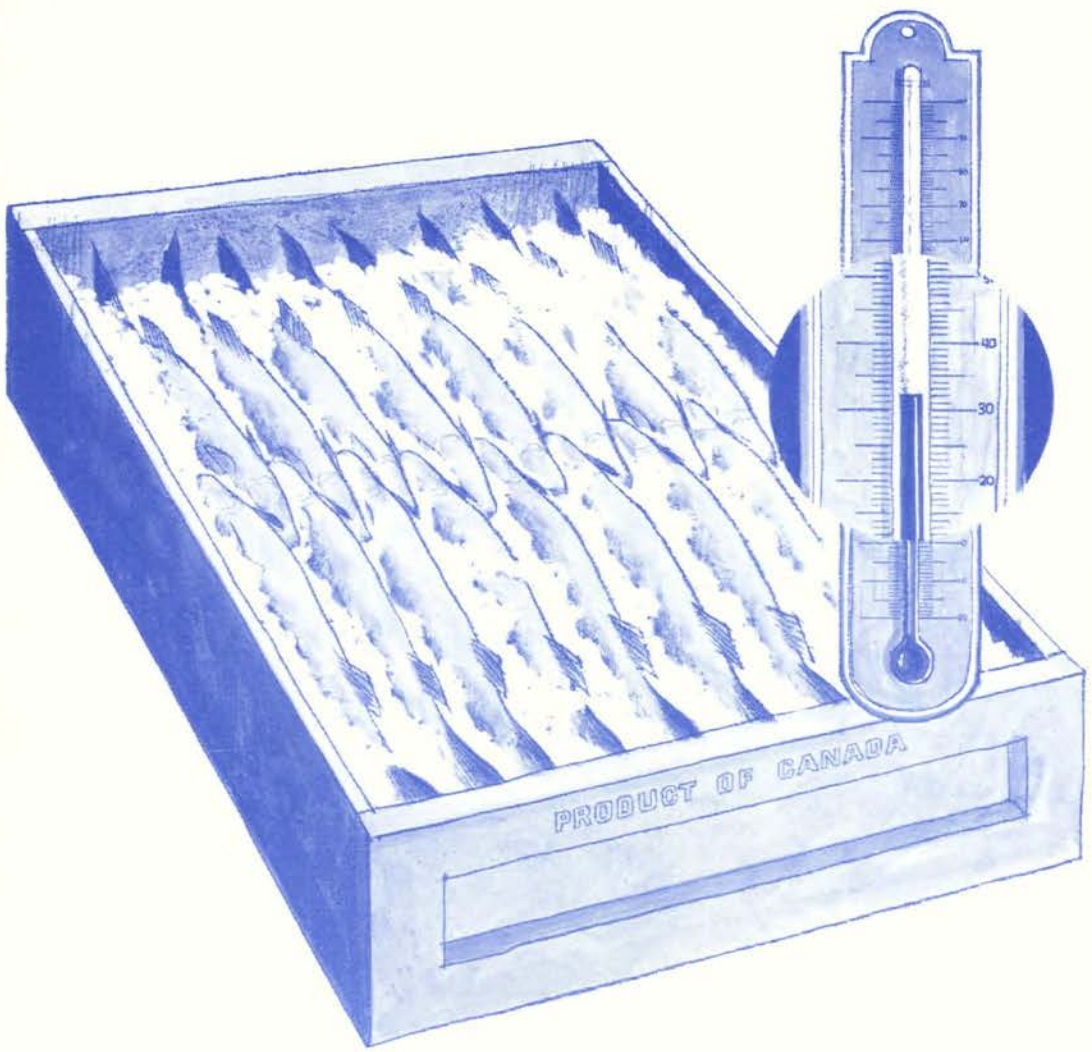
"GOOD FISH HANDLING PRACTICES GUARANTEE HIGHER PROFITS". That statement is equally true for the fisherman, the processor or wholesaler and for the retail trade. A highly perishable product, fish can continue to be profitable, only if the consumer is able to obtain top quality. Beginning immediately the fish is taken from sea or lake, a constant temperature of 32°F is recommended for fresh fish. Speed of handling is an important factor for all concerned. Fish, as soon as they are caught, should be stored at not more than 32°F in a freshly-cleaned hold, and should be delivered to the processor or wholesaler as soon as possible.



DEPARTMENT OF FISHERIES
Hon. H. J. Robichaud, M.P., Minister — Dr. A. W. H. Needler, Deputy Minister — Ottawa, Canada

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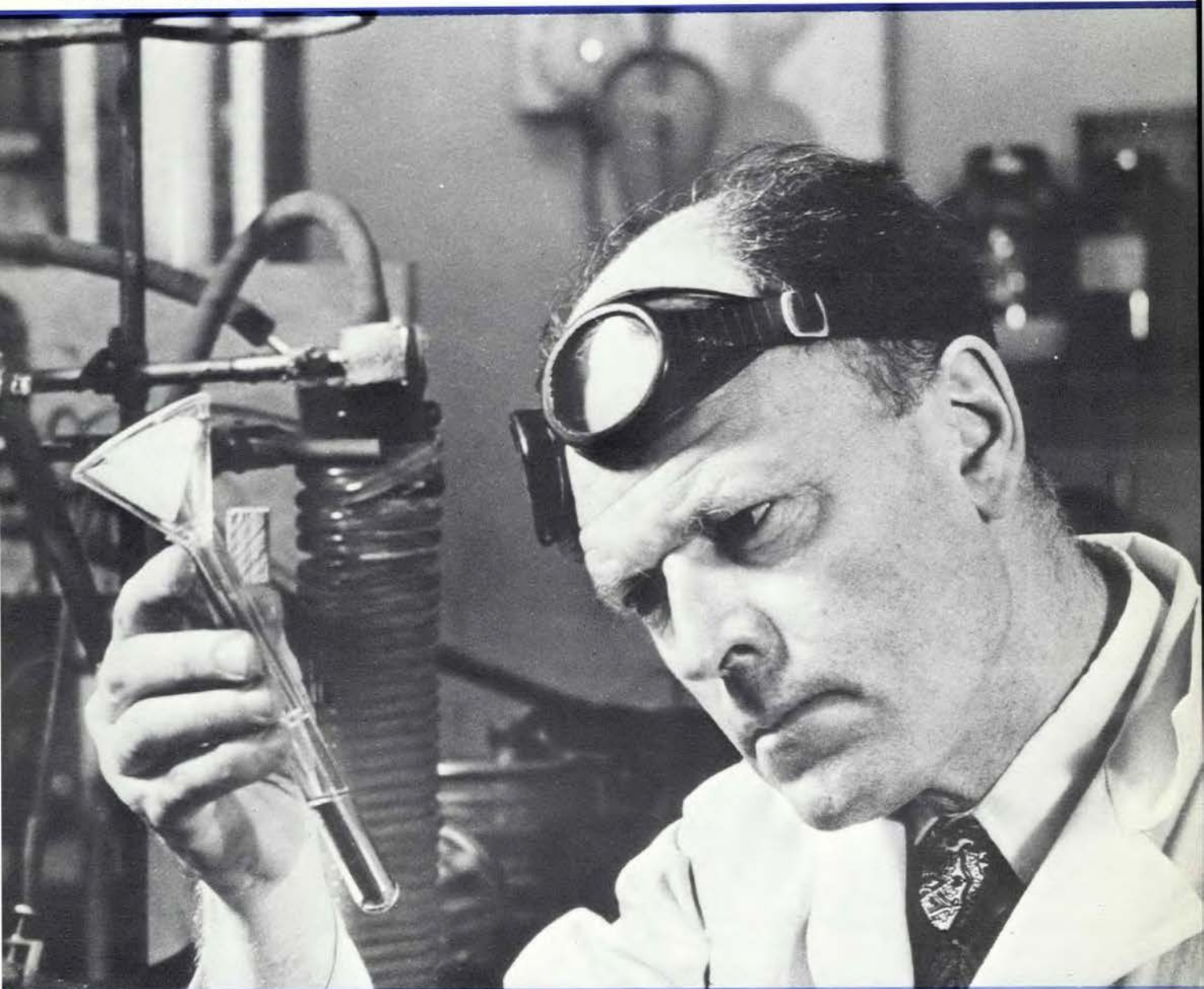

In This Issue

- Salmon Return to East River, Nova Scotia
- Technological Developments on Pacific Coast
- Predict Widening Use for Marine Oils

Department of Fisheries of Canada, Ottawa

FISHERIES
OF CANADA
(formerly Trade News)

Editor
E. H. HEARNDEN

Vol. 19 No. 6 December, 1966

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COVER PHOTOGRAPH - Dr. Hugh L. A. Tarr, Director of the Fisheries Research Board of Canada's Vancouver Technological Laboratory, has been experimenting with the use of antibiotics in food processing since 1944. An article by Dr. Tarr on technological developments in Pacific Coast fisheries is featured in this issue.

Salmon Return to East River, N.S.

By G.J. Gillespie

FOR THE FIRST time in more than 40 years, Atlantic salmon are again inhabiting the cool, clear waters of East River, near Sheet Harbour, Nova Scotia. This is by no means a natural occurrence. Since the early 1920s these kings of the sport fish species have been denied access to the upper reaches of the river by a series of hydro-power dams.

Now that has been changed by engineers, biologists and technicians of the Maritimes Region Resource Development Branch of the federal Department of Fisheries. The recent introduction of salmon to points along the river miles upstream from its mouth marks the beginning of a phase in a long-range program to restore East River as a salmon nursery area and an angling stream.

This undertaking -- the first of its kind in the Maritime Provinces -- is an experimental project which could be applied to other fishing waters threatened or already lost to fishing because of hydro-

Construction of power dams such as this on East River, Sheet Harbour, N.S., dealt a death blow to Atlantic salmon in the river. A long-term rehabilitation project by the federal Department of Fisheries is aimed at restoring salmon to the river.

electric and other industrial development.

Simple in operation, but involving much biological and engineering planning, the program consists of trapping adult salmon in nearby West River and trucking them overland to the spawning areas in the upper reaches of the East River system. In addition, juvenile salmon (fry, parr and smolts) reared in Department of Fisheries hatcheries will also be introduced to the East River.

INITIAL TRANSFER

The initial transfer of adult salmon was made from West River to East River in late September and continued throughout the fall. The salmon are transported in a specially designed truck equipped with a 600-gallon water tank and such ancillary equipment as oxygen supply, circulating pump, etc. Salmon are loaded into the tank from traps in West River. The truck then backs to the edge of the stream and salmon are released with the tank water into the East River through sluices. The dumping operation is over in a matter of seconds.

Before dam building in the early 1920's destroyed its salmon run, East River was one of Nova Scotia's better salmon angling streams. Generations of local anglers and visitors from afar enjoyed angling there and before them, the native Micmacs fished from its forested banks. Hydro development put an end to that.

For the past several years biologists of the Resource Development Branch in the Maritimes have been giving close attention to fishery problems associated with power dams and industry generally. Maintenance of fish runs under changing environmental conditions presented complex problems, and devising ways of permitting fish to spawn and develop in inaccessible areas appeared to be one of the solutions. The situation sparked the birth of the East River project.

Rehabilitation of East River will not be a short term affair. Four to five years will have elapsed before actual salmon angling can begin -- if then. The operation involves three management techniques which will be implemented and assessed during the next several years.

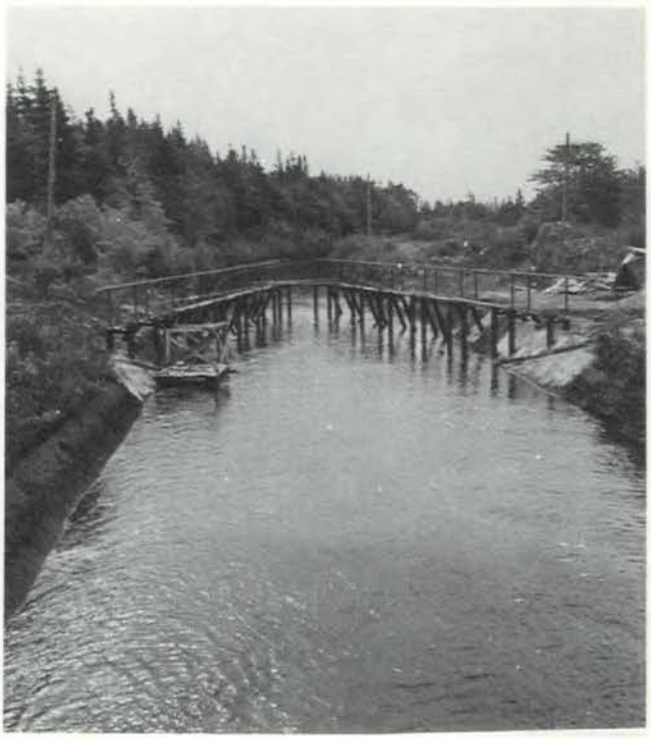
The first step was the installation of a trapping and trucking system to allow adult salmon access to the upriver spawning areas.

To overcome mortalities of salmon passing through turbines of the power stations a deflecting apparatus known technically as louvers is being installed at the upper end of the power canal above one of the power plants. If this system proves effective a second set of louvers will be installed in the power canal leading to the other plant.

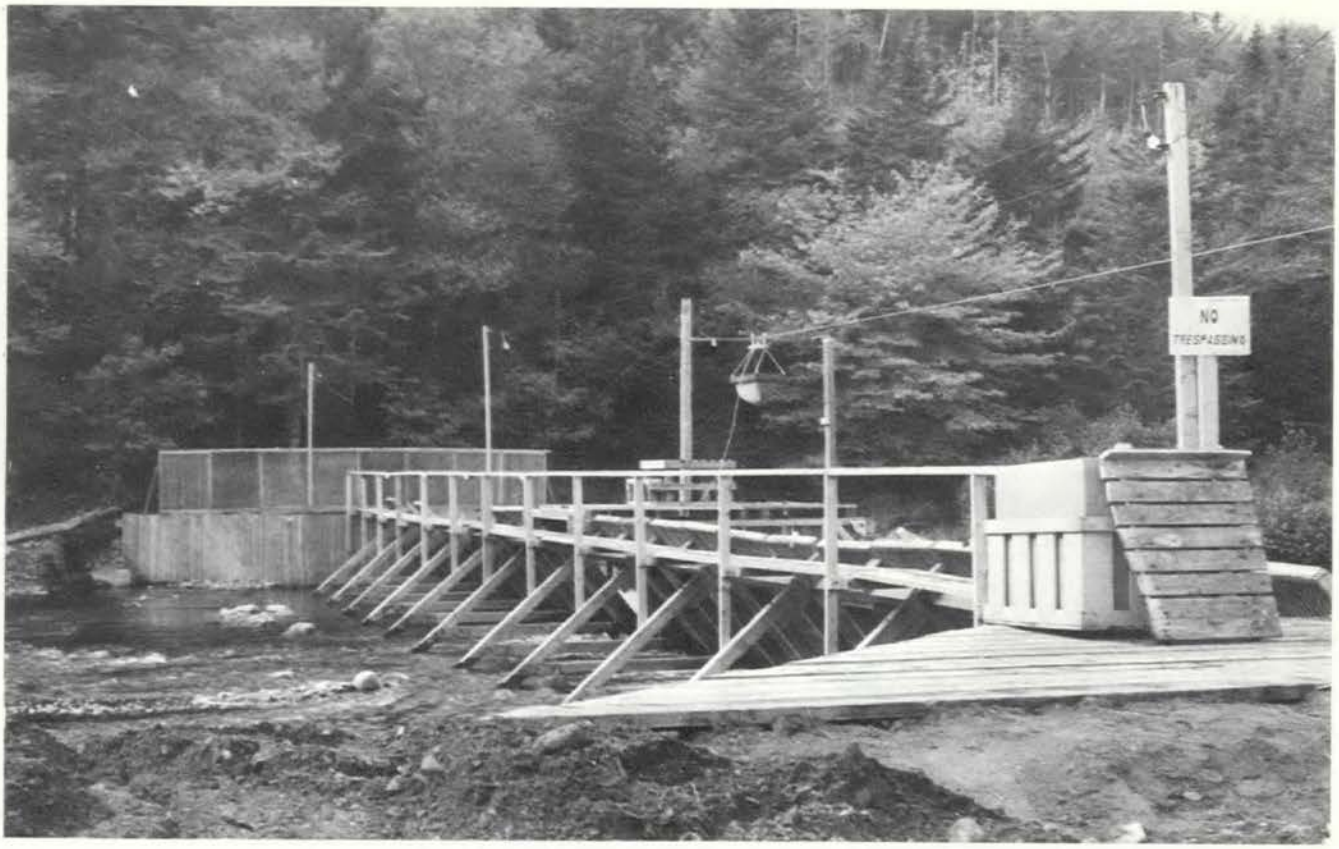
Repopulation of the river, of course, involves the transplant of salmon during the early stages of rehabilitation. Adult salmon from West River and juvenile fish raised in hatcheries will provide the stocks. Ultimately it is expected that the East River run will be of sufficient size to maintain itself.

Physical surveys were made of both rivers last year, and biologists concluded that salmon pro-

The specially-designed truck in which adult salmon are transported overland to spawning areas in the upper reaches of East River.



Louver deflector installation in the Ruth Falls power canal.



Fish counting and guiding fence on West River, N.S.

duction should be higher in East River than its sister stream, the West. The survey disclosed that salmon habitat in East River was well distributed. Assessment also showed that fish population in East River at present included chub, shiners, sticklebacks, suckers and killifish. Brown trout had been repeatedly introduced into the river since 1956 but none was found in the potential salmon rearing areas.

The trapping operation in West River involved the construction of a fish-counting and guiding fence. This obstruction forces all fish moving upstream to pass through a single opening into a fish trap. There some of the salmon are held until they are ready for transplanting in East River. ✔

Space Age Fishing

Space vehicles of the future may be utilized in helping man catch more fish from the world's oceans, U.S. Under Secretary of the Interior Charles F. Luce reported recently.

Mr. Luce said the U.S. Bureau of Commercial Fisheries is looking intensively to new developments to increase the efficiency of America's fishing fleet.

"One interesting aspect of this is the possible use of spacecraft to obtain oceanographic and fishery data," Mr. Luce added. "Experiments and feasibility studies underway now in use of spacecraft include determination of sea surface temperature using infrared detectors, radar detection of surface water disturbances caused by surface feeding fish schools, estimation of wave heights by radar, detection of chemical fish trails at the surface of the water left by migratory schools of fish...and direct spotting of large marine mammals by high resolution photography."

Mr. Luce said American astronauts have been briefed on fishery and oceanographic research and have already supplied much useful information.

It is predicted that the total consumption of commercial fish and fishery products in the United States, both from domestic and imported sources, will jump to nearly 28 billion pounds per year by the year 2000. The present consumption is approximately 12 billion pounds.

A Review of Technological Developments in Canada's Pacific Coast Fisheries

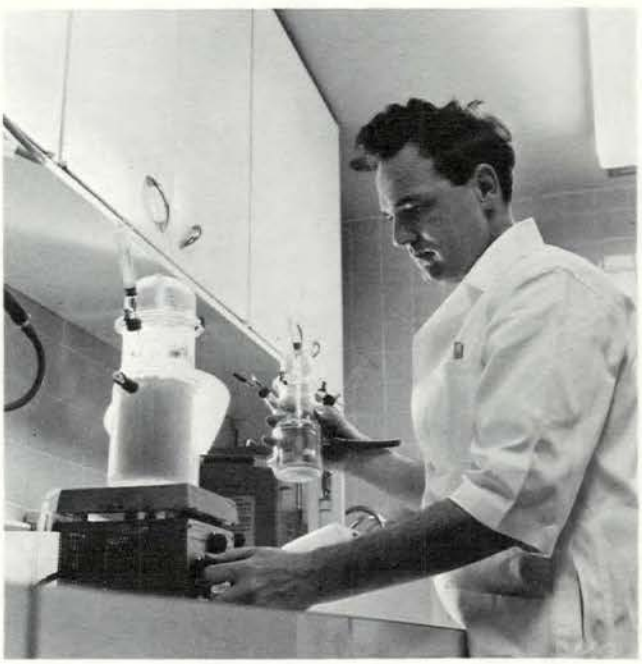
By H.L.A. Tarr

FISH IS ONE of the most perishable of all foods. Unlike red meats, fish are naturally contaminated with ordinary spoilage bacteria which grow remarkably well at refrigerator temperatures, and thus spoil much more rapidly at these lower temperatures than do red meats. Throughout the ages man has sought to preserve fish by crude methods such as salting and air drying, and while these methods are still used, they are not acceptable to the discriminating palate.

In fact it seems that people, when given a choice, usually prefer bland tasting products. Hence, modern methods of fish preservation involve chilling, freezing and canning with occasional use of permitted mild preservatives.

Even these methods are by no means infallible. Canning methods are rarely really successful with non-fatty fish. Most fish treated in this way are either comparatively fatty or are improved by addition of a bland oil. Examples are sardine, tuna, herring and salmon species. Frozen fish may be subject to several undesirable changes. Much of our research has involved attempts to improve fish quality by intelligent application of scientific findings, some of which have originated as a result of basic research carried out in our own laboratories.

Sometimes results have been applied on this coast, sometimes they have been applied elsewhere, as on our Atlantic seaboard; quite frequently findings have not yet been applied for economic reasons.



Dr. G.A. Strasdine, a scientist at the Fisheries Research Board's Vancouver Technological Laboratory, examines a 24-hour culture of Clostridium botulinum, the causative agent of botulinus food poisoning.

The contribution that technology has made to the fisheries of the Pacific coast was reviewed recently by Dr. H.L.A. Tarr in an address before the Canadian Research Management Association. Dr. Tarr is director of the Fisheries Research Board's Laboratory in Vancouver, B.C.

The address, on which the accompanying article is based, constitutes an important and timely document on the current status of research and the needs that exist for further study in the Pacific region.

ICING

Icing of fish is the usual method of preservation on fishing vessels and on shore before the fish are otherwise treated. However, while icing has many advantages, it has certain disadvantages. It has been recognized for many years that fish spoil about twice as fast at 37°F as they do at 30°F. Fish stored in melting ice should theoretically be at 32°F, but under practical fishing conditions this temperature is by no means always attained.

Many suggestions have been made regarding possible means of holding fish at about 30°F, which

is about the normal "freezing point" of fish flesh. Use of mechanical refrigeration and of proper insulation on vessels are two methods which have advantages if properly applied. However, great care must be taken not to freeze the ice on the fish, for apart from difficulties of "breaking out" the fish, the normal melting of the ice is prevented. This in turn prevents the washing action of the water from melting ice which carries away some of the bacteria and soluble decomposition products from the fish.

REFRIGERATED SEA WATER

In 1947 it was suggested in our laboratories that refrigerated sea water might be used to advantage on vessels, since small scale experiments carried out several decades before had indicated that the method could be used to hold fish on shore. It was not until about 1953 that experiments were carried out on trolling boats by placing on them small tanks in which sea water was chilled by mechanical refrigeration. It was not long before much larger tanks were placed on a moderate-sized fish packing vessel.

In these early installations cooling coils were placed directly in the tanks. However, as the work progressed it was found that much more rapid and convenient chilling resulted when heat exchange units were used as evaporators in conventional refrigeration systems. Compressed Freon 12 refrigerant expands in a system of a large number of pipes (copper usually) which are contained in a large diameter plastic pipe. Aided by proper baffles the sea water from the large tanks is circulated very rapidly past these tubes, and in this way temperatures may be lowered very quickly. If the system is properly designed, fish can be chilled to 30°F in a few hours.

This method has proved of great financial benefit to the West Coast salmon industry. Older vessels have been converted so that they can carry up to 500,000 lb. of fish in mechanically cooled refrigerated sea water, and in other instances barges have been converted so that they can chill and convey large loads of salmon in sea water cooled by ice and, where necessary, fortified by added salt. In these systems care must be taken to provide for proper circulation and circulating pumps and screens are installed.

The proper cleaning of refrigerated sea water systems is most important, since one deals with a closed system and the problems are similar to those of the dairy or brewery. Rules for cleaning and disinfecting have been worked out. If these are not enforced disastrous losses of fish may result due to initial contamination of the tank water. A common source of contamination is dirty chillers or pipes since these may warm up when vessels are not fishing and infect the fish tanks at the start of an operation.

Tissues collected during autopsy are first embedded in paraffin and then sectioned in the machine shown above to a thickness of less than 0.0004 inches. Tissue sections are then mounted on glass slides for microscopic examination.

BRINE SPRAY SYSTEMS

Another type of related activity in which Fisheries Research Board engineers have engaged has been design of brine spray systems for tuna freezing. These have proved quite successful in operation and have in general been considered superior to systems used elsewhere. Presently it is uncertain whether tuna fishing will prove profitable for our comparatively small West Coast vessels in view of distances involved, but on our Atlantic seaboard the situation is more hopeful.

The possible value of application of refrigerated sea water to other fisheries has been assessed to some extent. Pacific halibut and black cod can be preserved effectively on vessels since salt penetration is not a problem. However, with less fatty ground fish, swelling due to uptake of water, and salt penetration, have proved deterrents to successful application. In general, various varieties of cod and soles can be held 5 or 6 days in this medium before salt and water penetration become a problem. Tanks for holding fish on shore are often useful.

SUPER-CHILLING

One of the important causes of spoilage in non-eviscerated fish, especially in those which are feed-

Adjusting the column temperature of an argon detector gas-liquid chromatograph during the analysis of the flavor components of the oyster.

ing actively, is enzymic softening of the flesh near the visceral cavity. This has proved resistant to refrigerated sea water in some cases since the enzymes involved are active at these temperatures. Since present economic considerations preclude evisceration of these fish (as salmon for canning or groundfish), at sea, a technique termed "super chilling" or "partial freezing" is being studied in some detail.

Although, for various reasons, this method has not been applied commercially on this coast, it is quite satisfactory for non-eviscerated salmon if the proper conditions are observed. In fact, salmon can be stored for some days or weeks in partially frozen state at say 23°F and still give a satisfactory canned product. The method also looks promising for halibut and black cod, but so far attempts to use it for true cod, soles and other ground fish have been unsuccessful due to salt penetration and development of rancidity. Obviously the logical way to treat these fish if they must be held non-eviscerated for more than a few days is to freeze them on the vessel. Much thought has been given to this and certain systems have been worked out which can be used on our types of vessel. I feel that in the future we must turn to freezing some of our fish at sea, though presently it appears doubtful if we can afford factory ships.

Various additives that look promising for fish preservation have been under study for several years. This is rather difficult since the substances must meet with approval of strict Food and Drug Regulations and must not have any deleterious effect on the fish itself. One substance which was first used experimentally in our laboratories in 1939, eventually became a permitted fish preservative and was used for some 15 years for fillet treatment on our Atlantic seaboard. This was a salt, sodium nitrate, which is permitted for use in cured meats such as ham and bacon. About 1956 this substance was removed from the approved list of additives for fish and, again as a result of research carried out in our laboratories, was replaced by certain tetracycline antibiotics, which proved extremely effective. These were permitted in concentrations not to exceed 5 parts per million. In practice less than 1 part per million occurs in fish treated by approved methods and research has demonstrated that these small amounts are largely or entirely destroyed by cooking, so that the consumer is never exposed to significant antibiotic residues.

It has been calculated that one would have to consume at least a ton of treated fish to receive a normal small daily dose of the antibiotic as used in disease therapy. Several large countries use this method quite extensively, and on Canada's Atlantic coast some 8 or 10 million pounds of fillets are treated annually. Application methods are very simple and include use of ice containing a uniformly distributed 5 parts per million, and a dipping solution containing 10 parts per million, of the antibiotic.

Use of penetrating radiations in food sterilization, or partial sterilization, has been studied extensively in various laboratories in different parts of the world since about 1946. So far as fish is concerned the dose of radiation required to sterilize a product causes such adverse changes in taste and odour that the method is quite unacceptable. Reasonably successful "pasteurization" by use of quite mild exposure to gamma radiation, such as that obtained from Cobalt 60, is said to be fairly successful for certain non-fatty fish and shell fish. So far, however, there has been no real industrial application. One reason seems to be that initial equipment costs are high and the disintegration rate of Cobalt 60 is quite significant so that costs of treatment increase if the source is not used 24 hours a day.

FISH HANDLING

As processing and transportation costs increase we must look continually for simpler methods of handling fish. In many fisheries fish are still handled by forks or pughs, or are unloaded by baskets or nets. With the use of refrigerated sea water on this coast, other methods of transfer and unloading have been sought.

Initially it was found that a simple brailing net

device was quite adequate to remove fish from tanks of sea water. However, as loads of fish thus handled increased, more effective procedures were sought. Pumping of small fish such as herring which are almost all reduced to meal and oil is not particularly difficult since some damage to the fish is of no real significance.

With comparatively large fish such as salmon, the situation is very different because one is dealing with very valuable material, some of which will reach fresh or frozen fish markets and some of which will be canned. In view of this, industry requested that our laboratory look into this matter. As a result of this research, which needless to say was carried out in quite close collaboration with two of the larger companies, various devices for unloading salmon have been built.

Canadian Public Service patents were assigned last year to an "Air Lift Pump" and an "Hydraulic Elevator for Fish". The first of these devices is extremely simple. Very little equipment is required, but fairly deep water is necessary since the bottom of the "U" tube must be twice as deep as the outlet is above water level. As an example, a 10" pipe and flow rate of about 4 ft./sec. is adequate for most salmon transfer procedures. The other pump will unload salmon at the rate of about 1000-lb. a minute. However, it is advisable to do further research in order to improve this device. It should prove very useful in a variety of fisheries.

It has been common knowledge that certain fish, such as halibut, suffer from a so-called chalky condition, the cause of which remained in doubt until we decided to look into the matter. While the flesh of normal fresh halibut tends to be clear and translucent, that of chalky halibut is rather white and opaque. The possibilities that the condition could be due to attack by some parasite, or that a nutritional deficiency was to blame, were considered. The conclusion was reached that these possible defects were not responsible. Further work showed that the condition arose almost entirely in fish in which the muscle had attained a certain post-mortem acidity due to formation of lactic acid - a normal constituent of flesh.

Now that the cause of this complaint is known the next step is to look for a method of counteracting the condition. This is a very difficult problem. Lactic acid is formed by degradation of muscle glycogen in the struggling of fish; it forms rapidly, but only slowly disappears to form other compounds in live fish. Therefore if a way of preventing struggling could be devised - an almost impossible feat - this chalkiness might be overcome. The subject will be pursued to seek a method of counteracting this defect. Fortunately the flesh of chalky halibut is in no way harmful and is often quite satisfactory. However, as with certain other fish the rather high post-mortem acidities that occur tend to lower the water-holding ability of the flesh proteins. This in turn tends to promote a "dryness" in the cooked fish, and the fish may undergo a toughening (denaturation) more readily when frozen.

RANCIDITY STUDIES

Over the years we have conducted various studies on frozen fish, which is very susceptible to certain undesirable changes. The lipids or fats of all fish are usually very susceptible to oxidation by atmospheric oxygen. The presence of blood pigments greatly accelerates this change, so that the brown muscle layers usually become rancid very rapidly. The dark muscle of tuna is a typical example of this alteration, for it becomes rancid so quickly during the "pre-cook" before the canning procedure that the best use the industry can make of it on this continent is, when it is properly fortified with Vitamin E, to turn it into canned cat food.

Much research effort has gone into methods of overcoming or delaying the onset of rancidity in frozen stored fish. While hydrolytic rancidity may be of some significance in fish storage, oxidative rancidity is a much more serious problem. It is accompanied by development of objectionable odours and flavours discolouration of salmon pigments and "rusting" of exposed fats.

Several methods are available by which oxidative rancidity may be retarded or largely prevented. One of the most obvious of these is the exclusion of oxygen (air) from the fish. Industrially this has been accomplished to some extent by application of an ice glaze to the external surfaces of whole frozen fish. About 20 years ago our laboratories showed that frozen fillets held in a nitrogen atmosphere did not become significantly rancid even after storage for months at elevated storage temperatures. More recently it has been found that in packaging frozen salmon, a fish that is peculiarly susceptible to development of oxidative rancidity, Saran coated films (cellophane or polyethylene) are very effective in delaying this change. Saran is almost impermeable to oxygen. Polyethylene films alone, if they are of customary thinness, are practically ineffective since they are quite permeable to oxygen.

Some success has been attained by use of antioxidants, though they are little used in Canada. Our original finding that Vitamin C is a fairly good antioxidant for frozen fillets and whole fish has been exploited in Denmark, Japan and, to some extent Russia, particularly for use on frozen rainbow trout. However, exclusion of oxygen and holding at low cold storage temperatures are still the best methods for preventing development of rancidity. Fish should be held at -10°F or preferably at much lower temperatures; e.g. - 25°F.

Some of our work is carried out on a contract basis where we do not possess the required ex-

This apparatus at the Vancouver Technological Laboratory is used to grow marine phytoplankters in mass culture. Such culturing requires continuous illumination and strict temperature control.

perimental skills. One good example of this is work which has been carried out on herring meal and related products intended for animal nutrition with the Poultry Nutrition Laboratory of the University of British Columbia. Over the past 15 years work has been completed on a number of projects including the effect of heating (production conditions) on essential amino acids and certain vitamins in herring meals. Special qualities of the meals have also been investigated. Acid and enzyme digested ensilage herring products have been studied at the request of the fishing industry.

During the past few years, in realization of the fact that 10-15% of herring meal is lipid (fat) in nature, this fraction has been the subject of extensive study. Initial work involved almost complete solvent extraction of the herring meal lipid fraction with an appropriate solvent, and studies of the extracted lipids after removal of the solvent. The results obtained were important in that they demonstrated that the lipid of freshly produced herring meal possessed a somewhat lower nutritive value for chicks than did fresh herring oil. When the meals were stored for up to a year at normal warehouse temperatures the lipid fraction not only became very difficult to extract, but had lost much more of its nutritive value. However, this undesirable change that occurred on prolonged storage could be overcome very significantly by addition of a small amount of a permitted antioxidant.

Further work has extended these findings, and it has been found that the metabolizable energy of the whole herring meal for chicks can be improved if appropriate antioxidants are added just after the drying stage and prior to storage. Our studies along these lines have taken a slightly different direction during the past two years.

Rising costs of handling have made it imperative that all fish meal production be as economical as possible, and one possible way of reducing costs has been a suggested change of bulk handling. Fish meal is usually sacked in polyethylene lined kraft bags and this is an expense in itself. Experiments carried out in close collaboration with the fishing industry have shown that it is possible to convey herring meal mechanically to three compartment railway hopper cars (3,000 cubic ft.) and deliver it to a United States feed formulation plant without adverse effects. However, it is mandatory that such meal be treated with antioxidant promptly after manufacture, and it is wise to have the meal going into bulk storage at temperatures not greatly in excess of 100°F. It is hoped that an antioxidant that can be added to herring press cake prior to drying will be available in the future: presently used antioxidants volatilize readily with steam, and the lipid in the meal is not protected during the actual drying procedure.

CANNED SALMON COLOUR

Another study which is now proceeding partly under contract with the B. C. Research Council is that of a study of colour in canned salmon. Considerable progress was made some years ago in a study of the relation between colour of raw sockeye salmon flesh and colour of the canned product, with a view to evolving a method of colour sorting. Recently the industry has expressed an interest in devising a method of colour sorting for salmon that can be applied in canneries. Since we do not have on staff electrical engineers or electronics experts, a contract was drawn up with the B. C. Research Council and an investigation is under way in which one staff member of the laboratory collaborates with an engineer from the Council. Considerable progress has been made in this problem. One of the greatest difficulties is associated with the fact that small pieces of skin or bone can seriously influence the reflectance obtained from red flesh samples, so that it is difficult to evolve a convenient sensing device.

FISH FLAVOUR

The importance of desirable flavour in our foods is self-evident, but recent reviews indicate that only a little progress has been made in flavour research as far as flesh foods are concerned. In our laboratories a simple sulphur compound - dimethysulphide - was found to be the principal volatile con-

The Pacific Gray Cod

THE gray cod (*Gadus macrocephalus*) is the true cod of the Pacific Ocean and is closely related to the famous cod of the north Atlantic. It is an inhabitant of the colder waters of the coast and seldom ventures south of Oregon. The species is abundant off the west coast of Vancouver Island and in Hecate Strait. Extensive fisheries have occurred as far north as Alaska and the Bering Sea. Over the past few years the gray cod has been increasing in importance to the Canadian fishermen. The total catch by Canadian and American vessels of the British Columbia coast exceeded 30 million pounds in 1965.

GRAY COD (*Gadus macrocephalus*)

DESCRIPTION

The presence of three soft-rayed dorsal fins and two anal fins are characteristics which distinguish the members of the cod family. The gray cod is readily distinguishable from its relatives, the tomcod and whiting, by the long barbel on the lower jaw (the tomcod has a very short barbel and the whiting has none).

HABITS

Little is known of the life history of the gray cod. Spawning is known to take place during the winter months, but the actual location of the spawning grounds is known only for a few small inshore populations. The eggs of the cod, unlike those of some flatfish species, do not float after they have been liberated.

Small gray cod are encountered in shallow water during the summer months and the adults occur at depths of 30 to 60 fathoms.

Food consists mainly of herring, sand lance and flatfish. Other items in the diet include crabs, shrimps and euphausiids.

The gray cod grows very rapidly, reaching a length of 24 inches by the end of its third year. The average age in the commercial catches is three or four years but some fish may reach an age of eight years and a length of close to three feet. Maturity is reached in two or three years.

FISHING METHODS

Otter-trawlers, particularly those equipped with high opening nets of light web, account for the major part of the gray cod landings. Small quantities are caught incidentally in the line fisheries. Several decades ago there existed an active line fishery for gray cod off the Alaska coast and in the Bering Sea, but this petered out, probably because of marketing problems.

In the years following World War II there has been an increasing demand for gray cod. Some of the catch is landed dressed. It is then filleted and packaged for freezing. A fair percentage of the catch is used as halibut bait by longliners.

(Prepared by the Nanaimo Biological Station of the Fisheries Research Board of Canada).

Continued from previous page

stituent of really fresh oysters. It is interesting to note that some compounds that possess very unpleasant odours are considered to be important contributors to "flavour profiles" in foods. One that regularly occurs in extremely small amounts in chicken, for example, is hydrogen sulphide, a substance which is quite lethal in moderate concentrations. Thus this field promises to be complicated, but I am sure the work will eventually be rewarding for it may well lead in the future to practical methods of improving flavour in some of our more tasteless varieties of fish.

Much of our research is of a more fundamental nature. Thus, studies on live fish, including attractants and repellants for salmon, on effect of physical conditions on maturation in juvenile salmon, on bacteria that cause botulism, on metabolism of fish lipids, on protein changes in stored fish and on fish hormones are in progress. ✔

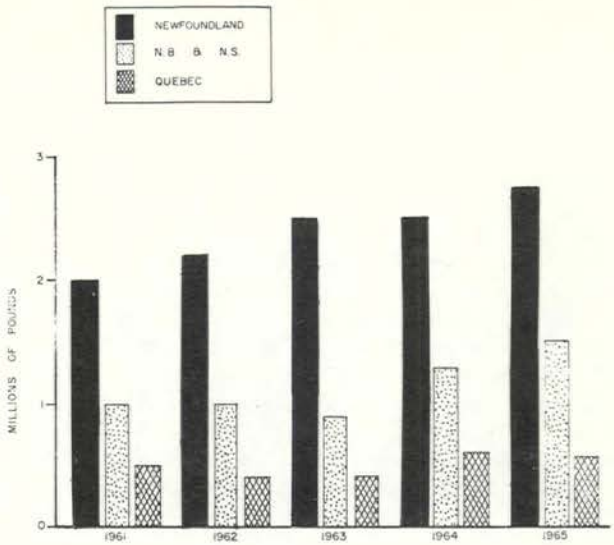
Atlantic Salmon Catch Continues Upward Trend

Commercial salmon landings for the Maritime Region in 1965 were the highest recorded since 1947. The catch weighed in at 1.8 million pounds and follows the general upward trend of landings in the region over the past 10 years.

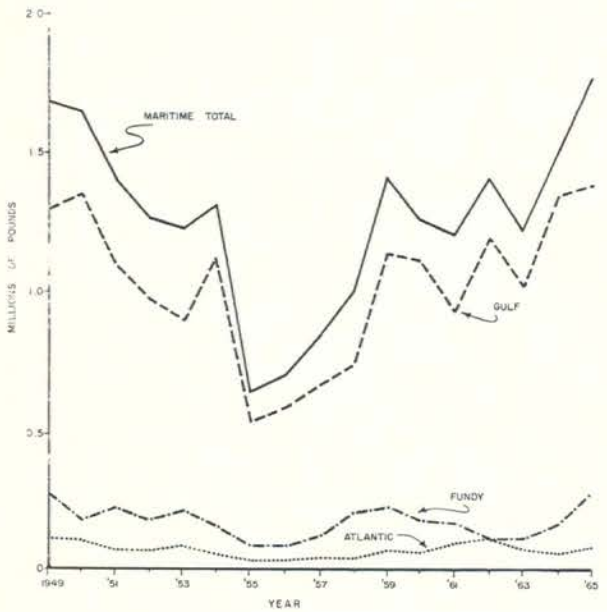
A report prepared by the Department of Fisheries' Resource Development Branch, Halifax, N.S., states that the bulk of this catch came from the Gulf area although the other two Maritime areas of Fundy and Atlantic (Nova Scotia) also showed increases over 1964. In fact the Fundy area catch was 85% more than the 1964 catch, and fishermen in the Saint John area claim that 1965 was one of their best years.

The salmon angling catch for the Maritime Region also increased in 1965, and amounted to 68,225 salmon, an increase of 16% over the 1964 catch. The biggest increase came from the Gulf area. The Fundy catch remained about the same as 1964 while the Atlantic catch decreased by about 50%. Because of low water conditions, angling returns were poor during the late spring and summer throughout the Maritime Region. But a noticeable increase in river flows occurred in the Gulf area during September when more than 40% of the catch was taken. In the Atlantic area water levels remained low all season and the catch was much below the 1964 returns.

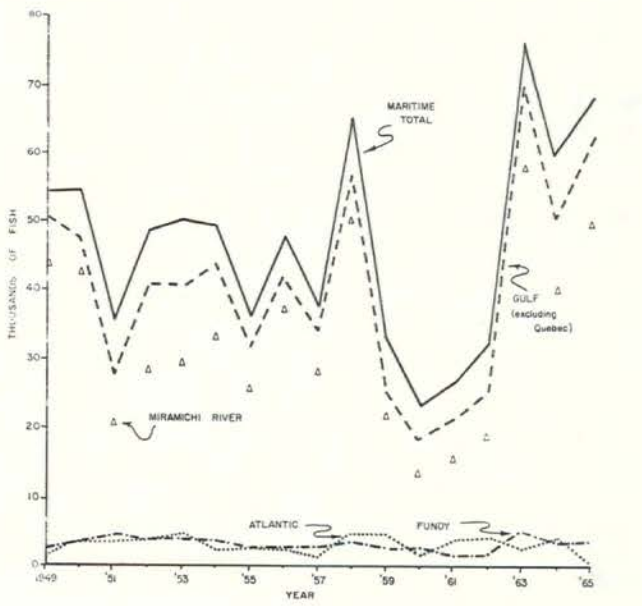
During the 1965 season angling catches in the Maritime Region were recorded as grilse or salm-



Commercial salmon catches for Newfoundland, New Brunswick and Nova Scotia and Quebec from 1961 to 1965.



Commercial salmon catch in the Maritime Region 1949 - 1965.



Angling salmon catches in the Maritime Region 1949 - 1965.

on. From these figures it is found that 81% of the catch was grilse.

CATCH IN OTHER AREAS

Both the other two major salmon fishing areas on the Canadian Atlantic coast, Newfoundland and Quebec, reported increases in the 1965 commercial catch over the 1964 landings. Department of Fisheries figures show that of the three major salmon fishing areas, Newfoundland harvested the largest portion of the commercial crop amounting to 60% of the catch, while the Maritime portion was 30%. Newfoundland's extensive coastline, which includes Labrador, not only allows the cropping of salmon returning to their native Newfoundland rivers, but also the possibility of fishing runs returning to Quebec and Maritime rivers.

The total commercial salmon catch for the ree major fishing regions on the Atlantic coast during 1965 was 4,807,000 pounds, and the landed value was $2,374,000. During the last five years the commercial catch has steadily increased, and the 1965 figure is 9% above the 1964 catch for the Atlantic coast. Both Newfoundland and the Maritime area landings have increased by 500,000 pounds since 1962, while Quebec landings have shown only a slight increase during the same period.

The total salmon angling catch for the Canadian Atlantic coast in 1965 was 119,000 fish, compared with 116,000 in 1964. The Maritime catch increased by 16%, the Quebec catch increased by 6% and the Newfoundland catch decreased 18% when compared with the 1964 figures. ✔

Study Training Methods

Russian, Norwegian and British methods of training recruits to the fishing industry are under study by a group of federal and provincial officials engaged in fisheries vocational training and administration in Canada. The group arrived in Moscow on November 23 and in the following two weeks planned to study Soviet methods of selecting and training personnel for the fishing industry. The group's schedule also included visits to training institutions in Norway, and the United Kingdom.

The tour was the result of a proposal made by the Federal-Provincial Atlantic Fisheries Committee and under a reciprocal arrangement, a group of Soviet fisheries officials will visit Canada early next year to study training methods used here. Arrangements for the tour were made by L. J. Crabbe, Ottawa, Administrator of the Vocational Training Program of the Industrial Development Service of the federal Department of Fisheries.

Others on the trip are Cyril Banikhin, Administrator of the Newfoundland College of Fisheries, St. John's; Rupert Prince, regional representative of the Industrial Development Service of the federal Department of Fisheries, St. John's; Guy Emond, Principal of the School of Fisheries, Grande Riviere, Quebec; Gerard Saint-Cyr, Director of the School of Fisheries, Caraquet, N. B.; Captain J. H. Hansen, Director of Training, Nova Scotia Department of Fisheries, Wolfville, N. S.; Dr. Yves Jean, Director of Fisheries, Quebec Department of Industry and Commerce, Quebec; Eugene Gorman, Deputy Minister of Fisheries of Prince Edward Island, Charlottetown; E. H. Collins, head of the Training and Industry Section of the Manpower Training Branch of the Department of Manpower and Immigration, Ottawa, and G. F. Vail, chief of the Manpower Training Service of the Department of Manpower and Immigration.

Dogfish Aid Program

In order to encourage the production and marketing of dogfish products, the Department of Fisheries has announced that the Government is prepared to assist by paying fishing companies 11 cents per pound on the production of up to 225,000 pounds of skinned dogfish flaps. This production would represent approximately 1,100 tons of whole dogfish.

This program is a continuation of the experimental marketing program the Department initiated a year ago which, at that time, gave promise of expanding and providing a regular market in Europe for dogfish products. Companies participating in this program will be required to provide the Department with a record of all costs associated with the program and will be required to reimburse fishermen at specified minimum rates.

While the Government is prepared to assist by paying a share of the production costs of skinned dogfish flaps, it is recognized that there is also a limited market for dogfish carcasses and under the suggested assistance program, companies are being given the choice of purchasing round, fresh, dogfish direct from fishermen and producing flaps, carcasses and livers, or purchasing only the unskinned flaps from the fishermen.

The livers from the dogfish in this latter case would be sold through the fishing company or directly by the fishermen to other buyers.

The Government is anxious that this program proceed in order to help reduce the large dogfish population that has become a problem to commercial and sport fishing in the Gulf of Georgia. At the same time, such a program would encourage new markets which could possibly develop into an operation that could sustain a dogfish operation without Government assistance.

A Freezer for Eskimo Fishermen

By A.W. Lantz

Fisheries Research Board of Canada, Winnipeg, Man.

THE ECONOMY of Canada's Eskimos is complicated by the fact that the population is scattered in remote and isolated areas with limited facilities for preserving products prior to transport to market. One available fishery product with excellent market potential is the Arctic char which has acquired prestige as a gourmet's food. To improve the economic condition of the Eskimos, the Department of Indian Affairs and Northern Development requested recommendations for freezing fish caught in the Mackenzie Delta area.

Efficient refrigeration equipment has been on the market for years but the Department needed an apparatus specifically suited to a local situation. Requirements included an efficient cooling unit, dependable even in an isolated area; a unit which could be easily installed on shore or for a barge operation; a completely compact unit for surface and often very difficult water transportation; a unit so simple that local inhabitants with a minimum of special training might eventually operate it.

An apparatus designed to fulfill these requirements was mounted on a barge and has been operating satisfactorily in the Mackenzie Delta and Cambridge Bay areas since 1963.

The recommendation favouring immersion freezing in eutectic sodium chloride brine was supported by performance data from a blast freezer of the same capacity.

There are disadvantages to the blast freezing

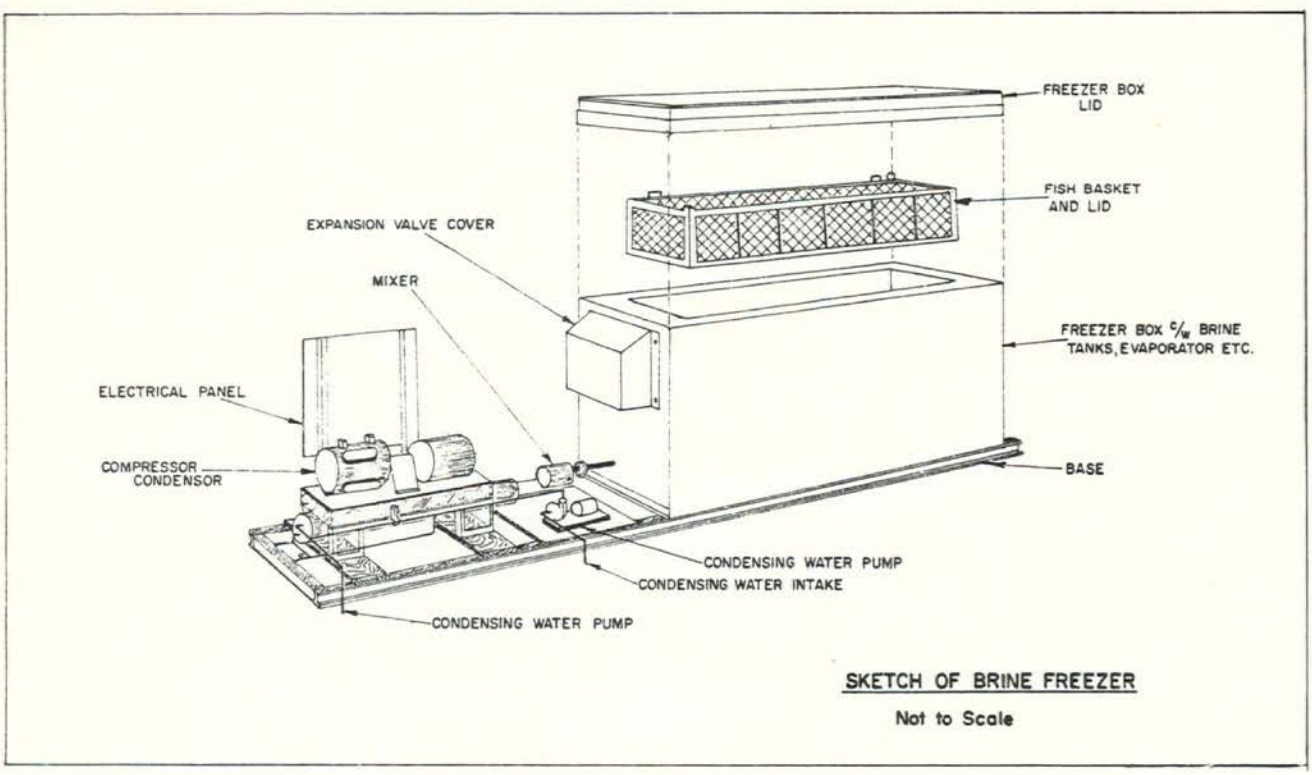


Fig. 1. The Mackenzie Delta commercial eutectic brine immersion freezer.

system. Vapor circulating in the freezer tunnel forms frost on the fin coils, obstructing air circulation and reducing heat transfer capacity. This forces frequent defrosting shutdowns which reduce output. The air required in the blast unit tends to increase dryness in the fish with a weight loss sometimes exceeding one per cent; small whole fish suffer greater loss than large whole fish. Weight loss is also dependent upon species of fish, packaging and mass/surface ratio. as reported by O. C. Young in Fisheries Research Board of Canada. Progress Reports of the Pacific Coast Stations, No. 26, 1935, pp. 12-16.

Compared with blast freezer units, the temperature in a brine immersion unit remains fairly constant, due to the high thermal capacity of the brine.

The Mackenzie Delta brine immersion unit was designed to freeze 500 pounds of fish every three hours. The greatest load the brine compressor is required to carry is during the initial chilling of the fish. If the equipment is kept in daily use, it can be left on automatic control and "pulldown" should be required only after prolonged shutdowns.

Holding baskets with metal dividers prevent fish of fine bone structure, such as Arctic char, from twisting or curving during the freezing process.

Immersion freezing systems (described in ASHRAE Guide and Data Book, 1964 Applications, pp. 535-37) have been in use since 1918. The writer, in 1944 and 1953, served as consultant on West Coast crab-freezing installations. In every instance the brine freezing unit was part of a larger refrigeration system and no attempt was made to freeze eutectic ice onto evaporator coils for use as reserve refrigeration. The coil ice reserve is an item of significant importance because it permits use of a smaller, more compact, brine tank and other small and more economical components. An experimental laboratory model was described by J.S.M. Harrison and S.W. Roach in Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 94, March, 1953, pp. 3-4.

The Mackenzie Delta installation became the first self-contained commercial eutectic brine immersion freezer (Fig. 1).

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(Editor's note: The technical aspects of this freezer have been described in a paper published in Canadian Fisheries Reports No. 6, under the title "Eutectic Brine Freezer for Eskimo Fishermen by A.W. Lantz").

Cooking in the Far North

What sort of fish cookery demonstration do you present to an audience that includes native Eskimos, Indians and Laplanders?

That was the problem that faced Miss Margaret Myer, chief of the Consumer Branch of the Department of Fisheries, on a recent visit to Inuvik, in the Northwest Territories

Miss M. Myer

The demonstration, given in the home economics room of the local school, was attended by about 30 women attending the first territorial Women's Institute convention at Inuvik. Some of the delegates could neither read nor write.

Following considerable consultation, Miss Myer decided to demonstrate the following dishes: Baked stuffed whitefish, crispy baked trout fillets, Johanne's fish chowder (pike fillets) and smoked whitefish potato cakes. The fish used in the demonstration came from Great Slave Lake.

Miss Myer reported afterwards: "I was particularly anxious to make the point that fish should be cooked before eating. When I was preparing the frozen trout, I was requested by some members of the audience to please let them have some raw frozen trout, so I did.

"Before I made the chowder, one of the ladies told me that pike or jackfish was dogfood, but she ate two helpings and declared she liked it. One point that got home was that fish could be cooked quickly."

Scientists, Industrialists Confer

See Widening Use of Marine Oils

MARINE oils figured prominently in the agenda of a meeting of the Canadian Committee on Fats and Oils held in Ottawa recently. Attended by fisheries and agriculture scientists and representatives of the food industry which uses edible oils, the meeting was given an encouraging picture of the marine oil industry generally.

Presided over by B. M. Craig, committee chairman, the delegates -- numbering almost 100 -- heard Dr. Jacob Bieley, University of British Columbia scientist, discuss the use of marine oils as supplements in poultry rations.

While marine oils had an unfavorable aspect -- that of fishy flavor -- there was also the positive factor of the high energy value of fish oils for poultry, he said. He considered it possible that further research might reveal methods by which stable oils would not induce off-flavors in either fresh or stored poultry meat, or in eggs.

Dr. Bieley noted that more than 123,000,000 chickens were slaughtered in Canada last year. He estimated food consumed by those birds as about a billion pounds. "If used at a level of one per cent of the ration, 10,000,000 pounds of fish oil could have been utilized for this class of poultry alone." Dr. Bieley said substantial amounts of fish oil could be used in rearing poultry for egg production, and in rearing turkeys. Two or three weeks prior to killing, the oil could be withdrawn from the ration and thus eliminating the fishy flavor problem.

Fisheries scientists laid special emphasis on the use of herring oil. It was noted in particular that the herring fishery on the Atlantic had made a phenomenal growth during the last couple of years. Peter Jangaard scientific liaison officer of the Fisheries Research Board of Canada's technological station in Halifax, produced figures showing that the 116,000 tons of herring caught in Atlantic waters last year was about 100 percent above the 1963 level. Prospects were, he said, that the 1966 catch will be even higher.

Dr. R. G. Ackman, marine oil expert of the research board's Halifax station, discussed his work on the fatty acid composition of fish oils, while edible oil production figures were given by L. G. Rupert, of the federal Department of Trade and Commerce, Ottawa. Total fish oil production last year totalled more than 51,000,000 pounds.

Mr. Jangaard said new herring processing plants were being built in the Maritimes and several plants were in the planning stage in Newfoundland. The largest plant in the latter province is at Harbor Breton which is being enlarged to handle a heavier volume of herring.

Dr. Graham Bligh, leader of the technological section of the Research Board's Freshwater Fisheries Institute, Winnipeg, told the meeting that, because of insufficient supply and economic factors, the potential of fresh water fish as a source for oil was negligible.

WHALES AND SEALS

The contribution of the whale and seal fisheries to marine oil production was discussed by E. B. Young, of the federal Fisheries Department's Conservation and Protection Service. He noted that the harvest of harp seals and whitecoats (baby seals) was under Canadian conservation in the Gulf of St. Lawrence, but did not apply to international waters known as "The Front" off the coast of Newfoundland. The harvest of gulf seals has become stabilized at 90,000 per year. This includes the 50,000 quota of whitecoasts permitted by the Department of Fisheries.

Mr. Young also discussed whaling operations in Nova Scotia and Newfoundland. The annual Atlantic catch is about 500 including fin, sei and sperm whales. In addition, smaller whales such as bottlenose and minke are hunted. In British Columbia the annual catch averages 750 whales. The beluga or white whale fishery in Hudson Bay accounted for about 500 whales. Mr. Young said. Both seals and whales yield oil.

Management of the herring fishery in British Columbia was the topic of a paper given by C. R. Levelton, director of the Conservation and Protection service.

Problems in the edible utilization of marine oils were discussed by a panel comprising representatives of the Canadian food industry. They included: R. B. Mitchell, D. Btoen, J. Ward, E. E. Russell, B. Teasdale, and P. Ziegler, all of Toronto, and D. F. Chalmers, Hamilton. Mr. L. G. Rupert was chairman. ✔

Landings Up, Fleet Enlarged

Ireland's Fishing Industry Booms

By W.G. Huxtable, Canadian Commercial Secretary in Dublin

THOUGH surrounded by some of the world's most heavily fished waters, it is only in recent years that the Republic of Ireland has begun to develop her own fishing industry. Now total landings are beginning to reach about $6,000,000 per year in value, Government fisheries research and aid is being increased and fishermen themselves are trading up to larger and better boats.

Despite a severe drop in the salmon catch, last year's total landings set a record.

About 1,650 Irishmen earn their living solely by fishing and about 3,850 men fish commercially for part of their living. More than 1,000 boats are engaged solely in fishing and about 800 are used for part time fishing. Almost half of the boats used full time for commercial fishing are powered by inboard motors. Only a few of the motor vessels are 50 tons or more in size. The largest group, totalling about 250, are under 10 tons in size, and about 150 fall in the 25 - 49 ton range.

But small boats are being replaced by bigger boats and big boats are being replaced by huge ones for Ireland. The oar powered curracle is being abandoned for 26-foot, 7 h.p. diesel motor boats, Irish built for inshore fishing, and 70 to 110-foot trawlers, some new and some second hand, from France and Scandinavia are being put into service by deep sea operators.

MARKETING

With improvements in catching methods have come interesting developments in fish distribution and consumption. As recently as three years ago Irish fishermen were almost solely dependent on the Dublin market for catch disposal. The then reconstituted Sea Fisheries Board undertook to encourage development of regional local markets with spectacular success, especially for the Northern and Southern coasts where 40 to 50 per cent of the catches are now sold locally.

Irish fish consumption per capita has risen

Ireland's first stern trawler, built at a cost of about $370,000, was launched earlier this year at St. Malo, France.

apace. In 1963 it was 7.5 lb., in 1964 it was 8.3 lb., and in 1965, 9.6 lb. In the past fish has been considered almost exclusively as a penitential food but changing attitudes to penitential observance coupled with better appreciation of fish as tasteful and appetizing food (inspired by Sea Fisheries Board promotions) suggest that per capita consumption of fish in Ireland will continue to increase. It is still less than half the figure for Britain.

Irish fish exports last year closely matched the total catch in value. Despite drops in salmon, prawns, escallops, mussels and canned shellfish exports, total fish exports last year at nearly $6 million were about one per cent higher than they were in the previous year. The drop in the salmon catch was also reflected in the 45 per cent increase in canned salmon imports.

The Irish Government aids the industry through two bodies: the Department of Agriculture

and Fisheries provides technical assistance and basic research services to fishermen besides controlling fisheries exploitation; and the Sea Fisheries Board, a statutory development body financed by the State, extends financial assistance to fishermen for vessels and also undertakes market development promotion in Ireland and in export markets. Government policy in other fields has a direct effect on the industry. Ireland adopted an exclusive twelve-mile fisheries limit in 1965, but allows ships of Britain, Belgium, France, Germany, The Netherlands and Spain to fish within the limit in certain circumstances. One of the terms of the Free Trade Area Agreements between the British and Irish Governments, effective July 1, 1966, guarantees access of Irish fish and fish products to Great Britain free of duty.

"Cap'n Gus" Ends Adventurous Career

WINDSHIPS, steamboats and diesel-powered vessels have all been part of the adventurous career of Captain John Angus MacLeod. Now he is leaving all that behind as he retires as marine supervisor of the federal Department of Fisheries sea-going patrol fleet in the Maritimes.

Captain MacLeod - "Cap'n Gus" to his many former shipmates and associates in the Department of Fisheries - left his post with fisheries in October after nearly 20 years' service.

A native of North Sydney, Captain MacLeod began his seafaring out of Nova Scotia ports as a young man. He sailed aboard sailing vessels including the famous *Constellation*, a U.S.-built schooner-type yacht designed to participate in international sailing races.

During the twenties he progressed through the various stages of seamanship and in 1930 was awarded a master's certificate. He sailed in ships of the old Canadian Government merchant marine and the Black Diamond Line. For a time he was a mate of *Clyde Valley*, the oldest ship of Canadian registry. This 80-year-old coal-burning freighter retired from sea service less than a year ago and is now awaiting her fate in a Sydney dock.

JOINED MOUNTIES

In 1932 Captain MacLeod joined the Marine Section of the Royal Canadian Mounted Police operating in Maritime waters. For seven years he sailed with the fleet of powerful, but relatively small, craft which kept law and order within the territorial waters of Canada's east coast. That was the era of the rum-runners when sleek, grey-hulled vessels carrying contraband liquor sought to outwit sea-going law officers by landing their cargoes by night in fog-shrouded bays and inlets.

When war came in September 1939, Captain MacLeod immediately volunteered for service in the Royal Canadian Navy. And he was immediately accepted. For six years he served with nation's sea-fighting service. After discharge late in 1945 he returned to sea in a civilian capacity, this time as master of a freighter in the Caribbean trade. He was no stranger to these waters of the olden-time Spanish Main as he had sailed there years before.

In 1947 Captain MacLeod joined the Department of Fisheries as master of its patrol flagship *C G S Cygnus*. This ocean-going vessel - a former mine-sweeper which saw wartime Atlantic service - was later replaced by a new *Cygnus* which is still in off-shore service. He remained as master of *Cygnus* until his appointment as marine supervisor in 1950.

Captain MacLeod and wife - formerly Miss Lottie Patterson, Middleton, N.S., - will live in Goldboro, Guysborough County. While Cap'n Gus has "swallowed the anchor", he'll be living by the sea and, occasionally, will sail on it in his Cape Island-type fishing boat which he bought recently for recreation in the days of leisure ahead.

Capt. J.A. MacLeod, right, who recently retired as Maritimes marine supervisor for the Department of Fisheries, receives congratulations from Maritimes Regional Director R.E.S. Homans.

News Roundup

Salmon Fishing Licences

Licences to engage in the British Columbia salmon fishery in 1967 will be issued to any persons applying for them, subject to the usual citizenship requirement, provided the application is made by the deadline date of next May 31, Fisheries Minister H. J. Robichaud announced recently.

It had been proposed earlier by the Department of Fisheries that such licences for 1967 would be issued only for vessels which had been licensed to fish salmon in 1966 or which replaced such vessels. There was also provision for special consideration of licence applications which did not meet this qualification.

However, Mr. Robichaud said it would not be possible to proceed with implementing the Department's proposals in 1967 because of unforeseen difficulties which will require more detailed discussions than had been anticipated with the fishermen and the industry in British Columbia. Further meetings on the matter will be held with all interested parties in B. C. within the next few months to discuss all aspects of the problem.

IPSFC Appointment

Richard Nelson, Sr., of New Westminster, B. C., has been appointed to the International Pacific Salmon Fisheries Commission for a two-year term, effective November 1, 1966.

Mr. Nelson succeeds A. J. Whitmore, of Burnaby, B. C., a member of the Commission since 1939, who is retiring for health reasons.

The six-man commission, on which Canada and the United States have equal representation, is responsible for the preservation, protection and extension of the sockeye and pink salmon stocks of the Fraser River system.

In a tribute to Mr. Whitmore's 27 years' service as a Canadian representative on the International Pacific Salmon Fisheries Commission, Fisheries Minister H. J. Robichaud referred to the Commissioner's untiring efforts in the field of salmon conservation and management. "Mr. Whitmore's dedication to the work of the Commission and the wise counsel he has contributed over the years stand out as a most significant individual contribution", the Minister added.

Mr. Whitmore retired as Pacific Regional Director for the Department of Fisheries in 1960, having joined the Department in British Columbia in 1917 as an office boy. During his long career he has earned the respect and friendship of all branches of the fishing industry.

Mr. Nelson, who has been prominently connected with the fishing industry on the West Coast for many years, has been a member of the Advisory Committee to the International Pacific Salmon Fisheries Commission since its inception. He served for 11 years as a member of the International Pacific Halibut Commission, and is a former chairman of that body.

Freshwater Fish Marketing

The establishment under federal legislation of a Freshwater Fish Marketing Board to handle all export and interprovincial sales of freshwater fish in Northwestern Ontario, Manitoba, Saskatchewan, Alberta, and the Northwest Territories has been recommended by a Royal Commission.

Report of the one-man Royal Commission of Inquiry into Freshwater Fish Marketing was tabled in the House of Commons recently by Trade and Commerce Minister R.H. Winters. The Commissioner was George H. McIvor.

The report proposes that the suggested Freshwater Fish Marketing Board should be the sole buyer of freshwater fish from the fishermen but that services of present exporters, packers and processors be utilized under contract with the Board.

The report is being studied by the Government which will consult with Provincial Governments and with representatives of the trade before decisions are made regarding its recommendations.

The Royal Commission's inquiry arose from recommendations made by the Federal-Provincial Prairie Fisheries Committee which had been studying instability of prices and demand in freshwater fisheries products and the means for improving returns to primary producers by more efficient marketing.

New Patrol Vessel

The latest addition to the federal Department of Fisheries' patrol fleet in the Newfoundland Region was launched at Clarenville, November 16.

The *Pistolet Bay*, built by Nfld. Shipyards Ltd., was christened by Mrs. H. R. Found, wife of the Assistant Regional Director of Fisheries in Newfoundland.

The 19 ton (net) *Pistolet Bay*, has an overall length of 66 feet, and a beam of 16 feet. The single screw craft, built of B. C. fir, with oak keel and stem, is powered by a 230 h. p. engine. She is fitted with the latest in navigational aids, including radar, depth recorder and radio-telephone and reinforced with greenheart sheathing, together with steel bow and stern plates fitted for navigation in ice.

In addition to quarters for the crew of four, the vessel has berthing accommodation for four others.

After a period of outfitting, followed by engine trials, the vessel will go into service in the Placentia Bay area.

FRB Appointments

The appointment of two new members of the Fisheries Research Board of Canada has been announced by Fisheries Minister H. J. Robichaud. David F. Corney, 46, of Mulgrave, Nova Scotia, will replace Ronald G. Smith, of Halifax, whose five-year-term expires at the end of the year, and Dr. Robert D. Connor, 44, Associate Dean of the Faculty of Arts and Sciences, University of Manitoba, will replace Dr. Sol. Sinclair, also of Winnipeg. Dr. Sinclair resigned from the Board earlier this year to undertake a two-year assignment with the Ford Foundation in Kenya, where he is special adviser on the improvement and modernization of agricultural and fishery practices. Both appointments are effective January 1, 1967.

Mr. Corney, who has been general manager of Acadia Fisheries Limited at Mulgrave since 1961, was born at Woodrow, Sask., and after engineering studies at the Chicago Industrial Training Institute, worked as a refrigeration engineer for a time and was also general manager of the Saskatchewan Marketing Service. He has been active in trade association work for 15 years and for ten years has been a director of the Fisheries Council of Canada, serving as its president in 1965-66.

Dr. Connor, a native of Edinburgh, Scotland, served with the R. A. F. after graduating in physics at Edinburgh University, where he was awarded the Neil Arnott Scholarship in Experimental Physics.

He returned to Edinburgh University in 1946 and was awarded his Ph. D. in experimental nuclear physics in 1949. He was lecturer in the Physics Department at Edinburgh University from 1949 to 1957, when he went to the University of Manitoba, where he was appointed Professor in the Department of Physics in 1960. In 1963, he was appointed to his present post as Associate Dean of the Faculty of Arts and Sciences. He is the author of about 30 publications, mostly on the subjects of radioactivity and low energy nuclear physics.

Scientific Leader

Dr. J. R. Vallentyne, 40, has been appointed Scientific Leader of the Eutrophication Section at the Fisheries Research Board of Canada Freshwater Institute, Winnipeg. He will have responsibility for investigations involving the complex changes that occur in lakes when they are polluted with nutrient-rich wastes.

A native of Toronto, Dr. Vallentyne has been Associate Professor and Professor of Zoology at Cornell University, Ithaca, N. Y., since 1958. Prior to that he was on the staff of Queen's University, Kingston, Ont.

Dr. Vallentyne received his early education in Toronto and, following wartime service with the Canadian army, he studied at Queen's University where he secured his B. A. degree in 1949. His post-graduate training was at Yale University, where he was awarded the degree of Doctor of Philosophy in 1953.

Dr. Vallentyne has maintained an enthusiastic participation in research throughout his teaching career. His scientific writing encompasses work in a wide range of freshwater studies and his work on the chemistry and bio-chemistry of lake bottom sediments is internationally recognized.

Dr. Vallentyne's appointment completes the key research positions at the new Institute. Other recent appointments to the three Scientific Leader posts are Dr. E. G. Bligh (Technology) and Dr. L. Johnson (Population Dynamics). Director of the Institute is Dr. W. E. Johnson.

INPFC Meets in Vancouver

The International North Pacific Fisheries Commission concluded its 13th annual meeting at Vancouver, B. C., on November 11. The final plenary session of the Commission marked the conclusion of three weeks' study and discussion of various aspects of international co-operation for the conservation of high seas fisheries resources in the North Pacific Ocean.

During the first two weeks, scientists from Canada, Japan and the United States reviewed the results of research carried out by the three countries in 1966 on the salmon, halibut, king crab and groundfish resources and prepared summary reports of their findings for the Commission's guidance. The scientists also exchanged information on high seas fishing operations during 1966.

HALIBUT CONSERVATION

One of the principal tasks on the Commission's agenda was to draw up a set of recommendations to member governments on fishing regulations for the halibut fishery of the eastern Bering Sea in the 1967 fishing season. The Commission has been performing this function since 1963, when line fishing for halibut in that area first became open to the operations of fishermen from all three countries. For 1967 the Commission agreed to recommend a slight lengthening of the fishing season in the focal part of the fishing ground referred to as Area A and intensified conservation measures for areas east and west of that area.

It will be recommended that an extensive area in the southeastern Bering Sea which is a nursery ground for young halibut be closed to halibut fishing completely, and within a part of this area Japan will undertake to prohibit all trawl fishing by Japanese fishing vessels. Canadian and United States representatives stated that their governments intend to require their fishermen to release all halibut taken by trawl nets in any part of the Bering Sea. The Japanese representatives expressed the intention of their government to apply a minimum size limit of 66 centimeters (26 inches) for halibut to Japanese fishing operations throughout the Bering Sea.

In the Gulf of Alaska, the Commission's studies were focused on the effects of the expanding trawl fisheries for various species of bottomfish and shrimp on the halibut stocks which are exploited by Canadian and United States setline fishermen in that area. The Commission approved a number of recommendations by its Gulf of Alaska Groundfish Committee for further research in this field. In its consideration of groundfish research, the Commission was assisted by consultants from the scientific staff of the International Pacific Halibut Commission.

KING CRAB RESEARCH

The Commission recommended that research on the king crab resources of the eastern Bering Sea be continued and further strengthened.

The Commissioners reviewed the progress during the year of the Commission's program for publication of scientific reports written by scientists of the three countries. A number of major papers resulting from the Commission's research were published in English and Japanese versions in the INPFC Bulletin, including several chapters of a nine-part comprehensive report on North Pacific salmon on which Canadian, Japanese and United States scientists have been collaborating over the past several years.

The Commission recommended no change in the provision of the Convention whereby Canada abstains from exploiting salmon of the Bristol Bay area of Alaska, and Japan abstains from fishing for salmon in the eastern North Pacific and Bering Sea, halibut in the northeastern Pacific south of the Aleutian Islands and the Alaska Peninsula and herring off most parts of the British Columbia coast.

On the final day of the meeting, the Commission took note of reports that the Republic of Korea may have plans to enter the salmon fishery and perhaps other fisheries in the area covered by the Convention and requested the Chairman of the Commission to call these reports to the attention of the member governments, to express the Commission's grave concern over the implications of such a development for its conservation program, and to ask the governments to give consideration to this matter.

OFFICERS FOR 1967

Dr. A. W. H. Needler, Deputy Minister of Fisheries for Canada, was Chairman at the meeting. New officers elected for 1967 are Kenjiro Nishimura of Japan, Chairman; Edward W. Allen of the United States, Vice-Chairman; and Dr. A. W. H. Needler of Canada, Secretary. Other members of the Commission are James C. Cameron, Carl E. Giske and Donovan F. Miller for Canada; Nobuyuki Nakashima, Tomoyoshi Kamenaga and Kenkichi Nakabe for Japan; and Clarence F. Pautzke, Roger Kent and Fred P. McGinnis for the United States. The Commission agreed that its 1967 annual meeting would be held in Tokyo beginning November 6.

Fishery Figures For September

SEAFISH: LANDED WEIGHT AND LANDED VALUE

	May-September 1965		May-September 1966 2/	
	'000 lbs	$'000	'000 lbs	$'000
CANADA - TOTAL	1,363,606	98,646	1,436,030	108,625
ATLANTIC COAST - Total	1,144,134	61,952	1,151,990	58,611
Cod	425,563	17,250	378,951	16,245
Haddock	44,149	2,819	46,577	3,271
Pollock, Hake, Cusk, etc.	41,757	1,350	41,235	1,474
Rosefish	77,397	2,043	106,754	2,966
Catfish	3,295	109	3,188	107
Halibut	2,724	856	2,356	765
Plaice & Other Flatfish	127,254	4,021	148,697	4,810
Herring & Sardines (3)	307,754	3,157	326,487	4,062
Mackerel	21,630	693	19,026	646
Alewives	12,084	202	7,906	140
Salmon	4,576	2,193	4,821	2,533
Smelts	230	22	251	23
Swordfish	5,592	2,253	5,437	2,346
Other Fish	13,171	304	12,220	192
Lobsters	31,114	18,392	27,390	14,821
Clams & Quahaugs	2,906	165	3,353	194
Scallops	10,570	5,823	9,867	3,763
Other Shellfish	12,368	295	7,474	253
PACIFIC COAST - Total	219,472	36,694	284,040	50,014
Pacific Cods	15,218	1,087	16,453	1,435
Halibut (1)	30,810	10,412	30,673	10,990
Soles & Other Flatfish	3,930	255	6,298	401
Herring	80,478	1,063	69,892	1,167
Salmon	80,107	23,213	149,584	35,244
Other Fish	3,616	115	5,301	173
Shellfish	5,313	549	5,839	604
BY PROVINCES				
British Columbia	219,472	36,694	284,040	50,014
Nova Scotia	368,477	25,339	410,312	23,319
New Brunswick	207,340	7,702	200,485	7,768
Prince Edward Island	36,269	6,107	40,969	5,018
Quebec	121,365	5,353	85,000 (2)	4,626 (2)
Newfoundland	410,683	17,451	415,224	17,880

(1) - Includes halibut landed in U. S. ports by Canadian fishermen. (2) - Figures for Quebec available to end of Aug. 1966 only. (3) - Includes herring landed in August 1966 for which data were not available in time to be included in May-August cumulative total.

MID-MONTH WHOLESALE PRICES - September 1966

	Montreal $	Toronto $
Cod fillets, Atl, fresh, unwrapped	.384	.453
Cod fillets, Atl, frozen, cello 5's	.369	.397
Cod fillets, smoked	.422	.473
Haddock fillets, fresh, unwrapped	.475	.580
Herring, kippered, Atl.	.258	.307
Mackerel, frozen, round	.193	.243
Lobsters, canned, Fancy Case 48-½s	59.680	60.660
Sardines, canned Case 100-¼s	9.693	9.567
Halibut, frozen, dressed	.568	.600
Silverbright, frozen, dressed	.622	.640
Coho, frozen, dressed	.802	.763
Sockeye, canned, grade A Case 48-½s	28.437	29.140
Pink, canned, grade A Case 100-½s	16.487	17.067
Whitefish, fresh	.483 (1)	.417
Lake trout, frozen	.432	.517

(1) - Dressed

PRICES PER CWT. PAID TO FISHERMEN

(Week ending Sept. 17)	1965 $	1966 $
Halifax		
Cod Steak	4.75	5.25
Cod Market	4.5	5
Haddock	7.5	8.5
Plaice	4	5
Yarmouth		
Haddock	6.5	8
Black's Harbour		
Sardines	-	-
St. John's Nfld.		
Cod	4	-
Haddock	-	-
Rosefish	2.5	-
Vancouver		
Ling Cod	10-12	10-12
Gray Cod	5-7	7.5
Soles	5-9	7-9.5
Salmon (Rdspg)	45-75	35-77

Fishery Figures For September

FROZEN FISH STOCKS AS AT END OF AUGUST

	1965 '000 lbs	1966 '000 lbs
TOTAL - Frozen Fish, Canada	99,847	118,529
Frozen - Fresh, Sea Fish - Total	73,580	91,626
Cod, Atlantic, Fillets & Blocks	15,066	26,225
Haddock, fillets & blocks	2,910	4,129
Rosefish, fillets & blocks	5,891	7,635
Flatfish, (excl. halibut), fillets & blocks	5,711	5,678
Halibut, Pacific, dressed & steaks	9,842	12,607
Other Groundfish, dressed & steaks	2,276	2,681
Other Groundfish, fillets & blocks	6,024	10.340
Salmon, Pacific, dressed & steaks	13,887	11,641
Herring, Atlantic & Pacific	736	437
All Other Sea Fish, all forms	6,862	5,776
Shellfish	4,375	4,477
Frozen - Fresh, Inland Fish - Total	5,575	6,694
Perch, round or dressed	13	383
Pickerel, (Yellow & Blue) fillets	94	204
Sauger, round or dressed	23	1/
Tullibee, round or dressed	100	233
Whitefish, round or dressed	2,360	2,183
Whitefish, fillets	310	284
Other, all forms	2,675	3,407
Frozen - Smoked Fish - Total	2,324	1,995
Cod Atlantic	1,095	1,161
Sea Herring, kippers	859	550
Other, all forms	370	284
Frozen for Bait and Animal Feed	18,368	18,214

1/ Confidential, included with "Other".

SALTED FISH STOCKS AS AT END OF AUGUST

Salted and Pickled Fish, Atlantic Coast		1965 '000 lb.	1966 '000 lb.
Wet-salted - Total		40,846	35,881
Cod		35,992	30,457
Other		4,854	5,424
Dried - salted - Total		15,145	12,389
Cod		14,394	11,324
Other		751	1,065
Boneless - Total		989	553
Cod		863	506
Other		126	47
Pickled - Total	(barrels)	25,336	22,787
Herring	"	5,166	7,480
Mackerel	"	11,836	7,226
Alewives	"	7,061	6,789
Turbot	"	1,273	1,292
Bloaters	(18 lb. boxes)	223,622	207,916
Boneless Herring	(10 lb. boxes)	5,478	9,416

CANADIAN EXPORT VALUE OF FISHERY PRODUCTS, MAY - JUNE

(Value in Thousands of Dollars)

		1965		1966
Total Exports		34,502		34,603
By Markets:				
United States		27,252		27,184
Caribbean Area		3,217		3,205
Europe		3,279		3,677
Other Countries		754		537
By Forms:				
Fresh and Frozen		26,020		26,358
Whole or Dressed	6,535		6,815	
Salmon, Pacific	1,814		2,215	
Halibut, Pacific	1,297		1,407	
Cod, Haddock, Pollock, etc.	63		77	
Swordfish	624		454	
Other Seafish	699		857	
Whitefish	659		586	
Pickerel	618		453	
Other Freshwater Fish, n.o.p.	761		766	
Fillets	9,835		11,016	
Cod, Atlantic	4,349		3,326	
Haddock	978		1,430	
Rosefish, Hake, Pollock, etc.	392		783	
Flatfish	1,379		2,755	
Pickerel	257		317	
Other	2,480		2,405	
Shellfish	9,650		8,527	
Lobster (Alive & Meat)	7,916		6,680	
Other	1,734		1,847	
Cured		3,528		3,542
Smoked	226		254	
Herring	113		101	
Other	113		153	
Salted, Wet & Dried	2,952		3,006	
Cod	2,618		2,637	
Other	334		369	
Pickled	350		282	
Herring	201		223	
Mackerel	85		11	
Other	64		48	
Canned		2,375		1,613
Salmon	1,260		274	
Sardines	637		660	
Lobsters	276		473	
Other	202		206	
Miscellaneous		2,579		3,090
Meal	1,918		1,952	
Oil	100		92	
Other	561		1,046	

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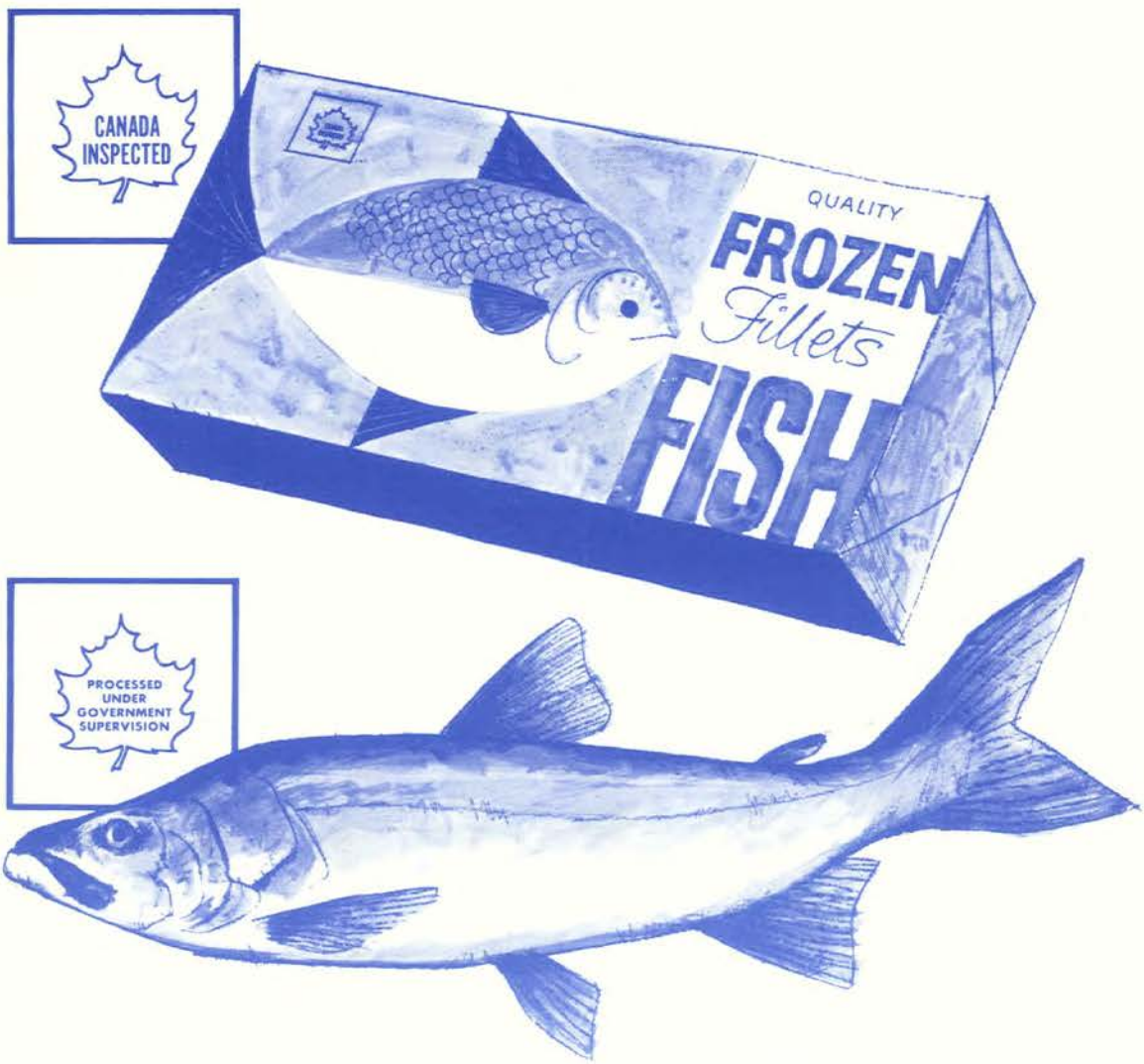

DEPARTMENT OF FISHERIES
Hon. H. J. Robichaud, M.P., Minister
Dr. A. W. H. Needler, Deputy Minister
Ottawa, Canada

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