PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

COMMISSIONER OF FISHERIES

FOR THE YEAR ENDED DECEMBER 31ST, 1935

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1936.

To His Honour E. W. HAMBER,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I beg to submit herewith the Report of the Provincial Fisheries Department for the year ended December 31st, 1935, with Appendices.

GEORGE SHARRATT PEARSON,
Commissioner of Fisheries.

Provincial Fisheries Department,
Commissioner of Fisheries' Office,
Victoria, British Columbia, June 1st, 1936.

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FISHERIES COMMISSIONER'S REPORT FOR 1935.

VALUE OF CANADIAN FISHERIES AND THE STANDING OF THE PROVINCES, 1934.

The value of the fisheries products of Canada for the year 1934 totalled $34,022,323. During that year British Columbia produced fisheries products to the value of $15,234,335, or nearly 45 per cent. of Canada's total.

British Columbia in 1934 led all the Provinces in the Dominion in respect to the production of fisheries wealth. Her output exceeded that of Nova Scotia, the second in rank, by $7,560,470.

The market value of the fisheries products of British Columbia in 1934 was $3,232,864 more than in the previous year. There was an increase in the value of salmon, halibut, pilchard, whaling, and cod fisheries.

The capital invested in the fisheries of British Columbia in 1934 was $21,359,019, or nearly 49 per cent. of the total capital employed in fisheries in all of Canada. Of the total invested in the fisheries of British Columbia in 1934, $9,641,534 was employed in catching and handling the catches and $11,717,485 invested in canneries, fish-packing establishments, and fish-reduction plants.

The number of persons engaged in British Columbia fisheries in 1934 was 17,926, or 25 per cent. of Canada's total fishery-workers. Of those engaged in British Columbia, 11,700 were employed in catching and handling the catches and 6,226 in packing, curing, and in fish-reduction plants. The total number engaged in the fisheries in British Columbia in 1934 was 1,070 more than in the preceding year.

The following statement gives in the order of their rank the value of the fishery products of the Provinces of Canada for the years 1930 to 1934, inclusive:—

Province.	1930.	1931.	1932.	1933.	1934.
British Columbia	$23,103,302	$11,108,873	$9,909,116	$12,001,471	$15,234,335
Nova Scotia	10,411,202	7,986,711	6,557,943	6,010,601	7,673,865
New Brunswick	4,853,575	4,169,811	2,972,682	3,061,152	3,679,970
Quebec	2,502,998	1,952,894	1,815,544	2,128,471	2,306,517
Ontario	3,294,629	2,477,131	2,147,990	2,089,842	2,218,550
Manitoba	1,811,962	1,241,575	1,204,892	1,076,136	1,465,358
Prince Edward Island	1,141,279	1,078,901	988,919	842,345	963,926
Saskatchewan	234,501	317,963	186,174	186,417	219,772
Alberta	421,258	153,897	153,789	144,518	245,405
Yukon Territory	29,510	29,550	20,060	17,100	14,625
Totals	$47,804,216	$30,517,306	$25,957,109	$27,558,053	$34,022,323

THE SPECIES AND VALUE OF FISH CAUGHT IN BRITISH COLUMBIA.

The total marketed value of each of the principal species of fish taken in British Columbia for the years 1930 to 1934, inclusive, is given in the following table:—

Species.	1930.	1931.	1932.	1933.	1934.
Salmon	$16,610,834	$7,195,220	$7,586,479	$9,184,090	$12,402,042
Halibut	2,446,775	1,373,679	960,166	1,391,941	797,390
Halibut-livers	.....	.....	.....	.....	36,439
Herring	1,222,303	1,058,139	536,491	738,522	628,982
Pilchard	1,589,609	807,842	383,920	77,464	549,910
Cod, ling	388,172	242,911	172,029	215,796	324,669
Carried forward	$22,207,693	$10,677,791	$9,639,085	$11,607,813	$14,739,432

THE SPECIES AND VALUE OF FISH CAUGHT IN BRITISH COLUMBIA—*Continued.*

Species.	1930.	1931.	1932.	1933.	1934.
Brought forward	$22,207,693	$10,677,791	$9,639,085	$11,607,813	$14,739,432
Clams	155,857	111,690	89,848	52,699	33,402
Black cod	120,583	29,521	38,754	41,443	44,057
Crabs	29,177	27,914	16,832	34,296	32,325
Soles	46,217	25,372	25,936	27,737	34,921
Shrimps	20,426	15,778	19,988	19,609	17,758
Oysters	58,146	61,247	28,800	25,670	38,922
Abalones	3,500	4,266	.....	.....	2,400
Flounders	20,268	4,894	3,923	5,208	5,216
Red cod	24,667	10,937	9,333	5,629	6,607
Perch	15,447	3,893	4,707	3,428	3,334
Smelt	18,416	14,928	7,084	4,916	8,423
Sturgeon	5,778	3,774	3,161	5,006	3,391
Octopus	2,569	1,156	1,336	1,048	1,406
Skate	4,241	4,271	2,748	2,483	2,872
Oolachans	4,214	477	470	771	1,134
Whiting	828	603	135	1,180	207
Trout	764	.....	544	1,062	.....
Grayfish, etc.—					
Oil	44,227	62,648	4,629	13,783	26,272
Meal	17,250	13,256	7,018	26,299	45,597
Fertilizer	61,272	10,272	.....	.....	.....
Whales	227,993	.....	.....	110,030	183,738
Fur-seals	13,769	7,004	4,885	7,060	547
Miscellaneous	.....	7,181	.....	4,301	2,374
Totals	$23,103,302	$11,108,873	$9,909,116	$12,001,471	$15,234,335

Previous to 1934 the totals for halibut included landings at British Columbia ports by United States vessels, whereas for 1934 the United States landings are excluded from the statistics. United States landings of halibut at British Columbia ports in 1934 were 84,921 cwt. and 1,598 cwt. of livers, valued approximately at $740,055.

VALUE OF BRITISH COLUMBIA'S FISHERIES SHOWS SLIGHT DECREASE IN 1935.

The dollar value of British Columbia's fisheries production in 1935 amounted to $15,169,529, which is $64,806 less than the year previous. These figures represent the value of the fishery products as marketed, whether sold for consumption fresh, canned, cured, or otherwise prepared.

While the marketed value was slightly less in 1935 than in 1934, the quantity of fish landed was greater. The total quantity of fish of all kinds landed in 1935 was 4,041,788 cwt., compared with 3,666,154 cwt. landed in 1934.

The fishermen of British Columbia received $752,234 more for their catch in 1935 than in 1934. The value to the fishermen at point of landing in 1935 was $8,082,353, compared with $7,330,119 for the year previous.

Salmon.—British Columbia is still the leading Province of the Dominion with respect to value of fisheries wealth. This leading position is due to the great wealth of the salmon-fishery, which accounts for 80 per cent. of the value of output of the whole of the British Columbia fisheries in 1935. The catch of salmon in British Columbia totalled 1,789,431 cwt., while the marketed value was $12,099,275. The quantity of salmon caught and landed was greater than in the previous year and the value to the fishermen was also larger, but the marketed value shows a reduction of $302,767, or 2 per cent. The main item in the salmon-fishery is the canned product, which in 1935 amounted to 1,529,022 cases, a slight decrease from the previous year. The reputation of British Columbia salmon for excellence of quality is world-wide and 508,478 cwt. (approximately 1,059,329 cases) were exported in 1935 to seventy countries. The principal countries of destination are the United Kingdom, Australia, France, and British South Africa.

Halibut.—The halibut-fishery is next in importance to the salmon-fishery in British Columbia. In this fishery there was a slight increase in the quantity landed and a corresponding increase in market value. The quantity landed in 1935 amounted to 101,927 cwt., compared with 97,681 cwt. in 1934, while the marketed value in 1935 was $940,862, compared with $833,829 in the previous year.

Pilchard and Herring.—Next in importance of British Columbia's fisheries is the herring and pilchard fishery, due largely to its importance in the production of meal and oil. In 1935 pilchards caught and landed amounted to 911,411 cwt., compared with 860,103 cwt. in 1934, while the marketed value in 1935 was $670,338, compared with $549,910 in 1934, an increase of 51,308 cwt. in quantity and an increase in value of $120,428 in market value.

Herring production in 1935 amounted to 1,008,507 cwt., an increase of 188,145 cwt. over the previous year, but the value in 1935 was less than in the previous year by $48,951, the values being $580,031 for 1935, compared with $628,982 in 1934.

Whales.—Whale products (meal, oil, fertilizer) dropped in value from $183,738 in 1934 to $105,360 in 1935, due to fewer whales having been taken in the latter year.

CAPITAL EQUIPMENT AND EMPLOYEES.

In Primary Operations.

Capital.—The total value placed on the vessels, boats, and gear used in the primary operations of catching and landing the fish was $9,507,989, compared with $9,641,534 in 1934. The principal item is that of gasoline and Diesel boats, which numbered 6,113, valued at $3,780,236. Sailing, gasoline, and Diesel vessels numbered 283 and had a total value of $2,599,040.

Employees.—The number of fishermen employed during the year was 10,965, a decrease from 1934 of 735.

Fish Canning and Curing Establishments.

Capital.—The number of fish canning and curing plants in operation in 1935 was ninety-three, compared with ninety-nine in the preceding year. Decreases of five in the number of salmon-canneries and two in the number of reduction plants, together with an increase of one in the number of clam-canneries, account for the difference between the two years. The capital investment of the plants in 1935 had a value of $11,325,388, compared with $11,717,485 in 1934.

Employees.—The establishments provided employment in 1935 for a total of 6,030 persons, compared with 6,226 in the preceding year. Employment is fairly constant from April to November, the slack months being December, January, February, and March.

The above figures are taken from the "Advance Report on the Fisheries of British Columbia, 1935," by the Dominion Bureau of Statistics, Ottawa, Canada. For more detailed information the reader is referred to other sections of this report.

THE CANNED-SALMON PACK FOR BRITISH COLUMBIA IN 1935.

The total pack of canned salmon in British Columbia for the season 1935 amounted to 1,529,022 full cases. This is a decrease of 54,844 cases from the year previous, but is 300,208 cases greater than the average for the five-year period 1931–35. The total pack for 1935 is, however, 287,386 cases below the average annual pack for the five-year period 1926–30, but is 6,411 cases greater than the average annual pack over the ten-year period 1926–35.

The 1935 pack consisted of 350,444 cases of sockeye, 21,920 cases of springs, 596 cases of steelhead, 231,492 cases of cohoe (which figure includes 15,319 cases of blueback), 514,966 cases of pinks, and 409,604 cases of chums.

The sockeye-pack for 1935 compared with the pack of this species for 1934 was less by 27,400 cases, but is 33,477 cases greater than the average annual pack of sockeye for the ten-year period 1926–35. The spring-salmon pack for 1935 was also less than for the year previous by 7,856 cases. The pack of cohoe was greater in 1935 than in 1934 by 6,061 cases and is the largest pack yet recorded for this species. The pack of pink salmon in 1935 exceeded that of the year previous by 78,612 cases, but the chum-pack in 1935 was less than in 1934 by 103,577 cases.

THE BRITISH COLUMBIA CANNED-SALMON PACK BY DISTRICTS.

Fraser River System.—The Canadian pack of Fraser River sockeye in 1935 amounting to 62,822 cases was 76,416 cases less than in 1934 and was 21,875 cases greater than in 1931, the cycle-year. Compared with the average annual Canadian pack over the past ten years, the pack in 1935 was 7,466 cases less than the average for the Canadian packs, 1926–35, although the Canadian fishermen secured a greater portion of the total Fraser River catch than in recent past years—the Canadian catch amounting to 53.5 per cent. of the total. This figure includes 5,610 cases of sockeye caught in the Sooke traps. The combined Canadian and American sockeye-packs for the Fraser River in 1935, including the Sooke trap catch, amounted to 117,499 full cases, which was 374,318 cases less than in 1934 and was 10,659 cases less than in 1931, the brood-year. The average sockeye-pack for the Fraser River over the past ten years, 1926–35, amounts to 207,254 cases, so the 1935 pack must be considered as below average by 89,755 cases. Expressed in terms of percentage, if the average annual pack for the past ten years is taken as 100 per cent., then the 1935 pack amounted to only 56.7 per cent., or a drop from average of 43.3 per cent. The elimination of traps in the State of Washington and a strike by the American seiners during the month of July no doubt had some effect on the amount of sockeye taken by Canadian gear, but cannot have had much effect on the total pack. Reports from the spawning-grounds do not indicate an unusually large escapement, except possibly in the Pitt Lake area, and this considered in relation to the size of the pack would indicate that the sockeye run to the Fraser in 1935 was very much below normal.

The years 1934 and 1935 were the cycle-years of what has become recognized by the industry as the late run to the Fraser. The following table gives the catch of sockeye by months in the State of Washington and British Columbia. These figures do not include the trap catch at Sooke:—

Table showing the Fraser River Sockeye-pack, by Months, in British Columbia and the State of Washington for 1934 and 1935.

Month.	British Columbia.		State of Washington.		Totals.	
	1934.	1935.	1934.	1935.	1934.	1935.
July	18,000	2,488	27,350	1,350	45,350	3,838
August	62,000	38,303	277,485	44,581	339,485	82,884
September	57,000	16,251	23,012	8,630	80,012	24,881
October	2,238	170	24,732	116	26,970	286

From the above it will be noted that in 1934 106,982 cases of sockeye were caught in the months of September and October, while for the same months in 1935 only 25,167 cases were taken. It should be pointed out, however, that in 1934 the "late run" accounted for nearly 22 per cent. of the total Fraser River pack for that year, and in 1935 the "late run" was just over 22 per cent. of the total sockeye-pack of this river.

In view of the size of the pack and reports from the spawning-grounds, the condition of this cycle of the runs to the Fraser River is far from satisfactory. This condition was not unanticipated. In their "Contributions to the Life-history of the Sockeye Salmon," Paper 17, published in this report for 1931, Drs. Clemens point out that this run has been overfished, and again, in Paper 20 of the same series published in this report for 1934, state: "The run of 1935 will be largely derived from the brood-year 1931 and the prospect is very discouraging. . . . The urgent need for a limitation of catch in 1935 is obvious."

The history of the sockeye-salmon fishery of the Fraser River is more complete and covers a longer period than any other similar fishery. The causes of the decline are known and remedial measures are quite evident, and with these facts in mind the present unsatisfactory condition is a tragic monument to man's greed and short-sightedness in the over-exploitation of this fishery.

The spring-salmon pack on the Fraser in 1935 amounted to 9,401 cases, compared with 16,218 cases in 1934 and 5,579 cases in 1933, while a pack of 28,701 cases of this species was

recorded in 1932. In the case of spring salmon it must be pointed out that the size of the pack is not necessarily indicative of this size of the run, as large numbers of this species are marketed through other channels than as the canned product.

The canned-cohoe pack for this district in 1935 amounted to 24,950 cases, which figure includes 350 cases of bluebacks. This district produced a pack of 11,392 cases in 1934, 13,901 cases in 1933, and 16,815 cases in 1932. The pack of cohoe in 1935 is the largest in this district since 1930, when 25,585 cases were canned.

The pink-salmon run occurs in this district each alternate year. 1934 was the " off-year " for this species. In 1935 there were canned 111,328 cases of this species, which was 18,582 cases more than in the brood-year 1933, and, with the exception of 1929, is the largest pack of pinks put up in this district since 1917, when 134,442 cases were canned. In 1929 the pink-salmon pack amounted to 158,208 cases, the largest pack recorded for this district. Reports from the spawning-grounds indicate that the pink-salmon streams were satisfactorily seeded.

The chum-salmon pack for the Fraser River District in 1935 was unusually small, amounting to only 8,227 cases, compared with 86,298 cases the year previous. Chum salmon appear in this district very late in the season and, as canners are reluctant to pack a greater quantity of this variety than they anticipate a ready sale for, the pack figures do not bear a direct relationship to the size of the run. Large quantities of this species also find an outlet through the dry-salt salmon industry as well as being frozen. It must also be noted that, according to spawning-ground reports, an excellent escapement took place to the spawning-beds in the Fraser system generally.

The Skeena River.—The total pack of all varieties of salmon on the Skeena River for 1935 amounted to 170,420 full cases. The pack in 1935 was 113,676 cases less than in 1934 and 7,434 cases greater than in 1931, the cycle-year.

The Skeena River pack was composed of 52,879 cases of sockeye, 4,039 cases of springs, 14 cases of steelhead, 23,498 cases of cohoe, 81,868 cases of pinks, and 8,122 cases of chums.

The sockeye-pack was lower than in 1934 by 17,776 cases and also lower than 1931, the cycle-year, by 40,144 cases. The 1935 pack of this variety is 18,949 cases less than the average for this river for the ten-year period 1926–35. In comparing the figures for 1935 packs with previous years, it must be pointed out that the opening date for fishing was July 1st instead of June 20th as in previous years, thus shortening the active fishing season ten days. There is no doubt that this shorter fishing season had the effect of permitting a greater escapement to the spawning-grounds, as reports indicate that practically the whole Skeena River watershed was fairly well seeded. Elsewhere in this report will be found a résumé of reports from the spawning-grounds by Major J. A. Motherwell, Chief Supervisor of Fisheries for the Federal Department of Fisheries. In comparing pack figures, due consideration must be given to the escapement and the reader is recommended to peruse the reports above referred to.

The pack of springs on the Skeena amounted to 4,039 cases, compared with 8,300 cases in 1934, 3,297 cases in 1933, 28,269 cases in 1932, and 9,857 cases in 1931. As spring salmon finds a market outlet through the mild-cure operations as well as in a frozen condition, the size of the canned pack is not necessarily indicative of the run, but other factors indicate that the run of springs to this river in 1935 was not satisfactory. Reports from the spawning-grounds show an unusually light seeding.

The cohoe-pack of 23,498 cases was 30,978 cases less than in the previous year and is the smallest pack of this variety since 1920, except in 1931, when only 10,637 cases were canned. It must be pointed out, however, that in 1931 canners were curtailing their packs very materially due to depressed economic conditions. The escapement of cohoes to the spawning-grounds is reported as reasonably satisfactory and compared favourably with other good years. In comparing the cohoe-pack of the Skeena in 1935 with that of 1934, attention is directed to the fact that the 1934 pack of this variety, amounting to 54,456 cases, was an exceptionally large one, the largest on record. The average annual pack for the ten-year period 1926–35 is a better criterion. This average for the period referred to amounted to 33,082 cases.

The pack of pinks in 1935, amounting to 81,868 cases, is 13,915 below the pack of 1933, the cycle-year, but is 37,061 cases more than was packed in 1931, although here again consideration must be given to the degree of curtailment which took place due to the depression. Escapement

to the spawning-grounds is reported as being heavy, which should result in a good supply in 1937.

The chum-pack on the Skeena in 1935, amounting to 8,122 cases, was very much below the figures for recent past years, the packs being 24,388 cases in 1934, 15,714 cases in 1933, and 38,549 cases in 1932. The pack in 1931, however, amounted to only 3,893 cases. Current marketing conditions have an important bearing on the size of the chum-pack in any given year. The escapement of this variety to the spawning-beds was considered normal, but it is pointed out that the Skeena is not a large producer of this variety.

The Nass River.—The sockeye runs to the Nass River are perhaps the most erratic of any of the runs to the principal spawning-grounds in British Columbia. Drs. Clemens have called attention to this fact on different occasions in their " Contributions to the Life-history of the Sockeye Salmon." The pack in 1935 amounted to 12,712 cases, compared with 28,701 cases in 1934, 9,757 cases in 1933, 14,154 cases in 1932, and 16,929 cases in 1931. The average annual pack of sockeye for this river for the past ten years amounts to 15,816 cases. A comparison with this average shows that in the year 1935 the pack was 3,104 cases short of the average.

The inspection of the spawning-grounds indicates that the early run was heavy, resulting in a good seeding similar to the seeding of 1930 and much better than in 1931. The late run was good, but not as heavy as in 1930, although much better than in 1931.

The pack of springs on the Nass is never large, but in 1935 the pack of 560 cases was exceedingly small, being even less than that for 1934, when the pack of this variety amounted to only 654 cases. The packs of springs for recent past years were: In 1933, 1,296 cases; 1932, 4,408 cases; 1931, 1,439 cases; and in 1930, 1,891 cases.

There were 21,810 cases of cohoe packed on the Nass in 1935. This was an exceptionally large pack of this variety for the Nass River and is the largest recorded since 1917, when 22,180 cases were put up. The average annual cohoe-pack for this river for the period 1926–35 amounts to 7,319 cases, and compared with this average the pack of 1935 is almost three times as much. On the other hand, the numbers reaching the spawning-grounds are reported to be only " fairly satisfactory."

The pack of pinks on this river, amounting to 25,508 cases, cannot be said to be satisfactory. The cycle-year 1933 produced a pack of 44,306 cases. It should be pointed out, however, that the 1934–36 cycle has consistently produced larger packs of this variety than the 1933–35 cycle-years. The pack in 1934 amounted to 32,964 cases and this was not a large pack for that cycle.

The escapement of pinks to the spawning-grounds is reported as " not so satisfactory as might be desired," and no doubt steps will be taken by the Federal Department of Fisheries to prevent dangerous depletion of this cycle run.

Chum salmon are seldom packed in any quantities on the Nass River. The pack of this variety, amounting to 17,481 cases in 1935, is therefore a large one—the largest since 1925, when 22,504 cases were packed; the pack in recent past years amounting to 2,648 cases in 1934, 1,775 cases in 1933, 14,515 cases in 1932, and 392 cases in 1931. The average annual pack of this variety over the past ten years for the Nass amounts to 6,423 cases. Reports from the spawning-grounds indicate that the escapement of chums was adequate.

Rivers Inlet.—The sockeye-salmon pack at Rivers Inlet for 1935, amounting to 135,038 cases, is the largest pack in this inlet since 1925, when the pack amounted to 159,554 cases. The year 1935 falls in the cycle of previous heavy production years, and while a pack of upwards of 100,000 cases was anticipated, the pack produced is most gratifying. The 1935 pack was 52,843 cases above the average annual pack for the period 1926–35. In addition to the large pack on Rivers Inlet, reports from the spawning-grounds at Owikeno Lake indicate that the escapement was better than for some time past, resulting in the spawning-beds being unusually well seeded.

Other varieties are not packed extensively on Rivers Inlet. The cohoe-pack, amounting to 8,375 cases, probably deserves special mention as this is the largest pack of this variety put up in Rivers Inlet in recent past years.

The packs of pinks and chums amounted to 4,554 and 7,136 cases respectively. Reports from the spawning-grounds indicate that the supply of cohoe was slightly better than usual, while the escapement of pinks is reported as normal and of chums good.

Smith Inlet.—The Smith Inlet sockeye-pack in 1935 amounted to 31,648 cases. This is 17,041 cases more than was packed here in 1934 and is 18,781 cases greater than the pack of 1931, the cycle-year, and is 7,872 cases greater than the average annual pack for the ten-year period 1926–35. In addition to a most satisfactory pack in this inlet, reports from the spawning-grounds indicate that the escapement was better than average. The main streams used by this variety were found to be crowded with spawning salmon.

The pack of springs and cohoes at Smith Inlet is incidental to the canning of sockeye, no special effort being made to obtain supplies of these varieties. The pack of springs amounted to 216 cases, while the cohoe-pack was 1,201 cases.

Pink salmon are not canned to any extent at Smith Inlet, the pack of 4,412 cases being incidental to the sockeye-canning operations.

In 1935 there were packed 12,427 cases of chums in this inlet. Previous to 1934 chums were not canned to any extent at Smith Inlet, but in 1934 the chum-pack reached 15,548 cases, which would indicate that some extra effort was being made by the canners to secure supplies of this variety, while the pack in 1935 would seem to indicate that this effort was again continued.

Reports from the pink and chum spawning-grounds in Smith Inlet indicate that these grounds were satisfactorily seeded. While the spring salmon is not fished commercially in this area, except incidental to sockeye-fishing, the escapement to the spawning-beds is reported to be fairly light.

Queen Charlotte Islands.—The canning of salmon on these islands is confined to two species, pinks and chums. Pink salmon appear only every second year, the run corresponding to the even-numbered years. 1935 was an off-year for this variety, consequently only 1,479 cases were canned, these being caught incidental to other fishing activities.

Cohoe were canned to the extent of 5,461 cases, while the chum-pack amounted to 86,298 cases. The chum-pack for these islands in 1934 amounted to 38,062 cases.

Vancouver Island.—The total canned salmon production for Vancouver Island in 1935 amounted to 469,427 cases, composed of 22,928 cases of sockeye, 6,525 cases of springs, 21 cases of steelhead, 104,366 cases of cohoe (of which 15,319 cases were blueback), 191,627 cases of pinks, and 143,960 cases of chums.

The total pack of canned salmon credited to Vancouver Island exceeds the total for this district in 1934 by 97,080 cases. The cohoe-pack in 1935 exceeded that of 1934 by 25,696 cases, while the pink-pack in 1935 was 137,101 cases greater than the pack of this variety for the preceding year. The pack of chums, however, was less in 1935 than in 1934 by 66,279 cases.

In considering the packs of the various districts and comparing the figures one year with another, due consideration must be given to the escapement to the spawning-grounds. In this connection the reader is referred to the Appendices of this report, which contains a detailed report of conditions obtaining on the various spawning-grounds. This report is compiled by Major J. A. Motherwell, Chief Supervisor of Fisheries, Federal Department of Fisheries, from detailed reports by his officers who make a personal inspection of the grounds each year.

Central Area.—This includes the area between Cape Calvert and the Skeena River and the waters adjacent thereto, exclusive of Rivers Inlet. Previous to this issue the pack of this area was placed under the heading of "Outlying Districts." This was found to be somewhat confusing, and in order to clear up this misunderstanding the heading "Outlying Districts" has been discontinued and the heading "Central Area" will be used instead. As no change has been made in the boundaries of this area, any figures given under the new heading will correspond to similar figures under the old heading without change.

The total production in 1935 in the Central Area amounted to 295,433 cases, which is 56,341 cases less than the year previous. This decrease is due largely to the smaller pack of pink salmon put up in 1935, the pack of this variety amounting to 94,190 cases, compared with 157,336 cases in 1934, a decrease of 63,146 cases. The sockeye-pack credited to this area for 1935, amounting to 32,417 cases, was 11,987 cases greater than in the year previous. The cohoe-pack in 1935 amounted to 41,831 cases, which is a decrease from the amount of this variety packed in 1934 of 12,019 cases; while the pack of chums in 1935 shows an increase

of 8,644 cases, there being 125,953 cases of chums packed in 1935, compared with 117,309 cases in 1934.

The reader is again directed to the report of conditions on the spawning-grounds which appears in the Appendices of this report.

OTHER CANNERIES (PILCHARD, HERRING, SHELL-FISH).

Pilchards have been canned in limited quantities on the Coast for a number of years and, while this is an excellent food, the demand is not what it should be. This is especially true when the price factor is considered. Due to the large quantity of this food available, canned pilchards can be and are offered to the consuming public at very low prices, but for some reason the demand is not great.

Production of canned pilchards in 1935 amounted to 27,184 full cases, while in 1934 there were canned 35,437 cases.

Herring.—Some years ago considerable quantities of herring were canned, but in recent years the production has fallen to almost nothing. It is therefore encouraging to note that this wholesome food-fish is again being canned. In 1935 there were 26,143 cases put up.

Shell-fish.—The shell-fish canneries in the Province are few and not large. The production in 1935 amounted to 10,212 cases of clams, 2,246 cases of oysters, 1,748 cases of crab, and 1,547 cases of shrimps.

REVIEW OF BRITISH COLUMBIA'S SALMON-CANNING INDUSTRY.

Salmon-canning in British Columbia in 1935 was conducted on a scale similar in extent to that of recent past years. There were forty-three salmon-canneries operated in the Province, compared with forty-nine the year previous. The operating canneries were distributed in the various districts as follows:—

Queen Charlotte Islands	1
Nass River	3
Skeena River	9
Central Area	5
Rivers Inlet	6
Smith Inlet	2
Johnstone Strait	4
Fraser River and Lower Mainland	10
West Coast of Vancouver Island	3

Compared by districts with 1934, there were two canneries less operating in the Queen Charlotte Islands in 1935. This was no doubt due to there being no pink run in this district in 1935. In Rivers Inlet there were two canneries less operating in 1935 than the year previous, although in each case the non-operating cannery was used as a net-camp and was a factor in production, in each case fishing its usual complement of gear. In Smith Inlet only two canneries operated in 1935, whereas there have been three operating in recent past years. Here also the non-operating cannery was a factor in production as there were the usual number of boats fishing for this cannery, the catches being canned at another of the operating canneries. There was also one less cannery operated on the Fraser River during 1935 than in the year previous.

The operating season of 1935, considered from the view-point of quantity canned, must be considered generally as having been satisfactory. The total canned salmon, amounting to 1,529,022 cases, compares favourably with the total for the previous year, which amounted to 1,583,866 cases. The sockeye-pack for 1935, however, is 27,400 cases short of the year previous, and on account of this variety being the most valuable, the difference in value of the two seasons' total packs places the 1935 pack proportionately of less value than that of 1934. The 1935 fishing season in northern districts opened ten days later than usual, the opening date being July 1st instead of June 20th as in previous years. On the Skeena and Nass Rivers early fishing was poor, due in some measure to unfavourable weather, although on the Skeena it remained poor throughout the season. Previous to the opening date considerable uncertainty existed regarding salmon prices, fishermen's demands and canners' offerings being considerably out of line with each other. There was also a strike of blueback-trollers in progress. However, a compromise was reached before the season opened and no loss through labour trouble was encountered. In discussing the salmon-canning industry in

the report for 1934, attention was directed to the overexpanded condition of this branch of the industry when viewed in conjunction with the fact that there is a definite limit to the supply of raw fish in any given year. The hope was expressed that as the Federal Department of Fisheries had announced a policy of restricting the amount of gear used under penalty of longer weekly closed seasons, and as the Provincial Department of Fisheries had adpoted a policy of discouraging any further expansion by considering application for cannery licences strictly on the individual merits of each case, the industry would take advantage of this action and endeavour to eliminate a portion of the unnecessary gear, thereby reducing production costs to the operators and increasing the individual fisherman's earnings. The necessary action on the part of the industry did not take place, however, with the result that production costs are again higher than they should be in view of selling-prices in world markets. The dissatisfaction of the fishermen with individual earnings is expressed in the constant demand for higher prices for fish. This dissatisfaction would, no doubt, largely disappear if the individual's earnings were increased by a reduction in the amount of gear fished. There is a slight tendency noticeable on the part of the whole industry toward better co-operation not only amongst the canners, but between the canners and the fishermen. Every effort should be made to foster and encourage this spirit of co-operation. However, much greater effort is required if the desired results are to be obtained.

Mention was made in a preceding paragraph of the closing of several canneries in 1935, particularly in the Rivers and Smith Inlets Districts. In this connection it should be pointed out that while a consolidation of operations of this kind may effect some slight saving in production costs to the company concerned, such consolidation has no effect on the total amount of gear fished, as these non-operating canners fished the same amount of gear as they would have done had they been operating. The economic losses incurred by the fishermen and canners alike, due largely to the excessive amount of gear being fished in recent years, was particularly stressed in this report for the year 1934. The attention of the industry is again directed to this condition in order that the canners and fishermen may be encouraged in an endeavour to eliminate this destructive waste for their mutual benefit.

HALIBUT PRODUCTION.

The halibut-fishery of the North-east Pacific is regulated by the International Fisheries Commission, composed of four members, two of whom are appointed by the Canadian Government and two by the United States Government. The Canadian members are Drs. J. P. Babcock and W. A. Found, while Mr. Frank T. Bell and Mr. E. W. Allen are the United States appointees. Dr. Babcock is Chairman of the Commission, while the scientific staff is under the direction of Dr. W. F. Thompson.

In regulating the halibut-fishery the International Commission has divided the coast into four areas. Area No. 1 roughly coincides with the coasts of California and Oregon and part of Washington. Area 2 includes all the convention waters from the northern boundary of Area 1 to Cape Spencer and embraces the coast of British Columbia and South-east Alaska. Area 3 extends from Cape Spencer to the Aleutian Islands; while Area 4 includes all the waters not covered in Areas 1, 2, and 3, which includes Behring Sea.

In the course of its scientific investigation the Commission found that different races of halibut existed in the different localities and that very little, if any, intermingling of the stocks takes place. The Commission also found that depletion was much more severe in some areas than in others. Owing to these facts it became necessary to divide the waters to correspond with different populations and to regulate each area according to the conditions prevailing in that area. This has been done and the results have been most successful.

Owing to the fact that the total halibut landings from Areas Nos. 2 and 3 are limited by the International Commission to 46,000,000 lb. annually and that very little halibut is landed from Areas Nos. 1 and 4, there is very little opportunity for wide variation in the catch figures from year to year. The total landings in 1935 from Areas Nos. 2 and 3 amounted to 46,060,000 lb., compared with 47,535,000 lb. in 1934. In previous years very little, if any, halibut was taken in Area No. 1, but in 1935 1,290,000 lb. were landed, making a total for Pacific landings of 47,350,000 lb. in 1935.

Of the total Pacific Coast landings, Canadian ports received 17,127,000 lb. This is 1,183,000 lb. less than in 1934. Northern British Columbia ports again handled by far the

greater portion of the Canadian landings, 14,535,000 lb. of the Canadian landings having passed through Northern British Columbia ports.

The Canadian fleet again increased their catch in 1935, the increase amounting to 488,000 lb. over the Canadian catch in 1934. The total Canadian catch in 1935 amounted to 10,206,000 lb., while in 1934 the Canadian catch was 9,718,000 lb. Expressed in percentage of total catch, Canadian vessels accounted for 28.4 per cent. in 1935, while in 1934 the Canadian catch amounted to 20.4 per cent. of the total.

The American catch in 1935 is again less than in the previous year. Their catch in 1934 amounted to 37,817,000 lb., while in 1935 the American fleet caught 35,854,000 lb.

Prices paid to Canadian fishermen in 1935 again reflect an upward trend, as is shown by the unweighted average prices of all Canadian landings at Prince Rupert. The average price in 1934 was 5 cents per pound, while in 1935 the average was 5.6 cents. It should be pointed out in this connection that these averages should be used only for showing the general trend.

Halibut-livers, once thrown away, have now become a valuable source of income to the fishermen. Since it was discovered that halibut-liver is a valuable source of concentrated vitamins, the pharmaceutical houses have constantly required more and more halibut-livers and the price paid has continuously risen in accordance with the increased demand. In 1932 the fishermen received 12 cents per pound for halibut-livers; in 1933 the price was 15 cents; in 1934 20½ cents was paid; while in 1935 the average price received by the fishermen was 40.75 cents. In 1935 the combined Canadian and American halibut fleets landed 891,000 lb. of halibut-livers, thus increasing the value of the catch by $363,082. Livers from other fish such as sable-fish and ling-cod were also in demand at the above prices.

MILD-CURED SALMON.

The production of mild-cured salmon in 1935 amounted to 2,775 tierces, compared with a total of 4,447 tierces packed in the year previous, a decrease of 1,672 tierces. The 1935 total was also less than the 1933 by 313 tierces. Five plants were licensed to operate.

DRY-SALT SALMON.

During the season 1935 the production of dry-salt salmon was regulated by the British Columbia Salt-fish Marketing Board, which is a scheme set up under the Federal Government's "Marketing Act." The Board is composed of representatives of the industry under a Chairman appointed by the Deputy Minister of Fisheries, Ottawa. This branch of the industry is regulated with a view to keeping production in line with market demands. The principal species entering the dry-salt trade is chum salmon and the entire production is exported to the Orient, principally Japan. The reader is referred to the annual report of the British Columbia Salt-fish Board, which is included in the Appendices to this report.

In the season 1935 thirty-one salteries were licensed to dry-salt salmon. Four of these did not operate; their quota from the Board, however, was salted at other operating plants. From the returns made to the Provincial Department of Fisheries there were 8,474 tons of salmon dry-salted in 1935. In 1934 the production of dry-salt salmon amounted to 4,675 tons.

DRY-SALT HERRING.

The salt-herring industry in recent years has been experiencing an exceedingly difficult time. The finished product is all exported to the Orient, principally China. Due to the chaotic conditions obtaining in China, the production of salt herring has fallen from a high of approximately 50,000 tons per season to a low in 1935 of 15,000 tons. During recent years and no doubt due to a lessened demand, certain practices detrimental to profitable operations have crept in, chief of which was the practice of shipping the product on consignment. Heavy losses were experienced and in 1934 the operators made application to the Federal Government, under the "Natural Products Marketing Act," for a Board to regulate the marketing of this product. A Board was set up and commenced regulating in 1934, but not before the season had already begun. In 1935, however, this product was all marketed under regulations promulgated by the Board. Conditions in China during the operating season of 1935 became so bad, however, that the quantity permitted had to be drastically curtailed. The total production amounted to 14,983 tons, compared with 20,666 tons the previous year. In this connection it must be pointed out that while the amount produced in 1935 is far from being satisfactory, the operations were carried on at a profit.

There were thirty-one plants licensed to operate on dry-salt herring in 1935. Actual operations, however, were confined to ten plants.

The reader is referred to the report of the British Columbia Salt-fish Marketing Board, printed in the Appendices of this report, for details of the marketing of this product.

FISH OIL AND MEAL.

The production of fish oil and meal has become an important factor in the fisheries activities of the Province. Practically the entire catch of pilchards is reduced to oil and meal. Whale reduction is also an important source of oil, meal, and fertilizer, while a greater amount of cannery waste is being utilized each year in the production of these valuable products.

Pilchard Reduction.—The pilchard-fishery is confined to the west coast of Vancouver Island. The fish usually appear off this coast early in July and generally remain until early November, when they disappear. Their annual appearance at this time makes this a summer fishery only. Fishing is not confined to the bays and large inlets, but is pursued far to sea, the boats sometimes fishing as far as 50 to 75 miles offshore. Fishing is done entirely by means of purse-seines and, due to the great distances and rough water encountered, the boats and equipment engaged are of the very best available. The reader is referred to "The Pilchard-fishery of British Columbia," by Dr. John L. Hart, published in this report for 1932.

Pilchards appeared off the coast of Vancouver Island about July 1st, but fishing did not commence immediately owing to the fact that a settlement on prices between the fishermen and operators had not yet been reached. A settlement was reached on July 9th and fishing commenced. In the early part of the season fish were plentiful in the Barkley Sound District, and it was not until some time later that catches were made farther to the westward.

Seven plants operated in 1935, while only six operated in 1934. The seven plants produced 8,666 tons of meal and 1,634,592 imperial gallons of oil. Production the year previous amounted to 7,628 tons of meal and 1,612,526 imperial gallons of oil. Due to the conditions under which this fishery is conducted, the weather is a very important factor. In this connection it may be said that weather conditions on the west coast during the season were not conducive to heavy catches.

Whale Reduction.—Activity in the whaling industry in 1935 was somewhat curtailed in that only one station operated, whereas two stations were in operation the year previous. A total of 202 whales were killed in 1935, compared with 350 in 1934. The 202 whales produced 211 tons of meal, 354 tons of fertilizer, and 426,722 imperial gallons of oil. Sperm whales were again taken in greater numbers than the other varieties, 175 of the total being sperms.

Herring Reduction.—Herring were permitted to be reduced to meal and oil to a limited extent in 1935. Licences to operate herring-reduction plants on the west coast of Vancouver Island were issued by the Provincial Department of Fisheries on agreement with the operators that the total amount was to be limited to a definite quantity. A limit of 12,500 tons was set for the Barkley Sound area and 12,500 tons for the area west of Wreck Bay. The fish appeared early and good catches were the rule, with the result that the reduction season was short, operations having been completed by December 20th to 25th.

Five plants were licensed to operate on the west coast and one at Prince Rupert. These six plants produced 5,313 tons of meal and 328,639 imperial gallons of oil.

Miscellaneous Reduction.—In addition to plants reducing whales, pilchards, and herring, fish oil and meal is produced in lesser quantities from other sources such as dogfish and cannery waste. Six plants operated in 1935, producing 2,226 tons of meal and 260,387 imperial gallons of oil. The production of meal and oil from these sources in 1934 amounted to 2,916 tons of meal and 371,271 imperial gallons of oil.

CONTRIBUTION TO THE LIFE-HISTORY OF THE SOCKEYE SALMON.

The twenty-first annual contribution to the series of papers on the life-history of the sockeye salmon, issued by the Department and contained in the Appendix of this report, is again contributed by Drs. W. A. and Lucy S. Clemens. This series presents a most valuable picture of the sockeye-salmon populations of the four principal producing river systems of the Province. The following is a brief digest of the present paper:—

In their introduction to present report, Drs. Clemens point out that the run to Rivers Inlet was the only one of a satisfactory character, taking into consideration both pack and escapement, although that to the Nass River was probably very good in spite of the low pack.

The authors indicate that there is no reason to believe the run to the Fraser River was any larger than that of four years ago, and state that no improvement in the situation may be looked for until there is an adjustment of catch so as to provide for larger escapement. Examination of the random samples obtained at Sooke showed that the four-year-old fish predominated as usual, forming approximately 70 per cent. of 1,108 individuals. The five-year-old fish of the one-year-in-the-lake group were more abundant than usual, constituting 23 per cent., and were remarkable by reason of their large size. The average length of the males was nearly 1 inch and that of the females nearly ½ inch above the average of the past fifteen years. Correspondingly, the average weight of the males was 1.4 lb. and that of the females 0.6 lb. greater than the average of the past twelve years. The sexes in the total sample were represented by 48 per cent. males and 52 per cent. females.

At Rivers Inlet the run of 1935, which falls in the premier cycle of this river system, exceeded expectation with a commercial yield of 135,038 cases, which is the second highest pack on record. In addition, the Fishery Officer reported a large escapement. The run there was highly successful. Drs. Clemens point out that this cycle, to which the present year belongs, was characterized in the early years by runs in which the five-year-old fish greatly exceeded the four-year-olds. The present run was composed of only 42 per cent. five-year-olds. However, this percentage is not directly comparable with those of other years, because the sampling was inadequate both as to extent and as to spacing. Had the sampling been similar to that of former years, it is doubtful if the five-year-old fish would have been as numerous as formerly, because the general trend in this river system has been toward a relatively greater percentage of 4_2's presumably brought about by a general change in fishing-gear; that is, the use of smaller-meshed nets. The size statistics show no unusual features. The sex proportions conform to the general pattern, with an excess of females in the 5_2 group and the reverse condition in the 4_2 class. Both groups show a relatively greater percentage of males than has been present in recent years. This may be due also to irregular sampling, since 40 per cent. of the entire sample was taken during five days early in the run, a time during which males tend to run more numerously than females.

The succession of small runs to the Skeena River in recent years is the cause of grave concern. The packs have been disappointingly small and there is no indication of increased escapements of significant proportions. Drastic action is unquestionably demanded if this once great sockeye-producing stream is to be restored to its former level of productivity. Drs. Clemens conclude that the run of 1935 was a relatively small one, although the reports of escapements were stated to be fairly good. Large runs are usually characterized by large percentages of five-year-old fish (one year in the lake). In 1935 the individuals of this age-group formed only 31 per cent. of the total sampling of 1,927 fish, but their average lengths and weights were well above the averages of the past years and approach the highest values recorded. The four-year-old fish formed 49 per cent. and were considerably below the averages of the past twenty years in both average length and weight. As a result of these extremes in length, the difference between the averages in the two age-groups is the greatest on record; namely, 3.2 inches in the case of the males and 2.3 inches of the females. In the total sampling the percentages of males and females were 40 and 60 respectively.

In discussing the Nass River conditions, the authors are of the opinion that the run of 1935 was of far greater extent than the pack of 12,712 cases would indicate. They base their opinion on the Fishery Officer's report that the escapement was similar to the unprecedented one of 1930. Drs. Clemens point out the desirability of such a relation between catch and escapement.

The former complex constitution of the Nass runs, where as many as eight age-classes were once represented, has largely given place to the simple four-group structure of the other river systems. This has been brought about at least in part by a shortening of the period of collection of data. As was the case in Rivers Inlet, the 1935 sampling was too irregular to give an adequate picture of the complete run. Analysis of the available data shows the age-classes to be distributed as follows: 11 per cent. 4_2's, 10 per cent. 5_2's, 73 per cent. 5_3's,

and 6 per cent. 6_3's. These percentages are similar to those of 1934 and unlike those of other recent years, in the 5_3's being somewhat more abundant and the 4_2's less numerous.

In 1933 and 1934 the large average size of the fish in the 4_2, 5_2, and 6_3 age-groups has been a noticeable feature. Such is the case again in 1935, there being two new high levels for length.

An unusual scarcity of males marked the sex-distribution. The dominant group set a new low level with 39 per cent., and the total number of males of only 42 per cent. has been recorded but once previously. These exceptional proportions are thought to be the result of irregular sampling.

INTERNATIONAL FISHERIES COMMISSION, 1935–36.

The International Fisheries Commission continued the investigation of the life-history of the Pacific halibut and the observation and regulation of the fishery, as provided in the treaty of May, 1930, between Canada and the United States. The investigations proved that, under regulation, the condition of the stocks on the banks has continued to improve.

The Commission continued to maintain close contact with all branches of the halibut industry. A public hearing was held at Prince Rupert on December 4th and 5th. Meetings were held at Seattle on February 19th and 20th with the Conference Board, composed of representatives of the different sections of the fishing fleet. Informal meetings were held at different times throughout the year with various committees and individuals. At the hearing and meetings the results of the Commission's investigations were explained and the problems of the fleet were presented and discussed.

The 1935 fishing season opened on March 1st, as in the preceding year. The catch-limits set by the Commission for Areas 2 and 3 were unchanged. The limit placed on Area 1 during 1934 was discontinued—the closing date for the area being made the same as for Area 2.

Due to improved fishing conditions and in spite of voluntary curtailment of production by the fishermen and a strike which delayed fishing operations at the beginning of the season for more than one month, the catch-limit in Area 2, which includes the grounds off South-eastern Alaska and British Columbia, was reached early in September. Areas 1 and 2 were closed at midnight of September 6th, with catches of approximately 567,000 and 22,028,000 lb. respectively. Areas 3 and 4 were closed at midnight of December 26th, with catches of approximately 23,732,000 and 906,000 lb. respectively.

The scientific investigations by the staff were pursued where necessary for the purposes of the treaty. They included the collection and analysis of the statistical and biological data, whereby the success of regulation can be determined and on which intelligent control must be based. The collection of the biological data made necessary the operation of a vessel.

The regulation of the fishery produced a further improvement in the condition of the halibut stocks. The abundance of fish, as indicated by the catch in pounds per standard unit of gear fished, increased from 55 to 61.1 lb. in Area 2 and from 85.6 to 88 lb. in Area 3. The abundance of fish was shown to be 76 per cent. greater in Area 2 and 37 per cent. greater in Area 3 than it was in 1930, when the abundance of halibut reached its lowest ebb.

Accompanying the changes in abundance, the proportion of medium and large increased in the landings and that of chickens and baby chickens decreased. These changes in the composition of the landings were expected on theoretical grounds, as a result of regulation, and indicate an increase in the abundance of halibut of spawning size.

Market measurements, which are a recognized method of detecting changes in the composition of the stock, were continued. More than 100 trips were sampled, involving the examination and measurement of about 80,000 fish. The results obtained showed a small increase in the average size of fish caught on the southern grounds and in conjunction with the general increase in abundance proved that the abundance of spawning halibut is increasing. This should be accompanied by an increase in the production of spawn and in due time should produce an increase in the numbers of young fish entering the fishery.

The study of age, rate of growth, and age composition of the stocks was also continued. Data collected prior to the inauguration of regulation were analysed as a basis for the determination of changes produced by regulation. Current material for the determination of age composition was collected in conjunction with the taking of market measurements.

Uncertainty regarding the percentage loss of tags from the halibut marked by the Commission led to experiments by which the loss might be determined. During a fishing-trip of the halibut-boat " Hoover " to Goose Island grounds in May, about 600 halibut were marked with metal tags similar to those used in the past. Fifty per cent. of these fish were also marked by tattooing. Since to the end of the fishing season the tattoo-marks were still very conspicuous and as no fish bearing tattoo-marks were returned without metal tags, it seems certain that the metal tags are not lost from the fish in any numbers. This indicates that there is little error in the use of the results of the Commission's marking experiments to determine the rate of removal of the fish by the fishery.

Particular attention was devoted to the study of the production of spawn, since conclusive proof of improved spawning conditions can best be obtained by the actual measurement of the changes as they occur. The analysis of previously collected material was completed; three reports bearing directly on the problem were prepared and published and the observation of spawning in the waters off the coast of British Columbia was continued.

Analysis of the results of the net-hauls made from the beginning of December, 1934, to the end of February, 1935, in the vicinity of the Queen Charlotte Islands, indicated the presence of a greater abundance of eggs than during the spawning seasons of the preceding years. In about five years the improvement should be reflected in the commercial fishery by an increase in the number of small fish.

The investigation of spawning in British Columbia waters was continued in January and early February, 1936, when the halibut-schooner " Eagle " was chartered and operated in the neighbourhood of Cape St. James. Net-hauls were made at a considerable number of stations to determine the abundance of eggs. Hydrographic sections were taken and drift-bottles were released to determine the currents that distribute the eggs and larvæ. A preliminary survey of the results of the net-hauls indicated the presence of a considerable abundance of eggs. More detailed examination will need to be made to determine whether there was an improvement over the preceding year.

A variety of subjects, all closely related and essential to the study of the production of spawn, are dealt with in Report No. 9. The known distribution of the halibut throughout the world is described and the discovery of any extensive new halibut banks is shown to be extremely unlikely. Detailed descriptions of the halibut-egg and all stages of the embryo and larva, necessary for their indentification in the study of their abundance and distribution by the ocean currents, are given. The drift of the eggs and larvæ off the west coast of North America is described, and the complete separation of the stocks on the banks off the British Columbia coast from those in the Gulf of Alaska is proved. The abundance of eggs produced in the waters off the coast of British Columbia is shown to be about one-thirtieth as great as in the Gulf of Alaska. The theory underlying the effect of various intensities of fishing upon the abundance of fish is given further consideration, and it is shown that the effect of small changes in the intensity of fishing may cause great changes in the production of spawn. Finally, by analysis of the results of drift-bottle experiments is shown the seasonal variation in the position of splitting of the so-called Japanese Current which has an important effect on the distribution of eggs and larvæ.

An account of the hydrographic work carried on by the Commission's staff during the spawning season of 1929 is contained in Report No. 10. The currents in the Gulf of Alaska are calculated. The results are a valuable addition to the knowledge of the currents by which the eggs and larvæ are distributed on that part of the coast.

The results of an investigation into the specific characters suitable for the separation of the young of a number of species of flatfish occurring in the North Pacific are given in Report No. 11. Data and keys necessary for the positive identification of the halibut larvæ are presented.

The investigations of the Commission during the past year explained the changes taking place in the stocks of halibut on the banks. They proved that the condition of the stocks continued to improve as a result of regulation and gave sound reasons for the belief that the total yield can be increased by continued regulation.

SOME FRESH-WATER FISHES OF BRITISH COLUMBIA.

In the Appendices to this report will be found a paper prepared by Professor J. R. Dymond entitled "Some Fresh-water Fishes of British Columbia." Professor Dymond is the Director of the Royal Ontario Museum of Zoology at Toronto. During the summers of 1926 and 1928 Professor Dymond was engaged in a study of the trout and other game fishes of the Province. Professor Dymond's paper was secured more or less incidental to this other work, but is nevertheless a valuable contribution to a better knowledge of the species of fish frequenting our inland waters. Professor Dymond lists some forty-five species, with notes on where they were taken and, in many cases, notes the measurements in per cent. of body-length, together with other distinguishing characteristics.

The author points out that "The most significant feature of the distribution of fresh-water fishes in British Columbia is the striking contrast between the fauna of the North and that of the South. The fish fauna of the northern part of the Province has many features in common with that of the Great Lakes, while many species found in the southern part of the Province are quite distinct from any elements of the Great Lakes fauna. The author also explains that this difference between the faunas of Southern and of Northern British Columbia may be partly ecological, but is probably due more to the geological history of the areas.

A bibliography of the literature cited in Professor Dymond's paper is included.

THE HERRING INVESTIGATION.

In 1929 a scientific investigation into the herring and pilchard fisheries of the Province was undertaken by the Biological Board jointly supported by the Federal and Provincial Departments of Fisheries. The Provincial Department was forced by economic pressure to withdraw its financial support in 1932. Since that time the Federal Department has continued the investigation. In the Appendices of this report will be found a paper, "Some Results of the British Columbia Herring Investigation and their Economic Bearing," by Albert L. Tester, Ph.D., Pacific Biological Station, Nanaimo. In Dr. Tester's paper he reviews the more important results and conclusions contained in two previously published scientific papers, particularly from the economic view. Dr. Tester points out that the runs of herring to the various localities on the British Columbia coast tend to form local populations and that very little intermingling takes place. From the evidence so far examined it is concluded that the runs of herring to the following places are separate and distinct from each other: Point Grey; Granite Bay; Saltspring Island-Departure Bay-Nanoose Bay; Barkley Sound; Sydney Inlet; Nootka Sound-Kyuquot Sound; Quatsino Sound; Bella Bella; Skidegate Inlet; Jap Inlet-Butler Cove; and possibly Pearl Harbour. Dr. Tester points out that while the runs frequenting these places have been called "local populations," it must be kept in mind, however, that a slight degree of intermingling may take place between those localities that are adjacent to each other. It is also shown that the herring of British Columbia are essentially non-migratory. These points are of very great importance in relation to the regulation of the fishery.

The paper also discloses the length and age composition of the herring in various localities as a means of indicating the relative abundance of herring from year to year. In conclusion, Dr. Tester points out that there is an optimum fishing intensity at which a fishery may be exploited, but as yet investigation has not been pursued to that point where this optimum intensity can be definitely stated. Further investigations must be made, but until the necessary information is available it is pointed out that it seems advisable to guard against intensive fishing similar to that in force between 1925 and 1929. Dr. Tester says: "It seems reasonably certain that because of this intensity the fishery has come to depend more and more on fish in their third year which are due to spawn for the first time. This seems to be particularly the case in Barkley Sound. Were fishing maintained at this high level of intensity the ultimate effects are unknown, but it is quite conceivable that both the total catch and the catch per unit of fishing effort would decrease and, at the same time, the numbers of incoming young would be progressively reduced. In this event a state of commercial extinction similar to that which has been caused in certain local populations of herring in South-eastern Alaska would eventually result. Such a possibility should be foreseen and guarded against until the optimum level of fishing has been determined by scientific research."

CONDITION OF BRITISH COLUMBIA'S SALMON-SPAWNING GROUNDS.

Owing to the discontinuance by the Department of making personal inspection of the spawning areas of the Fraser, Skeena, Rivers Inlet, and Nass River systems, we are again indebted to Major Motherwell, Chief Supervisor of Dominion Fisheries, who conducted these investigations, for furnishing us a copy of his report. His courtesy in supplying us with these reports is gratefully acknowledged.

Major Motherwell's report will be found in the Appendices to this report.

CONDITIONS OF BRITISH COLUMBIA'S HERRING-SPAWNING GROUNDS.

The Department is indebted to Major Motherwell, Chief Supervisor of Dominion Fisheries, for a report by his officers on the conditions of the herring-spawning grounds in the principal herring-fishing districts. Inspection of spawning-grounds is made by observation during the time of spawning. The report is printed in the Appendices of this report.

APPENDICES.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON. (No. 21.)

By Wilbert A. Clemens, Ph.D., Director, Pacific Biological Station, Nanaimo, and Lucy S. Clemens, Ph.D.

INTRODUCTION.

During the year 1935 the runs of sockeye salmon to the four main river systems of British Columbia presented some unusual features. With the exception of that to Rivers Inlet, the returns were comparatively small.

The pack on the Fraser River was 117,499 cases and, while smaller than its cycle predecessor, may be considered rather large in respect to the escapement of 1931. As will be pointed out in a subsequent section, the run was undoubtedly smaller than that of 1931, but there was evidently a slightly increased escapement.

The run to Rivers Inlet was large, producing the second largest pack on record (135,038 cases) and a large escapement as well.

The expected large run to the Skeena failed to appear. The pack was but 52,879 cases and only half that anticipated. Moreover, the escapement, while reported as good, was apparently not such as to indicate that the low pack meant a corresponding increased escapement.

While the pack on the Nass River was only 12,712 cases, the escapement was reported as very good. Because of the small number of fish involved it is impossible to arrive at a conclusion as to whether or not the run was below expectancy. At any rate, it would seem reasonable to conclude that the run to the Nass River in 1935 did represent a good production on the part of its brood-year 1930.

DESIGNATION OF AGE-GROUPS.

Two outstanding features in the life-history of the fish have been selected in designating the age-groups—namely, the age at maturity and the year of its life in which the fish migrates from fresh water. These are expressed symbolically by two numbers, one in large type, which indicates the age of maturity, and the other in small type, placed to the right and below, which signifies the year of life in which the fish left the fresh water. The age-groups which are met most commonly in these river systems are:—

3_1, 4_1—the "sea-types" or fish which migrate in their first year and mature at the ages of three and four years respectively.

3_2—"the grilse," usually males, which migrate in their second year and mature at the age of three.

4_2, 5_2—fish which migrate in their second year and mature at the ages of four and five respectively.

5_3, 6_3—fish which migrate in their third year and mature at the ages of five and six respectively.

6_4, 7_4—fish which migrate in their fourth year and mature at the ages of six and seven respectively.

1. THE FRASER RIVER SOCKEYE RUN OF 1935.

(1.) General Characteristics.

The total pack of Fraser River sockeye in the season 1935 amounted to 117,499 cases, of which 62,822 cases were packed in the Province of British Columbia and 54,677 cases in the State of Washington (Table I.). The percentages for the two areas are 53 and 47 respectively.

The pack of 117,499 cases is 10,659 cases less than four years ago. The escapement was apparently somewhat better than in 1931, but unlikely to the extent of the decrease in pack which would be equivalent to about 127,000 fish. It would seem probable that the run of 1935 was somewhat less than that of 1931. However, the improved escapement affords a very slight degree of encouragement. As pointed out in last year's report, the escapement in 1931 was very small and a relatively small return was to be expected in 1935. The cycle to which 1931 and 1935 belong is now reduced to a condition where it is probably the least productive of the four and calls for careful husbanding if it is to regain lost ground. A new factor was introduced into the Fraser River situation in 1935 through the non-operation of traps in Washington waters. Whether this circumstance had any effect on the relation of catch to escapement cannot be determined, but it is significant that for the first time in this cycle since 1903 the American pack is less than the Canadian. A strike among the American fishermen in the early part of the season undoubtedly also had an effect on the American catch.

The run of 1936 will be derived largely from the brood-year 1932. In that year the pack was 146,957 cases (approximately 1,750,000 fish) and the escapement was small in all areas, except in the Chilko, where 70,000 fish were estimated. Judging from the reports of Fishery Inspectors and records of hatchery operations, the escapement in all other regions combined did not equal that of the Chilko. The situation indicates the disproportion between catch and escapement and the small number of spawning fish now supporting the fishery in this cycle. Unless hatch of eggs and survival of fish in lake and sea have been exceptional, the run of 1936 will undoubtedly show no improvement over that of 1932.

(2.) Age-groups.

The material for this year's study consists of data and scales from 1,108 sockeye salmon taken at random from the catch in the traps at Sooke from June 6th to September 11th in thirty-two samplings. The 4_2 age-group is represented by 790 individuals or 71.3 per cent. and the 5_2's by 254 or 22.9 per cent. The remaining groups are present in small numbers as follows: 5_3's, 26 fish; 6_3, 3 fish; 3_1's, 4 fish; 4_1's, 14 fish; and the 3_2's, 17 fish; together constituting approximately 6 per cent.

The percentage of 5_2's in 1935—namely, 22.9 per cent.—is somewhat above that of recent years and only exceeded by that of 1925. A comparison of the percentages of the various age-groups since 1920 is given in Table II.

(3.) Lengths and Weights.

The outstanding feature of the length and weight data is the large size of the fish of the 5_2 age-group. The average length of the males is nearly 1 inch and that of the females nearly ½ inch above the average of the past fifteen years. Correspondingly, the average weight of the males is 1.4 lb. and of the females 0.6 lb. greater than the averages of the past twelve years.

The average lengths and weights of the other age-groups show no unusual features. The data are given in Tables III., IV., V., and VI.

(4.) Distribution of the Sexes.

The total number of males in the samplings is 530 and of females 578, being percentages of 48 and 52 respectively. The females are thus slightly in the majority, but the departure from the expected fifty-fifty relationship is slight. In the 4_2 age-group the females are slightly in excess with a percentage of 52, while in the 5_2 age-group the condition is exactly reversed with a male percentage of 52. In Table VII. are shown the percentages of the sexes for the past twenty-one years.

Table I.—Fraser River Packs, 1895–1935, arranged in accordance with the Four-year Cycle.

B.C.	1895—	395,984	1896—	356,984	1897—	860,459	1898—	256,101
Wash.		65,143		72,979		312,048		252,000
Total		461,127		429,963		1,172,507		508,101
B.C.	1899—	480,485	1900—	229,800	1901—	928,669	1902—	293,477
Wash.		499,646		228,704		1,105,096		339,556
Total		980,131		458,504		2,033,765		633,033
B.C.	1903—	204,809	1904—	72,688	1905—	837,489	1906—	183,007
Wash.		167,211		123,419		837,122		182,241
Total		372,020		196,107		1,674,611		365,248
B.C.	1907—	59,815	1908—	74,574	1909—	585,435	1910—	150,432
Wash.		96,974		170,951		1,097,904		248,014
Total		156,789		245,525		1,683,339		398,446
B.C.	1911—	58,487	1912—	123,879	1913—	719,796	1914—	198,183
Wash.		127,761		184,680		1,673,099		335,230
Total		186,248		308,559		2,392,895		533,413
B.C.	1915—	91,130	1916—	32,146	1917—	148,164	1918—	19,697
Wash.		64,584		84,637		411,538		50,723
Total		155,714		116,783		559,702		70,420
B.C.	1919—	38,854	1920—	48,399	1921—	39,631	1922—	51,832
Wash.		64,346		62,654		102,967		48,566
Total		103,200		111,053		142,598		100,398
B.C.	1923—	31,655	1924—	39,743	1925—	35,385	1926—	85,689
Wash.		47,402		69,369		112,023		44,673
Total		79,057		109,112		147,408		130,362
B.C.	1927—	61,393	1928—	29,299	1929—	61,569	1930—	103,692
Wash.		97,594		61,044		111,898		352,194
Total		158,987		90,343		173,467		455,886
B.C.	1931—	40,947	1932—	65,769	1933—	52,465	1934—	139,238
Wash.		87,211		81,188		126,604		352,579
Total		128,158		146,957		179,069		491,817
B.C.	1935—	62,822						
Wash.		54,677						
Total		117,499						

Table II.—Fraser River Sockeyes, Vancouver Island Traps, Percentages of the Year-classes from 1920 to 1935.

Year.	4_2	5_2	5_3	6_3	3_1	4_1	3_2
1920	69.6	21.2	6.2	0.2	1.9	0.9	-----
1921	78.1	14.6	4.1	0.7	0.5	2.0	-----
1922	70.5	9.3	4.5	2.0	6.3	5.6	0.9
1923	67.1	10.8	3.9	1.2	6.7	9.9	0.4
1924	68.2	18.7	9.2	0.5	0.5	2.0	0.8
1925	67.9	24.9	3.4	0.2	2.2	0.0	0.6
1926	66.1	20.3	5.2	1.6	2.0	2.5	2.1
1927	84.6	7.5	3.0	0.8	1.9	2.2	-----
1928	71.4	18.8	5.3	0.5	2.0	0.7	1.0
1929	77.3	11.9	7.8	0.4	0.1	0.1	2.5
1930	75.7	19.6	2.8	0.5	0.2	0.7	0.5
1931	79.0	13.1	1.3	-----	2.0	2.0	2.6
1932	80.7	13.5	2.8	-----	0.8	0.8	1.4
1933	83.6	9.2	1.9	-----	1.4	0.5	3.4
1934	84.2	10.7	2.3	-----	0.1	1.2	1.5
1935	71.3	22.9	2.3	0.3	0.4	1.3	1.5

Table III.—Fraser River Sockeyes, 1935, Vancouver Island Traps, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.														Total.
	4_2		5_2		5_3		6_3		3_1		4_1		3_2		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
15½	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	1
17	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	1
18	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2	-----	2
18½	2	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	2	6
19	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	-----	1
19½	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3	3	8
20	2	6	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	1	10
20½	1	7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	1	10
21	1	15	-----	-----	1	2	-----	-----	-----	1	-----	-----	-----	-----	20
21½	8	17	-----	2	1	2	-----	-----	1	-----	-----	-----	-----	-----	31
22	19	51	1	-----	1	1	-----	-----	-----	-----	-----	1	-----	-----	74
22½	24	74	2	1	1	2	-----	-----	-----	-----	-----	3	-----	-----	107
23	48	95	-----	5	-----	3	-----	-----	1	-----	1	1	-----	-----	154
23½	72	70	2	9	1	5	-----	1	-----	1	-----	4	-----	-----	165
24	72	48	3	8	1	1	-----	-----	-----	-----	-----	3	-----	-----	136
24½	64	20	5	18	-----	-----	-----	1	-----	-----	-----	1	-----	-----	109
25	40	6	13	32	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	91
25½	14	2	14	26	1	-----	1	-----	-----	-----	-----	-----	-----	-----	58
26	6	-----	15	11	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	33
26½	2	-----	16	8	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	27
27	1	-----	24	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	27
27½	-----	-----	18	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	19
28	-----	-----	8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	8
28½	-----	-----	8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	8
29	-----	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2
29½	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
30	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Totals	376	414	131	123	9	17	1	2	2	2	1	13	10	7	1,108
Ave. lengths	23.8	22.9	26.4	24.9	23.6	22.5	25.5	24.0	22.2	22.2	23.0	23.3	18.5	19.4	-----

Table IV.—Fraser River Sockeyes, 1935, Vancouver Island Traps, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.														Total.
	4_2		5_2		5_3		6_3		3_1		4_1		3_2		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
1½	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
2½	2	—	—	—	—	—	—	—	—	—	—	—	2	1	5
3	2	6	—	—	—	—	—	—	—	—	—	—	5	2	15
3½	3	15	—	—	1	2	—	—	—	—	—	—	1	3	25
4	14	27	—	—	1	1	—	—	—	—	—	—	—	1	44
4½	25	64	3	4	—	2	—	—	1	—	—	2	—	—	101
5	41	107	2	6	2	4	—	—	—	1	1	2	—	—	166
5½	74	76	4	7	1	5	—	—	—	—	—	3	—	—	170
6	78	71	4	16	—	3	1	2	1	1	—	4	—	—	181
6½	47	32	5	14	1	—	—	—	—	—	—	2	—	—	101
7	41	8	12	22	—	—	—	—	—	—	—	—	—	—	83
7½	24	7	13	16	—	—	—	—	—	—	—	—	—	—	60
8	17	—	12	19	1	—	—	—	—	—	—	—	—	—	49
8½	7	1	7	10	—	—	—	—	—	—	—	—	—	—	25
9	1	—	17	6	2	—	—	—	—	—	—	—	—	—	26
9½	—	—	17	2	—	—	—	—	—	—	—	—	—	—	19
10	—	—	16	—	—	—	—	—	—	—	—	—	—	—	16
10½	—	—	9	1	—	—	—	—	—	—	—	—	—	—	10
11	—	—	6	—	—	—	—	—	—	—	—	—	—	—	6
11½	—	—	2	—	—	—	—	—	—	—	—	—	—	—	2
12	—	—	2	—	—	—	—	—	—	—	—	—	—	—	2
Totals	376	414	131	123	9	17	1	2	2	2	1	13	10	7	1,108
Ave. weights	6.0	5.2	8.6	7.1	6.2	5.0	6.0	6.0	5.2	5.5	5.0	5.6	2.7	3.3	—

Table V.—Fraser River Sockeyes, Vancouver Island Traps, Average Lengths in Inches of Principal Classes from 1920 to 1935.

Year.	4_2		5_2		5_3		6_3		3_1		4_1	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1920	24.1	23.2	25.7	24.6	24.3	23.2	25.7	—	23.3	21.8	25.5	24.3
1921	23.7	23.0	25.9	24.6	—	—	—	—	—	—	—	—
1922	24.0	23.0	25.8	24.1	23.5	22.7	25.4	24.3	23.0	22.6	25.5	24.2
1923	24.3	23.3	25.8	24.8	24.2	22.9	26.3	24.9	23.3	22.7	25.2	24.1
1924	23.8	22.8	24.9	23.9	23.7	22.7	24.3	—	21.9	20.4	25.2	24.4
1925	23.5	22.9	25.8	24.6	24.0	22.0	—	—	22.5	21.7	—	—
1926	22.6	22.3	24.6	24.0	23.2	22.4	25.5	23.7	23.4	22.5	25.4	24.6
1927	24.1	23.1	26.1	24.6	21.7	22.0	25.3	24.6	23.4	22.2	25.1	24.5
1928	23.4	23.0	25.5	24.7	24.2	23.4	27.1	26.0	19.1	18.7	19.8	—
1929	23.7	22.9	25.5	24.3	24.8	23.7	26.2	24.8	—	23.0	25.0	24.0
1930	24.4	23.6	26.2	24.6	24.4	23.5	26.7	26.0	22.5	20.7	24.7	23.2
1931	23.4	22.8	25.6	24.6	24.3	24.1	—	—	21.5	21.6	25.3	22.5
1932	23.6	22.8	25.3	24.2	24.6	23.2	—	—	21.9	21.5	23.0	23.4
1933	23.1	22.7	24.9	24.0	24.0	22.9	27.0	—	22.5	22.3	24.3	23.8
1934	23.9	23.2	24.2	24.1	23.0	23.0	—	—	—	—	23.5	22.1
Average lengths	23.7	23.0	25.5	24.4	23.8	23.0	26.0	24.9	22.4	21.7	24.4	23.8
1935	23.8	22.8	26.4	24.9	23.6	22.5	25.5	24.0	22.2	22.2	23.0	23.5

Table VI.—Fraser River Sockeyes, Vancouver Island Traps, Average Weights in Pounds of Principal Classes from 1922 to 1935.

Year.	4_2		5_2		5_3		6_3		3_1		4_1	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1922	6.4	5.7	7.0	6.1	6.1	5.4	7.2	5.5	5.9	5.2	7.9	6.9
1923	6.6	5.8	7.8	6.9	6.0	5.2	7.3	6.5	6.2	5.3	7.3	6.5
1924	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1925	5.8	5.2	7.6	6.6	6.1	5.3	-----	-----	5.3	4.6	-----	-----
1926	5.2	4.9	6.2	5.7	5.4	4.8	7.4	5.7	6.1	5.4	7.3	6.6
1927	6.1	5.5	7.3	6.8	4.5	4.8	6.5	5.5	5.9	5.2	7.2	6.8
1928	6.0	5.5	7.4	6.9	6.5	5.7	8.6	8.0	6.4	5.4	8.0	6.6
1929	6.0	5.3	7.2	6.3	6.7	5.9	7.5	6.5	-----	5.0	6.5	6.0
1930	6.9	6.1	7.7	6.7	6.6	6.0	7.7	6.0	5.5	4.2	6.3	5.8
1931	5.8	5.2	7.3	6.5	6.1	6.3	-----	-----	4.5	4.6	7.3	6.0
1932	6.1	5.4	7.3	6.7	6.6	5.4	-----	-----	4.9	4.4	5.7	5.9
1933	5.4	5.0	7.0	6.3	6.0	5.2	8.8	-----	5.1	4.9	6.5	6.1
1934	6.3	5.6	6.5	6.4	5.2	5.1	-----	-----	-----	-----	6.6	5.1
Average weights	6.0	5.4	7.2	6.5	6.0	5.4	7.6	6.2	5.6	4.9	7.0	6.2
1935	6.0	5.2	8.6	7.1	6.2	5.0	6.0	6.0	5.2	5.5	5.0	5.6

Table VII.—Fraser River Sockeyes, Percentages of Males and Females of the 4_2, 5_2, and 5_3 Age-groups, 1915 to 1935.

Year.	4_2		5_2		5_3		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.	M.	F.		
1915	55	45	57	43	53	47	54	46
1916	49	51	50	50	38	62	51	49
1917	50	50	50	50	49	51	50	50
1918	51	49	56	44	57	43	52	48
1919	53	47	53	47	48	52	52	48
1920	50	50	47	53	47	53	49	51
1921	48	52	42	58	43	57	47	53
1922	49	51	52	48	46	54	53	47
1923	51	49	55	45	46	54	50	50
1924	51	49	50	50	47	53	51	49
1925	46	54	53	47	43	57	49	51
1926	52	48	48	52	50	50	51	49
1927	48	52	58	42	41	59	48	52
1928	53	47	64	36	66	34	56	44
1929	46	54	55	45	50	50	49	51
1930	42	58	55	45	44	56	45	55
1931	47	53	56	44	42	58	48	52
1932	44	56	58	42	30	70	46	54
1933	49	51	50	50	47	53	51	49
1934	54	46	56	44	46	54	55	45
1935	48	52	52	48	35	65	48	52
Average	49	51	53	47	46	54	50	50

2. THE RIVERS INLET SOCKEYE RUN OF 1935.

(1.) General Characteristics.

In 1928 an attempt was made to arrange the data of Rivers Inlet runs in orderly sequence. A fairly satisfactory correlation between size of pack and relative abundance of four- and five-year-old fish seemed to exist on the basis of five-year cycles. As the years passed additional data showed these correlations to be more or less unsound, but they were retained to await the run of 1935, which would fall in the premier cycle of the river system. It is particularly regrettable, however, to find the sampling of this year's run inadequate and its analysis necessarily not directly comparable with those of former years. Accordingly, it has seemed advisable to drop the correlation tables. The cycle 1915–1920–1925–1930–1935 of the big run was originally characterized by very large runs and a great excess of five-year-old fish. However, in 1930 the four-year-olds and the five-year-olds were present in equal numbers. This year the run is composed of 42 per cent. 5_2's and 58 per cent. 4_2's. These figures cannot be accepted on their face value because the sampling was irregular and covered only the middle part of the run. It is impossible to judge exactly how inaccurate these percentages are, but it does not seem likely that the error is great enough to presume that the five-year-old fish could have constituted from 77–95 per cent. of the run as in the earlier years of the cycle.

In passing, it may be well to mention the fact that the correlations have failed to hold in recent years largely because the five-year-old fish have seemed to decrease in numbers. In the report of 1934 it was pointed out that some of the so-called characteristics of this river system were more apparent than real because of incomplete sampling. Likewise some of the trends were brought about by a change in fishing gear; i.e., by the general adoption of smaller-meshed nets after the restrictions were removed in 1929. The apparent decrease in five-year-old fish is probably the result of an increase in the four-year-olds due to the use of smaller-meshed nets.

Both the size of the commercial yield and the report from the spawning-beds signify that the run of 1935 was exceptionally large. The pack amounted to 135,038 cases, which is the second largest pack in the history of the river (Table VIII.). To quote from the report of Mr. Lord, the Dominion Fishery Inspector: "Escapement of sockeye salmon to the spawning-beds of Owikeno Lake has been very good indeed. Most of the rivers show a really heavy escapement." He adds that no fear need be entertained for the runs four and five years hence unless adverse climatic conditions intervene.

The years 1931 and 1932 will be the brood-years for the run of 1936. In both these years the packs were mediocre, consisting of 76,428 and 69,732 cases. In commenting upon the escapement in 1931, Mr. Stone said that he believed the return four and five years hence would equal if not exceed that of the present year. This spawning made a good showing in 1935 and should contribute very materially to next year's run. The escapement in 1932 was described as "spotty" and the fear was expressed that "a large amount of spawn deposited will have been destroyed by freshets." Taking all these things into consideration, it is not likely that the run and pack of 1936 will reach more than 85,000 cases.

(2.) Age-groups.

The analysis of the run of 1935 is based on size and sex data obtained from 1,210 individuals taken between, and inclusive of, the dates July 4th and 30th. The sampling is inadequate in two respects. In the first place, the period of collection was confined to twenty-seven days instead of being spread over approximately five weeks, as has usually been the case. Secondly, the collections were poorly spaced; ten samples were taken in five lots of two successive days each, the first two lots being separated by a two-day interval and the others by five-day intervals. Reference to a discussion of seasonal changes which was given in the report for 1932 will show that this inadequate sampling may affect three phases of this study—namely, the relative numbers of the two major groups, the proportion of the sexes, and the average lengths and weights of the age-groups. In this river system there is no consistent sequence in the relative abundance of the age-groups as the runs progress. Conditions vary from year to year. Consequently the present figures of 42 per cent. five-year-olds and 58 per cent. four-year-olds probably do not represent the relative distribution in a complete cross-section of the run. However, as is always the case, the major part of the run consists of the 4_2 and 5_2 age-groups. This is augmented by a scattering of 5_3's and 6_3's. The four age-groups are distributed in the following proportions: 4_2, 56 per cent.; 5_2, 41; 5_3, 2; and 6_3, 1.

(3.) Lengths and Weights.

Tables IX. and X. contain the length and weight statistics for the individuals in the various age-groups and Tables XI. and XII. give the comparative average sizes over a period of years and the general averages. Scrutiny of the 1935 measurements does not show them to be abnormal in any way and yet it must be kept in mind that they cover only part of the run. The average weights and lengths of the 4_2 group are very slightly below the general averages, while the average lengths of the 5_2 class are 0.4 inch above for both sexes and the average weights, male 0.1 and female 0.4 lb., below the general averages.

As has often been the case in the past, the males and females of the 4_2 group have identical lengths (22.4 inches) and their weights vary by only 0.2 per cent. Last year's study (p. 28) showed that this relationship which had been regarded as a characteristic of the group was due to faulty sampling, the individuals, especially the females, at the lower size level being small enough to escape capture.

(4.) Distribution of Sexes.

In this river system the 5_2 females have always outnumbered the males and the 4_2 males have never failed to be more numerous than the females (Table XIII.). A general discussion of sex-distribution was given in the report of 1934 and the following conclusions were reached in regard to Rivers Inlet: First, the constant excess of 5_2 females is due to precocious development of the males; and, secondly, because of incomplete sampling of the 4_2 group, accurate conclusions cannot be reached, but it is likely that this group also exhibits precocious maturity, the deficiency of males being at least partly compensated for by the early-maturing 5_2 males; and, thirdly, the definite downward trend in the proportions of 4_2 males since 1929 is traceable to a change from larger to smaller gill-net mesh.

The 1935 proportions conform to the general pattern of distribution, there being in the 4_2 group 65 per cent. males and 35 per cent. females, and in the 5_2 class 36 per cent. males and 64 per cent. females. But in both age-groups the males are more numerous than they have been for a number of years and the total males exceed the total females, a relationship which has not existed since 1929. These proportions would seem to contradict the statement that there has been a definite decrease in 4_2 males since the finer-meshed gill-nets came into use. However, it may be that the explanation lies in the limited, irregular sampling. One of the generalizations made in 1932 in the study on seasonal succession was that the males tend to run earlier than the females. The following figures for 1935 certainly bear this out:—

Dates of Collection.	Total Sample.	No. of Males.	Percentage of Males.
July 4 and 5	242	154	64
July 8 and 9	240	141	59
July 15 and 16	234	135	58
July 22 and 23	246	111	45
July 29 and 30	248	94	38

Forty per cent. of the total 1,210 individuals was taken in the early sampling between July 4th and 9th, a period of six days, which is only one day more than the interval which elapsed before another collection was made. Such concentrated sampling at a time when the males were especially numerous has undoubtedly raised the total percentages of the males, but it is impossible to say how far these percentages vary from those which would have been obtained had the entire run been sampled at regular intervals.

Table VIII.—Rivers Inlet Sockeyes, Percentages of Age-groups in Runs of Successive Years and Packs.

Year.	Percentage of Individuals.			
	4_2	5_2	5_3	6_3
1907 (87,874 cases)	----	----	----	----
1908 (64,652 cases)	----	----	----	----
1909 (89,027 cases)	----	----	----	----
1910 (126,921 cases)	----	----	----	----
1911 (88,763 cases)	----	----	----	----
1912 (112,884 cases)	21	79	----	----
1913 (61,745 cases)	80	20	----	----
1914 (89,890 cases)	35	65	----	----
1915 (130,350 cases)	13	87	----	----
1916 (44,936 cases)	26	74	----	----
1917 (61,195 cases)	39	61	----	----
1918 (53,401 cases)	57	43	----	----
1919 (56,258 cases)	46	54	----	----
1920 (121,254 cases)	5	95	----	----
1921 (46,300 cases)	49	51	----	----
1922 (60,700 cases)	81	18	1	----
1923 (107,174 cases)	74	24	2	----
1924 (94,891 cases)	43	54	2	1
1925 (159,554 cases)	23	77	----	----
1926 (65,581 cases)	59	38	2	1
1927 (64,461 cases)	81	16	3	----
1928 (60,044 cases)	55	40	4	1
1929 (70,260 cases)	77	18	3	2
1930 (119,170 cases)	49	48	2	1
1931 (76,428 cases)	53	44	2	1
1932 (69,732 cases)	67	27	5	1
1933 (83,507 cases)	44	55	1	----
1934 (76,923 cases)	77	20	2	1
1935 (135,038 cases)	57	41	1	1

Table IX.—Rivers Inlet Sockeye, Run of 1935, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
18½	1	-----	-----	-----	-----	-----	-----	-----	1
19½	4	-----	-----	-----	-----	-----	-----	-----	4
20	8	1	-----	-----	-----	-----	-----	-----	9
20½	21	5	-----	-----	-----	-----	-----	-----	26
21	57	9	-----	-----	1	-----	-----	-----	67
21½	53	48	-----	1	-----	1	-----	-----	103
22	68	60	-----	-----	1	2	-----	-----	131
22½	51	51	3	6	1	2	-----	-----	114
23	63	48	10	12	-----	1	-----	-----	134
23½	46	19	16	17	1	1	-----	-----	100
24	30	9	14	35	-----	1	-----	-----	89
24½	11	4	9	42	1	1	-----	-----	68
25	8	-----	18	50	1	1	1	1	80
25½	6	-----	16	46	-----	-----	-----	2	70
26	-----	1	23	42	-----	1	-----	2	69
26½	1	-----	27	25	-----	-----	-----	2	55
27	-----	-----	23	20	-----	-----	1	1	45
27½	-----	-----	17	5	-----	-----	1	-----	23
28	-----	-----	10	-----	1	-----	1	-----	12
28½	-----	-----	5	-----	-----	-----	-----	-----	5
29	-----	-----	3	-----	-----	-----	-----	-----	3
29½	-----	-----	2	-----	-----	-----	-----	-----	2
Totals	428	255	196	301	7	11	4	8	1,210
Ave. lengths	22.4	22.4	25.8	25.1	23.8	23.3	26.9	26.0	-----

Table X.—Rivers Inlet Sockeyes, Run of 1935, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
2	1	-----	-----	-----	-----	-----	-----	-----	1
3	4	-----	-----	-----	-----	-----	-----	-----	4
3½	48	17	-----	1	-----	-----	-----	-----	66
4	139	116	1	2	2	3	-----	-----	263
4½	109	76	7	21	1	3	-----	-----	217
5	65	33	18	32	2	2	-----	-----	152
5½	36	12	22	54	-----	1	1	-----	126
6	12	1	25	61	-----	1	-----	2	102
6½	9	-----	16	51	1	1	-----	1	79
7	5	-----	29	33	-----	-----	-----	2	69
7½	-----	-----	24	31	-----	-----	2	2	59
8	-----	-----	20	9	-----	-----	1	1	31
8½	-----	-----	18	6	1	-----	-----	-----	25
9	-----	-----	9	-----	-----	-----	-----	-----	9
9½	-----	-----	4	-----	-----	-----	-----	-----	4
10	-----	-----	2	-----	-----	-----	-----	-----	2
10½	-----	-----	1	-----	-----	-----	-----	-----	1
Totals	428	255	193	301	7	11	4	8	1,210
Ave. weights	4.5	4.3	6.9	6.1	5.4	4.9	7.1	6.9	-----

Table XI.—Rivers Inlet Sockeyes, Average Length in Inches of the 4_2 and 5_2 Groups, 1912 to 1935.

Year.	Four-year Males.	Four-year Females.	Five-year Males.	Five-year Females.
1912	23.2	22.8	25.8	24.6
1913	22.9	23.0	25.9	25.2
1914	23.0	22.8	25.9	25.2
1915	22.9	22.8	26.0	25.1
1916	22.9	22.8	25.8	25.0
1917	22.5	22.3	25.0	24.4
1918	22.3	22.5	24.9	24.5
1919	22.4	22.3	24.8	24.4
1920	-----	-----	26.0	25.0
1921	22.9	22.6	25.2	24.2
1922	22.5	22.4	24.6	24.2
1923	22.4	22.3	24.6	24.1
1924	22.3	22.3	24.9	24.3
1925	22.2	22.2	25.5	24.8
1926	22.8	22.9	25.1	24.6
1927	22.1	22.4	24.6	24.2
1928	22.3	22.8	26.1	25.2
1929	22.6	22.2	25.2	25.3
1930	22.7	22.6	26.0	25.2
1931	21.9	22.0	25.2	24.8
1932	22.4	22.4	25.2	24.6
1933	22.1	22.0	25.5	24.7
1934	22.4	22.2	25.6	25.0
Average lengths	22.5	22.5	25.4	24.7
1935	22.4	22.4	25.8	25.1

Table XII.—Rivers Inlet Sockeyes, Average Weight in Pounds of the 4_2 and 5_2 Groups, 1914 to 1935.

Year.	Four-year Males.	Four-year Females.	Five-year Males.	Five-year Females.
1914	5.4	5.2	7.3	6.8
1915	5.3	5.1	7.3	6.6
1916	5.5	5.0	7.6	6.7
1917	5.0	4.9	6.6	6.2
1918	4.9	5.1	6.7	6.7
1919	4.9	4.8	6.3	5.9
1921	5.2	4.9	6.9	6.0
1922	6.0	5.9	7.4	7.0
1923	5.0	4.8	6.5	5.9
1924	4.9	4.8	6.6	6.1
1925	4.6	4.4	6.9	6.2
1926	5.2	5.2	6.9	6.3
1927	5.3	5.8	7.3	7.6
1928	4.8	5.0	7.5	6.7
1929	5.0	4.8	6.6	6.7
1930	4.9	4.8	7.5	6.9
1931	4.5	4.6	6.7	6.4
1932	4.7	4.7	6.5	6.5
1933	4.8	4.6	7.3	6.6
1934	4.9	4.6	7.3	6.7
Average weights	5.0	5.0	7.0	6.5
1935	4.5	4.3	6.9	6.1

Table XIII.—Rivers Inlet Sockeyes, Percentages of Males and Females of the 4_2 and 5_2 Age-groups, 1915 to 1935.

Year.	4_2		5_2		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.		
1915	---	---	---	---	45	55
1916	65	35	43	57	49	51
1917	63	37	39	61	48	52
1918	79	21	49	51	66	34
1919	77	23	41	59	58	42
1920	74	26	48	52	49	51
1921	63	37	40	60	51	49
1922	66	34	38	62	61	39
1923	71	29	31	69	62	38
1924	74	26	31	69	50	50
1925	66	34	34	66	41	59
1926	63	37	32	68	51	49
1927	68	32	36	64	62	38
1928	63	37	30	70	50	50
1929	57	43	36	64	53	47
1930	56	44	37	63	47	53
1931	59	41	33	67	47	53
1932	54	46	28	72	47	53
1933	56	44	32	68	42	58
1934	55	45	27	73	49	51
1935	63	37	39	61	53	47
Average	65	35	36	64	51	49

3. THE SKEENA RIVER SOCKEYE RUN OF 1935.

(1.) General Characteristics.

The pack on the Skeena amounted to 52,879 cases and again was below expectation (Table XIV.). It would seem that the relatively small run was due to a failure of the fish of the 5_2 age-group to return in numbers. The percentage of 5_2's in the samplings is 31 per cent. Further indication of the lack of 5_2's is indicated in the spawning-bed reports, which do not mention large numbers of large fish but rather large numbers of small fish.

The escapements to both the Babine and Lakelse areas were reported to be good, although the spawning of very large numbers of pink salmon in portions of the former area and freshets in the latter may adversely affect the production of young fish.

While the escapement was good, there is no reason to believe that there was an increase equivalent to the difference between predicted and actual catch. This difference would represent approximately 600,000 fish, and this additional number appearing on the spawning-beds would have resulted in reports of excellent escapements. The conclusion that the run to the Skeena in 1935 was a relatively small one seems justified.

The run of 1936 will be the product of the spawnings of 1931 and 1932. In the former year the pack was 93,023 cases and the escapement was reported as good. In the latter year the pack was 59,916 cases, with the escapement in the Babine area stated to be only fair and in the Lakelse area good, but freshets probably to have destroyed large quantities of eggs. Under present conditions, it does not seem of value to attempt to predict the size of the run in 1936.

(2.) Age-groups.

Scales and length, weight and sex data were obtained from 1,927 fish from July 3rd to August 14th in eighteen random samplings. The 4_2 age-group is represented by 935 individuals or 49 per cent., the 5_2 group by 605 individuals or 31 per cent., the 5_3 group by 340 individuals or 18 per cent., and the 6_3 group by forty-seven individuals or 2 per cent. As stated previously, the number of fish in the 5_2 age-group is smaller than expected, in that in 1930 the percentage was 52. It is interesting to note that the number of individuals in the 5_3 age-group is relatively large, forming 18 per cent. It is evident that considerable numbers

of the young fish of the spawning of 1930 remained an additional year in the lake and thus reduced the possibility of a large return of 5_2 individuals. Table XV. shows that large numbers of 5_3's have occurred sporadically—namely, in 1916, 1922, 1931, and 1935.

(3.) Lengths and Weights.

It will be noted from Tables XVIII. and XIX. that the average lengths and weights of the fish of the 4_2 and 5_3 age-groups are considerably below the averages of the past twenty or more years, and the observations of the inspectors of the spawning-beds indicating a high percentage of small fish are confirmed. On the other hand, the average lengths and weights of the 5_2 and 6_3 age-groups are well above the average of past years and, in fact, approach the highest values recorded.

In no year of record has there been so much difference between the average lengths of the 4_2 and 5_2 age-groups—namely, 3.2 inches in the case of the males and 2.3 inches of the females. Similarly, in the case of weights, the difference in the case of males is 2.3 lb. and of the female 1.6 lb.

The average lengths and weights for the year are as follows:—

4_2 males, 23.1 inches, 5.1 lb.; females, 22.9 inches, 4.9 lb.
5_2 males, 26.3 inches, 7.4 lb.; females, 25.2 inches, 6.5 lb.
5_3 males, 23.6 inches, 5.5 lb.; females, 22.8 inches, 4.7 lb.
6_3 males, 26.2 inches, 7.2 lb.; females, 25.1 inches, 6.4 lb.
(Tables XVI. and XVII.)

(4.) Proportions of the Sexes.

The total number of males in the samplings is 764 and of females 1,163, percentages of 40 and 60 respectively (Table XX.). The females outnumber the males in both the 4_2 and 5_2 age-groups, with percentages of 59 and 68 respectively, while the proportions of the sexes in the 5_3 and 6_3 groups are approximately equal. It would seem that considerable numbers of males matured as grilse, passed through the nets, and so escaped record. This belief is supported by the reports on the spawning-beds, which mention as high as " 20 per cent. runts and 15 per cent. small sockeye " in some areas, and state that these small fish could not be taken by the 5¾-inch nets used on the river.

Table XIV.—Skeena River Sockeyes, Percentages of Age-groups in Runs of Successive Years and Packs.

Year.	Percentage of Individuals.			
	4_2	5_2	5_3	6_3
1907 (108,413 cases)	----	----	----	----
1908 (139,846 cases)	----	----	----	----
1909 (87,901 cases)	----	----	----	----
1910 (187,246 cases)	----	----	----	----
1911 (131,066 cases)	----	----	----	----
1912 (92,498 cases)	57	43	----	----
1913 (52,927 cases)	50	50	----	----
1914 (130,166 cases)	25	75	----	----
1915 (116,553 cases)	36	64	----	----
1916 (60,923 cases)	34	38	13	18
1917 (65,760 cases)	57	29	9	5
1918 (123,322 cases)	51	34	9	6
1919 (184,945 cases)	27	60	9	4
1920 (90,869 cases)	15	71	6	8
1921 (41,018 cases)	69	22	6	3
1922 (96,277 cases)	70	16	12	2
1923 (131,731 cases)	56	29	8	7
1924 (144,747 cases)	23	69	7	1
1925 (77,784 cases)	51	45	3	1
1926 (82,360 cases)	62	26	9	3
1927 (83,996 cases)	62	28	9	1
1928 (34,559 cases)	51	39	7	3
1929 (78,017 cases)	62	30	6	2
1930 (132,372 cases)	39	52	8	1
1931 (93,023 cases)	40	30	28	2
1932 (59,916 cases)	44	37	7	12
1933 (30,506 cases)	57	36	5	2
1934 (54,558 cases)*	58	34	7	1
1935 (52,879 cases)	49	31	18	2

*The figure of 70,655 cases in the report of last year was incorrect in that the transference of fish from one river system to another was not recognized.

Table XV.—Skeena River Sockeyes, Percentages of the Principal Year-classes from 1916 to 1935.

Year.	One Year in Lake.		Two Years in Lake.	
	Four Years old.	Five Years old.	Five Years old.	Six Years old.
1916	34	38	13	18
1917	57	29	9	5
1918	51	34	9	6
1919	27	60	9	4
1920	15	71	6	8
1921	69	22	6	3
1922	70	16	12	2
1923	56	29	8	7
1924	23	69	7	1
1925	51	45	3	1
1926	62	26	9	3
1927	62	28	9	1
1928	51	39	7	3
1929	62	30	6	2
1930	39	52	8	1
1931	40	30	28	2
1932	44	37	7	12
1933	57	36	5	2
1934	58	34	7	1
1935	49	31	18	2

Table XVI.—Skeena River Sockeyes, 1935, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
18½	-----	-----	-----	-----	1	-----	-----	-----	1
19	1	-----	-----	-----	-----	-----	-----	-----	1
19½	-----	-----	-----	-----	-----	-----	-----	-----	-----
20	4	-----	-----	-----	-----	-----	-----	-----	4
20½	5	2	-----	-----	1	-----	-----	-----	8
21	33	16	-----	-----	1	4	-----	-----	54
21½	23	28	-----	-----	1	15	-----	-----	67
22	63	99	1	1	17	31	-----	-----	212
22½	25	68	-----	1	11	34	-----	-----	139
23	57	151	1	18	42	48	-----	1	318
23½	33	70	2	23	19	18	1	1	167
24	58	93	8	54	26	18	-----	3	260
24½	22	14	15	38	16	3	1	2	111
25	40	8	28	82	24	4	1	8	195
25½	9	3	11	56	2	-----	3	2	86
26	6	1	29	79	3	-----	6	3	127
26½	2	-----	18	23	-----	-----	3	2	48
27	1	-----	33	27	1	-----	4	2	68
27½	-----	-----	18	4	-----	-----	3	-----	25
28	-----	-----	18	3	-----	-----	1	-----	22
28½	-----	-----	8	1	-----	-----	-----	-----	9
29	-----	-----	3	1	-----	-----	-----	-----	4
29½	-----	-----	1	-----	-----	-----	-----	-----	1
Totals	382	553	194	411	165	175	23	24	1,927
Ave. lengths	23.1	22.9	26.3	25.2	23.6	22.8	26.2	25.1	-----

Table XVII.—Skeena River Sockeyes, 1935, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
2½	-----	-----	-----	-----	1	-----	-----	-----	1
3	3	1	-----	-----	-----	1	-----	-----	5
3½	14	5	-----	-----	1	6	-----	-----	26
4	68	70	1	1	11	25	-----	-----	176
4½	76	170	2	17	21	66	-----	-----	352
5	54	137	3	27	36	49	-----	1	307
5½	50	103	9	60	36	19	1	3	281
6	52	56	21	78	29	8	2	8	254
6½	47	8	26	58	20	1	5	6	171
7	14	3	25	79	5	-----	6	3	135
7½	4	-----	26	53	4	-----	2	-----	89
8	-----	-----	35	21	1	-----	4	3	64
8½	-----	-----	17	11	-----	-----	2	-----	30
9	-----	-----	15	4	-----	-----	1	-----	20
9½	-----	-----	9	1	-----	-----	-----	-----	10
10	-----	-----	4	1	-----	-----	-----	-----	5
10½	-----	-----	1	-----	-----	-----	-----	-----	1
Totals	382	553	194	411	165	175	23	24	1,927
Ave. weights	5.1	4.9	7.4	6.5	5.5	4.7	7.2	6.4	-----

Table XVIII.—Skeena River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1935.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912	24.6	23.5	26.4	25.2	-----	-----	-----	-----
1913	23.5	22.9	25.5	24.7	-----	-----	-----	-----
1914	24.2	23.4	26.2	25.1	-----	-----	-----	-----
1915	24.2	23.5	25.9	25.0	24.5	23.4	25.6	24.4
1916	23.9	23.6	26.2	25.0	24.1	23.8	26.2	24.8
1917	23.6	23.2	25.5	24.7	23.9	23.8	25.4	25.0
1918	24.1	23.3	25.9	25.0	23.9	23.4	25.2	24.7
1919	24.3	23.4	25.7	24.8	24.3	23.4	25.8	24.7
1920	23.8	23.2	26.2	25.3	24.1	23.4	26.2	25.1
1921	23.8	23.1	25.2	24.2	24.2	23.4	24.9	24.2
1922	23.6	23.2	25.3	24.4	23.8	23.3	24.6	24.1
1923	23.7	23.1	25.5	24.5	23.9	23.2	25.6	24.4
1924	24.1	23.3	26.2	25.2	24.7	23.6	25.8	24.8
1925	23.6	22.8	25.6	24.7	24.1	23.3	25.8	24.8
1926	23.8	23.4	25.6	24.8	24.6	23.8	26.0	25.0
1927	23.9	23.3	25.7	24.8	24.1	23.5	25.2	24.9
1928	23.3	22.8	25.3	24.7	23.5	22.8	25.6	24.7
1929	22.9	22.7	25.5	24.7	23.8	22.8	25.5	24.3
1930	23.1	22.7	24.7	23.9	23.5	22.4	24.6	23.2
1931	23.5	23.1	25.7	24.8	23.8	23.1	25.8	24.7
1932	23.4	22.7	25.2	24.4	24.1	22.8	25.4	24.4
1933	23.2	22.8	26.1	25.2	24.3	23.4	26.4	25.3
1934	23.8	23.2	26.3	25.2	25.2	24.1	26.0	24.9
Average lengths	23.7	23.1	25.7	24.8	24.1	23.3	25.6	24.6
1935	23.1	22.9	26.3	25.2	23.6	22.8	26.2	25.1

Table XIX.—Skeena River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1935.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1914	5.9	5.3	7.2	6.3	-----	-----	-----	-----
1915	5.7	5.2	6.8	6.2	5.9	5.2	6.6	6.0
1916	5.4	5.1	7.1	6.3	5.8	5.4	7.1	5.9
1917	5.3	5.0	6.4	6.0	5.5	5.2	6.3	5.8
1918	5.8	5.3	6.9	6.4	5.7	5.3	6.6	6.1
1919	6.1	5.5	7.0	6.2	6.1	5.4	6.9	6.3
1920	5.6	5.1	7.2	6.4	6.3	5.1	7.3	6.3
1921	5.7	5.1	6.4	5.7	5.8	5.1	6.0	5.6
1922	5.4	5.1	6.5	5.7	5.5	5.1	6.2	5.7
1923	5.3	4.9	6.3	5.7	5.3	4.8	6.3	5.4
1924	5.6	5.0	7.0	6.3	5.9	5.1	6.6	5.8
1925	5.1	4.7	6.5	5.8	5.5	4.9	6.9	5.4
1926	5.3	5.1	6.5	5.8	5.9	5.2	6.9	6.2
1927	5.4	5.1	6.5	5.9	5.4	5.0	6.0	5.8
1928	5.0	4.6	6.4	5.8	5.0	4.6	6.5	5.8
1929	4.9	4.7	6.8	6.2	5.6	4.9	6.8	5.7
1930	5.4	5.1	6.7	6.0	5.6	5.0	6.8	5.8
1931	5.4	5.1	6.8	6.3	5.5	5.0	6.9	6.0
1932	5.4	4.9	6.9	6.1	6.0	5.0	6.8	5.9
1933	4.9	4.7	7.1	6.3	5.7	5.0	7.1	6.3
1934	5.7	5.2	7.7	6.6	6.7	5.8	7.7	6.2
Average weights	5.4	5.0	6.8	6.1	5.7	5.1	6.7	5.9
1935	5.1	4.9	7.4	6.5	5.5	4.7	7.2	6.4

Table XX.—Skeena River Sockeyes, Percentages of Males and Females of the 4_2 and 5_2 Age-groups, 1915 to 1935.

Year.	4_2		5_2		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.		
1915	56	44	45	55	49	51
1916	70	30	43	57	55	45
1917	66	34	48	52	60	40
1918	63	37	46	54	57	43
1919	53	47	46	54	49	51
1920	41	59	37	63	38	62
1921	44	56	44	56	45	55
1922	52	48	41	59	50	50
1923	60	40	37	63	52	48
1924	50	50	43	57	45	55
1925	57	43	42	58	50	50
1926	40	60	43	57	42	58
1927	45	55	41	59	44	56
1928	48	52	45	55	46	54
1929	50	50	46	54	50	50
1930	47	53	56	44	53	47
1931	43	57	39	61	44	56
1932	47	53	63	37	54	46
1933	48	52	40	60	45	55
1934	42	58	33	67	39	61
1935	41	59	32	68	40	60
Average	51	49	43	57	48	52

4. THE NASS RIVER SOCKEYE RUN OF 1935.

(1.) General Characteristics.

Judging from the small pack of 12,712 cases (Table XXI.), it would seem that the prediction of " a goodly return in 1935 " had been as futile as many previous predictions. However, this seems to be a year in which the pack is not an index of the extent of the run. In 1930 Inspector Hickman saw more sockeye in the Meziadin District than he had seen in his twenty-three years' experience. This year's escapement is reported to be highly satisfactory, that of the early run being similar to the heavy seeding of 1930, and that of the late run good but not as extensive as in 1930. From the point of view of conservation, it is fortunate that such a large proportion of the fish reached the spawning-beds. It is possible that these two very good escapements of 1930 and 1935 may form the nucleus of a second cycle of big runs.

The brood-year for 1936 is 1931. In that year the pack amounted to 16,929 cases, and, quoting from Inspector Hickman's report, " the spawning-beds were not well enough seeded to ensure a good return in five years' time."

(2.) Age-groups.

As has been the case in many runs of recent years, so in this 1935 run the former complexity of age-groups has largely disappeared. This is partly due to the shortening of the period of sampling. When the collection of data was started in June and carried through at least the second week in August, there was usually a definite seasonal succession of eight age-groups. The two sea-type classes which were confined to the early days of the run no longer appear in the data of years such as 1935, when the first collection is made on July 5th. The oldest fish, the 6_4's and 7_4's, rarely occur now, although their disappearance seems to be less definitely linked with the length of the sampling period. In this river system there is a correlation between ultimate age and size, the oldest fish being the largest. For the past three years the average size of the Nass sockeyes has been extraordinarily large; consequently, if the 6_4's and 7_4's have increased in a similar manner, it is possible that they are large enough to entirely escape the nets.

The analysis of the run of 1935 is based on 1,477 individuals collected in twelve samples between July 5th and August 15th. There is little uniformity in the size of the samples and in the interval between collections; 42 per cent. of the total number of individuals was taken in four samples between August 10th and 15th. Consequently, the analysis of data will not furnish a picture of a complete cross-section of the run. Except for a single 4_3 male, the 1,477 fish are divided among the four age-groups which are common to all the river system. They are distributed as follows: 11 per cent. 4_2's, 10 per cent. 5_2's, 73 per cent. 5_3's, and 6 per cent. 6_3's. Both last year and again this year the major group, the 5_3's, has been relatively more abundant than in recent years and the 4_2's less numerous.

(3.) Lengths and Weights.

Tables XXII. and XXIII. present, with one exception, the length and weight frequencies for the entire 1935 sampling. The yearly averages and the general averages are recorded in Tables XXIV. and XXV. For the last two years attention has been directed to the unusually large size of the Nass sockeyes. In 1934 two of the eight average length measurements and seven of the eight average weight measurements were new high levels. This year the fish are again large. Among the lengths there are two new records, the 5_2 males averaging 27.3 inches, a measurement which exceeds the general average by 1.2 inches, and the 6_3 males averaging 28.9 inches, a length which betters the general average by 1.4 inches. All the other average lengths, except that of the 5_3 females, surpass the general averages by amounts varying from 0.3 to 1.4 inches. The average weight frequencies are much closer to those of the general averages, some of them being slightly above and others a little below. As last year, since the measurements both for length and weight of the dominant group approximate the general averages, one is inclined to accept the other measurements on their face value and conclude that for some unknown reason the average size of the individuals in the other groups (the 4_2, 5_2, and 6_3) has increased considerably. In addition to the fish listed in the tables, the sampling included a single 4_3 male, measuring 23¼ inches and weighing 5 lb.

(4.) Proportion of Sexes.

A glance at Table XXVI., which records the yearly percentages of males and females of the principal age-groups, reveals that deficiency of males is the outstanding feature of the Nass sex proportions. The general averages show both that the total number of males is less than the total number of females and also that the males are outnumbered by the females in the 4_2, 5_2, and 5_3 year-classes, while the reverse relationship obtains in the 6_3 age-group. Closer scrutiny of the table shows that deficiency of males has been most marked in the dominant age-group, the 5_3's, and in addition, as a natural consequence, in the yearly totals. This constant inequality is believed to be due to early maturity of males. Although only two such individuals—i.e., 4_3's—have been recorded in the Nass analyses, it is conjectured that they are present in considerable numbers but escape capture because of their small size. In Alaska, where traps, instead of gill-nets, are used for fishing, large numbers of these grilse are taken every year. Thus incomplete gill-net sampling may account for the lack of equality in the yearly total number of males and females. Although deficiency of males is less constant in the 4_2 and 5_2 age-groups, here also there appears to be indications of precocious maturity. The sex ratios of the 6_3 class are of very little significance, because the tabulation of this group on dates year after year indicates its period of occurrence to extend beyond the period of sampling.

The deficiency of males in 1935 is unusually great. A proportion of total males as small as 42 per cent. has been recorded only once before in the history of the river. Also 39 per cent. males in the 5_3 group is a new low figure. These exceptional ratios are believed to be the result of the irregular sampling of the run. A comparison of the sex-distribution of 370 sockeyes, taken in the first two samples on July 5th and 8th, with those of 376 individuals collected on the last two days, August 13th and 15th, show the males to have constituted 49 and 33 per cent. respectively of the samples. This shortage of males at the end of the collecting period would be reflected unproportionately on the total distributions, because 42 per cent. of the entire sampling was collected between August 10th and August 15th.

(5.) The Meziadin and Bowser Sockeye Colonies.

The greatest amount of Bowser colony material ever obtained came to hand in 1935 after a decision had been made last year to discontinue the comparison of Meziadin and Bowser populations because of scarcity of Bowser material. Instead of discontinuing the series it will be used, at least temporarily, with a redefinition of the colonies adapted to fit the actual facts of the case.

As was stated in 1934, the Fishery Inspectors' reports have indicated for many years that there are two runs to the Meziadin watershed, an early and a late one. The data which are obtained for this study concern only the fish in the late run. Consequently, the term Meziadin is now used not in a general sense but in a restricted way referring to the late run. Also since Bowser Lake was the only other known lake of importance in the Nass watershed to which sockeyes were known to have access, it was assumed in the past that the fish netted in the Nass above its junction with the Meziadin were bound for this lake and the colony was called Bowser Lake colony. Until there is more actual information concerning the destination of these fish, Bowser is used as a general term for the Upper Nass.

The data concerning these two populations are gathered each September by the Fishery Officer on his annual visit to the Meziadin watershed. The samples of the Meziadin run are taken in the Meziadin River below the lower falls and the Upper Nass fish are intercepted by a gill-net strung across the river about a mile above the point of entrance of the Meziadin River. Since these up-stream fish have never been seen or taken in great numbers, one must conclude either that they are the last arrivals of a late run or that the Upper Nass does not support a late run of any magnitude. This year when the water was low and fairly clear Fishery Officer Warne reported a steady "dribble" of sockeye and he caught fifty-one individuals.

Although the data concerning these two populations have been very meagre at times, two well-marked differences between the colonies have held, namely: (1) The average size of the Meziadin fish is considerably greater than that of the fish proceeding at the same time to the upper reaches of the Nass River, and (2) the former population is characterized by a longer fresh-water period than is the majority of the latter population. Since the margins of the scales are badly absorbed, no comparisons can be made of the length of life in the ocean or of ultimate ages.

The material used as the basis for the 1935 comparison of these two populations is seventy Meziadin individuals and fifty-one Upper Nass fish. Their length frequencies are enumerated in Table XXVII. and their average lengths, together with those for the last eleven years, are recorded in Table XXVIII. The size distinction is well marked, the Meziadin males averaging 27.5 inches and the females 25.6 inches, against 24.5 and 24.3 inches respectively for the Upper Nass males and females. The difference in lake residence is also noticeable. Ninety-nine per cent. of the Meziadin and only 65 per cent. of the Upper Nass fish spent their first two years in fresh water (Table XXIX.).

Table XXI.—Nass River Sockeyes, Percentages of Principal Age-groups from 1912 to 1935.

Year.	Percentage of Individuals that spent			
	One Year in Lake.		Two Years in Lake.	
	Four Years old.	Five Years old.	Five Years old.	Six Years old.
1912 (36,037 cases)	8	27	63	2
1913 (23,574 cases)	15	12	71	2
1914 (31,327 cases)	4	41	45	10
1915 (39,349 cases)	19	14	59	8
1916 (31,411 cases)	9	17	66	8
1917 (22,188 cases)	10	15	71	4
1918 (21,816 cases)	30	16	45	9
1919 (28,259 cases)	7	22	65	6
1920 (16,740 cases)	8	14	72	6
1921 (9,364 cases)	10	7	75	8
1922 (31,277 cases)	6	2	91	1
1923 (17,821 cases)	11	6	77	6
1924 (33,590 cases)	4	3	91	2
1925 (18,945 cases)	23	8	67	2
1926 (15,929 cases)	12	12	63	13
1927 (12,026 cases)	8	7	81	4
1928 (5,540 cases)	30	6	61	3
1929 (16,077 cases)	25	9	60	6
1930 (26,405 cases)	28	15	54	3
1931 (16,929 cases)	10	17	67	6
1932 (14,154 cases)	28	4	61	7
1933 (9,757 cases)	35	7	55	3
1934 (36,242 cases)*	13	9	74	4
1935 (12,712 cases)	11	10	73	6

* The figure of 28,701 cases in the report of last year was incorrect in that the transference of fish from one river system to another was not recognized.

Table XXII.—Nass River Sockeyes, 1935, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
22	2	2	.....	.....	.....	1	.....	.....	5
22½	1	7	.....	.....	1	1	.....	.....	10
23	2	11	.....	.....	1	7	.....	.....	21
23½	6	19	.....	1	6	17	.....	.....	49
24	9	19	.....	6	4	43	.....	.....	81
24½	7	20	.....	5	21	54	2	1	110
25	10	14	2	14	29	92	.....	1	162
25½	12	4	4	19	37	121	.....	2	199
26	7	1	3	9	58	136	.....	1	215
26½	7	2	6	16	67	89	.....	1	188
27	1	.....	14	6	91	62	.....	3	177
27½	.....	.....	10	4	49	15	5	6	89
28	.....	.....	9	2	45	10	6	2	74
28½	.....	.....	7	2	11	3	12	5	40
29	.....	.....	2	1	5	.....	17	3	28
29½	.....	.....	1	1	.....	1	8	1	12
30	.....	.....	.....	.....	.....	.....	11	.....	11
30½	.....	.....	.....	.....	.....	.....	4	1	5
Totals	64	99	58	86	425	652	65	27	1,476
Ave. lenghts	24.9	24.0	27.3	25.9	26.5	25.6	28.9	27.6	.....

Table XXIII.—Nass River Sockeyes, 1935, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
3½	1	-----	-----	-----	-----	-----	-----	-----	1
4	2	5	-----	-----	1	1	-----	-----	9
4½	3	14	-----	-----	1	11	-----	-----	29
5	5	35	-----	3	8	44	1	-----	96
5½	7	26	-----	9	23	132	-----	-----	197
6	20	13	1	25	50	195	1	4	309
6½	13	4	5	20	65	156	-----	4	267
7	5	1	11	17	121	77	3	5	240
7½	6	1	10	6	85	29	6	3	146
8	2	-----	16	1	48	7	22	4	100
8½	-----	-----	9	3	19	-----	5	3	39
9	-----	-----	4	2	4	-----	17	4	31
9½	-----	-----	2	-----	-----	-----	6	-----	8
10	-----	-----	-----	-----	-----	-----	3	-----	3
10½	-----	-----	-----	-----	-----	-----	1	-----	1
Totals	64	99	58	86	425	652	65	27	1,476
Ave. weights	6.1	5.2	7.8	6.2	7.0	6.1	8.4	7.4	-----

Table XXIV.—Nass River Sockeyes, Average Lengths in Inches of Principal Classes from 1912 to 1935.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912	24.6	23.3	26.5	25.1	26.2	25.4	27.0	25.6
1913	24.1	23.5	25.6	24.8	26.0	25.2	26.0	26.6
1914	24.6	22.7	26.1	25.1	26.3	25.5	26.9	25.6
1915	24.0	23.5	25.9	25.2	26.5	25.9	23.6	25.3
1916	24.5	23.3	26.4	25.0	26.5	25.6	27.9	25.7
1917	23.4	23.2	25.5	24.7	25.3	24.7	26.5	25.5
1918	25.0	24.3	25.7	24.7	25.9	25.0	27.2	25.2
1919	24.9	24.1	26.2	25.2	26.5	25.8	27.9	26.7
1920	24.0	23.4	23.3	25.0	26.7	25.9	27.4	25.9
1921	24.3	23.5	25.5	24.3	26.2	25.6	27.9	26.2
1922	24.2	23.4	25.6	24.6	25.7	25.0	28.0	25.9
1923	24.3	23.7	25.9	25.3	26.2	25.5	27.2	26.5
1924	24.7	23.8	26.2	24.9	26.3	25.4	28.0	25.4
1925	24.4	23.8	25.9	24.7	25.9	25.0	26.9	25.4
1926	24.9	24.1	26.1	25.3	26.1	25.3	27.9	27.0
1927	24.9	24.2	25.3	25.2	26.3	25.9	27.6	26.5
1928	24.3	23.5	26.0	25.1	25.5	24.6	28.1	26.2
1929	24.1	23.5	26.1	25.2	25.9	24.9	27.2	26.2
1930	24.5	23.7	26.5	25.4	26.4	25.3	27.9	26.8
1931	24.5	23.8	26.5	25.7	26.1	25.3	28.2	27.1
1932	24.9	23.9	26.4	25.2	26.6	25.6	28.3	27.1
1933	24.6	23.7	27.1	25.8	25.9	25.2	28.4	27.9
1934	24.9	24.1	26.9	25.9	26.3	25.4	28.6	27.1
Average lengths	24.4	23.7	26.1	25.1	26.1	25.3	27.5	26.2
1935	24.9	24.0	27.3	25.9	26.5	25.2	28.9	27.6

Table XXV.—Nass River Sockeyes, Average Weights in Pounds of Principal Classes from 1914 to 1935.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1914	6.2	5.0	7.4	6.5	7.2	6.5	7.9	6.8
1915	5.6	5.2	6.9	6.4	7.0	6.6	7.2	6.5
1916	6.0	5.3	7.2	6.3	7.2	6.2	8.1	6.4
1917	5.3	5.3	6.8	6.2	6.3	5.8	7.3	6.4
1918	6.3	5.8	7.2	6.3	7.2	6.4	8.3	6.7
1919	6.0	5.5	6.6	5.9	6.7	6.1	7.8	6.7
1920	5.6	5.2	7.4	6.3	7.4	6.7	7.9	7.0
1921	6.0	5.4	6.9	6.1	6.9	6.3	7.7	6.6
1922	5.9	5.4	6.8	6.2	6.8	6.3	8.1	6.6
1923	5.8	5.2	6.7	6.1	6.6	6.0	7.2	6.8
1924	5.9	5.4	7.2	6.1	6.8	6.1	8.0	6.5
1925	5.9	5.4	6.8	6.1	6.7	6.0	7.4	6.3
1926	6.0	5.4	6.9	6.2	6.7	6.0	7.8	7.1
1927	6.2	5.8	7.1	6.3	6.9	6.2	7.8	7.0
1928	5.6	5.0	7.0	6.2	6.2	5.5	8.1	6.6
1929	5.7	5.2	7.1	6.6	6.7	5.9	7.6	6.8
1930	5.9	5.2	7.3	6.5	7.1	6.1	8.2	7.2
1931	6.0	5.5	7.4	6.8	6.8	6.2	8.3	7.4
1932	6.3	5.6	7.5	6.6	7.3	6.3	8.7	7.5
1933	6.2	5.4	8.1	7.0	7.0	6.2	8.4	7.9
1934	6.7	5.9	8.4	7.3	7.6	6.7	9.4	8.1
Average weights	6.0	5.4	7.2	6.4	6.9	6.2	8.0	6.9
1935	6.1	5.2	7.8	6.5	7.0	6.1	8.4	7.4

Table XXVI.—Nass River Sockeyes, Percentages of Males and Females of the 4_2, 5_2, 5_3, and 6_3 Age-groups, 1915 to 1935.

Year.	4_2		5_2		5_3		6_3		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.	M.	F.	M.	F.		
1915	55	45	49	51	52	48	53	47	52	48
1916	61	39	61	39	50	50	68	32	55	45
1917	55	45	47	53	46	54	58	42	47	53
1918	52	48	40	60	50	50	70	30	51	49
1919	53	47	48	52	46	54	54	46	48	52
1920	46	54	39	61	40	60	66	34	42	58
1921	40	60	45	55	47	53	54	46	46	54
1922	36	64	32	68	46	54	64	36	44	56
1923	43	57	43	57	47	53	60	40	46	54
1924	55	45	44	56	47	53	67	33	48	52
1925	58	42	52	48	45	55	68	32	49	51
1926	43	57	44	56	44	56	57	43	46	54
1927	39	61	54	46	45	55	61	39	46	54
1928	50	50	48	52	42	58	62	38	46	54
1929	48	52	51	49	44	56	58	42	46	54
1930	49	51	43	57	40	60	63	37	43	57
1931	49	51	53	47	43	57	70	30	47	53
1932	49	51	46	54	45	55	72	28	48	52
1933	49	51	56	44	47	53	76	24	49	51
1934	48	52	51	49	50	50	58	42	50	50
1935	39	61	40	60	39	61	71	29	42	58
Average	48	52	47	53	45	55	63	37	47	53

Table XXVII.—Meziadin and Bowser Lake Sockeyes, Lengths of Individuals comprising Runs in 1935.

Length in Inches.	Number of Individuals from			
	Meziadin Lake.		Bowser Lake.	
	M.	F.	M.	F.
22	----	----	----	1
22½	----	----	1	2
23	----	1	1	11
23½	----	----	2	3
24	1	3	3	5
24½	----	2	----	----
25	1	2	2	4
25½	1	12	----	5
26	4	10	1	5
26½	2	4	1	2
27	5	2	1	1
27½	5	----	----	----
28	9	----	----	----
28½	2	----	----	----
29	2	----	----	----
29½	1	----	----	----
30	1	----	----	----
Totals	34	36	12	39
Average lengths	27.4	25.6	24.5	24.3

Table XXVIII.—Meziadin and Bowser Lake Sockeyes, Average Lengths in Inches for the Years 1924–1935.

Year.	Meziadin Lake.		Bowser Lake.	
	M.	F.	M.	F.
1924	26.8	25.7	25.5	23.6
1925	-----	-----	23.8	23.3
1926	28.1	26.3	25.9	24.8
1927	27.1	25.8	24.7	23.7
1928	-----	-----	-----	-----
1929	27.0	25.3	-----	-----
1930	27.2	25.7	24.9	22.9
1931	27.9	26.3	-----	-----
1932	27.7	25.5	-----	-----
1933	25.9	25.3	24.3	24.7
1934	27.9	26.1	-----	25.7
1935	27.5	25.6	24.5	24.3

Table XXIX.—Percentages of Meziadin and Bowser Lake Runs, showing Different Number of Years in Fresh Water.

	Years in Lake.			No. of Specimens.
	One Year.	Two Years.	Three Years.	
Meziadin, 1922	----	80	20	10
Meziadin, 1923	13	84	3	63
Meziadin, 1924	----	76	24	160
Meziadin, 1925 (no collection)	----	----	----	----
Meziadin, 1926	2	93	5	43
Meziadin, 1927	6	94	----	85
Meziadin, 1928 (no collection)	----	----	----	----
Meziadin, 1929	10	89	1	74
Meziadin, 1930	6	94	----	113
Meziadin, 1931	----	100	----	51
Meziadin, 1932	16	80	4	104
Meziadin, 1933	20	80	----	59
Meziadin, 1934	12	88	----	67
Meziadin, 1935	1	99	----	70
Bowser, 1922	40	60	----	15
Bowser, 1923	33	64	3	41
Bowser, 1924	18	79	3	34
Bowser, 1925	16	80	4	45
Bowser, 1926	27	55	18	11
Bowser, 1927	22	78	----	9
Bowser, 1928 (no collection)	----	----	----	----
Bowser, 1929 (no collection)	----	----	----	----
Bowser, 1930	44	56	----	34
Bowser, 1931 (no collection	----	----	----	----
Bowser, 1932 (no collection	----	----	----	----
Bowser, 1933	20	80	----	5
Bowser, 1934	33	67	----	3
Bowser, 1935	35	65	----	51

CONDITION OF SALMON-SPAWNING GROUNDS, 1935.

QUEEN CHARLOTTE ISLANDS.

The sockeye runs to the Queen Charlotte Islands are not materially important, but the supplies on the spawning-grounds of the Ian, Awan, and Yakoun Rivers and the river at Copper Bay were much the same as usual.

In the case of springs and cohoes, the escapement was an average one, but as this has been an " off " year for the pink variety, only a few were observed, apart from the Tlell River, where a medium escapement was experienced.

In the case of the chums, there was a fair escapement to the streams in Naden Harbour and to the Ian and Awan Rivers in Masset Inlet. The streams on the west coast of Graham Island were only lightly seeded.

The streams on the east coast of the Queen Charlottes from Skidegate south were well seeded with chums, notwithstanding the fact that over 1,000,000 fish of this variety were taken commercially. The conservation measures of recent years in the northern area appear to be bringing the desired results.

NASS AREA.

Inspection of the sockeye-spawning grounds was again made by Mr. Frank Warne, who reached the head of Meziadin Lake on September 8th. During the next few days the beaches on both shores at the head of the lake, down as far as 5-Mile Point, were found to be well covered with spawning sockeye. On the remainder of the spawning-grounds in this section the run was fairly light. There was evidence, however, of a good number of sockeye in the lake, spawning off the beaches, and a considerable number of dead sockeye were found on the beaches and in the lake. At the fishway at the foot of the lake, on September 12th, a good run of sockeye was in progress. Fresh supplies were observed coming in in good numbers at the lower falls each day up to September 22nd, and a fresh run was also observed on the morning of the 25th. As in the case of the early run mentioned above, the fish were mostly of large size, no runts being observed.

In summing up, the inspecting officer states that the early run was heavy, similar to the seeding of 1930, and much better than the seeding reported in 1931. The late run was good but not as heavy as the run reported in 1930. It was, however, much heavier than the run of 1931.

The spring-salmon supply found in Meziadin District is reported as heavy and far better than that of the previous year.

The fishway at the outlet of the lake was found to be in good condition.

An examination by the local Inspector of the lower reaches of the Nass area shows a good run of sockeye to the Tseax and Gingit Rivers, compared with other seasons.

The escapement of pinks was not so satisfactory as might be desired, and undoubtedly some further action will be required to see that this run is taken care of.

The supply of cohoe found on the spawning-grounds was only fairly satisfactory, while the chum seeding was quite adequate.

SKEENA RIVER.

Notwithstanding the poor sockeye-pack in this area, the escapement was found to be fairly heavy and nearly as good as the large run of 1930, and much better than that of 1931. This applies to practically the whole watershed and no doubt was partly, at any rate, the result of deferring the opening date of sockeye-fishing from June 20th to July 1st.

In the Babine Lake area the showing was very satisfactory; for instance, at 15-Mile Creek there was an extra heavy run. This also applies to Pierre Creek and, in a lesser degree, to Fulton River.

In the Upper Babine River there was a large supply of big sockeye and this area received a heavy seeding. This condition also obtained largely in the lower part of the Babine River and the seeding was undoubtedly good.

In the Lakelse District there was an excellent supply found and, in addition to the hatchery being filled, a large natural seeding occurred. Unfortunately, however, freshets practically destroyed all the eggs naturally deposited, and had not hatchery operations at this point permitted of the seeding of the streams after the freshets, the run, as far as the seeding is concerned, would have been an entire loss.

In the Morice Lake District spawning conditions were found very favourable. On the Nanika River more sockeye were observed than the inspecting officer had previously encountered.

The supply of spring salmon was found to be unusually light and steps are being taken, by means of lowering the boundary on the Skeena River, to take care of this variety.

The cohoe-supply was found to be reasonably satisfactory and compared favourably with other good years.

There was a heavy escapement of pinks to the spawning-grounds and a good supply should result in the year 1937.

The spawning of chums was found to be normal, although the Skeena is not a large producer of this variety.

LOWE INLET.

The escapement of sockeye was reasonably satisfactory and similar to that of the brood-year of 1931. This is not a spring-salmon area, but the escapement of cohoes was fair.

There was a general improvement in the supply of pinks over the brood-year of 1933. This area is not a big factor in the production of chums, but the escapement to the spawning-grounds was normal.

BUTEDALE AREA.

This is not a good sockeye district, but the escapement was normal. The run of springs is usually light, but the supply found this year was even smaller than usual.

In the case of cohoes the escapement was only fair. The pink escapement was not satisfactory as far as the small streams were concerned, due to the lack of water, but the larger streams fared better.

The supply of chums was found to be satisfactory.

BELLA BELLA AREA.

The sockeye in this district are of the creek variety. The escapement was heavy, notwithstanding small commercial catches.

This is not a spring area. The escapement of cohoes, however, was quite satisfactory.

The supply of pinks was excellent and the escapement to the spawning-beds is reported much heavier than during the brood-year of 1933.

This result was no doubt due to the special conservation measures taken this year by the Department.

Although the run of chums to the area was good, the escapement was not as satisfactory as could be desired.

BELLA COOLA AREA.

The escapement of sockeye shows an increase over that of the brood-year of 1931 and may be considered as good. This no doubt is partly due to the deferring of the opening date of fishing to July 1st, which permitted a larger early escapement, and also resulted in a greater portion of the run which passed through Fitzhugh Sound and Fisher Channel reaching the Bella Coola District.

The usual small run of springs was present and was not fished in this area. The cohoe escapement was quite heavy and the quantity of pinks found on the spawning-grounds was excellent.

The chum-supply found on the spawning-grounds is reported as heavy and better than that of the last five or six years.

RIVERS INLET AREA.

The sockeye-supply was found to be greater this year than for some time past. Notwithstanding an unusually large commercial catch, the spawning-grounds were unusually well supplied. The escapement to Rivers Inlet area generally can be considered as unusually large.

There is not a large run of pink salmon to the area, but the supply on the spawning-grounds was found to be a little less than normal.

The cohoe-supply, although never heavy, was only slightly better than usual. This is not an important pink area and the supply of this variety was normal. The chum escapement to such areas as Drainey Inlet and Moses Inlet was good.

SMITH INLET AREA.

There was a good escapement of sockeye to the spawning-grounds and the main streams used by this variety were found to be crowded with spawning salmon. There appears to be no doubt as to the present regulations being adequate for the purpose of taking care of this valuable run.

The spring-supply is not fished commercially in the district, but the escapement was found to be fairly light. The variety is not that most desired, being the large, coarse, white species. The pink run which proceeds to the Nekite River, situated at the head of the inlet, showed a fairly heavy escapement to the spawning-grounds. The supply at this point seems to be increasing. The chum-supply was found to be quite satisfactory.

FRASER RIVER WATERSHED.

It was not expected there would be any material quantity of sockeye salmon reaching the upper reaches of the Fraser River watershed during the year under review, in view of the fact that the brood-year showed very few fish. The inspection this season confirmed these expectations.

In the Chilko Lake area the sockeye-supply was equal to that of the brood-year of 1931 and is quite satisfactory.

It is to the Shuswap system that the late run of sockeye proceeds. This year it was feared at one time that this late run had not arrived as it did not make the sudden rush for the river which had been usual during the last three cycle-years. Undoubtedly the run did arrive, however, but passed up the Fraser gradually and largely during the special week's closure. They were found on the spawning-grounds in considerable numbers, although possibly not equalling those of the brood-year of 1931, yet very nearly so. The particular streams used by this run are the Adams and Little Rivers. Only an odd sockeye was observed in Eagle River, at the head of the Shuswap system, and none in Scotch Creek, Granite Creek, or the streams at the head of Seymour and Anistee Arms of Shuswap Lake.

The Cultus Lake run was about what was expected and can be considered as reasonably satisfactory.

The supply of sockeye reaching the Birkenhead system was the best for a number of years and was most gratifying. These conditions also obtained in the Pitt River system, where the run was the largest in the experience of the hatchery staff.

Spring-salmon spawning compared very favourably with that of recent years. Increased numbers were found in the Thompson and Quesnel Rivers. The cohoe-supply, as well as that of chums, was quite satisfactory and compared favourably with that of recent cycles.

This was a big pink-year on the Lower Mainland streams and the run was no disappointment. In the tributaries usually frequented by this variety there were found ample supplies for a good seeding. In the streams at the head of Burrard Inlet and Howe Sound unusually large quantities were found.

Extra closed season resulted in an excellent escapement of chums to the Fraser system generally and the seeding of the spawning-beds with this variety was satisfactory.

ALERT BAY AREA.

The run of sockeye to the Nimpkish River was the heaviest since 1927 and the escapement better than for a considerable number of years. The improvement over the brood-year of 1931 was quite marked and the spawning this year was unusually good.

In McKenzie Sound there was an increase over the brood-year and the seeding was quite satisfactory.

At Keough River, Knight Inlet, an improvement was shown over the brood-year and the Port Neville seeding was normal.

The runs of the creek variety to the Shushartie and Nahwitti Rivers were a decided improvement over those of 1931. These runs, however, are very rarely fished.

The supply of springs was satisfactory, the cohoe-supply better than normal, and the pink seeding exceeded that of 1933 by approximately 25 per cent.

QUATHIASKI AREA.

At Hayden Bay Creek the run appears to be improving as the supply of sockeye this year was found to be unusually large compared with those of the last five years. The seeding of the

spawning-grounds at the head of Phillips Arm was also more satisfactory than in the brood-year.

The spring-supply at Campbell River was not so good as in the year previous, but was about normal. An improvement was observed at Salmon River, but at Phillips River the supply was about average and to the rivers at the head of Bute Inlet heavier than usual.

All streams were well seeded with cohoes, with the exception of Campbell River, where at the time of inspection the quantities were not found up to normal, although the run was still continuing.

This being an " off " year for pinks in the district, few were expected, but the spawning was average for an " off " year. All streams were well supplied with chums.

COMOX AREA.

This area is not a sockeye area, but springs were observed in greater numbers than in most recent years. The supply of cohoes and pinks was quite satisfactory.

In the case of chums the numbers found were smaller than in the year previous, with the exception of Puntledge River, where the number observed was greater than for many years past. These conditions also applied to the Oyster River. The chum seeding generally was quite satisfactory.

PENDER HARBOUR.

Saginaw Creek contains the only run of sockeye in this area and the seeding of this variety was better than that of the brood-year.

In the case of cohoes the supply was the best observed in the last eight years at Toba Inlet and the seeding of the Toba and Brem Rivers was quite adequate. Throughout the rest of the district conditions were reasonably good.

The pink-supply was unusually good and the number found on the spawning-grounds was the best for many years. This applied particularly to Jervis Inlet, where the large portion of the run occurs, and at Mission Creek, near Sechelt.

NANAIMO AREA.

The cohoe-supply in all streams between Arbutus Point and Nanaimo showed an increase of approximately 25 per cent. over that of the previous year, and there would appear to be reason to believe that the cohoe-supply in these streams is on the increase. The chum seeding was the best in recent years and was very gratifying.

LADYSMITH AREA.

The supply of springs was an average one and the cohoe-supply was satisfactory. In the Chemainus and Nanaimo Rivers pinks were observed in small quantities, but of course this was an " off " year for that variety in the district.

The seeding of chums in the Chemainus River area was much heavier than for several years. The Nanaimo River also had a good average spawning. This also applies to the smaller streams in the district.

COWICHAN AREA.

The spawning of spring salmon was not as satisfactory and hardly up to the average, particularly in the Cowichan and Koksilah Rivers.

In the case of the cohoe, however, quite a satisfactory run passed to the spawning-grounds. The chum-supplies showed an increase over recent years and the run was one of the heaviest experienced. The steelhead-supply compared very favourably with previous years.

VICTORIA AREA.

The spawning of cohoe was, generally speaking, an average one, apart from Goldstream, where the quantity observed was smaller than usual. In the case of chums, however, Goldstream showed more satisfactory quantities, but in the streams along the west coast of the Victoria area the supplies were not as satisfactory as usual.

ALBERNI AREA.

The sockeye escapement to the spawning areas of Sproat Lake, Great Central Lake, and Anderson Lake was one of the best experienced, notwithstanding the very satisfactory com-

mercial catch. The spawning in the Nitinat Arm area of this variety was also quite satisfactory.

In the case of cohoes all the main rivers in the Barkley Sound section were heavily seeded. This also applies to the Port Renfrew and Nitinat portions of the district.

The spring escapement was a good average one and compared very favourably with those of recent years. The chum escapement to the Nitinat area was quite satisfactory. This also applies to Port Renfrew. In the case of Barkley Sound the run was not so large as expected, but the escapement to the spawning-grounds was excellent.

CLAYOQUOT SOUND AREA.

The sockeye-supplies found in the Kennedy Lake and Megin Lake spawning districts were unusually large.

The spring escapement was a good one and the cohoe-supply was eminently satisfactory. This also applies to the chums.

NOOTKA SOUND AREA.

The sockeye variety in this district is not a large factor in the fishing, but the parent fish on the spawning-beds were found to be in average numbers. Springs and cohoes were found in the usual quantities, but few pinks were observed as they do not frequent the Nootka District to any extent.

In the case of chums the supply was not up to expectations. The percentage of escapement from commercial fishing, however, was better than usual and the seeding may be regarded as reasonably satisfactory.

KYUQUOT SOUND AREA.

The small sockeye-supplies found on the spawning-grounds would appear to justify the conclusion that this run is being maintained, although it is never a large one. In the case of springs, cohoes, and chums the escapement cannot be considered as satisfactory.

QUATSINO SOUND AREA.

The usual small sockeye-supply was present, although this is not a material factor in the fishing operations in this area. The spring seeding can be considered only a bare average. The cohoes on the spawning-grounds of the Rupert Arm District, however, were in very satisfactory numbers and the rest of the area average. The chum-supply was heavy, with the exception of Winter Harbour.

COLLECTIONS OF SALMON-EGGS, BRITISH COLUMBIA HATCHERIES, 1935.

Hatchery.	Sockeye.	Spring.	Cohoe.
Anderson Lake	5,292,000	----------	----------
Babine Lake	7,800,000	----------	----------
Cowichan Lake	----------	277,152	----------
Cultus Lake	----------	----------	420,000
Kennedy Lake	9,114,600	----------	----------
Pemberton	24,410,000	----------	----------
Pitt Lake	3,880,000	----------	----------
Rivers Inlet	18,680,090	----------	----------
Skeena River	8,259,400	----------	----------
Totals	77,436,090	277,152	420,000

We are indebted to Major J. A. Motherwell, Chief Supervisor of the Dominion Fisheries Department, for the above table giving the number of salmon-eggs collected at the various hatcheries.

HERRING-SPAWNING CONDITIONS, SPAWNING SEASON 1935.

QUATSINO AREA.

In this area spawning mainly took place in Browning Creek, Winter Harbour, and Klaskish areas. Spawning was heavy in all of these areas and mortality light.

KYUQUOT AREA.

Spawning in this district was heavy, but there was in several areas also heavy mortality, especially on the spawning areas in the vicinity of Rugged Point. The spawning there covered a very large area, but the mortality was heavy, as in that area the bottom consists of fine sand and comparatively little eel-grass, and a large quantity of the eggs were washed up on the beaches. In 1935 in that locality also it was observed that the birds frequented the area in large numbers and doubtless large quantities of the eggs were consumed.

NOOTKA SOUND.

For a considerable number of years the runs to Nootka Sound have been light, the best year probably being 1930–31, and the spawning in 1935 was equal to if not heavier than that year. Spawning was very heavy in the Ewing Creek and vicinity and also at Bligh Island. There was no undue mortality.

CLAYOQUOT SOUND.

All this area was well seeded with the exception of Sidney Inlet, where seeding was unusually light. Some of the areas, especially Bedwell Sound and Matilda Creek, were exceptionally heavily seeded, the run to the Bedwell area being the heaviest for at least eight years. No undue mortality was observed in any of these areas and it might be mentioned that they are inside waters.

BARKLEY SOUND.

Spawning in this area for 1935, while fair to good in many places, is not considered as good as the previous two years, as many places were very lightly seeded. The seeding in 1934 was very heavy and compared with that year the seeding in 1935 was light. There was a certain mortality, due to eggs being washed ashore by floods and storms.

VICTORIA AREA.

Spawning in the areas at Esquimalt and Lagoon might be considered normal, with very little mortality.

COWICHAN AREA.

While some areas were comparatively lightly seeded, in other areas the seeding was heavier than usual, and on the whole the spawning in the Cowichan area was better than in 1934, with no undue mortality.

LADYSMITH AREA.

Throughout the Ladysmith area herring spawning in 1935 was heavy; in fact, in most areas conditions indicated a record seeding. In several areas, however, the loss was heavy, caused mainly by seagulls and ducks in unusually large numbers, and also an unusual prevalence of driftwood on the shores, which did a certain amount of damage to the spawning areas.

NANAIMO AREA.

The 1935 herring spawning in this area was heavier than for the previous four years. In the more exposed areas loss of spawn was fairly high, but, notwithstanding this, conditions were better than for several years previous.

COMOX AREA.

Spawning of herring was heavy in the vicinity of Englishman River, Parksville, and Qualicum, but in this area also the loss was comparatively heavy. Spawning in the vicinity of Deep Bay, Comox Bay, and Denman Island was comparatively light and the mortality in these areas would be very small.

QUATHIASKI AREA.

In nearly all the spawning localities in this area the spawning was heavy, the only exception being in the vicinity of Bold Point, where the spawning was considered light, and in the vicinity of Hyacinth Bay, where a medium run was reported.

ALERT BAY AREA.

In this area the spawning much the same as the previous year, excepting in Viner Sound and Retreat Pass area, where the spawning was heavier than usual.

ANNUAL REPORT, BRITISH COLUMBIA SALT-FISH BOARD.

Under the British Columbia Salt-fish Marketing Scheme two members to the Local Board are appointed annually by the Meal, Oil, and Salt-fish Section of the Canadian Manufacturers' Association and two members by Canadian Salt Herring Exporters, Limited. The Chairman of the Local Board is appointed by the Deputy Minister of Fisheries of the Federal Government. The following are the names and addresses of the members of the Local Board who hold office until August 31st, 1936:—

Appointees of the Meal, Oil, and Salt-fish Section.—Mr. Geo. E. Crawford, foot Gore Avenue, Vancouver, B.C.; Mr. R. Nelson, 325 Howe Street, Vancouver, B.C.

Alternates.—Mr. R. R. Payne, foot Gore Avenue, Vancouver, B.C.; Mr. S. K. Murray, 325 Howe Street, Vancouver, B.C.; Mr. J. J. Dorsey, 207 Hastings Street West, Vancouver, B.C.

Appointees of Messrs. Canadian Salt Herring Exporters, Ltd.—Mr. K. Kimura, 217 Dunlevy Avenue, Vancouver, B.C.; Mr. T. Matsuyama, 469 Powell Street, Vancouver, B.C.

Alternates.—Mr. I. Sugiyama, foot Campbell Avenue, Vancouver, B.C.; Mr. S. Kajiki, 406 Jackson Avenue, Vancouver, B.C.; Mr. S. Yoshida, P.O. Box 8, Steveston, B.C.

Chairman.—Mr. Hugh Dalton, 402 Pender Street West, Vancouver, B.C.

Secretary.—Mr. G. R. Clark, 402 Pender Street West, Vancouver, B.C.

The representatives of the Meal, Oil, and Salt-fish Section were appointed by that body on July 29th and confirmed at a meeting of the Local Board held on August 1st. The appointees of Messrs. Canadian Salt Herring Exporters, Limited, were elected by that organization on August 30th and confirmed at a meeting of the Board held on September 4th. The members of the Local Board are appointed annually and this must be done prior to August 31st of each year. The eligibility of present members for re-election rests entirely with the two above-mentioned organizations. The head office of the Local Branch is located at Room 706, B.C. Mining Building, 402 Pender Street West, Vancouver, B.C.

The products regulated under the Local Board are dry-salt herring and dry-salt salmon and the area covered by the scheme embraces the Province of British Columbia, although the regulated products are only produced on the Coast.

Dealing with the method of regulation, it must be pointed out that the Local Board regulates two quite distinct classes of salt fish; i.e., salmon and herring. First, in the case of dry-salt salmon, this product is shipped entirely to Japan, where it is consumed in large quantities during the Christmas and New Year holiday season. The Provincial Department of Fisheries licenses plants to operate as dry-salteries and in 1935 served notice on the industry that a time-limit was set after which no licences would be issued. In due course the Local Board was advised by the Provincial authorities that a total of thirty-one licences had been issued for the 1935–36 season covering dry-salt salmon operations. This was an increase of seventeen licences over the previous season.

It is thought well at this point to explain in some detail the workings of the Local Board since the last annual report. After the experience of the 1934–35 season the Local Board considered it highly desirable and necessary to send a representative to the Orient in advance of the 1935–36 season to make a survey of the markets both for dry-salt salmon and dry-salt herring. The Local Board outlined its proposal to the two producers' organizations and submitted it to them for approval. The producers approved of the Board's action, and on August 10th, 1935, Mr. A. J. Blackwell sailed from Vancouver for the Orient to make a survey of the markets on behalf of the Board. It so happened that Mr. K. Kimura, one of the members of the Board, was in Japan at the time, and the Board accordingly cabled him, asking if he would ascertain the condition of the Japanese market for salt salmon and to make a survey in conjunction with Mr. Blackwell. In due course the Board received word from Messrs. Blackwell and Kimura recommending a total maximum marketable quantity of dry-salt salmon for Japan of 30,000 boxes.

In view of the recommendation of the Board's representatives, who had made an extensive survey of market conditions in Japan for salt salmon, the Board was faced with a difficult situation in attempting to allocate 30,000 boxes of salmon among thirty-one licence-holders, and it was therefore decided to call the producers together and explain the position to them.

This meeting was held on September 21st, at which time no headway whatsoever was made in arriving at an equitable distribution of the recommended total marketable quantity. The producers' meeting was reported to the Board, and after the most careful consideration it was decided, in order to ensure an equitable distribution among the producers of a quantity which would show an economic operation, to take the responsibility of increasing the recommended quantity to a total of 35,000 boxes of salt-chum salmon. In arriving at the quantity to be marketed by individual producers, the Board based their decisions on past performances; i.e., the record of production of each licensed producer was obtained for a period of years and the average taken to ascertain if a given operator was a continuous producer or an intermittent one.

This procedure was followed and individual producer advised of the quantity which would be permitted to be marketed by him. With the exception of two producers, no dissatisfaction was expressed at the manner in which the Local Board had distributed the total marketable quantity. In the case of the two producers who complained at not having received a sufficient quantity, the Board pointed out that all producers had been dealt with on the same basis—namely, on past performance.

It is a requirement of the Local Board that all producers shall be registered, and to correspond with the number of plant licences issued by the Provincial Department of Fisheries, the Local Board issued thirty-one certificates of registration covering the marketing of dry-salt salmon.

On September 24th last the Local Board designated Messrs. Producers' Salt Fish Sales, Limited, and Messrs. Canadian Salt Herring Exporters, Limited, as the marketing agencies through which the regulated products shall be shipped. It is pointed out that the two marketing agencies are strictly producers' organizations, Messrs. Producers' Salt Fish Sales, Limited, being composed of all but one of the Canadian companies engaged in producing dry-salt fish, while Messrs. Canadian Salt Herring Exporters, Limited, embraces all of the Japanese dry-salt salmon and herring producers. The function of the two marketing agencies is that of exporter; that is, making of contracts with buyers, arranging steamship space, and attending to the actual physical export of the products.

The address of Messrs. Producers' Salt Fish Sales, Limited, is 402 Pender Street West, Vancouver, B.C., and that of Messrs. Canadian Salt Herring Exporters, Limited, is 217 Dunlevy Avenue, Vancouver, B.C.

On September 30th the Local Board met a delegation of fishermen from the Fraser River area who were desirous of ascertaining the functions of the Board, particularly in respect to the matter of prices paid to the fishermen for raw chum salmon. The Chairman informed the delegation that the Board was willing at any time to meet the fishermen and explained fully the operation of the Board. On the matter of raw-fish prices the Chairman stated that the Board had no power to set prices and were concerned only with the marketing of the regulated product, and that no attempt had been made by the Local Board to set prices to the fishermen, this being purely a matter for agreement between the fishermen and the producers.

AMENDMENT TO SCHEME.

Under subsection (1) of section 6 of the original Salt-fish Scheme the Local Board was authorized not to discriminate against any established marketing agency which complied fully with the orders or determinations of the Local Board. The difficult experience of the Local Board during the 1934–35 season in maintaining the orderly marketing of the products covered by the scheme was due in very large measure to the compulsion resting on the Local Board to authorize multiple agencies, the activities of such agencies tending to create confusion in the minds of Oriental buyers to the point of establishing doubt as to the strength of the Board in regulating the product.

In view, therefore, of the difficulties encountered by the Local Board due to the wording of the above-mentioned subsection, on May 27th, 1935, the Local Board unanimously adopted a resolution to request the Dominion Board to amend the said subsection to read as follows:—

" To regulate the time and place at which, and to designate the agencies through which, the regulated product shall be marketed; to determine the manner of distribution, the quantity and quality, grade or class of the regulated product that shall be marketed by any person at any time, and to prohibit the marketing of any of the regulated product of any grade, quality, or class."

The Local Board's request for the above amendment to the scheme was agreed to by the Dominion Board and was accordingly approved by Order in Council No. P.C. 2476, dated August 15th, 1935.

MOVEMENT AND PRICE OF REGULATED PRODUCT—DRY-SALT SALMON.

As stated earlier in this report, the Local Board finally decided on a total marketable quantity of 35,000 boxes of dry-salt chum salmon for the 1935–36 season. The Local Board also determined that the weight of each box of dry-salt salmon should be not less than 440 lb. net shipping weight of fish and salt, and that payment for the fish should be on consignment with a minimum guaranteed advance by the buyer covered by an irrevocable letter of credit.

Dry-salt chum salmon are divided into three grades or qualities as follows:—

(1.) Fraser River.
(2.) Island.
(3.) Queen Charlotte Island.

Fraser River quality dry-salt chum salmon commands a higher price in Japan than do the other two qualities, and the buyers in that market are always anxious to secure as large a quantity of Fraser River chums as possible. The minimum guaranteed advance received by the producer for Fraser River quality was $15 per box c.i.f. Yokohama. The minimum guaranteed advance for Island quality chums was $13 per box c.i.f. and for Queen Charlotte Island quality $12.50 per box c.i.f. The prices obtained in each case were in United States funds. Being on consignment, in the majority of cases the producer received a final return of slightly better than the guaranteed advance, although if the quality of a given shipment was not up to standard the producer received at least the minimum advance.

It is not possible to give a comparison with prices received in the previous year, for the reason that the Local Board did not come into operation until well into the shipping season for dry-salt salmon, and no attempt was made in 1934 to control marketing other than have the marketed quantities reported. There can be no doubt, however, but that the past season was a reasonably profitable one for the packers. The action of the Board in adopting the minimum guaranteed advance system protected the packer to the extent that he was in receipt of sufficient funds to carry on his operations, and in the case of a pack of good quality, as stated, the packer has since received additional returns on the final sale of his product in Japan.

In addition to chum salmon, a small amount of other species of salmon was salted for the Japanese market. The following table shows the total quantities of each species actually marketed and shipped in 1935:—

	Boxes.
Chums	35,206
Pinks	1,752
White springs	305
Cohoes	293
Sockeye	6

Due to the small quantity of other species salted and shipped, the Local Board did not attempt to regulate their marketing, although determining that all salt salmon must be reported.

Taken as a whole, the past season was a satisfactory one from the standpoint of operation and marketing in so far as dry-salt salmon is concerned. While the quantity of Fraser River salt chums packed was rather disappointing, due to the late arrival of the run, nevertheless there was an increase of 37.72 per cent. in the total production of dry-salt chum salmon over the previous year.

DRY-SALT HERRING.

The British Columbia production of dry-salt herring is consumed entirely in the Orient, over a period of years three main distributing ports or territories having been established. These centres are Kobe, Japan, which territory includes Kobe, Formosa, Korea, and Manchukuo; Shanghai, China, which takes in Shanghai, the Yangtze River area, and Foochow; Hong Kong, whose territory embraces Hong Kong, Amoy, Swatow, and Canton. The ports of Tsingtau, Takubar, and Tientsin were left open to be supplied either from Shanghai and (or) Kobe.

As stated previously, the Local Board deemed it advisable to send a representative to the Orient in advance of the season to make a survey of the markets with a view to ascertaining the maximum quantity which the three distributing territories could absorb during the 1935–36 season. In due course the Board's representative cabled his recommendations, and the Local Board on September 30th last determined that the total marketable quantity of dry-salt herring for the 1935–36 season should be 23,000 tons. This quantity was divided, upon the recommendation of the Board's representative in the Orient, as follows:—

	Tons.
Kobe	10,000
Shanghai	7,500
Hong Kong	5,500

Herring dry-salteries in British Columbia are all located on Vancouver Island, and the Board being in receipt of advice from the Provincial Department of Fisheries to the effect that twenty-one herring dry-saltery licences had been issued for the 1935–36 season, nine plants being located on the west coast of Vancouver Island and twelve on the east coast, the Local Board determined that the total marketable quantity of 23,000 tons should be allocated as follows:—

	Tons.
West coast	7,200
East coast	15,800

As in the case of dry-salt salmon, all dry-salt herring producers are required to be registered with the Local Board and therefore twenty-one certificates of registration were issued.

The agencies designated by the Local Board handled the exports of dry-salt herring as well as those of dry-salt salmon.

MOVEMENT AND PRICE OF REGULATED PRODUCT, DRY-SALT HERRING.

Through the efforts of the agencies designated by the Local Board, early in the season a block sale of 10,000 tons of dry-salt herring was effected to a group of importers in Kobe. This quantity was for shipment during the months from October to March, inclusive, at an average price of $28.26 per ton c.i.f. Kobe. Similar block sales were attempted for the quantities allotted to the Shanghai and Hong Kong territories, but as matters developed this was found to be impossible, due entirely to the chaotic exchange conditions obtaining in China and Hong Kong.

The Board was kept fully posted on developments in China by its representative, and on being advised that it was doubtful if Shanghai or Hong Kong would purchase in any volume owing to the precarious condition of the currency market, the Local Board on November 8th issued an order stating that in view of financial condition in the Orient no additional quantities of herring would be permitted to be marketed other than the quantity which had been packed up to that date. As at that date this quantity amounted to approximately 12,000 tons.

The serious condition of the Chinese currency situation is graphically set forth in the attached extracts from local newspapers. It will be readily understood that not only was the marketing of dry-salt herring found to be extremely difficult, but the action of the Chinese Government in issuing paper currency in lieu of silver affected the sale of all other products in that country.

The action of the Board in taking advantage of the powers conferred on it under subsection (1) of section 6 of the scheme to prohibit the marketing of the regulated product was done only after very full and careful consideration had been given to the seriousness of the situation in the Orient. The step taken by the Local Board was for the protection of the producers, as if marketing had continued it would have meant the sale of the herring at distress prices, with consequent severe losses to the producers.

As the season progressed the situation strengthened slightly, and both Shanghai and Hong Kong purchased small quantities at prices which showed a reasonable return to the producer. Shanghai purchased a total quantity of 2,297 tons, the average price realized

being $27.57 per ton c.i.f. A total of 2,077 tons was shipped to Hong Kong at an average price of $30.29 per ton c.i.f.

The total quantity of dry-salt herring, therefore, actually marketed and shipped fell short of the tonnage originally decided upon by the Board—14,333⅔ tons being the final figure. Of the 10,000 tons committed to Kobe, this amount was short-shipped by 41⅓ tons.

During the 1934–35 season the quantities and average prices were as follows:—

Kobe	7,250⅓	tons at	$27.19 c.i.f.
Shanghai	7,257	tons at	25.20 c.i.f.
Hong Kong	4,394⅓	tons at	28.90 c.i.f.
Keelung	1,523⅔	tons at	50.39 c.i.f.
Foochow	100	tons at	27.38 c.i.f.
Takubar	100	tons at	28.00 c.i.f.

When it was found necessary to curtail the marketing of our dry-salt herring the plants located on the west coast of Vancouver Island bore the brunt of the Board's order. However, on representations being made to the Provincial Government and the impossible marketing conditions obtaining in the Orient being fully explained, the Provincial Department of Fisheries granted their authority for plants on the west coast to take herring for reduction purposes. Thus, out of the nine plants situated on the west coast of Vancouver Island, three were able to operate on the reduction of herring for meal and oil, three plants transferred their operations to the east coast, while two plants, who are strictly salteries, subsequently were able to pack a certain quantity of salt herring which was shipped to Shanghai and Hong Kong. The ninth plant is a small one which is controlled by one of the companies who did salt a quantity of herring, but due to conditions did not operate.

It will be seen, therefore, that although the west-coast plants appeared to have been penalized, had it not been for the fact that the salt-herring markets in the Orient had become demoralized, the Provincial Department of Fisheries would not have agreed to allow the reduction operations. So that while certain plants did not pack dry-salt herring, they did not lose out entirely as they were permitted to operate in another branch of the fishing industry. In the case of the plants not being equipped to operate as fish-reduction units they were permitted to market a quantity which at least used up their supplies of salt and boxes.

It might be well at this point to outline actual fishing conditions of the British Columbia coast. Herring-fishing commences on the east and west coast of Vancouver Island on October 1st, but it is not until about the second or third week in November that the fish appear on the west coast. In other words, the east-coast operators are in a position to pack their herring almost a month and a half before the west-coast plants get into operation. It follows, therefore, that the east-coast producers receive the benefit of early shipments, for which, it being one of the peculiarities of the salt-herring business, fairly high prices are obtained. Had not the chaotic exchange condition developed this past season, the Local Board fully intended to equalize the returns received by east- and west-coast plants, the plan being to market the pack on a pro rata basis.

SUMMARY.

The action of the Local Board in sending a representative to the Orient prior to the season has been fully justified. Having a representative on the ground eliminated the experience of the previous year, when the Board found themselves at the mercy of the Oriental importers, who were inclined to play one group off against the other in an attempt to force down the price. The Board's representative was in daily touch with the importers, and consequently was in a position to fully inform the Board the true condition of the market. In addition to keeping the Local Board fully posted, the Board's representative created a spirit of confidence among the Oriental importers toward the Board to the point where the importers now admit that the Local Board assures them as well as the producers of orderly marketing. A copy of the report furnished the Local Board by its representative upon his return to Vancouver is attached, from which it will be seen that the groundwork for the future has been well laid.

During the period under review the Local Board had no cause to deal with violations of the orders or determinations issued by it, the producers and the Board working harmoniously together in an effort to stabilize the salt-fish industry.

We desire to express our sincere appreciation for the co-operation shown and work done by the Canadian Government Trade Commissioners in the Orient, without whose assistance and knowledge of conditions we would have found our efforts much more difficult.

NEW MARKETS.

As previously pointed out, the entire pack of salt fish produced in British Columbia has hitherto been marketed exclusively in Japan and China. In view of the experience of the 1935–36 season, when through no fault of the producers, but due entirely to exchange conditions, the market particularly for salt herring was severely curtailed, the Board took under consideration in December last the desirability, if possible, of developing other markets for both salt herring and salt salmon, even though possibly entailing a change in methods of packing from those acceptable in the Orient. After investigation of various consuming markets for salt fish, it appeared that the most promising market might be in the Caribbean area and in Central and South America, the countries in those areas, according to figures supplied us by the Department of Trade and Commerce, being large importers of salt fish of various types. After extended consideration the Board decided, as a preliminary step in developing new markets, to send Mr. A. J. Blackwell to make a survey of potential markets in Cuba and in the West Indies for dry-salt herring and dry-salt salmon. At the time of writing, Mr. Blackwell has just concluded his survey in Cuba, the results having been most encouraging for the marketing of British Columbia salt fish in Cuba next season. Mr. Blackwell has proceeded to the West Indies, and if the samples of the British Columbia product are equally as well received there as in Cuba, a substantial and entirely new outlet for our product should be available next season.

Depending on the results of Mr. Blackwell's investigations and his report to the Board, decision will be made later as to whether Mr. Blackwell should proceed at this time with a survey of the South and Central American markets. This likewise constitutes entirely new territory as far as British Columbia salt fish is concerned, but it is possible that a survey of this market will be deferred until another season.

FINANCIAL.

The Board for the 1935–36 season reduced its tolls from 15 cents per box on both salt salmon and salt herring to 10 cents and 8 cents per box respectively. The attached consolidated statement of income and expenditure is, we believe, self-explanatory.

Respectfully submitted.

BRITISH COLUMBIA SALT-FISH BOARD.

HUGH DALTON, *Chairman.*
T. MATSUYAMA, *Member.*
R. R. PAYNE, *Member.*
R. NELSON, *Member.*
K. KIMURA, *Member.*

G. R. CLARK,
Secretary.

(Extract from the Vancouver News-Herald, December 28th, 1935.)

CHINA HAS SERIOUS CURRENCY PROBLEM. PROSPECTS OF CONVERTING SILVER-USERS TO PAPER MONEY.

Interest in China's prospects of success in reorganizing and stabilizing its currency system is naturally very great among all those doing business in that country. It is clear that the Chinese Government is taking a momentous step in attempting to convert 400,000,000 people, long accustomed to the use of silver, to the use of paper money, and it is certain that the Government would never have attempted to do so had not the situation become desperate as result of the continued drain of specie to America, and contraction of credit and loss of confidence resulting therefrom. It is evident that the path is beset with many difficulties and uncertainties, says the December monthly bank letter of the National City Bank of New York.

In the first place, there is doubt as to how much silver the Chinese Government will be able to get out of the people in exchange for paper. The authorities, of course, can take

over the silver held by the banks in Shanghai and a few other large cities, but the attitude of the public with respect to the surrender of silver is highly problematical, to say the least, particularly in the areas outside of Nanking's immediate sphere of influence. In view of recent political developments in North China, it is questionable whether much silver from that area can be counted on to flow into Nanking coffers. Moreover, it must be borne in mind that the further fall of the Chinese dollar has increased the incentive to smuggling.

Exchange Case.—In the second place, there is uncertainty regarding the future of exchange. Undoubtedly, the success of the stabilization plan will be conditioned very largely by the exent to which the Government is able to establish confidence in its ability to manage a paper currency without the safeguard imposed by the requirement to maintain certain specified reserves of metal.

It is always a question as to how far a Government attempting a managed currency can be trusted to impose voluntary restraints upon itself, and the question becomes still more important when, as is the case with China, the Government attempting management lacks a strong, highly centralized authority. It can be said on behalf of the new currency plan that the low level of stabilization enhances its chances of success. Internally, the country is experiencing a release from deflationary influences. Security values have shown a tendency to recover, and, what is more important, there may be and should be an unblocking of the stream of credit in the real property market. Externally, the low rate of exchange should tend to improve the balance of payments, which was already showing a tendency to become less adverse.

At the same time, the nationalization of silver, even though not broadly successful, will provide the Government with a large fund of silver which it can sell abroad, if need be, in support of exchange. In Shanghai the Chinese banks alone hold $295,000,000 (Chinese dollars) of silver which will be available immediately to the control board, and of course a great deal more silver will be got in than this. When all has been said, however, it must be repeated that everything depends upon the degree to which the Government is able to inspire respect for and confidence in its policies.

Situation as affecting Silver.—The outstanding feature of the situation from the standpoint of silver is that China now has a huge quantity of the metal which she can sell as freely as she wants to in world markets without injury to her internal credits structure. How much she will sell will depend upon: (1) The extent to which the drop in the exchange rate, and consequent increase in the premium of silver, encourages smuggling rather than compliance with the nationalization order; (2) whether the Government follows a policy of selling only so much as needed in order to maintain the stability of the currency, in which case the determining factor will be the degree of confidence with which the Government is able to engender in its currency control; and (3) whether the Government hopes eventually to return to the silver standard on some devalued basis, in which case it will sell no more silver than it has to; or whether it intends to permanently demonetize silver in favour of some form of managed paper currency, in which case the quantity of silver in China available for sale would be enormous.

Should China elect to dispose of her vast silver hoards, the effect upon silver would be catastrophic. Either the United States Treasury would be forced to hold the bag, enabling China to unload at high prices, or see the whole scheme for raising silver prices go into collapse. When consideration is given to the depressing influence exerted upon silver prices from 1926 on by the stocks in the Indian Treasury which never amounted to more than 470,000,000 ounces, it is possible to visualize what it would mean to have China's 2,000,000,000 or so ounces overhanging the market.

Enforced Education.—No doubt it would be an exaggeration to assume that any such quantity of silver could or would be disposed of, at least not for a considerable period. However, the fact is that a policy supposedly friendly to silver is having the effect of giving the Chinese people an enforced education in the use of another form of currency—paper. To the extent that the Chinese prove to be apt pupils in this schooling, by just so much will silver have one of its most important uses permanently curtailed.

It has been claimed by friends of the American silver policy that by raising and holding up the price of silver it would encourage a wider use of the metal among the nations. As a matter of fact, the reverse appears to be happening. As silver has been made more costly,

country after country, including at last China, has found it advantageous to discontinue its use as money.

Unless the United States can persuade the other nations to use more silver money (something which thus far they have shown very little disposition to do) before its buying-power as defined in the "Silver Purchase Act" is exhausted, it looks as though silver were headed eventually for another slump, possibly to levels lower even than before. In that event, not only will the silver-producers pay dearly for this experiment, but the United States Treasury will be left carrying an asset against the currency that could not be liquidated save at tremendous sacrifice.

(Extract from the Vancouver News-Herald, February 29th, 1935.)

CHINA'S SILVER DEBACLE SLOWS SALE OF FLOUR.

One of the principal features of Western Canada export flour business during the past year was the sale of established brands to countries across the Pacific at unsatisfactory prices, mills selling mainly to keep established brands alive.

The operation of managed currency in Hong Kong has not been in use long enough for merchants and importers to know whether it will be feasible, the experiment being made following the sharp break in silver exchange, and which has had the effect of practically paralysing markets in China.

There have been quite a number of bakery failures of late in some of the larger Chinese cities, no doubt the result of the silver debacle, and this has brought about a considerable loss of importers, creating a feeling of timidity on the part of merchants in regard to future business.

North China is getting most of her supplies from Shanghai and Japanese mills, while in markets like Manila and New Zealand, where the volume has held up fairly well, it has only been maintained at the expense of very unsatisfactory prices to the Canadian flour exporter.

The outlook for this season in the China market would perhaps be highly favourable were it not for the financial situation, but until it has been demonstrated that the new Chinese Government has created sufficient public confidence in its ability to manage their currency, it is doubtful whether any important volume of business can be done.

In any case, Australia continues to quote flour at lower prices than can be offered by Canadian mills for low-grade straights, but it is felt in some quarters that in due course Australian quotations may advance to a point where Canadian mills can do some business, but this hope is hardly likely to be realized for some months at least.

SOME FRESH-WATER FISHES OF BRITISH COLUMBIA.

By J. R. Dymond, Director, Royal Museum of Zoology, Toronto, Ont.

The following notes are based largely on specimens and information obtained in British Columbia during the summers of 1926 and 1928, when the writer was engaged in a study of the trout and other game fishes of the Province. The results of those studies so far as they concern the trout have been reported elsewhere (Dymond, 1927, 1931, and 1932). The specimens and information on which these notes are based were secured more or less incidentally, which will explain the nature of the present contribution.

During the summer of 1926 no field-work was undertaken. Specimens of trout and occasionally of other fresh-water species were sent for study by officers of the Federal and Provincial Departments of Fisheries to the Pacific Biological Station at Nanaimo. In 1928 the months of June and July were spent in Southern British Columbia in visiting a number of lakes and streams in connection with the trout studies. At that time I was accompanied by C. McC. Mottley, of the Biological Board of Canada, and Messrs. T. B. Kurata and E. B. S. Logier, of the Royal Ontario Museum of Zoology, to whom I wish to express my thanks for assistance in connection with the field-work.

I am also indebted to Dr. W. A. Clemens, Director of the Pacific Biological Station, for the opportunity of becoming acquainted at first hand with the fresh-water fish fauna of British Columbia.

The waters visited during 1928 included Monroe Lake and other waters in the vicinity of Cranbrook, Kootenay Lake, and Kootenay River below Nelson as far as Bonnington Falls, Christina Lake, Okanagan Lake, Vaseaux Lake, Kalamalka Lake, Paul Lake, and Fish Lake near Kamloops, Cultus Lake, Chilliwack River above Sweltzer Creek, Stamp River, Diver Lake near Wellington, Cowichan Lake, Nanaimo River, and Horne Lake.

The most significant feature of the distribution of fresh-water fishes in British Columbia is the striking contrast between the fauna of the north and that of the south. The fish fauna of the northern part of the Province has many features in common with that of the Great Lakes, as the following list of genera and species common to these two areas will indicate: *Cristivomer namaycush, Leucichthys, Corgeonus clupeaformis, Prosopium quadrilaterale, Chrosomus erythrogaster, Couesius, Esox lucius, Lota maculosa,* and *Eucalia inconstans.* Of these, only two, *Couesius* and *Lota maculosa,* are known to occur in the southern part of the Province, while there are found in the waters of that area many species quite distinct from any elements of the Great Lakes fauna. Included among these are *Prosopium williamsoni, Mylocheilus caurinus, Ptychocheilus oregonensis, Richardsonius balteatus,* and *Apocope falcata.* These are part of a fauna which extends southward. The explanation of this difference between the faunas of Southern and of Northern British Columbia may be partly ecological, but it is probably due more to the geological history of the areas.

ANNOTATED LIST.

Entosphenus tridentatus (Gairdner). (Sea lamprey.)

Specimens of this lamprey were taken from the Millstream at Nanaimo, V.I., from the Chilliwack River, and from the Slocan River at West Kootenay. C. Carl reports its occurrence in Beaver Lake, Stanley Park.

Lampetra ayresii (Günther).

Several specimens from Cultus Lake are in the collections of the Royal Ontario Museum of Zoology.

Acipenser sp. (Sturgeon.)

Sturgeon are taken in the Kootenay River in the Creston District and southward in the United States in the vicinity of Bonners Ferry, Idaho. Locally they are called rock-sturgeon and are said to average 100 to 150 lb. in weight, but a 375-lb. specimen has been reported. They are taken most commonly during high water in May and June.

These sturgeon must be permanent fresh-water residents, as it is impossible for them to ascend from the sea. As no specimens were seen, I am unable to offer an opinion as to the species.

A sturgeon weighing 171 lb., possibly of marine origin, was killed below Bonnington Falls by a blast of dynamite in April, 1925.

Oncorhynchus nerka kennerlyi (Suckley). (Kokanee.)

This landlocked sockeye occurs in many lakes in the Province. We have specimens from Kootenay, Okanagan, Christina, and Woods Lakes, and it has been reported by reliable observers as occurring in Shuswap, Adams, Niskonlith, Arrow, Slocan, Kalamalka, Skaha, Osoyoos, Mizzezzula, Blue, Round, and Burns Lakes and from Sooke, Cowichan, Shawnigan, Nanaimo, Horne, and Cameron Lakes on Vancouver Island. Babcock (1902) records it from Seton and Anderson Lakes, and Jordan (1894) and Green (1893) from Shawnigan Lake, Vancouver Island. Dawson (1879) refers to the occurrence of "landlocked salmon" in Okanagan, Shuswap, and other large lakes, also in Canim Lake, 70 miles east of the 100-Mile post on the Cariboo Wagon-road. The same fish, he said, was to be found in Lac la Hache. Evermann (1897), on the authority of Dr. Dawson, records it from "Chiloweyuck Lake (north latitude 49°) near Fraser River; Nicola, Francois, Fraser, Okanagan, Stuart, and Shuswap Lakes," and Evermann and Meek (1898) from Stuart and Nicola Lakes.

Kokanees vary in size from lake to lake, and in the same lake from year to year. In Christina Lake, we were informed, the greatest weight to which kokanees grow is 1 lb., and the smallest weight of adults about ⅕ lb. It is said that in any one year the mature fish are all of the same size. A few kokanees of a greater weight than 1 lb. have been reported, but in general 1 lb. appears to be the maximum weight, while the average is considerably less.

The kokanee is important as a food for Kamloops trout. Although our information on the food of the latter is rather meagre, what is available suggests that kokanees are a staple food of trout over 16 inches in length, and trout seldom grow larger than this in lakes from which kokanees are absent, unless other species of fish are present to take their place. The Kokanee fills an important niche in the economy of lakes. It is a plankton feeder, and is thus a link between the smaller organisms and the large trout. In the absence of such a species it is doubted, as suggested above, whether trout usually grow much larger than 16 inches in length, the length at which trout turn from a diet of insects and other small organisms to fish. The conservation of the kokanee is therefore important from the standpoint of trout propagation. In British Columbia lakes lacking an adequate supply of trout food, this native plankton feeder should be preferred for introduction to non-native species of the same habit.

The abundance attained by kokanees in some waters is indicated by the fact that 14 tons of them have been seined in a single night in Christina Lake, about 1898 or 1899.

Two specimens 25.6 and 31.6 cm. long to end of vertebral column (11½ and 13¾ inches to fork of tail) taken in Christina Lake June 27th, 1928, gave the following measurements in per cent. of the body-length to end of vertebral column: Head-length, 22; head-depth, 15; eye, 4.8; snout, 4.9; maxillary, 10.4; body-depth, 23.6; body-width, 11 in case of female, 12.4 in case of male; caudal-peduncle length 16, and depth 8.2; dorsal fin with 10 or 11 fully developed rays preceded by 2 or 3 shorter ones, its height 13 and base 11; anal with 14 fully developed rays preceded by 2 shorter ones, its height 10 and base 13; pectoral, 17; ventral, 13; caudal, 22; scales, 131–132; gill-rakers, 14+20; branchiostegals, 13–14.

Salmo gairdnerii Richardson. (Steelhead.)

In previous account of this species (Dymond, 1932) it is stated that "it is not known how far steelheads ascend from the sea in the Fraser River, but it is probable that few, if any, penetrate beyond Hell's Gate." I have been informed, however, by Mr. W. A. Newcombe, who was stationed at the Gate for the Provincial Government, during several seasons when the salmon were running, that "it was well known by us working at the Gate that the steelhead could force his way through when the various species of *Oncorhynchus* would have to give up." He further states that "during the hold-up at the Gate in the earlier years, 1913–16, the fish were detained for much longer periods below and the Indians were still permitted to fish with nets and gaff. Steelhead were taken by them quite often, especially in October, and other runs were reported to be at the Gate early in the year (January and February), but I have never had the opportunity of personally checking these statements."

Mr. Newcombe's statements are corroborated by Mr. C. P. Hickman, assistant to the Commissioner of Fisheries, who says that "at the time of the first discovery of the obstruction

to salmon at the Fraser Canyon I was between Camp 16 and North Bend from early in October until December 15th in 1913. It was a common occurrence to see steelhead plough right through the swift water, where a sockeye could not begin to negotiate it."

The localities represented by specimens in the collections of the Royal Ontario Museum of Zoology are: In the Skeena drainage—Skeena River at Prince Rupert, Babine River and Lake, Meziadin River, Lakelse River, and Cluculz Lake; on Rivers Inlet—Hatchery Creek; on Howe Sound—Cheakamus River, Daisy Lake, Lake Marie, and Deadman's Lake; in the Fraser drainage—Upper Pitt River, Fraser River below Mission Bridge, Birkenhead Creek at Pemberton Hatchery, Chilliwack River, Cultus Lake, and Harrison River; on Vancouver Island—Cameron Lake, Lower Campbell Lake, Campbell River, Great Central Lake, Oliver Creek (Cowichan), Cowichan River, Stamp Falls, Comox Lake, Brown's River tributary to Puntledge River, Bevon, Millstream at Nanaimo.

Lord (1866) reported this species as "common in the Fraser, Chilukweyuk, and Sumas Rivers and in every stream along the mainland and island coasts up which salmon ascend." He gave the average weight as 8 to 11 lb.

Salmo kamloops Jordan. (Kamloops trout.)

The collections of the Royal Ontario Museum of Zoology contain specimens of the Kamloops trout from the following waters: Kootenay Lake and River and Lardeau River; Okanagan Lake; Farley, Fish, and McCullough Lakes, tributary to Okanagan Lake; Christina Lake, Kamloops Lake; Paul, Pinantan, Knouff, and Fish or Trout Lakes, and Tranquille Creek near Kamloops; Quilchena Creek; Kalamalka, Sugar, and Haddow Lakes, Squaw Valley Creek near Vernon; Mara Lake, Adams and Eagle Rivers and Manson Creek, tributaries of Shuswap Lake; Frog Lake and Creek, Tumtum Creek, Illecillewaet River, and Columbia River near Revelstoke; Louis Creek, tributary of the North Thompson; Coquihalla River and its tributary, the Nicolum; Thompson River 2 miles east of Lytton; Similkameen River and Bear Lake, near Tulameen; Clearwater Lake near Hedley; 1-Mile and 5-Mile Creeks near Princeton; Fraser and Burns Lakes near Prince George; Cunningham Lake, tributary to Stuart Lake.

Through fish-cultural operations the Kamloops trout has been distributed to many waters in British Columbia from which it was formerly absent.

Salmo kamloops whitehousei Dymond. (Mountain Kamloops trout.)

This dwarf form of Kamloops trout which is found in small lakes at high altitudes was described (1931) from specimens taken in 6-Mile Lake near Nelson. Besides the type locality we have specimens from Bear and Fish Lakes near Kaslo.

Salmo clarkii clarkii Richardson. (Coast cut-throat trout.)

The localities represented by specimens of this form in the collections of the Royal Ontario Museum of Zoology are as follows: Skeena drainage—Lakelse Lake and River; Rivers Inlet drainage—Owikeno Lake; Fraser drainage—Harrison River, Thompson River, Upper Pitt River, Chilliwack River and Lake, Sweltzer Creek, Cultus Lake, Anderson Lake, Stave Lake, 3 miles east of Ashcroft in the Thompson River; Vancouver Island—Nimpkish River, Lower Campbell Lake, Campbell River, Great Central Lake, Comox Lake, Bevon, Alberni, Diver Lake, Wellington Lake, stream at Departure Bay, Cowichan Lake, Shaw, Mead, and Nixon Creeks (Cowichan Lake), Tranquille Creek and Lake, Glendale River, Kennedy Lake and River, Salmon River, Oyster River, Clayoquot River.

Salmo clarkii lewisi (Girard). (Yellowstone cut-throat trout.)

This form is represented by specimens from Monroe Lake near Cranbrook and White River, a tributary of Upper Kootenay. A few cut-throats are reported as occurring in the upper reaches of the Columbia from Athalmer to Arrowhead, but I have seen no specimens and so cannot say whether they are of the *lewisi* or *alpestris* variety. The trout of this section of the Province deserve careful study.

Salmo clarkii alpestris Dymond. (Mountain cut-throat trout.)

The waters represented by specimens of this form are: The upper reaches of Isaac, Frog, and Canyon Creeks flowing into the Columbia River near Revelstoke; Crazy, Yard, and Frog Creeks, tributary to Eagle River and Mabel Lake in the Shuswap area; in some

small lakes on Griffin Mountain and in 6-Mile and 9-Mile Creeks flowing into the West Arm of Kootenay Lake.

Salmo trutta Linnæus. (Brown trout.)

The brown trout has been introduced into the Cowichan Lake and River and into the Little Qualicum River. The Annual Reports of the Biological Board of Canada for 1932 and subsequent years refer to these introductions. According to information supplied by Dr. Clemens, specimens have been taken in both the Cowichan and Qualicum Rivers; one taken during the early summer of 1936 was 15 inches in length and 1 lb. 7½ oz. in weight.

Salvelinus fontinalis (Mitchill). (Eastern speckled trout.)

The eastern speckled trout has been introduced into a number of waters of British Columbia. We have specimens from Tumtum Creek, near Revelstoke and Boundary Lake, and it has been reported to us as occurring in Leviathan Lake near Kaslo and Big Sheep Creek near Grand Forks, and a small stream tributary to Okanagan Lake. On Vancouver Island it has been placed in Cowichan Lake and River, Spectacle Lake, and Somenos Lake.

Cristivomer namaycush (Walbaum). (Great Lake trout.)

This char, which appears to be common in the lakes of the northern part of the Province, is not found south of the Shuswap, in British Columbia. There are specimens in the Royal Ontario Museum of Zoology from Lake Atlin and from Cunningham Lake, tributary to Stuart Lake.

Eigenmann (1895A) records the species from "Golden and Revelstoke . . . a large head in the University's collection from 20 miles east of New Westminster, B.C. . . ." Jordan (1889) had it from Canim Lake and Evermann and Goldsborough (1907) from Lake Atlin, Tagish Arm, Lake Bennett, and Summit Lake (at White Pass). We have reports from reliable observers of the occurrence of the species in Victor and Three Valley Lakes near Griffin Lake, also in Stuart, Fraser, and Francois Lakes in the north. In the latter lake it is said to reach a weight of 60 lb.

Salvelinus malma (Walbaum). (Dolly Varden.)

The Dolly Varden char seems to be generally distributed throughout the Columbia, Fraser, and Skeena River basins and on Vancouver Island. There are specimens in the collection of the Royal Ontario Museum of Zoology from Kootenay Lake, Shuswap Lake, and Scotch and Ross Creeks entering Shuswap Lake, Eagle River, Kamloops Lake, Cultus Lake, 11-Mile Creek near Revelstoke, stream entering Sugar Lake, Upper Pitt River, Owikeno Lake, Glendale River (Knight Inlet), Livingstone River (Crow's Nest Forest Reserve), Seeley Lake near Hazelton, stream on Kaien Island near Prince Rupert, and mouth of Salmon River (Vancouver Island).

The species has also been reported by reliable observers as occurring in Harrison Lake, Columbia River from Waneta and Arrow Lakes to Arrowhead, Whatshan Lake, Arrow Park Lake, Slocan Lake, Goat River, Moyie Lake, St. Mary Lake, Elk River, White River (a tributary of the Kootenay), Columbia Lake, Sugar and Mabel Lakes. Babcock, in Report of the Commissioner of Fisheries for 1902, reports it as occurring in Seton and Anderson Lakes. H. H. Beadnell, of Comox, reported on October 28th, 1927, that many Dolly Vardens were coming up from the sea with the cohoes, which he said was unusual; some of them weighed a pound. C. Hearn, of Skeena, reports the species as "found in nearly all waters along the lower reaches of the Skeena River watershed, ascending some of the larger tributaries such as the Copper River in large numbers during early spring."

Proportionate measurements of specimens 20–30 cm. to end of vertebral column (10–14 inches to fork of tail) are as follows, in per cent. of body-length to end of vertebral column: Head-length, 24 (21–27.5); head-depth, 14.5 (14–16); eye, 4.5 (4.0–5.0); snout, 7.3 (6.5–9.5); interorbital, 8 (6.7–9.5); maxillary, 13 (11–17); body-depth, 21 (17–25); body-width, 13 (11–15); caudal-peduncle length, 16.5 (15–18.5); caudal-peduncle depth, 9 (8–10); dorsal fin with 8 to 10 fully developed rays preceded by 1 or 2 shorter ones, its height 14 (12.5–16) and base 12 (11–13.5); anal fin with 7 or 8 fully developed rays preceded by 1 or 2 shorter ones, its height 13.5 (12–14.5) and base 9.7 (8.2–10.7); pectoral, 16 (15–17); ventral, 13 (12.5–15); caudal, 18 (16.5–20.8); snout to occiput, 17.5 (14.5–19.5); snout to dorsal insertion, 46.5 (43.5–48.8); snout to ventral insertion, 53.8 (52–55.4); diagonal rows of scales,

222 (197-244); gill-rakers, 6+10 (5+10 to 8+10), about 5 mm. long in specimens 30 cm. to end of vertebral column; branchiostegals, 10 to 12 (13 in one specimen).

Leucichthys pusillus (Bean). (Cisco.)

There is a specimen of cisco from Lake Atlin in the Provincial Museum, which has been provisionally identified as being of this species. Bean (1889) in his original description regards this form as very close if not identical with the Asiatic *merki (sardinella)*.

Coregonus clupeaformis (Mitchill). (Eastern whitefish.)

The eastern whitefish has been planted in the waters of British Columbia on a number of occasions, but in no instance has it fulfilled the expectations of those responsible for its introduction.

On July 11th, 1928, we took seventy-five specimens of this whitefish in Okanagan Lake opposite Kelowna. They ranged in length from 14 and 3/16 inches to fork of tail (1 lb. ½ oz.) to 7½ inches. These were all taken in 3-, 2-, 1½-, and 1¼-inch gill-nets, although a length of 4½ inches was included in the gang set. The nets were in the water about forty-three hours. The small size to which this species grows in Okanagan Lake, together with the comparative scarcity, is an indication that conditions here are far from ideal for it. Their scarcity is indicated by the failure of our nets to take them off Summerland, and by the fact that their presence in the lake was practically unknown.

The stomach of one of the specimens taken in our nets in Okanagan Lake contained a number of eggs, probably those of the Kamloops trout. It is not known whether the eggs were dead or not when eaten, and it is perhaps unfair to condemn a species on such evidence, but such an occurrence should serve as a reminder of the dangers attendant on indiscriminate introduction of species into waters to which they are not native.

The following statement with regard to the introduction of these whitefish was supplied me by Mr. Price Ellison, of Vernon:—

" I cannot remember the exact date that the above event took place, but it was somewhere between 1894 and 1898. I obtained the fry through our Dominion Government member at that time, Mr. J. Mara. The Fish Commissioner at New Westminster was named MacNabb, and he told me that the eggs came from Selkirk and were hatched at New Westminster. They were sent up here, under the care of a man named MacNeish, in galvanized containers holding about 10 or 12 gallons of water, having concave covers with a hole in the centre. MacNeish's orders were to put a piece of ice on each cover, and not to touch them again until they arrived at Vernon. They were put in the express baggage-car, and as it was early summer the ice had all melted by the time they reached North Bend, about 200 miles from New Westminster, but MacNeish's orders were not to touch them until he arrived at Vernon, and he carried them out by not placing more ice on the covers. By the time they reached here he was under the impression that they were all dead.

" However, I took them out to the lake, and, according to instructions, they were deposited in about 10 feet of water, and whatever they were they all sank, so I concluded that there must be some life in them, but when I put my hand in the container I could not feel anything but water. They certainly were not fry, though possibly eggs hatched to some extent. There were 3,000,000 deposited in Okanagan Lake and 2,000,000 in Long Lake, now known as Kalamalka Lake."

The records of the Vancouver office of the Fisheries Branch contain the following record of the distribution of whitefish in British Columbia in 1896:—

Waters stocked.	Number.
Coquitlam Lake	250,000
Deer Lake	125,000
Harrison Lake	2,225,000
Pitt Lake	250,000
Shawnigan Lake	1,125,000

The fry were all distributed by the Fraser River Hatchery and came originally from Selkirk.

Although there is no official record of the distribution of whitefish to Okanagan Lake in 1896, it is highly probable that such occurred in that year. It was Major Allan Brooks, of

Okanagan Landing, who first told me that it was Mr. Ellison who was instrumental in having whitefish planted in the lake, and the date given me by Major Brooks was 1896.

The annual reports of the Commissioner of Fisheries for British Columbia contain references to introductions of the eastern whitefish in 1911 and 1913. In the report for 1907 occurs the following:—

"I believe that great good would be accomplished by the introduction of the Lake Superior whitefish to Kootenay, Okanagan, Shuswap, and Harrison Lakes."

In the 1911 report it is recorded that "the long-continued efforts of the Provincial Department looking to the establishment of the whitefish of the Great Lakes (*Coregonus clupeaformis*) in the lake system tributary to the Fraser seem about to be crowned with success. A hatching-battery is being established in the Harrison Lake Hatchery and a shipment of eggs will be sent thither from the Dominion egg-taking stations during the next distribution."

And again in 1913 it is reported that "the 5,000,000 whitefish-eggs which through the courtesy of the United States Bureau of Fisheries were received from Put-in-Bay Station were successfully hatched at the Harrison Lake Hatchery of the Dominion Government and planted in Harrison Lake. A further shipment of 3,500,000 from the Dominion egg-taking stations in the East were also hatched and planted."

Introductions into Okanagan Lake were also made in the years 1928 and 1929. In each year approximately 5,000,000 eggs were brought from the Fort Qu'Appelle Hatchery to the Summerland Hatchery.

As previously indicated, *Coregonus clupeaformis* is indigenous in Northern British Columbia. Specimens have been examined by Dr. W. A. Clemens and Dr. J. L. Hart.

Prosopium quadrilaterale (Richardson). (Round whitefish.)

This species, which occurs from New England, through the Great Lakes region and north-westward, is confined, so far as present records for British Columbia are concerned, to the extreme northern part of the Province. It has been recorded from Lake Bennett, Lake Atlin, and Cariboo Crossing by Evermann and Goldsborough (1907), who remark that it is apparently the most abundant species of whitefish in the headwaters of the Yukon.

Two specimens from Lake Atlin, a male and female, 36.8 and 35.4 cm. long respectively to end of vertebral column, gave the following measurement (in per cent. of the standard length): Head-length, 19; head-depth, 12.1; eye, 4; snout, 4.7; interorbital, 5.8; maxillary, 4.4; body-depth, 20.5; body-width, 14; caudal-peduncle length, 14; caudal-peduncle depth, 7.4; dorsal with twelve fully developed rays preceded by one or two shorter ones, its height 13.1 and base 10.7; anal with 11 fully developed rays preceded by 1 shorter ray, its height 10.5 and base 9.8; pectoral length, 15.4; ventral, 12.8; caudal, 19.4; adipose, 6; branchiostegals, 7 or 8; scales, 97; gill-rakers, 6+11; pyloric cæca, 107 (104–110). The stomach of one of these specimens contained 140 shells of a snail *Valvata* sp. Except in the greater number of scales, these specimens closely resemble Great Lake specimens of the same species.

Prosopium williamsoni (Girard). (Rocky Mountain whitefish.)

There are specimens of this species in the collection of the Royal Ontario Museum of Zoology from Kootenay Lake, Kootenay River at Slocan Pool, Okanagan Lake, Kalamalka Lake, Cultus Lake, Harrison Lake, Chilliwack River, Columbia River at Revelstoke, Adams River, and Eagle River. It has also been reported to us as occurring in Moyie and St. Mary Lakes, and Goat and Elk Rivers, Columbia Lake, Lake Windermere, Slocan Lake, Watshan Lake, Arrow Lakes, Christina Lake, and in Sugar and Mabel Lakes.

Eigenmann (1895A) records it from the Columbia River at Golden and Revelstoke and from Shuswap Lake at Sicamous. Evermann and Goldsborough (1907) record it from Kootenay Lake at Nelson.

The collection consists of twenty-six specimens ranging in size from 7 to 18½ inches in length; the majority, however, are rather small, averaging 9 to 10 inches. The species appears to be very variable in body proportions, but none of the differences shown by the present collection are correlated in such a way as to indicate that more than a single species is represented. While some of the differences may indicate the existence of local or geographical forms, the majority appear to be the result of individual differences in rates of growth, sex, and sexual maturity. Following are average measurements of the various body-parts

in percentages of the body-length to end of vertebral column. The percentages in parentheses indicate the range of variations shown by the present collection: Head-length, 21 (20–23); specimens with heads 22–23 per cent. of the total length are usually the larger, sexually mature individuals. Such specimens have long snouts and maxillaries and wide interorbitals. Head-depth, 13.8 (13–15); eye, 5 (4–6). The eye, of course, is relatively larger in small individuals, but there seems to be considerable variation between specimens of the same size from different localities, perhaps correlated with the transparency of the water. Snout, 6 (5.5–7); the snout is especially long in older, sexually mature individuals, reaching in the case of the 18½-inch individual, a ripe female, 18.6 per cent. of the standard length; interorbital, 6 (5–7); maxillary, 6 (5–7); body-depth, 21 (18–25); body-width, 13 (10–16.7); larger, sexually mature individuals have much deeper and wider bodies than small, immature ones; caudal-peduncle length, 14 (12–16); caudal-peduncle depth, 6.5 (5.5–7.5). Dorsal fin with 11 to 13 fully developed rays preceded by 1 or 2 shorter ones, its height 14.5 (13–17); dorsal base, 12.5 (10–14.5); anal with 10 to 12 developed rays preceded by 1 or 2 shorter ones, its height 12 (10–16), its base 10 (8–11); pectoral length, 17 (15–20); ventral, 14.5 (12–18); caudal, 20 (18–22); adipose, 10 (8.7–11.7); branchiostegals, usually 8, sometimes 9; scales, 82 (78–86); gill-rakers, 8+13 (8+12 to 9+14), quite short, 2 to 3½ mm. in length; pyloric cæca usually nearly 100, ranging from 82 to 133. Ripe males have pearl organs on the scales especially pronounced on the four or five rows immediately above and below the lateral line.

As indicated above, some of the differences shown by the present collection suggest the existence of geographical or ecological forms. For instance, a collection of seven specimens from the Columbia River at Revelstoke have much deeper caudal peduncles than those from other localities represented, being 7 to 7.5 per cent. of the standard length, whereas others are rarely 7 per cent. These Revelstoke specimens also have much longer fins than the others. In other body proportions, however, as well as in number of gill-rakers, scales, and pyloric cæca, the Revelstoke specimens agree with those from other parts of the Province. As already indicated also, larger, sexually mature individuals differ considerably from smaller, immature specimens with respect to some body proportions. Large, sexually mature specimens have relatively much longer and deeper heads with longer snouts, and maxillaries, and wider interorbitals; the body is also much deeper and wider.

As indicated by the above description, *williamsoni* differs from *quadrilaterale* in the more numerous gill-rakers, fewer scales, longer and deeper head, snout not only longer relative to the body, but also when compared with the longer head; since the depth and width of the body varies so much with size and state of sexual maturity, it is difficult to arrive at a comparison of the two species from a comparison of the specimens at hand, but it seems probable that *williamsoni* has a somewhat deeper body than *quadrilaterale*; *williamsoni* is also characterized by a much longer adipose fin.

This species is said to spawn in the Okanagan region about November 15th.

Thymallus signifer (Richardson). (Arctic grayling.)

There are eight specimens of grayling from Lake Atlin in the collections of the Royal Ontario Museum of Zoology.

Catostomus catostomus (Forster). (Long-nosed sucker.)

This sucker was taken from deep water in Kootenay and Okanagan Lakes. Eigenmann (1895A) took it at Golden and Revelstoke and Evermann and Goldsborough (1907) reported it from the Watson River at Caribou Crossing. It is also known to occur in Shuswap Lake.

A specimen taken in Okanagan Lake, 39.5 cm. long to end of vertebral column (17⅞ inches to fork of caudal fin), gave the following proportionate measurements in per cent. of standard length: Head, 24.3; eye, 3.5; snout, 13; interorbital, 8.8; body-depth, 18.2; body-width, 14.4; caudal-peduncle length, 14.4; caudal-peduncle depth, 7.8; dorsal fin with 11 fully developed rays and 1 shorter one in front, its height 15.7 and base 13.9; anal with 7 fully developed and 1 shorter ray, its height 15.9 and base 7.6; pectoral, 19.7; ventral, 14.2; scales, 18–107–14.

Small or dwarf specimens, identified as *Catostomus catostomus*, were taken from shallow water in Garnet Valley Lake, near Summerland. A similarly dwarfed, lacustrine form has been described from the lakes of Jasper Park under the name *Catostomus catostomus lacustris* by Bajkov (1927).

Catostomus macrocheilus Girard. (Columbia River sucker.)

This is the common sucker of Southern British Columbia. Our specimens are from Kootenay, Okanagan, Christina, and Harrison Lakes, and a grassy lake along the course of Tumtum Creek near Revelstoke. It has also been reported by reliable observers as occurring in Columbia and Windermere Lakes and in the following lakes in the Columbia system: Arrow Lakes, Slocan Lake, Little Slocan Lake, Whatshan Lakes, Arrow Park Lake, and Summit Lake; and it is also said to occur in Hawser or Duncan Lake, Trout Lake, Stobbard Lake, and Erie Lake, and in the following lakes in the Moyie system: Moyie, St. Mary, and Premier. Eigenmann (1895A) has recorded it from Sicamous and Kamloops.

Measurements in per cent. of body-length to end of vertebral column of specimens 30 to 40 cm. in standard length (13 to 17 inches to fork of tail) are as follows: Head, 25; eye, 3.8; snout, 12.7; interorbital, 9.5; body-depth, 21.5 (20–23); body-width, 15.5 (14–16); length of caudal peduncle, 15; depth of caudal peduncle, 7.8; dorsal fin with 14 or 15, sometimes 13 developed rays, preceded by 1 or 2 shorter ones, its height 16 (14–17) and base 19; anal with 7 developed rays, preceded by 1 shorter ray, its height 18 (17–19.5) and base 8 (7–9); pectoral length 20 (19–22) and ventral 15 (14–17); scales, 13 (12–15)–70 (66–72)–12 (10–13). A male 11 inches long taken in Harrison Lake in October, 1925, had traces of tubercles on the anal fin, and also at the base of the lower three or four caudal rays.

Tinca tinca (Linnæus). (European tench.)

Specimens of this European species were taken in Christina Lake, to which they have no doubt gained entrance from the south through the outlet stream. They are said to have been first noticed in the lake about 1915. I am indebted to Dr. L. P. Schultz, of the College of Fisheries, University of Washington, for the following information on the introduction of this species:—

"The European tench was brought to Seattle for the World's Fair, and afterwards were dumped into geyser basin (a large goldfish-pond on the campus) and probably at that time or perhaps later some were taken to Lake Union. They remain in the geyser basin to-day in abundance and are collected occasionally for laboratory dissection. No attention is paid to them at all; they propagate naturally. Specimens have been reported from Lake Union that were nearly 2 feet long."

Two specimens measured gave the following proportions: Head, 28 per cent. of body-length to end of vertebral column; eye, 3.9; snout, 10–11; body-depth, 30–32; body-width, 14–16; dorsal rays I, 9, anal I, 8; scale, 92–94; teeth, 5–6.

Cyprinus carpio Linnæus. (Carp.)

Carp are not uncommon in the shallower parts of Okanagan Lake. Quite a number of small specimens were seined at the northern end of the lake, and many larger ones were seen at the foot of Okanagan Falls.

It is also known to occur in Kalamalka, Woods, and Shuswap Lakes.

Mylocheilus caurinus (Richardson). (Chub; Peamouth.)

The chub is common in most of the lakes visited in Southern British Columbia. We have specimens from Kootenay, Okanagan, Cultus, and Harrison Lakes, Columbia River in the vicinity of Revelstoke, from Babine Lake and some unspecified water in the vicinity of Prince George, and also from Cecilia Lake, on Vancouver Island.

Jordan and Evermann (1896) say of this species: "Often entering the sea . . . specimens from Nanaimo sent by Mr. Ashdown H. Green, who says that this is the only cyprinoid found in Vancouver Island." It has been recorded from Fishhook Lake, Vancouver Island, by Green (1893). Confirmation of the occurrence of this species in salt water is furnished by C. Carl, who took it in English Bay while fishing along the shore for the surf-smelt, *Hypomesus pretiosus*. Eigenmann (1895A) records this species from Mission, Kamloops, Sicamous, Revelstoke, and Golden. Our largest specimen, taken in Cultus Lake, measured 12½ inches (13.5 cm.) to fork of tail.

Hubbs and Schultz (1931) have discussed the scientific name of this species and conclude that Richardson's (1836) name *caurinus* must stand. They point out that previous to 1905 the name *Mylocheilus caurinus* was generally accepted, but in that year Snyder (1905) stated

that the name should be *Mylocheilus lateralis* Agassiz and Pickering, and many have adopted the latter name in consequence.

Proportionate measurements based on twelve specimens ranging from 16 to 23 cm. in length to end of vertebral column are as follows in per cent. of standard length: Head-length, 22.5 (21.5–24); eye, 4.9 (4.7–5.3); snout, 7.0 (6.6–7.6); maxillary, 5.6 (5.0–6.3); interorbital, 7.3 (7.0–7.9); body-depth, 20 (19.5–21); body-width, 13.8 (13–14.2); caudal-peduncle length, 18 (17–19); caudal-peduncle depth, 8 (7.7–8.5); dorsal fin with 8 fully developed rays preceded by 1 or 2 shorter ones, its height 18 (16–20) and base 10.5 (10–11; anal with 8 fully developed rays preceded by 1 or 2 shorter ones, its height 14 (13–15) and base 10 (9.5–10.3); pectoral length, 19 (17–22); ventral length, 15.5 (14–17); scales, 13 to 15 – 71 (68–74) – 8 or 9; teeth, usually 1–5–5–1, occasionally 4 in one of the outer rows, hooked in young, one or more becoming stump-like with age; premaxillary protractile, a barbel near end of maxillary; peritoneum dusky, tubercles on top of head, on opercle and on scales of back and sides nearly to lateral line, of specimen 20 cm. long to end of vertebral column, taken in Kootenay Lake June 12th, 1928.

Chrosomus erythrogaster Rafinesque. (Red-bellied dace.)

A specimen sent by Dr. Clemens to the Royal Ontario Museum of Zoology was taken in Charlie Lake in the Peace River Block. This lake lies west of Fort St. John and is tributary to the Peace River.

Ptychocheilus oregonensis (Richardson). (Squawfish.)

The squawfish is one of the commonest and most generally distributed fish in Southern British Columbia. Specimens were secured in Kootenay, Okanagan, Christina, and Harrison Lakes, and it has been reported by reliable observers as occurring from Columbia and Windermere Lakes throughout the Columbia River, including the Arrow Lakes, Slocan Lake, Little Slocan Lake, Whatshan Lakes, Arrow Park Lake, Summit Lake, the Kootenay River between Nelson and Castlegar and between Kootenay Landing and the United States border, Goat River below the Canyon, Hawser or Duncan Lake, Trout Lake, Stobbard Lake, Erie Lake, Kalamalka, Woods, Duck, Cultus, Blue, Cluculz Lakes, and the Nechako and Lower Fraser Rivers. It has also been recorded from the Thompson River at Kamloops and Shuswap Lake at Sicamous by Eigenmann (1895A).

It grows to a large size, a specimen 8 lb. in weight having been taken in Arrow Lakes near Edgewood in June, 1928.

Proportionate measurements based on five specimens averaging 27 cm. in length to end of vertebral column are as follows in per cent. of standard length: Head-length, 28 (27–29); eye, 4.5 (4.2–5.0); snout, 10 (9–11); maxillary, 11.5 (11–12); interorbital, 7.8 (7.3–8.8); body-depth, 20 (18–21); body-width, 14; caudal-peduncle length, 18 (16.5–19.5); caudal-peduncle depth, 9; dorsal fin with 9 fully developed rays preceded by 1 or 2 shorter ones, its height 16 (15–17) and base 12 (11.5–13); anal with 8 fully developed rays preceded by 1 or 2 shorter ones, its height 13.5 (12.5–16) and base 10.5 (9.5–12); pectoral, 18 (15.5–21.5); ventral, 13.5 (12–16); scales in lateral line, 73 (69–77); teeth, 2–4–5–2, outer row sometimes 3 instead of 2 and inner sometimes 4–4, some or all of teeth hooked.

Richardsonius balteatus (Richardson). (Shiner.)

The shiner is usually common and generally distributed at least in the southern part of the Province. There are specimens in the collection of the Royal Ontario Museum of Zoology from Kootenay, Okanagan, Cultus, and Shuswap Lakes, the Thompson River at Kamloops, Summit Lake near Revelstoke, and Garnet Valley Lake, a small lake near Summerland. C. Carl reports having taken the species in Burnaby Lake and Dr. W. A. Clemens from Kalamalka, Woods, Duck, and Blue Lakes.

It has also been recorded by Eigenmann (1895A) from Kamloops and Mission, and as variety *lateralis* from Sicamous, Griffin Lake, Kamloops, Revelstoke, and Golden. Later, Eigenmann (1895B) made a rather extensive study of variation in this species and in the paper in which he published his results regarded *lateralis* as a synonym of *balteatus*.

This minnow does not reach a very large size, our largest specimen being 6.6 cm. to end of vertebral column (3 inches to fork of tail). It is characterized by its deep, rather compressed body, long anal fin, and insertion of the dorsal well behind a vertical through ventral

insertion. A dark lateral band on posterior half of the body; the lateral line follows the contour of the ventral surface.

The species is said to show wide variations from one locality to another. The following measurements in per cent. of the standard length were secured from specimens from Okanagan Lake, 5.7 to 6.6 cm. long, to end of vertebral column: Head, 26 (25–27); eye, 8.3 (7.7–8.7); depth of body, 28.5 (27–29.5); width of body, 16 (15–18); dorsal with 10 fully developed rays preceded by 1 or 2 shorter ones; and with 15 to 17 fully developed and 1 or 2 preceding shorter rays; scales, about 58; teeth, usually 2–5–4–2, sometimes 1 or 3 in the inner row on one or both sides.

Couesius plumbeus (Agassiz). (Lake chub.)

A number of specimens of the lake chub were taken in Garnet Valley Lake near Summerland, July 6th, 1928. Only four of them are large enough to furnish useful comparative measurements; these are as follows, in percentage of the body-length to end of vertebral column: Head, 26.3; eye, 6.5; snout, 7.8; interorbital, 7.5; body-depth, 21.8; body-width, 15.0; caudal-peduncle length 21.7 and depth 9.3; dorsal fin with 8 fully developed rays, preceded by 1 shorter one, its height 16.8; anal fin with 8 fully developed and 1 shorter ray, its height 14.3; pectoral length, 18.3; ventral length, 14.2; scales, 60 (58–64), 27 scales before dorsal; teeth, 2–4–4–2; barbel evident, attached above and near posterior end of maxillary.

Specimens of a lake chub collected in Stuart Lake near Fort. St. James, B.C., have been described by Jordan (1894) as *Couesius greeni;* Green (1893) mentions the same locality. Evermann and Goldsborough (1907) also record specimens taken by Evermann in Kootenay Lake.

The specimens collected in Garnet Valley Lake and described above agree closely with specimens of *C. plumbeus* from Lake Nipigon (Dymond, 1926) and they are accordingly regarded as being of the same species.

Specimens have also been taken in Jewel Lake.

Rhinichthys cataractæ (Cuvier and Valenciennes). (Long-nosed dace.)

During the course of our studies this species was taken in Kootenay Lake at Kaslo, at the north end of Okanagan Lake, and in Garnet Valley Lake, a small lake near Summerland. There is also a specimen in the collection of the Biological Station, from Morrison Lake, taken December 15th, 1928. C. Carl reports specimens from streams tributary to Burnaby Lake.

Apocope falcata (Eigenmann and Eigenmann).

This species was taken in the seine at the north end of Okanagan Lake. I have also examined specimens taken in Shuswap Lake by Dr. Clemens. It has previously been recorded from the latter locality by Eigenmann and Eigenmann (1893) as *Agosia shuswap.*

Apocope nubila (Girard).

This species has been recorded from Yellowhead Lake, Mount Robson National Park, by Bajkov (1927).

Ameiurus nebulosus (Le Sueur). (Common bullhead.)

A specimen of this species was taken July 18th, 1925, in Sumas River and presented by Dr. R. E. Foerster to the collection of the Royal Ontario Museum of Zoology. Catfish are said to be rather common in the area.

The records of *Ameiurus melas* from New Westminster and Shawnigan Lake in the Report of the Provincial Museum for 1931 may refer to the present species.

Esox lucius Linnæus. (Common pike.)

Inspector T. V. Sandys-Wunsch, of the Royal Canadian Mounted Police, informs me that pike occur in Northern British Columbia. He first found them in Dease Lake and from there down the Dease River, in the Liard River, and in all the lakes adjacent.

According to Mr. W. M. Ferrier, Fisheries Inspector at Prince George, pike are native to the waters of Northern British Columbia tributary to the Arctic Ocean, but he has never known of any pike found in the waters of Northern British Columbia tributary to the Pacific Ocean.

Lota maculosa (Le Sueur). (Burbot; Ling.)

This species is generally distributed through British Columbia. From information secured by personal observation and from the reports of Fishery Officers, it is known to occur in the large lakes such as Kootenay, Okanagan, Arrow, and Shuswap, also in all suitable waters throughout the Columbia system, including Slocan Lake, Christina Lake, at Revelstoke, and Golden (Eigenmann, 1895A), and in Windermere and Columbia Lakes. In the Upper Kootenay drainage it is found in Moyie, St. Mary, and McBains Lakes, and in suitable situations in the river to its upper reaches. In the Fraser drainage it occurs, in addition to Shuswap Lake, in Cluculz, Sugar, Mabel, Mara, Nicola, Douglas, and Seton. Macoun (1883) records it from Fort McLeod in Northern British Columbia. Babcock (1902) records the species from Seton and Anderson Lakes, and Evermann and Goldsborough (1907) believe it to be "common in Lake Bennett, Tagish Arm, Lake Atlin, and probably in all suitable waters in the Yukon basin."

In Christina Lake it is caught on set-lines in winter and used as food. Of it Cobb (1926) says, "rarely utilized as food except in British Columbia and Washington, where small quantities are marketed." Babcock (1907) also speaks of the ling as furnishing excellent food to some sections.

Gasterosteus aculeatus Linnæus. (Common stickleback.)

The common stickleback of Southern British Columbia, both fresh-water and marine, is now regarded as of the same species as the common three-spined stickleback of the Northern Atlantic—namely, *Gasterosteus aculeatus*. Considerable differences do occur between sticklebacks of this species in fresh water as compared with salt water, and southward as compared with those in the north, but, as Hubbs (1929) has pointed out, "So numerous are these local races, so confused their geographical distribution, that it seems unwise to recognize any one of them as a distinct species." *Gasterosteus cataphractus* and *Gasterosteus williamsoni microcephalus* therefore become synonyms of *G. aculeatus*.

Our specimens are from Millstream, Nanaimo, Big Lake, Wellington, V.I., Cultus Lake, and Harrison Lake. It is also known to occur in the Nanaimo Lakes, and Dr. L. P. Schultz has identified specimens collected by Dr. A. L. Pritchard from Meyer Lake, Queen Charlotte Islands. It will be noticed that none of these localities are beyond Hell's Gate Canyon, which seems to mark the limit of the distribution of a number of anadromous species.

Lord's (1866) classic account of the nest-building habit of the stickleback was based on observations made in British Columbia.

Eucalia inconstans (Kirtland). (Brook stickleback.)

A specimen taken in Charlie Lake, tributary to the Peace River, in the Peace River Block, west of Fort St. John, was sent to the Royal Ontario Museum of Zoology by Dr. Clemens.

Micropterus dolomieu Lacépède. (Small-mouthed black bass.)

The story of the introduction of black bass into Christina Lake and other British Columbia waters is recounted by Prince (1902). The fry were placed in Christina Lake in the autumn of 1901. Such poor care was taken of them from the time they were taken from the train at Revelstoke until they were placed in the lake that few survived the journey. According to information given us by Mr. Sandner, it was five years before bass began to be noticed in the lake. After that they steadily increased until they became fairly common, but at the time of our visit in 1928 their numbers had been decreasing for several years. This circumstance we attributed to the depletion of food. Crayfish and shiners (*R. balteatus*) were said to have been formerly very common around the shores, but in 1928 both were quite scarce. The largest bass taken in Christina Lake weighed 6 lb.

It is difficult to estimate the effect of the bass on the native Kamloops trout of the lake. The latter were said to be quite scarce as compared with former conditions, but how much of this can be attributed to the bass, and how much to overfishing, or other causes, is impossible to state.

The only report of bass in Moyie Lake was furnished by C. H. Robinson, Fishery Overseer of Nelson, who said that about 1925 Mr. H. Ryder, in charge of the Cranbrook Hatchery, had found a dead bass on the shore of that lake. Dr. J. L. Hart has sent us a specimen of young small-mouthed black bass taken in Spider Lake, Vancouver Island, on June 15th, 1930.

Aplites salmoides (Lacépède). (Large-mouthed black bass.)

This species, which of course is not native to the Province, is now rather common towards the southern end of Kootenay Lake, where there is a good deal of shallow water. It is said to have escaped into the Kootenay River at Bonners Ferry in 1916 from private ponds. It was caught near Kootenay Landing for the first time about 1921. In that year Mr. A. Bush, of Nelson, caught a specimen weighing 5½ lb. at Sirdar. By the summer of 1928 they had spread to Pilot Bay.

The large-mouthed black bass also occurs in Osoyoos and Vaseaux Lakes, having gained access to it from the south. It has also been reported by anglers as occurring in a lake on Saltspring Island, near Vancouver Island.

Pomoxis sparoides (Lacépède). (Calico bass.)

Hart (1934) has recorded the calico bass from Hatzic Lake, a backwater of the Fraser River near Mission.

Eupomotis gibbosus (Linnæus). (Pumpkinseed.)

The pumpkinseed is rather common in Christina Lake, to which it was probably introduced along with the black bass.

Perca flavescens (Mitchill). (Yellow perch.)

Perch occur in Vaseaux Lake, to which they are said to have gained entrance from the south.

Cottus asper Richardson. (Prickly bullhead.)

This sculpin appears to be very generally distributed throughout South-western British Columbia, including Southern Vancouver Island. There are specimens in our collections from Okanagan Lake, Christina Lake, Shuswap Lake, Summit Lake near Revelstoke, Cultus Lake, pond at Harrison Hatchery, Nass River, Horne Lake, and Spider Lake on Vancouver Island, Millstream at Nanaimo, and a small stream entering Departure Bay near the Biological Station. Eigenmann (1895A) records the species from Mission, Sicamous, Kamloops, and Griffin Lake and remarks that it is very abundant in the Fraser system from tide-water to an altitude of 1,900 feet. Bean and Weed (1920) record "five specimens 12.5–18.5 cm. long, mouth of Fraser River, B.C. A. Halkett." Dr. Clemens reports the species as occurring in McClinton Creek, Queen Charlotte Islands, on the basis of identification by Dr. L. P. Schultz.

In percentage of the length to end of vertebral column following are measurements of various body-parts: Head, 33 (30–35); eye, 7.5 (6.7–8.0); snout, 9.8 (9.0–11.5); interorbital, 4.8 (4.2–5.3); body-depth, 22 (21–24); body-width, 20 (19–21.5); length of caudal peduncle, 11 (10–13); depth of caudal peduncle, 7.2 (7.0–7.4); first dorsal with 9 spines in fourteen specimens and 8 in one, its height 8.5 (8.0–9.0) and base 17.5 (15.5–20); second dorsal with 20 rays in seven specimens, 21 in six and 22 in two, its height 14 (12–16.5) and base 42 (36–46); last membrane of first dorsal connected to lower half of first ray of second dorsal; anal with 16 rays in seven specimens and 17 in eight, its height 12.5 (10–15) and base 33 (32–34); pectoral length, 28 (25–30); ventral rays I, 4 in every one of fifteen specimens examined, its length 20 (17–22); one almost straight upward and backward pointing preopercular spine; a prominent dark vertical bar at base of caudal, a few dark saddle-shaped markings on back and upper sides, especially anteriorly, a round dark spot on membrane between last few spines of first dorsal, edge of fin reddish; the extent to which prickles are present varies from that in which they are confined to a small patch behind the pectoral fin to that in which they cover most of the body with the exception of the ventral surface, and in front of and beside the dorsal fin; they are commonly absent from the caudal peduncle; lateral line sometimes complete, but often lacking on part or all of caudal peduncle.

Cottus rhothea (Rosa Smith).

Following are some of the characters of specimens of this sculpin taken at Slocan Pool, in the Kootenay River below Bonnington Falls: First dorsal rays, 7 or 8; second dorsal rays, 16 or 17; anal rays, 12 or 13; ventral rays I, 4; body, including top of head, covered with prickles, except on ventral surface and on lower sides in front; lateral line incomplete, a few pores missing on caudal peduncle, sometimes the whole caudal peduncle on one or both sides lacking pores; largest specimen, 5.5 cm. to end of vertebral column.

Cottus aleuticus Gilbert.

This species is found in both fresh and salt water. Specimens were obtained in a small stream entering Departure Bay; this is probably the same locality as that for which Gilbert (1895) records "four specimens were collected by us May 26th, 1889, in a small stream entering Departure Bay, Vancouver Island."

I am also indebted to W. E. Ricker for a number of specimens 3–4 cm. in length taken from the stomach of a specimen of *Salvelinus malma* collected in Cultus Lake.

There is a specimen at the Pacific Biological Station collected by Dr. A. L. Pritchard from McClinton Creek, Queen Charlotte Islands, and identified by Dr. Schultz.

Cottus cognatus Richardson. (Miller's thumb.)

Specimens of this species were taken at Kaslo in Kootenay Lake and in Christina Lake. Of the three specimens taken, two had ventral rays I, 3 and one had I, 4; first dorsal rays were 7 in one case and 8 in two; second dorsal rays were 16, 15, and 17 respectively, and anal 12, 12, and 10. The lateral line was quite short, in one case not reaching a vertical through the insertion of the first dorsal, in others extending only a little beyond this point; there was a patch of prickles behind the pectoral fins. Length of specimens, 2.8, 3.0, and 3.7 cm. to end of vertebral column.

Evermann and Goldsborough (1907) report having taken forty-five specimens which they identified as belonging to the present species in Lake Bennett, Northern British Columbia.

LITERATURE CITED.

BABCOCK, J. P. Reports of the Commissioner of Fisheries for British Columbia. 1901–1930.

BAJKOV, A. Reports of the Jasper Park lakes investigation, 1925–1926. I. The fishes. Contr. Canad. Biol. Fish. 3 (16): 377–404. 1927.

BEAN, B. A. and A. C. WEED. Notes on a collection of fishes from Vancouver Island, B.C. Trans. Roy. Soc. Canada. Ser. III., Vol. XIII., Sec. V., pp. 69–83. 1920.

COBB, J. N. Pacific cod fisheries. Appendix VII., Rept. U.S. Comm. Fish. for 1926. 1926.

DAWSON, G. M. Salmon in rivers of the Pacific slope. Nature 19: 528. 1879.

DYMOND, J. R. The fishes of Lake Nipigon. Univ. Tor. Stud., Biol. Ser. 27, Pub. Ont. Fish. Res. Lab. 27. 1926.

DYMOND, J. R. The trout of British Columbia. Trans. Amer. Fish. Soc. 58: 71–77. 1927.

DYMOND, J. R. Descriptions of two new forms of British Columbia trout. Contrib. Canad. Biol. Fish. 6: 393–395. 1931.

DYMOND, J. R. The trout and other game fishes of British Columbia. Dept. of Fisher., Ottawa. 1932.

EIGENMANN, C. H. Explorations in western Canada. Proc. Ind. Acad. Sci., 56. 1892.

EIGENMANN, C. H. Results of explorations in western Canada and the north-western United States. Bull. U.S. Fish. Comm. 14: 101–132. 1895A.

EIGENMANN, C. H. *Leuciscus balteatus* (Richardson), a study in variation. Amer. Nat. 29: 10–25. 1895B.

EIGENMANN, C. H., and R. S. EIGENMANN. New fishes from western Canada. Amer. Nat. 26: 961–964. 1892.

EIGENMANN, C. H., and R. S. EIGENMANN. Preliminary description of new fishes from the north-west. Amer. Nat. 27: 151–154. 1893.

EVERMANN, B. W. A report upon salmon investigations in the headwaters of the Columbia River in the State of Idaho in 1895, together with notes upon the fishes observed in that State in 1894 and 1895. Bull. U.S. Fish. Comm. 16: 151–202. 1897.

EVERMANN, B. W., and E. L. GOLDSBOROUGH. A check list of the fresh-water fishes of Canada. Proc. Biol. Soc. Wash. 20: 89–120. 1907.

GILBERT, C. H. The ichthyological collections of the steamer Albatross during the years 1890 and 1891. Rept. U.S. Comm. Fish and Fisheries, 1893: 393–476. 1895.

GREEN, ASHDOWN H. Notes on the occurrence of new and rare fish in British Columbia. Bull. Nat. Hist. Soc. B.C., pp. 9–10. 1893.

GUNTHER, A. Description of fish from Vancouver. (In Lord, J. K., The Naturalist in Vancouver Island and British Columbia, Vol. II.). 1866.

HART, J. L. Black crappies in British Columbia. Can. Field Nat., 48, pp. 103–104. 1934.

HUBBS, C. L. The Atlantic American species of the fish genus Gasterosteus. Occ. Pap. Mus. Zool. Univ. Mich. No. 200. 1929.

HUBBS, C. L., and L. P. SCHULTZ. The scientific name of the Columbia River chub. Occ. Pap. Mus. Zool. Univ. Mich. No. 232. 1931.

JORDAN, D. S. On the occurrence of the great lake trout (*Salvelinus namaycush*) in the waters of British Columbia. Proc. U.S. Nat. Mus. 11: 58. 1889.

JORDAN, D. S. Description of a new species of cyprinoid fish *Couesius greeni*, from the head-waters of the Fraser River in British Columbia. Proc. U.S. Nat. Mus. 16: 313–314. 1894.

JORDAN, D. S., and B. W. EVERMANN. The fishes of North and Middle America. Bull. 47, U.S. Nat. Mus. 1896.

LORD, J. K. The Naturalist in Vancouver Island and British Columbia. 2 vols., London. Appendix contains "List of Specimens Collected with Descriptions of the Fish," by A. Gunther. 1866.

MACOUN, JOHN. Manitoba and the great north-west. Fishes. pp. 377–392. 1883.

PRINCE, E. E. Thirty-fourth Ann. Rept. Marine and Fisheries (1901). Fisheries, p. 235. 1902.

RICHARDSON, JOHN. Fauna Boreali-Americana, pt. 3. The Fish. 1836.

SNYDER, J. O. Critical notes on *Mylocheilus lateralis* and *Leuciscus caurinus*. Rept. U.S. Comm. Fish. 1904: 341–342. 1905.

SOME RESULTS OF THE BRITISH COLUMBIA HERRING INVESTIGATION AND THEIR ECONOMIC BEARING.

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In 1929 an investgation of the herring of British Columbia was inaugurated under the combined auspices of the Department of the Provincial Fisheries and the Biological Board of Canada. The immediate purpose of this investigation was to determine whether fishing activity, which has removed over 50,000 tons of herring from the waters each year since 1920, was sufficiently intense to materially reduce the available supply and endanger the future of the fishery. It was realized that fluctuations in the abundance of herring and in their availability to the fishermen might be induced by factors other than the activity of the fishery. In order that the effect of these "natural" factors might not be confused with that of the fishery the scope of the investigation was broadened considerably. The rôle of fishing activity formed but one aspect of the more general problem of determining the causes of fluctuation in the abundance and availability of herring.

With this fundamental problem under consideration, the investigation was carried on jointly by the two Departments for three years (until March, 1932). During the next four years (until March, 1936) it was continued by the Biological Board alone. Since 1929 several articles dealing with various phases of the investigation, but mostly of a preliminary nature, have been published. These include racial studies (Tester, A. L. *Biol. Bd. Can. Prog. Rep. Pacific No. 12, 1932; Trans. Amer. Fish. Soc., Vol. 63, 1933*); studies of age and growth (Tester, A. L. *Biol. Bd. Can. Prog. Rep. Pacific No. 18, 1933*);* studies of egg production on the spawning-grounds (Hart, J. L., and A. L. Tester. *Trans. Amer. Fish Soc., Vol. 64, 1934*); food studies (Wailes, G. H. *J. Biol. Bd. Can., Vol. I., No. 6, 1936*); a study of the selectivity of drift-nets (Tester, A. L. *Biol. Bd. Can. Prog. Rep. Pacific No. 24, 1935*); and an account of the history of the herring-fishery, fishing methods, and marketed products (Tester, A. L. *Biol. Bd. Can. Bull. No. 47, 1935*).†

In addition to those already listed, two scientific papers by the author have been presented for publication (June, 1936) in the Journal of the Biological Board of Canada. These, dealing with local populations of herring and with the length and age composition of the runs, contain the results of the six years of investigation and complete a general study of these two phases. The more important results and conclusions contained in these two articles will be reviewed briefly and discussed from the economic point of view in the following pages.

LOCAL POPULATIONS.

When one group of fish is living under conditions of partial or complete isolation from another group, differences in body-structure arising from differences in either environmental conditions or hereditary tendencies are preserved for several years at least. These differences in structure are small, but they may be detected by comparing averages based on large numbers of individuals from each group. One of the most useful of these "racial" characters is the vertebral count. Although individual fish in all localities throughout the waters of the Province have a definite number of segments or vertebræ in the backbone (usually 51, 52, or 53), it has been found that the average number increases more or less regularly from south to north along the coast (Fig. 1). In other words, there are more fish with 53 and fewer fish with 51 vertebræ in Hecate Strait than in Barkley Sound. This gradation in average vertebral count is probably related to a gradation in water temperatures, the water becoming progressively colder from south to north along the coast. Evidence for this arises from the observation that in one locality high temperatures in the spring, when the backbone of the larval fish is in the process of formation, are associated with low average counts, whereas low spring temperatures are associated with high average counts. Another character, the keeled scale count, shows a similar but opposite gradation, the number decreasing rather than increasing towards the north. The presence of these gradations and their persistence from year to year proves that extensive intermingling of the herring of the various runs along the coast does not take place. If it were to occur, the gradations would be quickly obliterated

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and herring in both southern and northern waters would have approximately the same average counts.

Having established the fact that extensive intermingling does not take place, it remains to segregate the various local groups or " local populations " which are present in the waters. This may be accomplished by the comparison of racial characters and, again, the vertebral count is of great value. Taking into consideration various sources of variation in vertebral count with year-class, age, and length, comparisons of the average counts in the various localities reveal the presence of many statistically significant differences; i.e., differences which cannot be attributed solely to chance. Similar differences are found between the averages of other characters, such as the count of the segments in the abdominal portion of the backbone, the length of the head, the length to the dorsal fin, the proportion of the sexes, and the rate of growth in length. As many of these differences are present consistently for several years, the obvious conclusion is that runs showing such differences intermingle slightly, if at all.

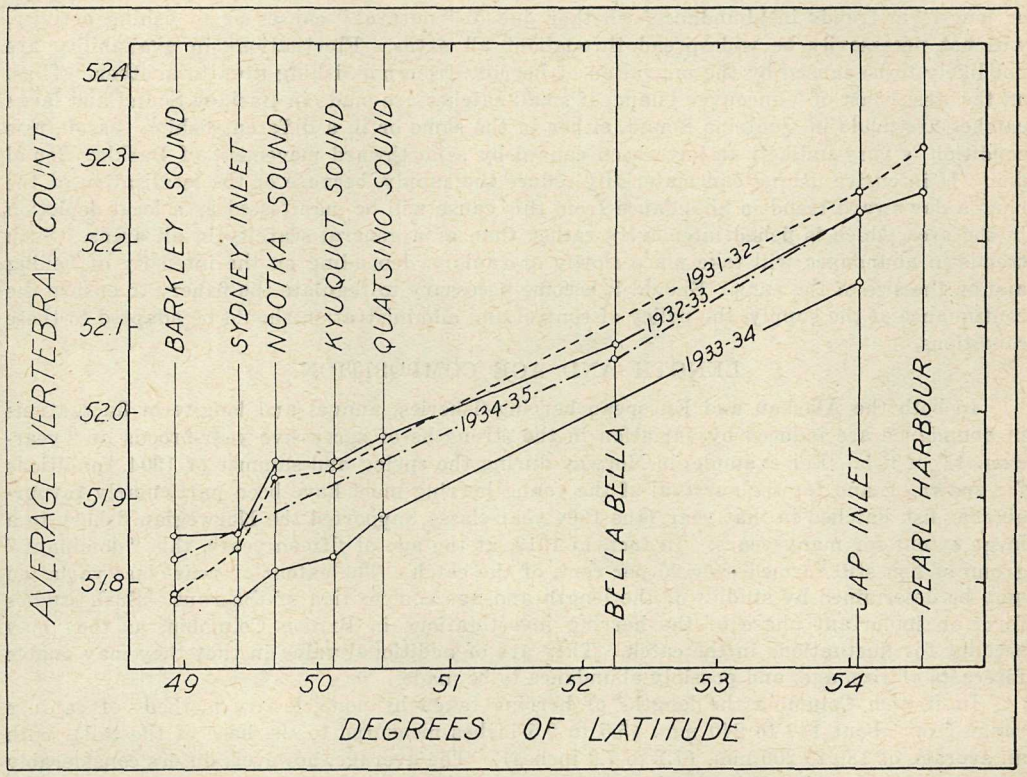

Fig. 1. Showing the gradation in average vertebral count with latitude in four seasons.

From this type of evidence, together with a consideration of age composition, it is concluded that over the period of investigation at least, the following runs have tended to form local populations: Point Grey, Granite Bay, Saltspring Island-Departure Bay-Nanoose Bay, Barkley Sound, Sydney Inlet, Nootka Sound-Kyuquot Sound, Quatsino Sound, Bella Bella, Skidegate Inlet, Jap Inlet-Butler Cove, and possibly Pearl Harbour. No differences have been demonstrated between runs which have been hyphenated and it is assumed that these belong to one population.

Although these runs have been called " local populations," it must be kept in mind that a slight degree of intermingling between those to closely situated or adjacent localities is possible and that more complete intermingling may have taken place in the past and may take place occasionally in the future. On the other hand, additional data may show that these populations are further divisible into two or more separate units. No attempt is made

to define precisely the areas occupied by the populations because of this uncertainty and also because of lack of knowledge concerning the extent of seasonal migrations. As mature herring are observed in each fishing area during only a part of the year, usually in the autumn, winter, and spring, it seems probable that they move from summer feeding-grounds to these winter habitats prior to spawning in the spring. It is proposed to direct future investigation to a more intensive study of the populations on the south-east and west coasts of Vancouver Island in an endeavour to obtain more accurate knowledge of the extent of intermingling and migration of the fish, and hence a more concrete concept of the limits and stability of each population. The tagging of herring by means of magnetic metal belly-tags and the recovery of these by an electro-magnetic apparatus, a procedure developed for similar studies on the Alaskan herring by Dr. G. A. Rounsefell and Mr. E. H. Dahlgren, of the United States Bureau of Fisheries, will form part of the programme.

Apart from the seasonal movements which must take place, the herring of British Columbia appears to be essentially a non-migratory species. This has an important bearing on the nature and extent of fluctuations in abundance and availability. Annual fluctuations or long-term trends in abundance, whether due to "natural" causes or to fishing activity, will not necessarily be widespread throughout all areas. Fluctuations in availability are not likely to be caused by the migration of herring from one fishing area to another. Thus, on the west coast of Vancouver Island, if small catches are made in Barkley Sound and large catches are made in Quatsino Sound, either in the same or in a different fishing season, this condition is very unlikely to have been caused by a northward movement of Barkley Sound fish. If intensive fishing can materially reduce the supply, because of the localization of the runs a downward trend in abundance from this cause will be manifested as a local depletion in the area which is fished intensively rather than as a general scarcity in all areas. Such trends in abundance will take place slowly or rapidly, depending on the intensity of fishing and on the size of the runs. Should it become necessary to regulate the fishery to ensure the continuance of the supply, the policy of control and administration should be adapted to these conditions.

LENGTH AND AGE COMPOSITION.

In both the Alaskan and European herring-fisheries, annual and long-term fluctuations in abundance are induced by variation in the strengths of successive year-broods or "year-classes" of fish. For example, in Norway during the spring and summer of 1904, conditions for spawning and for the survival of the young herring must have been particularly favourable, as fish hatched in that year (the 1904 year-class) supported the Norwegian fishery to a large extent for many years. In fact, in 1919, at the age of fifteen years, this "dominant" group of fish still formed over 20 per cent. of the catch. The extent of year-class variation may be determined by studies of the length and age composition of the runs. Such studies form an important phase of the herring investigations in British Columbia, as they may account for fluctuations in the catch. They are of additional value in that they may enable forecasts of size, age, and possibly abundance to be made.

In British Columbia the lengths of herring taken by non-selective methods of capture range from about 140 to 240 mm. (5.5 to 9.5 inches measured to the base of the tail), with an average of 180 to 200 mm. (7.1 to 7.9 inches). The average, however, differs considerably among the various localities in the same year and also to some extent in one locality from year to year. An examination of the scales of these fish shows the presence of "winter rings." Although these are less clearly marked on scales of fish in southern as compared with northern waters of the Province, they may be relied upon to give reasonably accurate estimates of the age composition of the runs. Ages range from II. (1+) to XI. (10+) or more, but the bulk of the catch is made up of fish from age III. to VI., inclusive (Fig. 2). However, a considerable diversity in age composition is found both between localities in one year and in the same locality from year to year. It is noted that the spread in both lengths and ages tends to be greater in northern than in southern samples.

The diversity in age composition is well illustrated by the results for 1932–33. In that season fish in their fifth year formed the most abundant age-class at Sydney Inlet, whereas fish in their third year predominated in the catches from Barkley Sound to the south and Nootka Sound to the north. In still another region on the west coast of Vancouver Island, Quatsino Sound, fish in their sixth year formed the most abundant age-group in this same

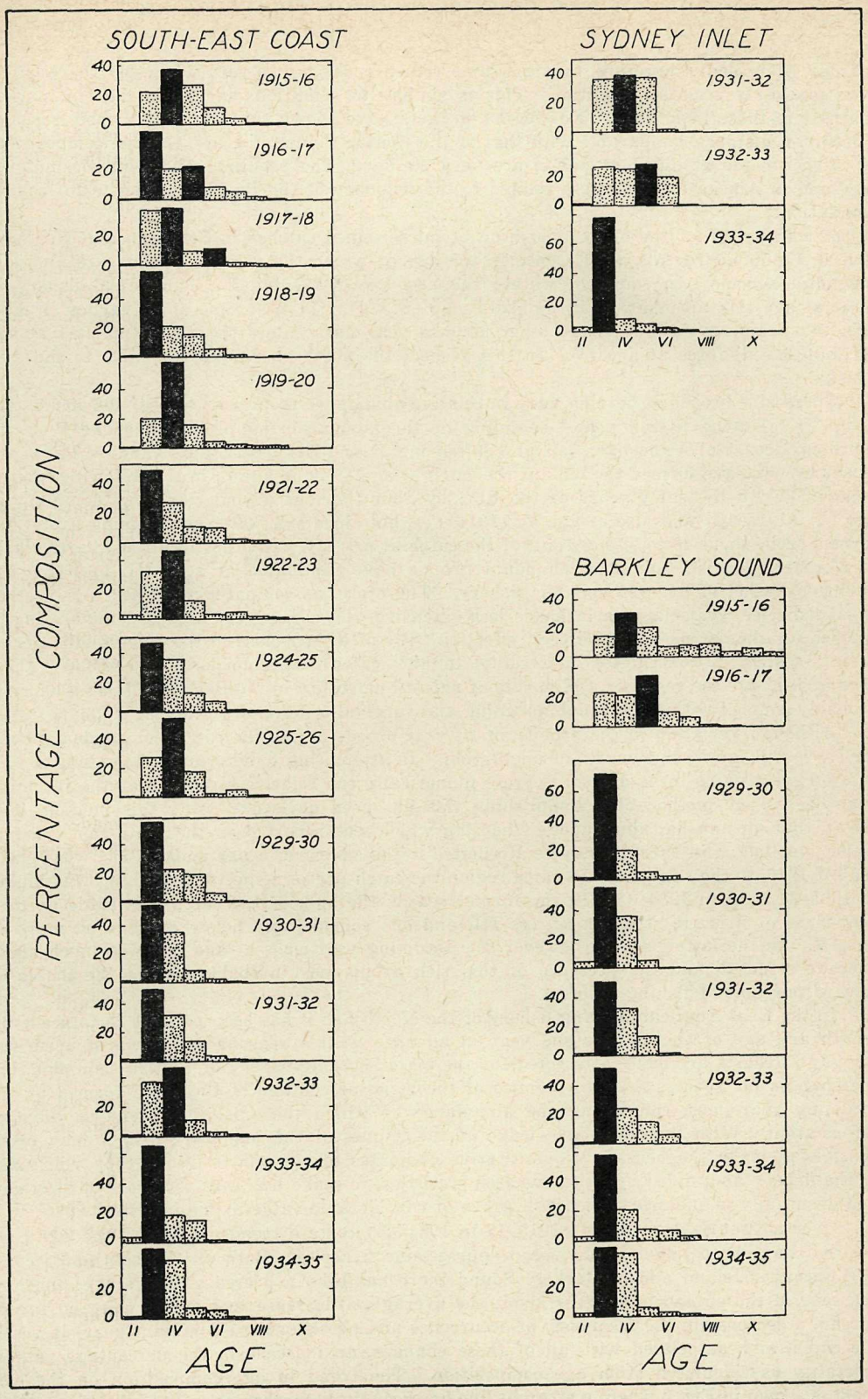

Fig. 2. Showing the age composition of samples from the south-east coast of Vancouver Island, Barkley Sound, and Sydney Inlet.

season. It is clear, therefore, that the same year-broods may be very unequally represented, even in closely situated localities. This is similar to conditions in Alaska but in marked contrast to those in Europe. Norwegian workers have shown that along the whole coast of Norway, a distance comparable with that of the British Columbia coast, the age compositions of catches made at different points are very similar. The peculiar conditions encountered here and in Alaska are doubtless related to the tendency of the Pacific herring to form local populations.

A comparison of the age composition of purse-seined catches in Southern and Northern British Columbia reveals a difference in the age at which the year-broods mature and join the adult schools. In southern waters the new recruits enter the commercial fishery in force at age III., although small numbers may enter for the first time at an earlier or later age. In northern waters, on the other hand, a year-class enters the fishery in part at age III. but in full force at age IV. In this respect the northern runs are similar to those of Alaska.

Successive broods of herring vary in relative abundance from year to year to some extent (Fig. 2). During fifteen years' sampling of the population supplying the fishery on the south-east coast of Vancouver Island (Saltspring Island-Departure Bay-Nanoose Bay), the richer broods have formed the bulk of the catch at age III. and again, in the following season, at age IV. In the early years of the Barkley Sound fishery a year-class was dominant at age IV. (1915–16) and also at age V. (1916–17), but since 1929–30 each incoming group has formed from about 40 to 70 per cent. of the catch at age III. In other localities, particularly in Northern British Columbia, abundant groups have dominated at ages III. to VII.; i.e., during a period of five years in the fishery. Therefore, as compared with herring in other great fisheries, year-class variation is less extensive, the richer year-broods dominate in the catches for shorter periods, and the " effective " life of a year-class in the fishery (the period during which it contributes materially to the catch) is considerably shorter. These peculiarities are the result of a high rate of natural mortality in the British Columbia herring, probably coupled with more equal spawning and survival conditions from year to year.

Although variation in the production of year-broods is less than in other regions, nevertheless it will cause some degree of fluctuation. In attempting to determine the extent of this, it is of great value to be able to express numerically the relative strengths of the incoming year-classes. A method of accomplishing this has been devised. Using this method, it is shown that an unusual abundance of herring which was reported on the south-east coast of Vancouver Island in 1918–19 may be attributed to the advent of a particularly rich year-class, that of 1916, to the runs. In the same region the catch per seine per day's fishing was higher in 1933–34 than in 1934–35. In the former season the bulk of the catch was made up of a year-class of average strength at age III. and one considerably below average strength at age IV. In the latter season, however, the incoming year-class at age III. was much above average strength and the presence of this rich group most probably caused the increased reward per unit of fishing effort.

In the East Anglican herring-fishery of the North Sea it has been possible to forecast the length and age of the catches one year in advance with a reasonable degree of accuracy. Similar forecasts are being attempted for the major herring-fishery of British Columbia, but the chances for success are less because of the large percentage of the catch formed by the incoming year-class, concerning the abundance of which there is at present no advance information. With increased knowledge of the haunts of the immature fish, it may prove possible to make the necessary quantitative estimates of the contributions they will make to the fishery and, aided by suitable catch statistics, to make accurate forecasts of size, age, and eventually abundance, which will prove of considerable value to the industry.

Over a twenty-year period (1915–16 to 1934–35) certain trends in length and age composition have been noted in the major purse-seine fisheries. Both on the south-east coast of Vancouver Island and in Barkley Sound there has been a decrease in average length, a decrease in the spread of lengths about the average, a decrease in average age and in age spread, a decrease in the frequency of occurrence and persistence of dominant year-classes in the catch, and, associated with all of these changes, an increase in the percentage rate of mortality as calculated from age composition. The trend in age composition on the east coast is shown in Fig. 3 where a straight line has been fitted mathematically to the percentages

of fish over age IV. in the various years. On the average there has been a decrease from about 30 to 13 per cent. over the period. A similar or even greater decrease has occurred in Barkley Sound. Here the percentage of fish over age IV. was 57 and 54 per cent. in 1915–16 and 1916–17, whereas it has averaged but 13 per cent. over the recent six-year period of investigation. The change in the percentage rate of mortality from one age-group to the

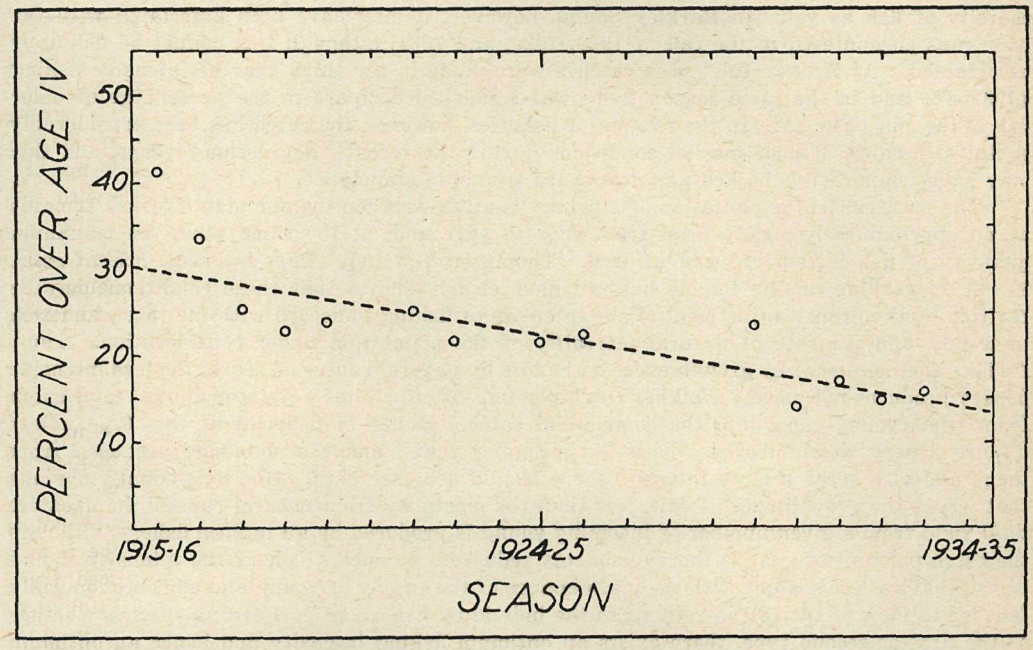

Fig. 3. Showing the trend in the percentage of fish older than IV. in samples from the south-east coast of Vancouver Island.

next is shown by the following figures for an early five-year and more recent six-year period in the east coast fishery:—

Ages.	1915–16 to 1919–20.	1929–30 to 1934–35.
III. to IV.	4.7	45.9
IV. to V.	49.6	62.8
V. to VI.	56.6	72.5
VI. to VII.	67.1	81.8
VII. to VIII.	72.0	83.8

There are two possible explanations of these trends in length and age composition. Either the actual numbers of the incoming young have been greater and the year-classes have been more equally represented, or the actual numbers of larger and older fish have been smaller and year-class variation has been similar in recent as compared with the earlier years of the fishery. The former might be caused by natural factors such as changes in the physical, chemical, or food conditions in the waters on the south-east or west coasts of Vancouver Island, the latter by an increased mortality imposed on the stock in these two areas by fishing activity. The latter seems to be the more plausible interpretation.

In several other marine fisheries, notably that for plaice in the North Sea, that for halibut off the British Columbia coast, and that for herring in South-eastern Alaska, similar trends in length and age composition have been caused by intensive exploitation and, because of the elimination of the larger and older fish, there have been serious declines in abundance. It must be pointed out that such trends in size and age are the natural consequences of the increased mortality caused by fishing activity and must happen to some extent in any fishery. In the three cases cited above, however, the increased exploitation has resulted in relatively

rapid trends to a point at which some measure of control has been advisable to maintain the fisheries at an economically feasible level of abundance.

Unfortunately, catch statistics which are sufficiently detailed to be used as a measure of abundance are not available for the British Columbia herring over the twenty-year period under consideration. The downward trend in length and age composition in the fishery on the east coast of Vancouver Island, if caused by fishing activity, has not resulted in any marked scarcity of fish as yet. In Barkley Sound, however, it may have been associated with the poor runs encountered in the fall of 1925, 1929, and 1931, although this cannot be definitely ascertained. At Sydney Inlet poor catches were made in the third year of intensive fishing (1933–34) and in the same season there was a marked decrease in the percentage of older fish in the run (Fig. 2). In the two major fisheries, however, the catch has been considerably curtailed because of poor market conditions during the recent " depression " years, and this may have temporarily checked any downward trends in abundance.

The most efficient exploitation of a fishery is attained when the abundance of fish remains at an approximately steady level from year to year and, at the same time, the maximum quantity of fish is removed and utilized. Thompson and Bell (*Rep. Internat. Fish. Comm. 8, 1934*), working on the Pacific halibut, have clearly shown that these conditions may be realized by the proper adjustment of the intensity of fishing to accord with the rate of growth in weight and the rate of natural mortality of the population under consideration. Thus, " where the increment by growth exceeds the loss by natural causes of death, the less intensive fishery produces not merely a higher catch per unit of effort, but a greater annual total catch from what young come into the commercial catch. Hence in fisheries of this type a less intense fishery should increase both the incoming young and the poundage produced from them, and vice versa a more intense fishery should decrease both. But it is equally obvious that where the growth-rate is slow, less than the mortality from natural causes, the greatest total yield from a given number of incoming young is produced by an intense fishery, although the catch per unit of gear is thereby sharply reduced. In such a fishery the intensity should be as great as is consistent with the maintenance of the supply of young and as is economically feasible in view of the fall in returns to the individual fisherman." For any species, whether of the first or second type, there exists an optimum fishing intensity and hence an optimum age composition at which the total yield of the fishery is a maximum. It is conceivable, therefore, that as long as the escapement of mature fish is sufficient to produce an approximately constant supply of young, a decline in age composition to this optimum level will be beneficial, as then fish are utilized which would otherwise die of " natural " causes.

In the British Columbia herring-fishery the optimum intensity of fishing is not known as yet. For its determination, investigations must be made into the rate of fishing mortality, the rate of natural mortality, and the rate of growth in weight. Fishing and natural mortalities may be determined by the tagging methods referred to previously. Sufficient data are on hand to calculate the rate of growth in weight. However, the problem of maintaining an optimum level of intensity will be more complicated than in the halibut-fishery because of variation in the contributions made by successive year-broods, but it will be less complicated than that in the Alaskan and other herring-fisheries because of the lesser extent of this variation. The administration and control of the fishery as a whole will also be complicated by the localization and varied sizes of the runs to the different fishing areas.

Until such investigations are made, it seems advisable to guard against intensive fishing similar to that in force between 1925 and 1929. It seems reasonably certain that because of this intensity the fishery has come to depend more and more on fish in their third year which are about to spawn for the first time. This seems to be particularly the case in Barkley Sound. Were fishing maintained at this high level of intensity, the ultimate effects are unknown, but it is quite conceivable that both the total catch and the catch per unit of fishing effort would decrease and, at the same time, the numbers of incoming young would be progressively reduced. In this event a state of commercial extinction, similar to that which has been caused in certain local populations of herring in South-eastern Alaska, would eventually result. Such a possibility should be foreseen and guarded against until the optimum level of fishing has been determined by scientific research.

PACK OF BRITISH COLUMBIA SALMON, SEASON 1935.

SHOWING THE ORIGIN OF SALMON CAUGHT IN EACH DISTRICT.

District.	Sockeye.	Springs.	Steel-heads.	Cohoes.	Pinks.	Chums.	Grand Total (Cases).
Fraser River	62,822	9,401	.....	24,950	111,328	8,227	216,728
Queen Charlotte Islands	.....	63	.....	5,461	1,479	86,298	93,301
Nass River	12,712	560	143	21,810	25,508	17,481	78,214
Skeena River	52,879	4,039	14	23,498	81,868	8,122	170,420
Rivers Inlet	135,038	429	39	8,375	4,554	7,136	155,571
Smith Inlet	31,648	216	24	1,201	4,412	12,427	49,928
Central Area	32,417	687	355	41,831	94,190	125,953	295,433
Vancouver Island	22,928	6,525	21	104,366	191,627	143,960	469,427
Totals	350,444	21,920	596	231,492	514,966	409,604	1,529,022

15,319 cases of bluebacks are combined with cohoes in this table.

5,610 cases of sockeye packed at Esquimalt are credited to the Fraser.

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1920 TO 1935, INCLUSIVE.

FRASER RIVER.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.
Sockeyes	62,822	139,238	52,465	65,769	40,947	103,692	61,569	29,299
Springs, Red	4,205	5,150	5,579	18,298	9,740	11,366	3,305	1,173
Springs, White	5,193	11,068	.....	10,403	.....	9,761	6,699	3,909
Chums	8,227	104,092	34,391	14,948	251	68,946	144,159	193,106
Pinks	111,328	2,199	92,746	385	13,307	30,754	158,208	2,881
Cohoes	24,950	11,392	13,901	16,815	8,165	25,585	40,520	27,061
Bluebacks and Steelheads	.....	.....	.....	23	657	27,879	12,013	795
Totals	216,728	273,139	199,082	126,641	73,067	277,983	426,473	258,224

	1927.	1926.	1925.	1924.	1923.	1922.	1921.	1920.
Sockeyes	61,393	85,689	35,385	39,743	31,655	51,832	39,631	48,399
Springs, Red	7,925	12,783	7,989	2,982	3,854	10,561	11,360	10,691
Springs, White	10,528	20,169	25,701	4,648	4,279	6,300	5,949	4,432
Chums	67,259	88,495	66,111	109,495	103,248	17,895	11,233	23,884
Pinks	102,536	32,256	99,800	31,968	63,645	29,578	8,178	12,839
Cohoes	24,079	21,783	36,717	21,401	20,173	23,587	29,978	22,934
Bluebacks and Steelheads	10,658	13,776	5,152	1,822	15	817	1,331	4,522
Totals	284,378	274,951	276,855	212,059	226,869	140,570	107,650	136,661

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1920 TO 1935, INCLUSIVE—*Contd.*

Skeena River.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.
Sockeyes	52,879	70,655	30,506	59,916	93,023	132,372	78,017	34,559
Springs	4,039	8,300	3,297	28,269	9,857	7,501	4,324	6,420
Chums	8,122	24,388	15,714	38,549	3,893	5,187	4,908	17,716
Pinks	81,868	126,163	95,783	58,261	44,807	275,642	95,305	209,579
Cohoes	23,498	54,456	39,896	48,312	10,637	29,617	37,678	30,194
Steelhead Trout	14	114	267	404	768	58	13	241
Totals	170,420	284,096	185,463	233,711	162,986	450,377	220,245	298,709

	1927.	1926.	1925.	1924.	1923.	1922.	1921.	1920.
Sockeyes	83,996	82,360	81,146	144,747	131,731	96,277	41,018	89,364
Springs	19,038	30,594	23,445	12,028	12,247	14,176	21,766	37,403
Chums	19,006	63,527	74,308	25,588	16,527	39,758	1,993	3,834
Pinks	38,768	210,081	130,079	181,313	145,973	301,655	124,457	177,679
Cohoes	26,326	30,208	39,168	26,968	31,967	24,699	45,033	18,068
Steelhead Trout	582	754	713	214	418	1,050	498	1,218
Totals	187,716	407,524	348,859	390,858	338,863	477,915	234,765	332,887

Rivers Inlet.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.
Sockeyes	135,038	76,923	83,507	69,732	76,428	119,170	70,260	60,044
Springs	429	436	449	459	325	434	342	468
Chums	7,136	895	677	944	429	492	989	3,594
Pinks	4,554	2,815	5,059	3,483	5,089	18,023	2,386	16,546
Cohoes	8,375	4,852	3,446	7,062	6,571	756	1,120	868
Steelhead Trout	39	79	82	29	32	105	29	7
Totals	155,571	86,000	93,220	81,709	88,874	138,980	75,126	81,527

	1927.	1926.	1925.	1924.	1923.	1922.	1921.	1920.
Sockeyes	65,269	65,581	192,323*	94,891	116,850	53,584	48,615	125,742
Springs	608	685	496	545	599	323	364	1,793
Chums	1,122	11,727	11,510	4,924	3,242	311	173	1,226
Pinks	671	12,815	8,625	15,105	10,057	24,292	5,303	25,647
Cohoes	2,094	7,286	4,946	1,980	1,526	1,120	4,718	2,908
Steelhead Trout	9	11	----------	----------	----------	82	97	----------
Totals	69,773	98,105	217,900	117,445	132,274	79,712	59,272	133,248

*** Including 40,000 cases caught in Smith Inlet and 20,813 cases packed at Namu.**

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1920 TO 1935, INCLUSIVE—*Contd.*

SMITH INLET, 1926–35.*

	1935.	1934.	1933.	1932.	1931.
Sockeyes	31,648	14,607	37,369	25,488	12,867
Springs, Red	214	164	354	46	122
Springs, White	2	.....	.....	2	.....
Cohoes	1,201	3,941	5,068	273	112
Pinks	4,412	6,953	19,995	1,148	824
Chums	12,427	15,548	8,841	165	133
Bluebacks and Steelheads	24	43	87	20	36
Totals	49,928	41,256	71,714	27,142	14,094

	1930.	1929.	1928.	1927.	1926.
Sockeyes	32,057	9,683	33,442	22,682	17,921
Springs, Red	268	18	108	270	73
Springs, White	22	60	178	79	39
Cohoes	1,460	275	230	2,990	164
Pinks	16,615	853	167	732	689
Chums	1,660	113	19	2,605	31
Bluebacks and Steelheads	103	12	6	8	.....
Totals	52,185	11,014	34,150	29,366	18,917

* Previously reported in Queen Charlotte and other Districts.

NASS RIVER.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.
Sockeyes	12,712	28,701	9,757	14,154	16,929	26,405	16,077	5,540
Springs	560	654	1,296	4,408	1,439	1,891	352	1,846
Chums	17,481	2,648	1,775	14,515	392	3,978	1,212	3,538
Pinks	25,508	32,964	44,306	44,629	5,178	79,976	10,342	83,183
Cohoes	21,810	9,935	3,251	7,955	8,943	1,126	1,202	10,734
Steelhead Trout	143	311	49	10	.....	84	.....	36
Totals	78,214	75,213	60,434	85,671	32,881	113,460	29,185	104,877

	1927.	1926.	1925.	1924.	1923.	1922.	1921.	1920.
Sockeyes	12,026	15,929	18,945	33,590	17,821	31,277	9,364	16,740
Springs	3,824	5,964	3,757	2,725	3,314	2,062	2,088	4,857
Chums	3,307	15,392	22,504	26,612	25,791	11,277	2,176	12,145
Pinks	16,609	50,815	35,530	72,496	44,165	75,687	29,488	43,151
Cohoes	3,966	4,274	8,027	6,481	7,894	3,533	8,236	3,700
Steelhead Trout	96	375	245	1,035	595	235	413	560
Totals	39,828	92,749	89,008	142,939	99,580	124,071	51,765	81,153

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1920 TO 1935, INCLUSIVE—*Contd.*

VANCOUVER ISLAND DISTRICT, 1927–35.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.	1927.
Sockeyes	22,928	27,282	18,397	27,611	22,199	24,784	10,340	14,248	24,835
Springs	6,525	1,630	4,875	10,559	4,055	3,431	1,645	2,269	6,769
Chums	143,960	210,239	96,642	70,629	16,329	177,856	162,246	303,474	220,270
Pinks	191,627	54,526	172,945	33,403	81,965	89,941	74,001	41,885	52,561
Cohoes	104,366	78,670	60,019	35,132	26,310	30,206	35,504	23,345	58,834
Steelheads and Bluebacks	21	.....	147	28,596	24,638	14,177	11,118	5,249	10,194
Totals	469,427	372,347	353,025	205,930	175,541	340,395	294,854	390,470	373,463

QUEEN CHARLOTTE AND OTHER DISTRICTS.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.
Sockeyes	32,417	20,438	26,106	21,685	29,071	39,198	35,331	59,852
Springs	750	2,374	4,416	3,514	1,608	1,852	1,020	2,806
Chums	212,251	155,371	135,590	167,011	34,570	143,781	111,263	341,802
Pinks	95,669	210,734	101,701	82,449	55,825	600,986	136,758	438,298
Cohoes	47,292	62,165	33,471	44,977	16,141	61,418	56,938	58,455
Steelheads and Bluebacks	355	733	827	591	466	1,204	575	609
Totals	388,734	451,815	302,111	320,227	137,661	848,439	341,873	901,822

	1927.	1926.	1925.	1924.	1923.	1922.	1921.	1920.
Sockeyes	60,533	62,383*	49,962	40,926	24,584	47,107	18,350	64,473
Springs	7,826	3,650	5,002	4,245	2,711	4,988	4,995	15,633
Chums	252,230	348,682	305,256	195,357	148,727	80,485	21,412	30,946
Pinks	36,481	380,243	120,747	141,878	146,943	113,824	14,818	247,149
Cohoes	47,433	47,183	40,269	26,031	29,142	31,331	18,203	33,807
Steelheads and Bluebacks	973	973	1,520	497	732	409	2,790	3,721
Totals	405,476	844,114	522,756	408,934	352,839	278,144	80,568	395,728

* Including 17,921 cases of sockeye packed at Smith Inlet.

STATEMENT SHOWING THE SOCKEYE-PACK OF THE ENTIRE FRASER RIVER SYSTEM FROM 1894 TO 1935, INCLUSIVE.

	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
Fraser River, B.C.	363,967	395,984	356,984	860,459	240,000	486,409	170,889	974,911	293,477
State of Washington	41,781	65,143	72,979	312,048	252,000	499,646	228,704	1,105,096	339,556
Totals	405,748	461,127	429,963	1,172,507	492,000	986,055	399,593	2,080,007	633,033

	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.
Fraser River, B.C.	204,809	72,688	837,489	183,007	59,815	74,574	585,435	150,432	58,487
State of Washington	167,211	123,419	837,122	182,241	96,974	170,951	1,097,904	248,014	127,761
Totals	372,020	196,107	1,674,611	365,248	156,789	245,525	1,683,339	398,446	186,248

	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.
Fraser River, B.C.	123,879	719,796	198,183	91,130	32,146	148,164	19,397	38,854	48,399
State of Washington	184,680	1,673,099	335,230	64,584	84,637	411,538	50,723	64,364	62,654
Totals	308,559	2,392,895	533,413	155,714	116,783	559,702	70,420	103,200	111,053

	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.
Fraser River, B.C.	39,631	51,832	31,655	39,743	35,385	85,689	61,393	29,299	61,569
State of Washington	102,937	48,566	47,402	69,369	112,023	44,673	97,594	61,044	111,898
Totals	142,598	100,398	79,057	109,112	147,408	130,362	158,987	90,343	173,464

	1930.	1931.	1932.	1933.	1934.	1935.			
Fraser River, B.C.	103,692	40,947	65,769	52,465	139,238	62,822	.....	.....	.....
State of Washington	352,194	87,211	81,188	126,604	352,579	54,677	.....	.....	.....
Totals	455,886	128,158	146,957	179,069	491,817	117,499	.....	.....	.....

STATEMENT SHOWING THE SOCKEYE-PACK OF THE PROVINCE, BY DISTRICTS, 1920 TO 1935, INCLUSIVE.

	1935.	1934.	1933.	1932.	1931.	1930.	1929.	1928.
Fraser River	62,822	139,238	52,465	65,769	40,947	103,692	61,569	29,299
Skeena River	52,879	70,655	30,506	59,916	93,023	132,372	78,017	34,559
Rivers Inlet	135,038	76,923	83,507	69,732	76,428	119,170	70,260	60,044
Smith Inlet	31,648	14,607	37,369	25,488	12,867	32,057	9,683	33,442
Nass River	12,712	28,701	9,757	14,154	16,929	26,405	16,077	5,540
Vancouver Island	22,928	27,282	18,397	27,611	22,199	24,784	10,340	14,248
Other Districts	32,417	20,438	26,106	21,685	29,071	39,198	35,331	26,410
Totals	350,444	377,844	258,107	284,355	291,464	477,678	281,277	203,542

	1927.	1926.	1925.	1924.	1923.	1922.	1921.	1920.
Fraser River	61,393	85,689	35,385	39,743	31,655	51,832	39,631	48,399
Skeena River	83,996	82,360	81,146	144,747	131,731	96,277	41,018	89,064
Rivers Inlet	65,269	65,581	192,323	94,891	116,850	53,584	48,615	125,742
Smith Inlet	22,682	17,921	33,764	11,435	11,864	.....	.....	.....
Nass River	12,026	15,929	18,945	33,590	17,821	31,277	9,364	16,740
Vancouver Island	24,835	25,070	14,757	15,618	12,006	15,147	6,936	6,987
Other Districts	37,851	44,462	16,198	20,579	12,720	47,107	18,350	64,473
Totals	308,052	337,012	392,518	369,603	334,647	295,224	163,914	351,405

STATEMENT SHOWING THE PILCHARD INDUSTRY OF THE PROVINCE, 1920 TO 1935, INCLUSIVE.

Year.	Total Catch.	Canned.	Used in Reduction.	Oil.	Meal.	Bait.
	Cwt.	Cases.	Cwt.	Gals.	Tons.	Bbls.
1920	88,050	91,929	.....	.....	.....	9,937
1921	19,737	16,091	.....	.....	.....	4,232
1922	20,342	19,186	.....	.....	.....	3,125
1923	19,492	17,195	.....	.....	.....	3,625
1924	27,485	14,898	.....	.....	.....	923
1925	318,973	37,182	220,000	495,653	2,083	4,045
1926	969,958	26,731	940,000	1,898,721	8,481	2,950
1927	1,368,582	58,501	1,310,000	2,610,120	12,145	1,737
1928	1,610,252	65,097	1,560,000	3,997,656	14,502	2,149
1929	1,726,851	98,821	1,654,575	2,856,579	15,823	1,538
1930	1,501,404	55,166	1,468,840	3,204,058	13,934	926
1931	1,472,085	17,336	1,456,846	2,551,914	14,200	1,552
1932	886,964	4,622	876,700	1,315,864	8,842	1,603
1933	120,999	2,946	119,545	275,879	1,108	20
1934	860,103	35,437	845,849	1,635,123	7,628	40
1935	911,411	27,184	896,586	1,634,592	8,666	521

PRODUCTION OF FISH OIL AND MEAL, 1920 TO 1935 (OTHER THAN FROM PILCHARD).

Year.	From Whales.			From other Sources.	
	Whalebone and Meal.	Fertilizer.	Oil.	Meal and Fertilizer.	Oil.
	Tons.	Tons.	Gals.	Tons.	Gals.
1920	503	1,035	604,070	466	55,669
1921	.....	.....	.....	489	44,700
1922	326	230	283,314	911	75,461
1923	485	910	706,514	823	180,318
1924	292	926	645,657	1,709	241,376
1925	347	835	556,939	2,468	354,853
1926	340	666	468,203	1,752	217,150
1927	345	651	437,967	1,948	250,811
1928	376	754	571,914	3,205	387,276
1929	417	780	712,597	3,626	459,575
1930	273	581	525,533	3,335	243,009
1931	.....	.....	.....	5,647	352,492
1932	.....	.....	.....	6,608	231,690
1933	249	223	509,310	5,583	497,643
1934	340	631	813,724	5,028	441,735
1935	211	354	426,772	7,509	588,629

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