auditing; but to-day a better organized and integrated movement, coupled with the Extension program of St. Francis Xavier University and other agencies, is attempting to remedy these three defects. These co-operatives still do only a small percentage of the total Maritime retail business, but their volume is increasing steadily. Government statistics placed their total sales at almost $10,000,000 in 1945. Outside Cape Breton, as yet the consumer co-operative movement is largely rural.

At present Cape Breton Island has the greatest concentration of co-operatives in the Maritimes. Counting the business of the British—Canadian, about forty other local co-operatives under a regional wholesale, Cape Breton Co-operative Services, twelve marketing co-operatives, and credit union loans, the total business turnover was approximately $7,000,000 last year. In addition, the industrial area of Cape Breton has several housing co-operatives that are pioneers in America in this social venture.

Adult Education

The Co-operative Movement in the Maritimes derives strength and stability from its connection with an adult education program. It is conscious of a social mission and an ultimate goal that cannot be measured in dollars. It is not surprising, therefore, to find that centres of successful co-operative activity are advancing in other ways, with more thought now given to better education, better social services, better community life generally. People who learn to co-operate on an economic level easily move up to a higher plane, and are less likely to dissipate their energies in petty jealousies and contentions when they attempt anything in the way of community endeavour. Of course, like true democracy, a co-operative economy with its resulting social benefits is difficult to realize, and achievement always lags behind the ideal which the movement has set for itself.

In conclusion, it should be noted that the Co-operative Movement here, as elsewhere in the world, was set in motion and developed by those who, in the beginning, were least qualified to carry on a program of economic reconstruction. Progress had to be made the hard way, often by trial and error. In general, the people have received only half-hearted, tongue-in-the-cheek encouragement from those whose support might have already made the movement the deciding force in rebuilding our Maritime economy. Whatever their role and development in the future, the co-operatives of the Maritimes to-day represent the protest of the people against all signs of exploitation or impoverishment that stand in contradiction to the vigor of a new land and the potential wealth of this country.

British Columbia Fisheries

By William S. Hoar

CANADA holds an enviable position among fishing nations. On east and west she touches two of the four great fishing areas of the world. In addition, about half of all the fresh water of the globe is within her boundaries. Of the nine provinces, British Columbia is, without doubt, the most fortunate in her fisheries, contributing about 40% of the total value of the Canadian products. In recent years the British Columbia production of fish has exceeded forty-four million dollars.

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Contrast of East and West Coast Fisheries

There are very definite reasons for saying that British Columbia is the most fortunate of the provinces in this respect. For one thing the kinds of fish produced in British Columbia are those which men value most and the return to the fisherman for his efforts is correspondingly greater. If codfish sold for the same price as salmon, Nova Scotia would be the foremost fishing province in Canada, but the cod and its allies are not worth as much as salmon, on a straight nutritional or preference basis, and this disparity in return to fishermen per unit effort expended will continue to exist. Thus there are almost as many fishermen employed in Nova Scotia as in British Columbia and the tonnage landed is equivalent but the British Columbia products are worth twice as much. British Columbia's fortunate position is evident also in the fact that she produces 40% of the value of Canadian fisheries with 23% of the total fishery workers and 50% of the total capital investment.

Canada's fishing wealth on the east coast rests in her ground fisheries. The relatively shallow waters (50 to 100 fathoms) of the Gulf of St. Lawrence and the off-shore banks of Nova Scotia and Newfoundland have been yielding tremendous catches of cod, haddock, hake, cusk etc. (the so-called ground fishes) for centuries. The area of these off-shore banks (less than 50 fathoms below surface) is said to be about 65,000 square miles—a larger area than the whole of the Maritime Provinces. The east coastline, too, is more extensive than the west. The shores of the Gulf of St. Lawrence alone equal the whole coastline of British Columbia (7,000 nautical miles). British Columbia, in contrast, has relatively little of this shallow water and a shorter coastline. Less than forty miles off-shore the continental shelf drops abruptly into the depths of the Pacific. The ground fisheries—except halibut—are relatively small. British Columbia's wealth, on the contrary, rests in the great schools of pelagic fishes which feed and mature in the very productive off-shore waters and come near shore or into the rivers to spawn. Salmon, herring, halibut, and pilchards are the "big four" of British Columbia fishes and of these salmon is king with a value of more than 50% of the total British Columbia fish production ($25,424,954 in 1945). Contrasts in east and west coast fishing and processing methods, capital investments and so on can all be traced to these basic differences in geography and the kind of fishes living in these very different situations.

Kinds of Pacific Salmon

The Pacific Salmon is truly a Pacific Ocean fish found naturally only in the waters of that ocean. Superficially it might be confused with the Atlantic Salmon and some of the larger trout but the scientist places it in a special group (*Oncorhynchus*) and distinguishes six different types. These six types range around the fringe of the North Pacific from the waters of Japan and Siberia to the Sacramento and Columbia Rivers. Five of these types are found on the American shores and these five abound in the waters of British Columbia. The sixth species is found in Asiatic waters. All Pacific salmon agree in having a life history which involves spawning in fresh waters and maturing in the ocean. Unlike the Atlantic salmon and trout, the Pacific salmon completes its life cycle with the first spawning then dies. These five salmon show many variations in this life cycle. The sockeye, coho and spring salmon run long distances into fresh water, often to the very headwaters of the great west coast rivers before spawning. Sockeye may travel over 2,000 miles from the ocean to a spawning ground. On the other hand chum and pink salmon usually spawn in the lower reaches of the river sometimes even in brackish waters. Again the young of the chum and pink salmon

go to sea as soon as they can swim, while coho, spring and sockeye stay in rivers for one or two years before moving seaward. The sockeye differs from the others in that its young descend the rivers into some lake where they feed for a season before continuing their journey to the sea. Likewise, the life in the ocean varies with the species. The pink salmon has the shortest ocean career returning to the fivers after one full season at sea or when only two years old (weighing about five pounds) while the spring salmon stays longest and may not return to spawn until it is eight years old (up to 110 pounds) although the average age is four to five years (weight 10-50 pounds).

To anyone who has seen the salmon runs of EasternCanada or looked for young salmon in the streams there, the British Columbia picture forms an amazing contrast. The almost countless numbers must be seen to be appreciated. A single purse seine haul may contain 1000 fish or more. Such a haul may be considered a very mediocre morning's work. A purse seiner may make five or six seine sets in a day of favourable weather.

Salmon Fishing Methods

Salmon fishing methods vary with the type of fish. The bulk of the sockeye are taken in the drift nets operated from small forty to fifty foot boats. A drift net is about 1300 feet long, very similar to the salmon drift nets of the Bay of Fundy, but in British Columbia they are hauled in over a roller by the engine. The sockeye are highly valued and handled individually and carefully. Trolling for spring and coho salmon forms a distinctive west coast summer fishing scene. Everywhere along the coast one sees these boats—forty to seventy-five feet long—with their six long spars each with its line and trolling spoon and the small bell at the top of the spar to waken the captain and his helper when a salmon strikes. Sport fishermen also go after the spring and coho with trolling gear. Chums and pinks may be taken in the above ways but are usually fished with purse seines. The purse seine is used extensively in British Columbia waters not only for salmon but also for pilchards and herring. The seine boats are much larger boats—100 feet long or more—operated by six or eight men. The web of the purse seine is paid out from the stern of the boat and hauled around the school of fish by a skiff. The deep web—about 600 feet long—has a draw in the bottom enabling the net to be closed or pursed. It is then partly hauled into the boat before the fish are bailed out.

These five salmon have quite different commercial qualities. The sockeye is the most highly valued. Its firm bright red flesh produces a superior canned product. Coho and spring salmon are also canned but quantities are sold on the fresh fish market. Chums and pinks are less highly regarded than the others, are almost entirely canned and appear as the less expensive brands of canned salmon. Before the war considerable quantities of chum salmon were salted for shipment to the Orient but the bulk of British Columbia salmon goes into cans.

Conservation of Salmon Resources

British Columbia salmon canning is the most valuable fisheries industry in Canada. Canadians must realize how important it is and take every step to preserve it while there is yet time. Canada can have a continuing salmon industry or she can have none. A fish such as the salmon which must return to fresh waters to spawn is particularly vulnerable and everywhere—east and west—the salmon seem to fight a losing battle against civilization. The salmon can be over-fished when it returns to the rivers but this is not the greatest danger. It is doubtful whether we can have immense water power developments, deforestation and high agricultural develop on salmon streams. Perhaps the British Columbia salmon are fortunate in the rugged character of much of the British Columbia hinterland. The fish

hatchery was, at one time, considered adequate to compensate for man's direct (fishing toll) and indirect (power, irrigation and agricultural developments) attacks on the salmon. Today we are very uncertain whether hatcheries are either biologically or economically sound. In spite of large hatcheries, the salmon have practically gone from the Sacramento and are fast disappearing from the Columbia. The fisheries biologist wonders what will happen with the development of some of the projects now contemplated on the Fraser.

Two scientific groups are charged with the conservation of Canadian Pacific coast salmon. The International Pacific Salmon Fisheries Commission appointed by the Canadian and American governments is charged with the conservation of the Fraser River Sockeye salmon and the Fisheries Research Board of Canada has two major divisions of its work devoted to salmon—an extensive study of all salmon on the Skeena River and a General Salmon Investigation for other areas.

Herring Fishery

Herring fisheries rank second in value ($8,423,136) in the latest British Columbia statistics. The Pacific herring is very similar in all respects to its Atlantic cousin but the industry presents great contrasts. There is no British Columbia fishery for the small "sardine-size" herring which forms such a big industry in the Bay of Fundy. The immense schools of large herring taken in the purse seines on the Pacific Coast are largely used for the production of fish meal and oil. Herring canning has assumed an impressive position during the war and since, with packs netting over a million dollars in the past few years. The Imperial Cannery at Steveston can pack 10,000 cases per day and the total pack is shipped to Britain. Smaller amounts of herring are kippered or salted. Since 1926, however, the reduction plants have become more and more a part of the British Columbia herring industry and the future of the industry will probably rest in the production of oil and meal. Prior to the war-time canning development, annual production had reached about 1,700,000 gallons of oil and 25,000 tons of meal. It may be noted in passing that 90% of Canada's fish oil—both industrial and vitamin—is produced on the west coast.

Study has shown the dangers from overfishing and the necessity for conservation of our herring resources also. Although the herring does not come into the rivers it does come near shore at its spawning time and with modern purse seines and the echo sounder for locating the schools of fish it is ever more vulnerable to fishing attack. Tagging experiments—in which thousands of fish are marked by placing a slug of metal in the body cavity to be picked up later with special devices in reduction plants—have enabled the scientist to determine the fishing and natural mortality rates. Ages and growth rates have been determined by studying the scales. The problem of the fisheries biologist is to balance growth rates and rates of reproduction against natural and fishing mortalities and see that the herring industry is a continuing one.

Pilchard Catches Erratic

The pilchard is a member of the herring family. This fish, called the California sardine, does not breed in our northern waters. It sometimes, however, appears on the British Columbia coast in immense numbers when on feeding migration from the Southern California coast where it spawns. The British Columbia pilchard industry is of comparatively recent origin. Although a few thousand cases were packed annually between 1918 and 1924 it was in the latter year that the important industry started when permission was granted to use pilchards for reduction purposes. Like the herring this fish contains much oil and provides excellent material for the production of fish meals and oil. This industry expanded rapidly in the twenties—with far more reduction plants being built

than were required to handle the available pilchards. In 1928 the pilchard products reached a high value of $2,563,137 with 4,000,000 gallons of oil and 14,500 tons of meal produced. The investment in plant equipment amounted to over $3,000,000. But the industry is an uncertain one and has sometimes been an almost complete failure when the fish have failed to appear. This has been the case during the past two seasons and fisheries biologists from California to British Columbia are very skeptical about pilchard fishing in the immediate future This industry is an international problem and Canadian and United States scientists have jointly collected a great deal of information about it. However, all the necessary facts are not yet available to manage this industry and to predict the natural fluctuations inevitable in any fishery.

Canada's Halibut Fishery

Halibut the last of the "big four" of Canadian west coast fishes does not actually stand in fourth place for it often has been second only to salmon. Canada's halibut fishery is actually a west coast industry for 85% to 90% of the total Canadian halibut landings are from British Columbia. The story of the Pacific Halibut Fisheries is now a classic in fisheries biology the world over. The International North Pacific Halibut Commission appointed in 1924 has investigated the fishery from every angle and applied modern fish conservation ideas to it. At present it appears that stocks of halibut are insured. The international treaty of 1923 which provided for this commission is particularly interesting to Canada for it was the first to be negotiated and signed by Canada without the intervention of the British Government.

The halibut is a large slow-growing bottom feeding fish. Females may attain a weight of 470 pounds and an age of more than 35 years.

The halibut industry like so many others developed soon after the arrival of the rail lines from the east. Stocks of halibut seemed inexhaustible back in 1893 when the New England Fish Company of Boston established a branch in Vancouver and started the Canadian west coast halibut fishery. The nineteenth century halibut fishery was carried on with dories and short lines. Steamers, ranging from 100 to 145 feet in length, would carry a number of dories to the fishing ground for a load of halibut. In 1913 long-lining was introduced and soon demonstrated that half the number of men would take the same numbers of fish with the new gear. Present day halibut boats, ranging from 10 to 20 tons, carry miles of long line with baited hooks every few feet. This line is set out and pulled in, by means of a steam-driven gurdy-winch, from the deck of the vessel. In the days since 1893 gasoline engines have replaced steam and sail; diesel engines in turn have replaced gasoline. Each year fishermen have been able to go farther afield. The industry started near Vancouver and Seattle but with improved fishing gear and the arrival of the Grand Trunk Railway at Prince Rupert in 1914 it spread northward and westward along the Alaska Peninsula even to the Bering Sea. And for a time the halibut catches mounted year by year in an encouraging manner to level off in the early 20th century in a seemingly stable fashion. But the fishermen knew that they must work harder and harder and make longer journeys each year to maintain these catches. The International Commission was able to show that while catches were rising or being maintained the effort had to be intensified each year to do this and the catch per unit effort was falling. The stocks of halibut are not inexhaustible, this fish grows slowly and it is better to let it mature, to take few large fish and leave the small ones to grow. By applying the modern ideas of fisheries conservation,—balancing rates of growth against mortality rates and limiting the halibut catches to a definite level—the stocks of this valuable fish are coming

back. Fishermen are catching more pounds of halibut and larger halibut with less effort every year. Quantities of halibut landed are rising each year and the fishermen get their quota in fewer days. This is a practical demonstration of our ideas of convervation—a continuing maximum yield—an economy of effort.

Secondary Fisheries

We speak of the "big four" but there are other British Columbia fisheries of great economic value. During the war the once despised dogfish (a small shark) became increasingly valuable because of its vitamin-rich liver. In 1944 dogfish was third in value of British Columbia fish netting nearly $4,000,000 to the industry. It is doubtful whether the industry could be maintained at this level, however, even if the price of vitamin oils were maintained.

Another recent development is the tuna fishery. The British Columbia tuna (albacore) is a 40-50 pound fish which migrates north from southern breeding grounds in late summer and many halibut fishermen are now seeking tuna when the halibut fishery ends. They are usually fished by trolling with bright feather lures but the more venturesome fishermen are equipping boats with tanks for live bait (anchovies). This tuna is one of several large mackerel fishes found in the Pacific Ocean. In general the west coast fisheries are now mature in the sense that the stocks have been located and fished—probably to a maximum degree. There are, however, considerable stocks of unexploited fish in the central Pacific. The most important of these belong to the tuna or mackerel family (albacore, yellow fin, and skipjack). Other nations are preparing to exploit these stocks. Marine fisheries, more than most resources, are international assets. Canada, as a great fishing nation, should be prepared to play her part in the exploitation and conservation of the stocks of tuna and other fish in the Central Pacific.

Industry Highly Centralized

The otter trawl (drag net) fishery yields a variety of flat fish, rock cod, black cod and others. The "shell fisheries" for oysters, crabs, shrimp, etc. are sizable but there is no "shell fishery" to compare with the Atlantic lobster or even the Malapeque oyster.

The British Columbia fishing industry is very highly industrialized and mechanized. The present tendency is very definitely towards centralization. In 1917 there were 94 salmon canneries in operation. Today there are about 30 plants and these pack more fish than was possible in the 94 of thirty years ago. A similar change is noted everywhere. Fish are iced and transported in cold storage to central places for processing and distribution. The floating cold storage barge is a common picture along the coast. The larger companies station these barges in good fishing areas; fish are received and held in cold storage here until transported by the large packer to Vancouver or elsewhere for processing. The fishermen are just as mobile. Many of them go many hundreds of miles north to fish for the seasons living on their boat, sometimes with their families. Perhaps the long coast of British Columbia will never be dotted with farms and villages as Canada's east coast is. Certainly to-day it is a solemn rugged country which does not invite the fishermen to establish a home at any distance from the populated areas. Coastal roadways do not exist. The ocean is the highway. The opportunities for developing secondary occupations such as farming are thus limited. The large cities of British Columbia—Vancouver, Victoria, New Westminster and Prince Rupert,—are and probably will remain the centers for this great fishing area.