PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

COMMISSIONER OF FISHERIES

FOR THE YEAR ENDED DECEMBER 31ST, 1923

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1924.

To His Honour WALTER CAMERON NICHOL,

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, 1923, with Appendices.

WILLIAM SLOAN,

Commissioner of Fisheries.

Provincial Fisheries Department,

Commissioner of Fisheries' Office,

Victoria, British Columbia, December 30th, 1923.

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FISHERIES COMMISSIONER'S REPORT FOR 1923.

Value of Canadian Fisheries and the Standing of Provinces.

The value of the fishery products of Canada for the year 1922 totalled $41,800,210, as against $34,931,935 in 1921 and $49,241,339 in 1920.

During the year 1922 British Columbia produced fishery products of the value of $18,849,658, or 45+ per cent. of the total fishery products of Canada. British Columbia again led all the Provinces of Canada in the value of her fishery products. Her output for 1922 exceeded that of Nova Scotia, the second in rank, by $8,640,400, and it exceeded that of all the other Provinces combined by $12,741,294.

The capital employed in fishing and fish-curing in Canada in 1922, including value of lands, buildings, equipment, vessels, boats, and gear, totalled $47,764,988, of which $22,763,813, or 47+ per cent., was employed in British Columbia.

The capital employed in agencies of fishery production in British Columbia in 1922 totalled $22,763,813, of which $15,994,036 was invested in plants, $4,992,462 in vessels and boats, and $1,777,315 in fishing-gear.

The persons engaged in actual fishing in Canada in 1922 totalled 57,880 and those employed in fish packing and curing totalled 16,577, a grand total of 74,457 persons, of whom 15,813, or 21+ per cent., were engaged in British Columbia.

British Columbia in 1922, with but 21 per cent. of the total persons engaged in the fisheries of Canada, produced 45 per cent. of the total value of the fishery products of Canada.

In 1922 there were 6,318 persons engaged in fish packing and curing plants in British Columbia and 9,495 in fishing, a total of 15,813. There were 149 fish packing and curing establishments, valued at $15,994,036, and their 6,318 employees received in wages and salaries $2,152,743.

The following statement gives in the order of their rank the value of the fishery products of the Provinces of the Dominion for the years 1919, 1920, 1921, and 1922:—

Value of Fisheries by Provinces. 1919, 1920, 1921, and 1922.

Province.	1919.	1920.	1921.	1922.
British Columbia	$25,301,607	$22,329,161	$13,953,670	$18,849,658
Nova Scotia	15,171,929	12,742,659	9,778,623	10,209,258
New Brunswick	4,979,074	4,423,745	3,690,726	4,685,660
Ontario	3,410,750	3,306,412	3,065,042	2,858,122
Quebec	4,258,731	2,592,382	1,815,284	2,089,414
Prince Edward Island	1,536,844	.....	924,529	1,612,599
Manitoba	1,008,717	.....	1,023,107	908,816
Saskatchewan	475,797	2,108,257	243,018	245,337
Alberta	333,330	.....	408,868	331,239
Yukon	8,800	.....	28,988	10,107
Total	.....	.....	.....	$41,800,210

The Species and Value of Fish caught in British Columbia.

The total value of each principal species of fish taken in British Columbia for the year ended December 31st, 1922, is given in the following statement:—

Salmon	$13,073,927
Halibut	3,918,441
Herring	850,734
Pilchards	106,055
Cod	212,871
Black cod	119,026
Flounders, brill, etc.	18,220
Carried forward	$18,299,274

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

Brought forward	$18,299,274
Soles	59,505
Crabs	60,765
Clams and quahaugs	68,206
Red cod	23,479
Oysters	33,081
Perch	16,404
Grayfish	10,085
Shrimps	8,201
Smelts	4,414
Octopus	3,297
Sturgeon	6,440
Skate	2,709
Oolachans	1,212
Fur-seals	18,600
Shad	232
Hake and cusk	49
Whiting	1,012
Whales	158,814
Fish-oils	22,655
Fish-meal	34,270
Fish-fertilizer	14,656
Miscellaneous	2,298
Total	$18,849,658

From the above statement it will be noted that the value of the salmon-fishery of British Columbia for 1922 totalled $13,073,927, or 69 per cent. of that year's total fishery products. The increase over 1921 in the value of salmon products was $4,496,325. The halibut-fisheries also show an increased value over that of the previous year of $282,365, notwithstanding that the total catch was not as large.

The foregoing data are derived from the "Fisheries Statistics of Canada," issued by the Dominion Bureau of Statistics.

THE SALMON-PACK OF 1923.

The salmon-pack of the Province in 1923 totalled 1,341,677 cases, as against 1,290,336 in 1922, 603,548 cases in 1921, 1,187,616 cases in 1920, and 1,393,156 cases in 1919. The gain in the pack of 1923 is largely due to an increase in the catch of pink and chum salmon. Seventy per cent. of the total pack consisted of these two species. The total pack consisted of 334,647 cases of sockeye, 27,142 cases of red and white springs, 440,932 cases of pinks, 418,055 cases of chums, 112,044 cases of cohoe, and 8,857 cases of bluebacks and steelheads.

THE 1923 SALMON-PACK BY DISTRICTS.

The Fraser River System.—The pack of all species of salmon in the Fraser River system in the Province totalled 226,869 cases, and consisted of 31,655 cases of sockeye, 8,133 cases of red and white springs, 20,173 cases of cohoe, 63,645 cases of pinks, and 103,248 cases of chums. The pack of pinks and chums constituted 74 per cent. of all grades.

The pack of sockeye in the State of Washington waters of the Fraser River system in 1923 totalled but 47,402 cases and was the smallest ever made in that section of the system.

The pack of sockeye in the entire Fraser River system in 1923 totalled but 79,057 cases, as against 100,398 cases in the preceding year, again showing that year after year the catch of sockeye declines.

The Skeena River Pack.—The catch of salmon from the Skeena River in 1923 totalled 338,863 cases, as against 477,915 in 1922, 234,765 in 1921, 332,887 in 1920, and 398,877 in 1919. The pack was made up of 131,731 cases of sockeye, 12,247 cases of springs, 31,967 cases of cohoe, 145,973 cases of pinks, 16,527 cases of chums, and 418 cases of steelheads. The total pack of 1923 was 139,052 cases less than in 1922. There was a gain of 35,454 cases of sockeye and a

loss of 155,682 cases of pinks. There were 900 gill-nets used on the Skeena this year, as against 1,109 in 1921 and 1,091 in 1922.

Rivers and Smith Inlets Pack.—The pack at Rivers Inlet, including 50 per cent. of the sockeye-catch at Smith Inlet, in 1923 totalled 132,274 cases, as against 80,367 cases in 1919 and 103,155 cases in 1918. The pack of sockeye totalled 116,850 cases. The pack of sockeye has only been exceeded since the record high pack of 1915 by the pack of 125,742 cases in 1920. As is usually the case at Rivers Inlet, almost the entire pack consisted of sockeye. There were 975 gill-nets engaged at Rivers Inlet in 1923, as against 1,000 in 1921 and 1,012 in 1922.

Nass River Pack.—The catch of salmon in the Nass River District produced a total pack of 99,580 cases, consisting of 17,821 cases of sockeye, 3,314 cases of springs, 44,165 cases of pinks, 25,791 cases of chums, 7,894 cases of cohoe, and 595 cases of steelheads. The sockeye-pack was the third smallest made in that district. It was 7,134 cases less than the average for the last ten years. There were 244 gill-nets used on the Nass in 1923, as against 338 in 1921 and 304 in 1922.

The Mild-cured-salmon Pack of 1923.—The four mild-curing fish-packing establishments operated in the Province in 1923 produced 1,819 tierces of salmon, totalling close to 1,465,200 lb. The pack was 700 tierces less than in 1922, owing to the fact that the bulk of the catch of springs made on the west coast of Vancouver Island was purchased by buyers who marketed the fish in fresh state in Seattle.

Salmon marketed in Frozen State.—The four food-fish-freezing plants operated in the Province in 1923 marketed 7,396,943 lb. of salmon. The tierced and fresh salmon products totalled 8,853,143 lb.

CONTRIBUTION TO THE LIFE-HISTORY OF THE SOCKEYE SALMON.

Dr. C. H. Gilbert's ninth contribution to the reports of the Department on the life-history of the sockeye salmon, which is issued herewith, contains an analysis of the sockeye runs to the principal waters of the Province for the year 1923. We therefore have an uninterrupted series of observations for twelve years. As it is the only extended record of the kind that has been made of any run of fish to any water, it is of high value to the fisherman and the student.

The following is a digest of Dr. Gilbert's present paper:—

The Fraser River Sockeye Run of 1923.

After the slight recovery in 1922 the run of sockeye to the Fraser River subsided to a still lower level in 1923. The total product of the run amounted to 79,057 cases, of which 31,655 were packed in British Columbia and 47,402 in Puget Sound. The Sound pack, as stated in previous reports, includes not only the sockeye bound for the Fraser, but also those headed for the Skagit River, in the State of Washington. The run to the Skagit, however, is not believed to be considered of importance. The number of sockeye known to have reached the spawning area of the Skagit in 1921 was reported to be unusually large, but totalled only 7,850 fish of both sexes. If we assume, Dr. Gilbert states, that the escapement comprised only 10 per cent. of the run—though it probably amounted to much more than 10 per cent.—the commercial yield of the Skagit in 1921 would be only some 7,000 cases. Not all of that can be credited to the operations of the Baker Lake Hatchery, for there would be some yield if the brood fish had been permitted to spawn naturally. The results of a hatchery are confined to the excess of production under hatchery methods over that which would obtain under natural production. This should be made the subject of vigorous investigation to ascertain whether the assumed increase of output is sufficient to warrant the very considerable expenditure incurred in the operation of hatcheries.

The One-year-in-lake Type in 1923.—The sockeye run to the Fraser in 1923 again consisted largely of the one-year-in-lake type. Of the total of 947 specimens examined, taken by random sampling from the traps along the south shore of Vancouver Island, 741, or 78 per cent., belonged to the one-year-in-lake type, while 80 per cent. belonged to that group in 1922.

A conspicuous feature in the run of 1923 was the great reduction in certain races which were formerly dominant and the relative increase in certain others. The Morris Creek race, the scales of which are characterized by a large sharply defined nucleus representing the growth in fresh water, occupied a very subordinate position, while the Birkenhead race, with its small nucleus and its very small first year's growth in the ocean (resembling in these respects the Rivers Inlet sockeyes), formed a much more conspicuous feature than in former years. A

characteristic scale of the Birkenhead race is reproduced in Dr. Gilbert's present paper. Such scales were extraordinarily numerous among the 1923 samples and give a satisfactory cross-section of the entire run. The number of males and females was remarkably even in this, as in all the other types of the Fraser River sockeye. The 1923 samples contained 379 males and 359 females of this type, there being a very slight excess of males in both the four- and the five-year classes. The reverse was the case in 1922, but the difference in both years is so slight as to be without significance. Taking all the year-classes in each group, there were in the 1923 samples 466 males and 477 females. This equality in the sexes among all the year-classes has been evident in the Fraser River run during the twelve years in which Dr. Gilbert has had the run under observation, and is to be considered a racial peculiarity of value in perpetuation of the salmon-supply of the Fraser. We may contrast with it the condition in such a race as the Rivers Inlet sockeye, in which, as Dr. Gilbert has shown, the four-year males are constantly more numerous than the females, and the five-year females more numerous than the five-year males. In seasons when the four-year Rivers Inlet fish greatly predominate, as was strikingly the case in 1923, the efficiency of the spawning reserve is seriously diminished by the relative scarcity of females, which in 1923 constituted only 32 per cent. of the run.

The average lengths of the four-year males and females in the Fraser run of 1923 are slightly greater than in the four years immediately preceding, but are still notably less than the average for the five years from 1914 to 1918. Dr. Gilbert has previously adduced similar figures to show apparent reduction in average size during recent years.

The Two-years-in-lake Type in 1923.—This group consists of individuals which reside for two full years in fresh water before their seaward migration. It has been shown in previous reports that they gain nothing by way of increased stature through the additional year in fresh water. They remain in the sea the same length of time as those which migrate seawards after a single year's lake residence. They are then no larger than the four- and five-year fish of the one-year-in-lake group, which are one year younger but have spent the same time in the sea. In fact, the former group at times averages even smaller, as was shown in Dr. Gilbert's report for 1922. In less degree that was also the case in 1923, as is shown by the following figures:—

Four years (one-year-in-lake group): Males, 24.3 inches; females, 23 inches.

Five years (two-years-in-lake group): Males, 24.2 inches; females, 22.9 inches.

Inasmuch, therefore, as the members of this group gain nothing by their additional year in fresh water, and as they are during that year constantly exposed to the depredations of trout and other enemies which must materially reduce their numbers, it is evident that the habit of prolonged residence in the lake before migrating must be considered a very undesirable one. Different river systems, even within the same general vicinity, vary widely in the relative abundance of this group. In the Fraser River it has never assumed large dimensions, only 7 per cent. in 1922 and 5 per cent. in 1923. Dr. Gilbert noted for the first time in 1922 that this group was very sparsely represented in the August part of the run, whereas in previous years there was a well-marked increase during August. The same was the case in 1923, when there was not only no increase in number in August, but the representation fell off materially from that which obtained during July. *It seems probable that this change in the constitution of the run is caused by progressive impoverishment and the practical disappearance of certain races in which the two-years-in-lake group were most abundantly represented.*

The Sea-type.—In his report for 1922 Dr. Gilbert called attention to the unusually large representation of the members of this group in the run of that year, of which they constituted 12 per cent. They were relatively even more numerous in 1923, forming 17 per cent. of the run. They were not only present in larger numbers, but they made their appearance earlier in the season than in previous years. The first were taken June 25th, one on July 2nd, and two more on July 5th. From the latter date on they appeared throughout July and August and five were included in a small sample on September 4th. It has been shown in previous years that this type is produced, to the apparent exclusion of any other, by the Harrison River spawning-beds. There are no lakes below these beds, and the areas of slack water below the spawning-grounds are apparently too shallow to afford protection during the winter. So the young have perforce adopted the habit of striking out for the open sea as soon as they have absorbed the yolk-sac and become free-swimming. Other portions of the watershed may also produce fry which run precociously to salt water, and may share the responsibility for the apparent increase

of fish to this group in the last two years, notwithstanding that no sea-type adults have been found in other beds. Advocates of hatchery methods may contend that young liberated from hatcheries at the time the yolk-sac is absorbed are more likely to adopt the immediate migration habit than is the case with fry that emerge from the gravels as the result of natural propagation. This may indeed be the fact, but there is no data bearing on the question.

The Rivers Inlet Sockeye Run of 1923.

The Rivers Inlet pack of 1923 mounted to the high level of 107,174 cases, the best exhibit made since 1920. It comes as a welcome break, Dr. Gilbert states, in a long series of declining runs and is the most promising indication for the future that recent years have produced.

The pack figures for 1918 and 1919, the two brood-years of 1923, gave no indication of a successful season, being 53,401 and 56,258 cases respectively. As estimated by pack statistics, they were thus among the very poorest seasons the inlet has ever produced. What, then, was the origin of the very favourable run of 1923? In this case the composition of the run itself and the reports from the spawning-beds during the brood-years are in entire harmony, and seem to afford a wholly satisfactory answer to the question. As reported by Fishery Overseer Stone, there was a good spawning escapement in 1917, but many of the tributaries were rendered wholly unproductive by tremendous freshets, which scoured out the gravels and destroyed the eggs. It seems probable that the destruction was even greater than that estimated at the time, and was responsible for the very poor showing during the two years (1921 and 1922) when the progeny of 1917 were due to return as mature fish.

In 1918, one of the brood-years for 1923, the spawning escapement was reported by Overseer Stone as very deficient and unpromising. Conditions in many tributaries were most unsatisfactory. The hatchery, which in most seasons was filled to its capacity of 14,000,000 eggs, secured but 3,000,000. In summing up the results of his investigations, Overseer Stone stated: "I am of the opinion the serious shortage of sockeye salmon disclosed on the beds, and amounting to approximately 25 per cent. of the 1913, 1914, and 1915 runs, will have a correspondingly serious effect on the number of adult sockeye which will return from this season's spawning." This prophecy, Dr. Gilbert states, has been abundantly verified in the runs of 1922 and 1923. In 1922 a portion of the 1918 progeny returned as four-year fish, and while they constituted a relatively large proportion of the run of that year, the total run was very small. In 1923 the remainder of the 1918 brood returned as five-year-olds, and while the run of 1923 was a large one, the five-year component was extremely small; 1918 thus contributed very little to it.

As regards the brood-year 1919, there were no reasons to anticipate any considerable yield from it, on the basis of its commercial yield as shown by the pack statistics. We have here, Mr. Gilbert states, a conspicuous example of the unreliable nature of such evidence. Turning to the reports from the spawning-beds of 1919, we find Overseer Stone emphasizing the abundance of salmon in practically all the tributaries of the spawning area of the Rivers Inlet run. Furthermore, the Dominion Department of Fisheries had since the previous year removed the log-jams which obstructed the mouths of some of the most important spawning-streams, and had thus opened up miles of spawning-grounds. Mr. Stone states that the exceptionally large number of sockeye salmon observed on the beds and schooled up in tens of thousands in the deeper portions of the tributaries precluded the opinion generally expressed by canners that the run of that year was a small one, and he expresses the belief that the spawning-beds were as abundantly seeded as in 1914 (89,890 cases) and more so than in 1915 (130,350 cases). On that basis he concluded that a favourable return should be expected in 1923 and 1924.

No more striking example could be found of the high value of the inspection of the spawning-beds of all the important sockeye-rivers of British Columbia, which was inaugurated by the Provincial Fisheries Department in 1902. The Rivers Inlet pack of 1923 was one of the largest in the history of the river, and it was comprised to a very exceptional degree of four-year fish derived from the spawning of 1919. The five-year component from the 1919 hatching is due in 1924, and the Rivers Inlet is pre-eminently a five-year stream. If these fish appear in their customary proportions and are accompanied by the four-year fish that may justly be expected from the almost unexampled spawning of 1920, there will be a satisfactory run in 1924.

In this connection it is interesting to note that in 1920 Mr. Stone was impressed by the large size of the spawning fish. The analysis of that season's run indicated that 95 per cent. of it consisted of fish in their fifth year, and it is to be remembered that in five-year fish of the Rivers

Inlet race the females are constantly in excess of the males, a condition much more favourable to successful spawning than where the males are in the majority. In 1919 the same observer called attention to the reverse condition, when the spawning fish were unusually small and the males outnumbered very largely the females, there being in some streams as many as three males to one female. The analysis of the run in 1919 determined that the five-year fish constituted but 54 per cent., instead of the 95 per cent. as in the following year.

The samples from which Dr. Gilbert made these estimates were chosen at random, without selection, from gill-net fish captured for commercial purposes. Taken in that way at frequent intervals during the entire run, they afford a satisfactory basis for estimating the contents of the season's catch. But neither the commercial catch nor the spawning escapement have the same constitution as the untouched run when it first approaches the mouth of the inlet. The use of gill-nets of a certain mesh effectually screens out the larger sizes in undue proportion and permits larger numbers of the smaller fish to escape to the spawning-grounds. All the Rivers Inlet three-year males (grilse) pass through the nets and are a detriment rather than an aid on the spawning-beds, where they have no useful function. The total result of limiting the size of the mesh by law is to ensure propagation to an undesirable extent from the smaller fish, which consist of the three-year-olds, which are all males, the four-year-olds, and the stunted five-year-olds. The four-year-olds contain a considerable proportion of excess males which are wholly useless on the spawning-beds and were better caught and put in tins. The common practice of limiting by law the size of mesh in sockeye gill-nets is not a conservation measure and may, Dr. Gilbert states, result detrimentally. As all members of the sockeye spawning run die at the close of the spawning season, it cannot be in the interest of conservation to save from capture the smaller individuals. It were far better to permit the fishermen to employ any mesh they consider most effective, and then secure an adequate escapement by some other method.

Among the many distinct racial peculiarities of the runs to the different sockeye-streams, that of size is the most prominent and most easily observed. To one acquainted with the appearance of the fish brought into the canneries from the large rivers and from the smaller streams of British Columbia and the adjacent districts of Alaska, the characteristic size attained from year to year by the various colonies would alone be sufficient demonstration of the independence of the runs and the prevalence of the habit of returning to the home stream at maturity. It was, Dr. Gilbert states, ignorance of the facts in this connection which led to the denial of the existence of independent races by certain scientists who early concerned themselves with this question. The conclusions reached on the basis of characteristic size and general appearance have now been supplemented by evidence of other racial differences in colour and quality of flesh, and in the prevalence of certain racial habits and tendencies, concerning which Dr. Gilbert's information has been derived wholly from microscopic examination of the scales. The total result has been such complete demonstration of the existence and distinctness of sockeye colonies that the conclusion is universally accepted, and the question is no longer in controversy.

There is almost certainly a small percentage of strays from one colony to another. Spring salmon planted many years ago in a certain river in New Zealand have gradually spread to other streams along a considerable stretch of coast. And in the case of sockeye salmon, spawning individuals are occasionally encountered in small streams which have no lakes in their course and no sockeye colonies. But the percentage of strays must be very small. In none of the marking experiments which have been carried through, in which thousands of marked fingerlings have been liberated, has the capture of any of them been recorded at maturity, except in the home stream. In the home stream itself hundreds of the marked fish have been recovered in a single season.

The Skeena River Sockeye Run of 1923.

The Skeena River sockeye-pack of 1923 was the fourth largest in the history of the industry, and it had for its two brood-years 1918, which produced a pack almost equally large, and 1919, which stands second in rank among the largest packs. So far as pack records can be relied upon, therefore, there was good reason to anticipate a successful season in 1923. The run of that year, Dr. Gilbert determined, was composed as usual almost wholly of four- and of five-year fish. Fifty-six per cent. of the entire run was made up of four-year fish, derived from eggs laid down in 1919, while 37 per cent. were in their fifth year, developed from the spawning of 1918. The remainder of the run, 7 per cent., were six-year fish from 1917.

The five-year fish were of two classes, one of which had remained in their native lake for a single year before passing to the sea, where they spent four years, while the other class had remained in fresh water for two years and had spent three years in the sea. The first of these two classes, Dr. Gilbert states, is always far more numerous than the second in the Skeena watershed, while the reverse is the case in the Nass.

As there was no inspection of the spawning-beds of the Skeena in 1918 and 1919, there is no direct evidence as to the spawning colonies in those years. It can only be inferred from the size of the packs that there was a good run in both years, with the probability of large spawning escapements, that of 1919 being probably the largest. This inference is borne out by the results of Dr. Gilbert's analysis of the run, for he found it composed more largely of four-year fish than is customary in the Skeena. He has shown that for a period of seven consecutive years they averaged 46 per cent. of the total run, and the five-year fish averaged 48 per cent. In 1923 the four-year component of the run consisted of 56 per cent. and the five-year 37 per cent., from which he concludes that 1919 was extraordinarily successful on the spawning-grounds.

In 1922 Dr. Gilbert noted that the Skeena run of that year averaged smaller in size and weight than usual in each year-group, and that was true also of the sockeye in Rivers Inlet and the Nass in 1922. He again records a similar tendency in the 1923 run. Each group was slightly below the normal length for the race in the last ten years, and the average weight of each age-group was distinctly less than the average for former years. It is interesting to note that in 1923, as in 1922, the dwarfing in the Skeena was accompanied by similar decrease in size in other rivers. The analysis shows that each group of sockeye averaged smaller in length and weight in 1923 than is usual in the Fraser River and Rivers Inlet.

In the Skeena River race, Dr. Gilbert notes, there is never such a wide inequality between the numbers of males and females in the different age-groups as is found in the run to Rivers Inlet, and, on the other hand, it is much more marked than in the Fraser River colonies. In the Skeena, as in Rivers Inlet, the four-year males outnumber the females, and the five-year females of the one-year-in-lake group are correspondingly more numerous than the males. On the other hand, the five-year group that spent two years in the lake before migrating to sea, and which at maturity agrees in size with the four-year fish of the one-year-in-lake type, agrees with the latter also in the proportions of the sexes represented. The males are more numerous than the females. The material examined by Dr. Gilbert in 1923 consisted of 2,029 individuals, of which 1,051 were males and 978 females. The slight excess of males is due to the unusual percentage of four-year fish, in which the males always predominate.

The Nass River Sockeye Run of 1923.

In his analysis of the sockeye run to the Nass River in 1923, Dr. Gilbert states that the run of 1923 again registered a decline from its former high average of production. The pack was 17,821 cases, a smaller yield than during any season of the twelve-year period from 1908 to 1919. The smallest pack for that twelve-year period was 21,816 cases. Comparing this record with the packs of the last four years—16,740, 9,364, 31,277, and 17,821—there is a basis for uneasiness concerning the future of the Nass River run of sockeye. In his previous reports Dr. Gilbert advanced certain reasons for fearing that the Nass run is declining in size and stated that the phenomenal run of 1922 is not conclusive of this question. An exceptionally favourable season in a declining run is not an unusual occurrence, but the experience of the next two or three years should demonstrate beyond doubt the truth of the matter.

The principal brood-year for the 1923 run to the Nass was 1918, as nearly 80 per cent. of the run were in their fifth year. The pack of 1918 was 21,816 cases, this being the smallest of the twelve-year period from 1908 to 1919. As no report was made of the Nass spawning-grounds in 1918, we are without information concerning the size of the spawning escapement.

The great complexity of the Nass River run is one of the best-marked characteristics of the race. In each year a portion of the young pass down to the sea immediately after they absorb the yolk-sac and become free-swimming, returning at maturity in their third or fourth year. A second group remain in the lake for one year after hatching, and after spending three or four years at sea mature in their fourth or fifth year. A third group spend two years in the lake and remain in the sea until five or six years of age. Still a fourth group postpone their descent to the sea until after spending three years in fresh water, and return to their native stream after maturing in their sixth or seventh year. In accordance with this history,

Dr. Gilbert finds individuals in the run ranging from three to seven years of age, and belonging to any one of the eight different year-classes above indicated. These eight-year classes were all represented in the 1923 run, and, in addition, a single individual was present in the samples taken from the 1923 run which belonged to a ninth-year class heretofore unreported. It was a male specimen, 27 inches long and weighing 8 lb., which had spent two years in the lake and five years at sea, returning to the spawning-beds in its seventh year. Another large male was also in its seventh year, having spent three years in the lake and four at sea, but this type had been previously noted from the Nass by Dr. Gilbert.

As in all previous years, the two-years-in-lake group in the 1923 run of sockeye to the Nass greatly outnumbered all the others, comprising 77 per cent., while the one-year-in-lake group made 16 per cent., the three-years-in-lake 6 per cent., and the sea-type 1 per cent.

Disregarding their early history in fresh water, and considering only their final age as indicative of the brood-year from which they were derived, Dr. Gilbert found 12 per cent. were in their fourth year and were derived from the spawning run of 1919, 77 per cent. were in their fifth year and came from the 1918 spawning, and 11 per cent. were in their sixth year, the progeny of the run of 1917. One individual was in its third year and two in their seventh. The total percentages of four-, five-, and six-year fish of these groups were identical in 1923 with the average of the past eleven years.

From the tables which Dr. Gilbert presents it will be noted that the 1923 lengths compare very closely with the general past averages in the Nass, while the weights were in each year-class below the average. This is most unusual, as weights and lengths usually agree in the Nass. But in Rivers Inlet in 1923 Dr. Gilbert found a like disparity, only in that case the reverse of the above was true, the lengths being well below the average and the weights were conspicuously above. In neither of these cases is there reason for doubting the reliability of the material examined. The lengths were taken with steel tapes and the weights with spring-balances which were tested as to accuracy.

The Bowser and Meziadin Lake Sockeye Colonies of the Nass River.

In his report for 1922 Dr. Gilbert noted the examination of fifteen specimens from the Bowser Lake spawning-grounds and ten from the Meziadin, and stated that while the material was wholly inadequate to produce conclusive evidence, it apparently indicated that separate sockeye colonies populated these two large lakes, distinguished in part by the fact that the young of the Meziadin colony spent more years in the lake before migrating to sea than did the young of the Bowser Lake colony. Of the ten Meziadin specimens, none had remained but a single year in that lake, 80 per cent. had spent two years there, and 20 per cent. had spent three. Of the fifteen Bowser Lake specimens, 40 per cent. had remained a single year in the lake, 60 per cent. had remained two years, and none had remained three years.

In 1923 the material collected by Inspector Hickman from the two lakes was more extensive, there being sixty-three specimens from the Meziadin Lake and forty-one from Bowser Lake, the latter being procured at the mouth of the Bowser River as the fish were entering. Examination of this new material verifies in general the differences previously pointed out as distinguishing the two colonies, and establishes certain other differences of undoubted significance, sufficient to warrant the asserting of the substantial independence of the two races, with the necessary corollary that the members of each race return at maturity to the same tributary in which they were hatched. This distinctness of tributary races has been demonstrated as yet in comparatively few watersheds, but the present instance is a clear-cut one and is worthy of being placed on record.

It is, Dr. Gilbert states, very difficult to procure from spawning fish the data required for racial discrimination. The differences between the races of sockeye are found largely in habits of growth and development, including differing percentages of the various year-classes present, and the average size of these classes. But data of this kind can be procured only in connection with the microscopic examination of the scales, as used in determination of age. Unfortunately, in the spawning fish, the scales have suffered such extensive erosion about the margins that age-determination is impossible and the segregation of the year-classes cannot be made. In the Meziadin and Bowser Lake material the age could not be ascertained in a single specimen.

The only data which these imperfect scales can furnish are those derived from an examination of the central or nuclear area of the scales, which records the growth as fry and fingerling

during their life in fresh water. Outside this nuclear area was found a portion of the scale still preserved sufficiently to furnish a record of the first and sometimes the second year's growth in the sea, but in no case was the margin of the scale kept intact at any point, and it was thus impossible to ascertain how much of the total record had been destroyed.

The record of the growth in fresh water is, however, of high value for the purpose, and is not infrequently sufficient in itself to establish the complete differentiation of races. The nuclear area of the scale establishes the length of time the individual remained as a resident of its native lake, whether one, two, or three years, or whether it belonged to the sea-type, which descends to the sea as soon as free-swimming. The proportions in which individuals of these different classes are found in a colony constitute racial peculiarities which are relatively constant from year to year, as is abundantly shown in the series of reports of Dr. Gilbert's analysis of the runs to the four principal sockeye-streams of British Columbia, from 1912 to 1923, inclusive.

From the nuclear area of the scale the relative size attained by fingerlings at the time they reach the sea can be determined. This may vary widely in the different sockeye strains, and is frequently so diagnostic that members of two races can be distinguished at a glance on inspection of the centres of the scales. Bowser and Meziadin Lake colonies exhibit differences belonging to both of these categories. They differ with regard to the average number of years they spend in fresh water before descent to the sea, and they differ in the size the young attain during their residence in fresh water. No specimen in the material from Meziadin and Bowser Lakes belonged to the sea-type. All had spent as fingerling either one, two, or three years in their native lake before seeking the sea. Considering the limited amount of material available, the correspondence in the two years is remarkably close and displays well the differing constitution of the runs to the two tributaries of the Nass River. A very large majority of the Meziadin fish belong to the two-years-in-lake type, while the Bowser Lake race contains a liberal percentage of one-year-in-lake fish.

As regards the size attained by the fingerlings of the two races, and the picture of the nucleus of the scale presented by the two, the difference was sufficiently striking to attract immediate attention. As the two-years-in-lake type was the only one in the samples from the two colonies possessing sufficient material for comparison, Dr. Gilbert confined his attention to that type. In the Meziadin specimens he found in the nuclear area of the scale a remarkable uniformity, as though all were in close conformity to the same pattern. The young had made a uniform vigorous growth in each of the two years in the lake. He found no subsidiary checks during the growing season, testifying to the occurrence of unfavourable conditions, and the annuli, or normal winter-checks, are unusually well defined.

The Bowser Lake nuclei are, on the other hand, much less regular in appearance, by no means giving the impression of being constructed after the same pattern, but suggesting the possibility of representing the progeny from a number of spawning-streams. Growth was less constant, there were more subsidiary checks, and the total growth attained is distinctly less than that attained by the specimen from Meziadin Lake.

Dr. Gilbert's report with its thirty-five tabulations is reproduced in the Appendix of this report. As the foregoing digest shows, it is of great economic importance.

REPORTS FROM THE SALMON-SPAWNING AREAS OF THE PROVINCE IN 1923.

Following the practice inaugurated in 1902, the Department again conducted investigations of the salmon-spawning beds of the Fraser, Skeena, and Nass Rivers and Rivers and Smith Inlets. Detailed reports from each section are reproduced in the Appendix of this report.

The Fraser River.—John P. Babcock, Assistant to the Commissioner, inspected the salmon-spawning beds of the Fraser River basin, his twenty-first annual inspection. He states:—

"As a result of the season's investigations I am of the opinion that the number of sockeye that spawned in the waters above Hell's Gate Canyon was less than in any previous year. In no section above that canyon were sockeye found in sufficient numbers to be worthy of notice. In many of the northern sections, where in earlier years large numbers spawned annually, not a sockeye was seen this year. . . . The number of sockeye which now reach the waters above Yale is so insignificant as to make a hunt for them fruitless. . . . It is again a pleasure," he states, "to record that the numbers of sockeye which this year reached the spawning-beds of the Birkenhead River, at the head of the Harrison-Lillooet Lakes section, equalled those seen there in any one of the last twenty-one years with which I am familiar.

The run to this section shows no decrease. It is the only section in the Fraser basin to which the run has not very materially decreased. The family of sockeye in the Birkenhead apparently enters the Fraser in August and has to run the same gauntlet of traps, gill and purse nets employed by fishermen as all other salmon have to do. Why the escapement of the Birkenhead sockeye is so much greater than the run to any other section is not therefore manifest. One cannot study present conditions in the Fraser without being impressed with the fact that the present run of sockeye largely consists of fish spawned in the Birkenhead River, Harrison, Cultus, and Pitt Lakes.

"For the first time since the fatal blockade of 1913 a few pink salmon were noted at Hell's Gate, several were found in Lake Creek at the outlet of Seton Lake, and others in tributaries of the Thompson—the first year since 1913 that any pink salmon have been reported in any section above Hell's Gate."

The Skeena River.—Fishery Officer Robert Gibson again inspected the salmon-spawning beds of the Skeena River. He found conditions in all tributaries as favourable as in any previous season. All were well seeded by sockeye this year.

Rivers Inlet Spawning Area.—Fishery Officer A. W. Stone was again detailed to an inspection of the spawning area of the salmon that run through Rivers Inlet—his eleventh yearly consecutive inspection of that area. In summarizing the results of his inspection of the many tributaries of Owikeno Lake, he states: "Summarizing the results of the inspection of the spawning-grounds of the Rivers Inlet run of salmon, I am able to record a highly satisfactory run of sockeye to all tributaries, with the possible exception of Sunday Creek, the Sheemahant and Nookins Rivers. All of them contained a run of fish which in my opinion exceeded the run in 1919. Since the spawning-beds in 1918 were found to be in such an unsatisfactory state, it must be assumed that the return of adult sockeye this year is due in a great measure to the spawn deposited in 1919. . . . Other factors responsible for the big run were the clearance of obstructions in rivers, the extension of the weekly closed season, and the extension of the closed fishing area at the head of Rivers Inlet."

Smith Inlet.—The spawning-beds of the salmon that run through Smith Inlet were again inspected by Fishery Overseer Stone. He found them all abundantly seeded. He summarizes his report as follows: "Summing up the results of my inspection, I am of the opinion that the run was even greater than that recorded in 1919 and equalled in numbers the great run of 1914. The run to Smith Inlet this year was the result of spawnings of 1918 and 1919. As the beds were poorly seeded in 1918 and abundantly seeded in 1919, it is concluded that the bulk of the run this year consisted of fish hatched from the seeding of 1919. The abundant seeding of 1923 should eventually give a big return."

SALMON- AND TROUT-EGG COLLECTIONS FOR HATCHERIES IN THE PROVINCE.

The Department is indebted to Major J. A. Motherwell, Chief Inspector of Fisheries for the Dominion Government in British Columbia, for the following statement of salmon- and trout-egg collections placed in hatcheries in the Province:—

Statement of Egg Collections placed in Hatcheries in British Columbia, 1923.

Hatchery.	Sockeye Salmon.	Spring Salmon.	Cohoe Salmon.	Pink Salmon.	Steel-head.	Cutthroat Trout.	Rainbow Trout.	Kamloops Trout.	Eastern Brook-trout.
Anderson Lake	8,505,000	.....	.....	.....	.....	.....	.....	.....	.....
Babine Lake	8,430,000	.....	.....	.....	.....	.....	.....	.....	.....
Cowichan Lake	.....	374,000	1,680,000	.....	18,300	115,800	.....	.....	6,200
Cultus Lake	5,190,000	.....	.....	.....	25,350	800	.....	.....	.....
Gerrard	.....	.....	.....	.....	.....	.....	.....	728,500	.....
Harrison Lake	15,258,000	677,000	50,000	4,003,900	.....	.....	.....	.....	.....
Kennedy Lake	5,306,000	.....	.....	.....	.....	.....	.....	.....	.....
Pemberton	30,629,000	.....	.....	.....	.....	.....	.....	.....	.....
Pitt Lake	3,447,000	22,000	278,000	.....	.....	.....	.....	.....	.....
Rivers Inlet	15,379,000	.....	.....	.....	.....	.....	.....	.....	.....
Skeena River	10,245,000	.....	.....	.....	.....	12,000	.....	.....	.....
Stuart Lake	.....	.....	.....	.....	.....	.....	20,500	.....	.....
Lloyds Creek	.....	.....	.....	.....	.....	.....	.....	1,512,000	.....
Nelson	.....	.....	.....	.....	.....	.....	.....	.....	969,000
Totals	102,389,000	1,073,000	2,008,000	4,003,900	43,650	128,600	20,500	2,240,500	975,200

APPENDICES.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON.

(No. 9.)

BY CHARLES H. GILBERT, PH.D., PROFESSOR OF ZOOLOGY, STANFORD UNIVERSITY.

1. THE FRASER RIVER SOCKEYE RUN OF 1923.

After the slight recovery in 1922 the Fraser River sockeye run subsided to a still lower level during the season of 1923. The total product of the run amounted to 79,057 cases, of which 31,655 were packed in British Columbia and 47,402 in Puget Sound. The Puget Sound pack, as we have stated in previous reports, includes not only the sockeyes bound for the Fraser River, but also those headed for the Skagit River, in the State of Washington. It is not believed, however, that the Skagit run is of any considerable importance. It is known to be intercepted by traps in Puget Sound, especially those on the West Beach, near the northern part of Whidbey Island. Whether the traps which extend out into the Strait of Fuca from the southern shores of Vancouver Island also capture Skagit River fish is not known, for the migration route has not been determined and it may or may not coincide with that of the Fraser River sockeyes.

The spawning escapement of sockeyes (bluebacks) to the Skagit River in 1921 was reported as unusually large in comparison with previous years, but it totalled only 7,850 fish of both sexes. If we assume that the escapement comprised only 10 per cent. of the run—it probably amounted to much more than 10 per cent.—the commercial yield of the Skagit in 1921 would be only about 7,000 cases. Not all of this can be credited to the operations of the Baker Lake Hatchery, for there would be some yield if the brood fish were permitted to spawn naturally. The results of a hatchery are confined to the excess of production under hatchery methods over that which would obtain under natural propagation. This should be made the subject of rigorous investigation to ascertain whether the assumed increase of output is sufficient to warrant the very considerable expenditures incurred in the operation of hatcheries.

(1.) THE ONE-YEAR-IN-LAKE TYPE.

This type, which always greatly prevails in the Fraser River, was present in the 1923 run in about the same proportions as during the previous season. Of the total of 947 specimens, taken by random sampling from the traps along the southern shore of Vancouver Island, 741, or 78 per cent., belonged to the one-year-in-lake type in 1923, while 80 per cent. belonged to this group in 1922. Only four of the 1923 samples were three-year-old males (grilse), and of the remainder, 86 per cent. were in their fourth and 14 per cent. in their fifth years, as compared with 88 and 12 per cent. in 1922.

A conspicuous feature in the run of 1923 was the great reduction in certain races which were formerly dominant and the relative increase in certain others. The Morris Creek race, the scales of which are characterized by a very large sharply-defined nucleus representing the growth in fresh water, occupied a very subordinate position, while the Birkenhead race, with its small scale nucleus and its very small first year's growth in the ocean (resembling in these respects the Rivers Inlet sockeyes), formed a much more conspicuous feature than in former years. A characteristic scale from the Birkenhead is figured in Paper No. 4 of this series, Fig. 2, and is reproduced here. Such scales were extraordinarily numerous among the 1923 samples, which gave a satisfactory cross-section of the entire run.

The number of males and females is remarkably even in this, as in all the other types of Fraser River sockeyes. Our 1923 samples contained 379 males and 359 females in this type, there being a very slight excess of males in both the four-year and the five-year classes. The reverse was the case in 1922, but the difference in both years is so slight as to be without significance. Taking all the year-classes in each group, there were in the 1923 samples 466 males and 477 females.

This equality in the sexes among all the year-classes has been evident in the Fraser River run during the twelve years in which we have had this run under observation, and is to be considered a racial peculiarity of value in the perpetuation of the salmon-supply of this river.

A characteristic scale from the Birkenhead sockeye, which were extraordinarily numerous in the 1923 run of the Fraser.

We may contrast with it the condition in such a race as the Rivers Inlet sockeyes, in which, as we have shown, the four-year males are constantly much more numerous than the females, and the five-year females more numerous than the five-year males. In seasons when the four-year Rivers Inlet fish greatly predominate, as was strikingly the case in 1923, the efficiency of the spawning reserve is seriously diminished by the relative scarcity of females, which in this year constituted only 32 per cent. of the run.

The grilse (three-year males) were in less than usual abundance, only four individuals appearing among our samples. In 1922, when they were slightly more numerous, none appeared prior to July 12th, but in 1923 the first one was taken on June 4th, the others July 19th, August 15th, and August 21st. They were respectively 16, 17, 18½, and 19½ inches long, and weighed 1½, 2, 3½, and 4 lb. Undoubtedly they were relatively more numerous on the spawning-beds than these figures indicate, for they pass freely through the meshes of the vast array of gill-nets at the mouth of the Fraser, while the larger sizes are in great measure captured.

The two tables which follow give lengths and weights of all four- and five-year specimens of the one-year-in-lake group which are included in our material.

The average lengths of the four-year males and females are slightly greater than in any of the four years immediately preceding, but are still notably less than the average for the five years from 1914 to 1918. We have previously adduced similar figures to show apparent reduction in average size during recent years. This is indicated in the figures which follow:—

	Males.	Females.
Average lengths for five years prior to 1919	25.0	24.1
Lengths in 1919	24.1	22.8
Lengths in 1920	24.1	23.2
Lengths in 1921	23.7	23.0
Lengths in 1922	24.0	23.0
Lengths in 1923	24.3	23.3

Table I.—Fraser River Sockeyes, One Year in Lake, 1923, from Vancouver Island Traps, grouped by Age, Sex, and Length.

Length in Inches.	Number of Individuals.				Total.
	Four Years old.		Five Years old.		
	Males.	Females.	Males.	Females.	
18½	....	1	....	....	1
19	2	....	....	....	2
19½	1	1	....	....	2
20	3	3	....	....	6
20½	1	8	....	....	9
21	5	6	....	....	11
21½	3	7	....	....	10
22	10	22	....	1	33
22½	14	36	2	....	52
23	23	56	....	1	80
23½	29	50	1	3	83
24	52	71	3	6	132
24½	55	37	4	11	107
25	43	7	8	7	65
25½	34	7	10	9	60
26	22	....	6	7	35
26½	15	....	8	1	24
27	9	....	8	....	17
27½	1	....	4	....	5
28	....	....	2	....	2
28½	1	....	....	....	1
Totals	323	312	56	46	737
Total each group	635		102		
Average lengths	24.3	23.3	25.8	24.8	24

Table II.—Fraser River Sockeyes, One Year in Lake, 1923, from Vancouver Island Traps, grouped by Age, Sex, and Weight.

Weight in Pounds.	Number of Individuals.				Total.
	Four Years old.		Five Years old.		
	Males.	Females.	Males.	Females.	
2½	....	1	....	....	1
3	3	4	....	....	7
3½	5	6	....	....	11
4	12	12	1	1	26
4½	9	20	....	....	29
5	20	37	1	....	58
5½	28	55	1	6	90
6	45	85	2	5	137
6½	42	51	8	8	109
7	56	32	4	11	103
7½	36	8	10	5	59
8	34	1	11	6	52
8½	14	....	5	4	23
9	13	....	6	....	19
9½	4	....	4	....	8
10	2	....	1	....	3
10½	....	....	2	....	2
Totals	323	312	56	46	737
Averages	6.6	5.8	7.8	6.9	6.4

(2.) THE TWO-YEARS-IN-LAKE TYPE.

This group consists of individuals which reside for two full years in fresh water before undertaking their downward migration to the sea. It has been shown in previous reports that they gain nothing by way of increased stature through the additional year in fresh water. They remain at sea the same length of time as those which migrate seawards after a single year in lake residence, and return as mature fish when five and six years old. They are then no larger than the four- and five-year fish of the one-year-in-lake group, which are one year younger but have spent the same time feeding at sea. In fact, the former group at times averages even smaller than its younger relative, as was shown in our report of the 1922 run (page 22). In less degree that was also the case in 1923, as shown by the following figures:—

Four years (one-year-in-lake group).....Males, 24.3 inches; females, 23.0 inches.
Five years (two-years-in-lake group).....Males, 24.2 inches; females, 22.9 inches.

Inasmuch, therefore, as the members of this group gain nothing by their additional year in fresh water, and as they are during that year constantly exposed to the depredations of trout and other enemies which must very materially reduce their numbers, it is evident that the habit of prolonged residence in the lake before migrating must be considered a very undesirable one. Different river systems, even within the same general vicinity, vary widely in the relative abundance of this group which they produce. In the Fraser River it never assumes large dimensions, constituting only 7 per cent. in 1922 and 5 per cent. in 1923. No four-year-old individuals were found among our material in 1923, of which 77 per cent. were in their fifth year and 23 per cent. in their sixth year.

We noted for the first time in 1922 that this group was very sparsely represented in the August part of the run, whereas in previous years there was a well-marked increase in numbers during August. The same was the case in 1923, when there was not only no increase in numbers during August, but the representation fell off materially from that which obtained during July. It seems probable that this change in the constitution of the run is caused by progressive impoverishment and the practical disappearance of certain races in which the two-years-in-lake group were most abundantly represented.

Table III.—Fraser River Sockeyes, Two Years in Lake, 1923, from Vancouver Island Traps, grouped by Age, Sex, and Length.

Length in Inches.	Number of Individuals.				
	Five Years old.		Six Years old.		Total.
	Males.	Females.	Males.	Females.	
19	....	1	....	....	1
19½	....	....	....	....	....
20	1	1	....	....	2
20½	....	....	....	....	....
21	....	....	....	....	....
21½	1	2	....	....	3
22	1	1	....	....	2
22½	....	....	....	1	1
23	....	5	....	....	5
23½	4	5	....	1	10
24	1	4	....	1	6
24½	3	1	1	....	5
25	3	....	....	....	3
25½	2	....	....	5	7
26	....	....	....	....	....
26½	1	....	....	....	1
27	....	....	....	1	1
27½	....	....	....	....	....
28	....	....	1	....	1
Totals	17	20	2	9	48
Average lengths	24.2	22.9	26.3	24.9	24.1

Table IV.—Fraser River Sockeyes, Two Years in Lake, 1923, from Vancouver Island Traps, grouped by Age, Sex, and Weight.

Weight in Pounds.	Number of Individuals.				
	Five Years old.		Six Years old.		Total.
	Males.	Females.	Males.	Females.	
3	....	2	....	....	2
3½	....	1	....	....	1
4	2	2	....	1	5
4½	1	1	....	1	3
5	1	1	....	....	2
5½	1	4	....	....	5
6	3	7	....	1	11
6½	5	2	1	1	9
7	2	....	....	2	4
7½	2	....	....	1	3
8	....	....	1	2	3
Totals	17	20	2	9	48
Averages	6.0	5.2	7.3	6.5	5.8

(3.) THE SEA-TYPE.

In our report for 1922 we called attention to the unusually large representation of the members of this group in the run of that year, of which they constituted 12 per cent. In 1923 they were relatively even more numerous, forming 17 per cent. of the run. Our material includes 158 sea-type individuals, of which 64, or 41 per cent., are in their third year and 94, or 59 per cent., are in their fourth year.

They were not only present in larger numbers, but they made their appearance earlier in the season than in previous years. The first to be included in our material was taken June 25th. Another was captured on July 2nd and two more on July 5th. From the latter date on they

appeared throughout July and August, and five were even included in a small sample taken at the end of the season on September 11th.

It has been shown in previous years that this type is produced to the apparent exclusion of any other by the Harrison River spawning-beds. There are no lakes below these, and the areas of slack water below the spawning-gravels are apparently too shallow to afford protection during the rigorous winter. So the young have perforce adopted the habit of striking out for the open sea as soon as they have absorbed the yolk-sac and become free-swimming. Other portions of the watershed may also produce fry which run precociously to salt water, and may share the responsibility for the apparent increase of fish of this group in the last two years. Advocates of hatchery methods may even contend that young fry liberated from hatchery-troughs at the time the yolk-sac is absorbed are more likely to adopt the immediate migration habit than is the case with fry that emerge from the gravels as the result of natural propagation. This may indeed be the fact, but we have no data bearing on the question.

Table V.—Fraser River Sockeyes, Sea-type, 1923, from Vancouver Island Traps, grouped by Age, Sex, and Length.

Length in Inches.	Number of Individuals.				Total.
	Three Years old.		Four Years old.		
	Males.	Females.	Males.	Females.	
20	1	....	....	....	1
20½	....	....	....	....	....
21	....	2	....	....	2
21½	....	4	....	....	4
22	4	7	1	....	12
22½	3	4	....	2	9
23	5	4	1	4	14
23½	10	5	....	16	31
24	6	2	2	14	24
24½	3	....	5	10	18
25	2	2	7	10	21
25½	....	....	10	3	13
26	....	....	2	....	2
26½	....	....	3	1	4
27	....	....	3	....	3
Totals	34	30	34	60	158
Total each group	64		94		
Average lengths	23.3	22.7	25.2	24.1	24.2

Table VI.—Fraser River Sockeyes, Sea-type, 1923, from Vancouver Island Traps, arranged by Age, Sex, and Weight.

Weight in Pounds.	Number of Individuals.				Total.
	Three Years old.		Four Years old.		
	Males.	Females.	Males.	Females.	
3½	1	2	....	....	3
4	....	1	....	....	1
4½	....	1	....	....	1
5	4	8	2	2	16
5½	2	10	1	9	22
6	9	6	2	16	33
6½	8	1	3	7	19
7	8	1	6	18	33
7½	2	....	7	5	14
8	....	....	7	2	9
8½	....	....	3	1	4
9	....	....	3	....	3
Totals	34	30	34	60	158
Average weights	6.2	5.3	7.3	6.5	6.4

2. THE RIVERS INLET SOCKEYE RUN OF 1923.

(1.) GENERAL CHARACTERISTICS AND AGE-GROUPS.

The Rivers Inlet pack of 1923 mounted to the high level of 107,174 cases, the best exhibit made since 1920. It comes as a welcome break in long series of declining runs, and is the most promising indication for the future that recent years have produced.

The pack figures for 1918 and 1919, the two brood-years of 1923, gave no indication of a successful season, being 53,401 and 56,258 cases respectively. As estimated by pack statistics, they were thus among the very poorest seasons the inlet has ever known. What, then, was the origin of the very favourable run of 1923? In this case the composition of the run itself and the reports from the spawning-beds during the brood-years are in entire harmony, and seem to afford a wholly satisfactory answer to the question.

In discussing spawning-bed records we must here correct an unfortunate error that was made in our report for 1922 (page 28), where the records for the two years 1917 and 1918 were interchanged. As reported by Overseer Stone, there was a good spawning escapement in 1917, but many of the tributaries were rendered wholly unproductive by tremendous freshets, which scoured out the gravels and destroyed the eggs. It seems probable that the destruction was even greater than was estimated at the time, and was responsible for the very poor showing during the two years (1921 and 1922) when the progeny of 1917 were due to return as mature fish.

In 1918, one of the brood-years for 1923, the spawning escapement was reported by Overseer Stone as very deficient and unpromising. Tributary after tributary, which could usually be depended on to contain fine spawning colonies, were signalled as "very unsatisfactory," or "containing nothing," "empty," or "a complete failure." The Rivers Inlet Hatchery, which has a capacity of 14,000,000 eggs and is in most seasons filled, was able to secure only about 3,000,000 eggs. Summing up the results of his investigation, Overseer Stone states: "I am of the opinion the serious shortage of sockeye salmon disclosed by a visit to these beds, and amounting to approximately 25 per cent. of the 1913, 1914, and 1915 runs, will have a correspondingly serious effect on the number of adult sockeye which will return from this season's spawning."

This prophecy has been abundantly verified in the runs of 1922 and 1923. In 1922 a portion of the 1918 progeny returned as four-year fish, and while they constituted a relatively large proportion of the run of that year, the total run was very small. In 1923 the remainder of the 1918 brood, maturing one year later, returned as five-year-olds, and while the run of 1923 was a large one, the five-year component was extremely small, and 1918 thus contributed very little to it.

As regards the brood-year 1919, we should have no reason, as we have seen, to anticipate any considerable yield from it, on the basis of its commercial yield as shown by the pack statistics. But we have here a conspicuous example of the unreliable nature of such evidence. Turning to the reports from the spawning-beds of 1919, we find Overseer Stone emphasizing the abundance of salmon in practically all the tributaries of Owikeno Lake. Furthermore, the Dominion Department of Fisheries had since the previous year removed the log-jams which were obstructing the mouths of some of the most important spawning-streams, and had thus opened up miles of spawning-gravels that otherwise would have been inaccessible. Mr. Stone states that the exceptionally large number of sockeye salmon which he observed spawning on the beds, and schooled up in tens of thousands in the deeper portions of the various tributaries, precluded the opinion generally expressed by the canning fraternity that the run of that year was a small one, and he expresses the belief that the spawning-beds were as abundantly seeded as in 1914 (89,890 cases), and more so than in 1915 (130,350 cases). On this basis he concludes that a favourable return should be expected in 1923 and 1924.

No more striking example could be found of the high value of the inspection of the spawning-beds of all the important sockeye-rivers of British Columbia, which was inaugurated by Mr. J. P. Babcock and is made annually under his direction. The Rivers Inlet pack of 1923 was one of the largest in the history of the river, and it was composed to a very exceptional degree of four-year fish derived from the spawning of 1919. The five-year component from the 1919 hatching is due in 1924, and Rivers Inlet is pre-eminently a five-year stream. If these fish appear in their customary proportion and are accompanied by the four-year fish that may

justly be expected from the almost unexampled spawning of 1920, we should experience a very satisfactory run in 1924.

It is interesting to note that in 1920 Mr. Stone was impressed by the large size of the spawning fish. Our analysis of that season's run indicated that 95 per cent. of it consisted of fish in their fifth year, and it is to be remembered that in five-year fish of the Rivers Inlet race the females are constantly in excess of the males, a condition much more favourable to successful spawning than where the males are in the majority. In 1919 Mr. Stone called attention to the reverse condition, when the spawning fish were unusually small. He also noted that males very largely outnumbered the females, there being in some tributaries as many as three males to one female. In our analysis of the run of 1919 we found the five-year fish to constitute but 54 per cent., instead of 95 per cent. as in the following year.

The samples from which we make these estimates are chosen in a random fashion, without selection, from the gill-net fish captured for commercial purposes. Taken in this way at frequent intervals during the run, they afford a satisfactory basis for estimating the contents of the commercial catch. But neither the commercial catch nor the spawning escapement have the same constitution as the untouched run when it first approaches the mouth of the inlet. The use of gill-nets of a certain mesh effectually screens out the larger sizes in undue proportion, and permits larger numbers of the smaller fish to escape to the spawning-grounds. All the Rivers Inlet three-year males (grilse) pass through the nets and are a detriment rather than an aid on the spawning-beds, where they have no useful function. The total result of limiting the size of the mesh by law is to ensure propagating to an undesirable extent from the smaller fish, which consist of the three-year-olds, which are all males, the four-year-olds, and the stunted five-year-olds. The four-year-olds contain a considerable proportion of excess males which are wholly useless on the spawning-beds and were better put in tins. The common practice of limiting by law the size of mesh in sockeye gill-nets is not a conservation measure and may even result detrimentally. As all members of the sockeye spawning run die at the close of the spawning season, it cannot be in the interest of conservation to save from capture the smaller individuals. It were far better to permit the fishermen to employ any mesh they consider most effective, and then secure an adequate escapement by some other method.

As in all previous years, the run of 1923 consisted almost exclusively of sockeyes of the one-year-in-lake type. Our samples, taken at intervals throughout the season, consisted of 807 individuals. Of these, 782 were of the prevailing type, having remained one year in fresh water after hatching, before passing down to the sea, eighteen belonged to the two-year-in-lake type, and seven were of the sea-type, having left for the ocean as soon as free-swimming. The following table (No. VII.) concerns itself only with the one-year-in-lake group. The seven sea-type individuals comprised two in their third year, both males, and five in their fourth year, three males and two females. It will be shown in a later table that the two-years-in-lake group is represented by fifteen males and two females of the five-year class and a single male specimen of the six-year class.

Table VII.—Percentages of Four- and Five-year Rivers Inlet Sockeyes, in Runs from 1912 to 1923, with Broods from which they were derived.

Run of the Year.	Percentage, Four and Five Years old.	Brood-year from which derived.
1912 (112,884 cases)	5 yrs. 79% 4 yrs. 21%	1907 (87,874 cases). 1908 (64,652 cases).
1913 (61,745 cases)	5 yrs. 20% 4 yrs. 80%	1909 (89,027 cases).
1914 (89,890 cases)	5 yrs. 65% 4 yrs. 35%	1910 (126,921 cases).
1915 (130,350 cases)	5 yrs. 87% 4 yrs. 13%	1911 (88,763 cases).
1916 (44,936 cases)	5 yrs. 76% 4 yrs. 24%	1912 (112,884 cases).
1917 (61,195 cases)	5 yrs. 67% 4 yrs. 33%	1913 (61,745 cases).
1918 (53,401 cases)	5 yrs. 43% 4 yrs. 57%	1914 (89,890 cases).
1919 (56,258 cases)	5 yrs. 54% 4 yrs. 46%	1915 (130,350 cases).
1920 (121,254 cases)	5 yrs. 95% 4 yrs. 5%	1916 (44,936 cases).
1921 (46,300 cases)	5 yrs. 51% 4 yrs. 49%	1917 (61,195 cases).
1922 (60,700 cases)	5 yrs. 18% 4 yrs. 82%	1918 (53,401 cases).
1923 (107,174 cases)	5 yrs. 24% 4 yrs. 76%	1919 (56,258 cases).

(2.) LENGTHS AND WEIGHTS AS RACIAL CHARACTERISTICS.

Among the many distinct racial peculiarities of the runs to the different sockeye-streams, that of size is most prominent and most easily observed. To one acquainted with the appearance of the fish brought into the canneries from the larger rivers and from the smaller streams of British Columbia and the adjacent districts of Alaska, the characteristic sizes attained from year to year by the various colonies would alone be sufficient demonstration of the independence of the runs, and the prevalence of the habit of returning to the home stream at maturity. It was ignorance of the facts in this connection which led to the denial of the existence of independent races by certain scientists who early concerned themselves with this question.

The conclusions reached on the basis of characteristic size and general appearance have now been supplemented by evidence of other racial differences in colour and quality of flesh, and in the prevalence of certain racial habits and tendencies concerning which our information has been derived wholly from microscopic examination of the scales. The total result has been such complete demonstration of the existence and distinctness of sockeye colonies that the conclusion is universally accepted, and the question is no longer in controversy.

There is almost certainly a small percentage of straying from one colony to another. Chinook salmon planted many years ago in a certain river in New Zealand have gradually spread to other streams along a considerable stretch of coast. And in the case of sockeye salmon, spawning individuals are occasionally encountered in small streams which have no lakes in their course and no sockeye colonies. But the percentage of strays must be very small. In none of the many marking experiments which have been carried through, in which thousands of

marked fingerlings have been liberated, has the capture of any of them been recorded at maturity, except in the home stream. In the home stream itself hundreds of the marked fish have been recaptured in a single season.

The Rivers Inlet race is the smallest of any of those inhabiting the important sockeye-streams of British Columbia. Comparing the average lengths for a period of ten years of sockeyes belonging to the same year-classes in Rivers Inlet, the Skeena and the Nass, we obtain the following results:—

Table VIII.—Average Lengths in Inches, for Ten Years, of Sockeyes One-year-in-lake Class from Rivers Inlet, the Skeena, and the Nass.

	Rivers Inlet.	Skeena.	Nass.
Four-year males	22.8	24.0	24.3
Four-year females	22.6	23.3	23.5
Five-year males	25.4	25.8	26.0
Five-year females	24.7	24.9	24.9

In addition to the smaller average lengths of Rivers Inlet fish, there is less difference between the lengths of four-year males and females than we find in any other stream. This has been a constant factor throughout our series of observations. In Table X. it is shown that the difference between average lengths of males and females of this group in six years out of eleven did not exceed one-tenth of an inch, and in only two of the eleven years did it exceed two-tenths.

Not only are the sockeyes of the Rivers Inlet race shorter than those of the Skeena and the Nass, but they are comparatively deeper and plumper, as is shown in the following table giving average weights over a term of years:—

Table IX.—Average Weights in Pounds, for Nine Years, of Sockeyes One-year-in-lake Class from Rivers Inlet, the Skeena, and the Nass.

	Rivers Inlet.	Skeena.	Nass.
Four-year males	5.2	5.7	5.9
Four-year females	5.1	5.2	5.3
Five-year males	7.0	6.8	7.0
Five-year females	6.5	6.1	6.2

It will be noted again, on the basis of weights, that the four-year males and females of the Rivers Inlet race are of almost equal size, while in other races the females are decidedly smaller. Despite their shorter stature, the Rivers Inlet five-year-olds equal or exceed in weight those from the Skeena and the Nass. The female four-year-olds from Rivers Inlet are but little lighter than are those from the other two rivers, and only the four-year males are greatly below the averages from the other streams. The substantial equality in size of males and females of the four-year group in Rivers Inlet seems to be due to the proportionally smaller size of the males rather than to the larger size of the females in this race.

Table X.—Average Length in Inches of Rivers Inlet Sockeyes for Eleven Years.

	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1921.	1922.	1923.	Average.
Four-year males	23.2	22.9	23.0	22.9	22.9	22.5	22.3	22.4	22.9	22.5	22.4	22.7
Four-year females	22.8	23.0	22.8	22.8	22.8	22.3	22.5	22.3	22.6	22.4	22.3	22.6
Five-year males	25.8	25.9	25.9	26.0	25.8	25.0	24.9	24.8	25.2	24.6	24.6	25.3
Five-year females	24.6	25.2	25.2	25.1	25.0	24.4	24.5	24.4	24.2	24.2	24.1	24.6

It is apparent from the above table that the Rivers Inlet sockeyes have for several years averaged smaller than they had previously done. This is made clearly evident by the following figures:—

	Inches.
Four-year males, average length, 1912 to 1916	23.0
Four-year males, average length, 1918 to 1923	22.5
Four-year females, average length, 1912 to 1916	22.8
Four-year females, average length, 1918 to 1923	22.4
Five-year males, average length, 1912 to 1916	25.9
Five-year males, average length, 1918 to 1923	24.8
Five-year females, average length, 1912 to 1916	25.0
Five-year females, average length, 1918 to 1923	24.3

It will be noted that the four-year males and females, as well as the five-year males and females for 1923, are slightly smaller than the averages for the last five years.

Table XI.—Average Weight in Pounds of Rivers Inlet Sockeyes for Nine Years.

	1914.	1915.	1916.	1917.	1918.	1919.	1921.	1922.	1923.	Average.
Four-year males	5.4	5.3	5.5	5.0	4.9	4.9	5.2	6.0	5.0	5.2
Four-year females	5.2	5.1	5.0	4.9	5.1	4.8	4.9	5.9	4.8	5.1
Five-year males	7.3	7.3	7.6	6.6	6.7	6.3	6.9	7.4	6.5	7.0
Five-year females	6.8	6.6	6.7	6.2	6.7	5.9	6.0	7.0	5.9	6.4

Table XII.—Rivers Inlet Sockeyes, Run of 1923, grouped by Age, Sex, and Length, and by their Early History.

Inches.	Number of Individuals.								Total.
	One Year in Lake.				Two Years in Lake.				
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
19½	....	1	....	....	....	....	....	....	1
20	1	....	....	....	....	....	....	....	1
20½	7	....	....	....	....	....	....	....	7
21	37	10	2	....	....	....	....	....	49
21½	74	26	....	....	1	....	....	....	101
22	96	47	3	1	4	....	....	....	151
22½	71	43	....	6	3	1	....	....	124
23	59	30	6	15	....	....	....	....	110
23½	29	6	6	19	3	1	....	....	64
24	24	5	11	37	2	....	....	....	79
24½	14	2	6	20	1	....	....	....	43
25	4	1	6	21	1	....	....	....	33
25½	6	....	3	3	....	....	....	....	12
26	1	....	2	4	....	....	1	....	8
26½	....	....	6	2	....	....	....	....	8
27	....	....	1	1	....	....	....	....	2
27½	....	....	4	....	....	....	....	....	4
28	....	....	2	....	....	....	....	....	2
30	....	....	1	....	....	....	....	....	1
Totals	423	171	59	129	15	2	1	....	800
Ave. length	22.4	22.3	24.6	24.1	23.0	23.0	26.0	....	22.8

Table XIII.—Rivers Inlet Sockeyes, Run of 1923, grouped by Age, Sex, and Weight, and by their Early History.

Pounds.	Number of Individuals.								Total.
	One Year in Lake.				Two Years in Lake.				
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
3	....	1	....	....	....	....	....	....	1
3½	1	2	....	....	....	....	....	....	3
4	39	14	2	....	....	....	....	....	55
4½	146	75	1	6	4	1	....	....	233
5	124	46	8	20	4	1	....	....	203
5½	57	25	11	32	5	....	....	....	130
6	40	7	11	37	1	....	....	....	96
6½	6	1	6	18	1	....	....	....	32
7	4	....	4	10	....	....	....	....	18
7½	5	....	3	1	....	....	1	....	10
8	1	....	9	3	....	....	....	....	13
8½	....	....	....	2	....	....	....	....	2
9	....	....	1	....	....	....	....	....	1
9½	....	....	1	....	....	....	....	....	1
10	....	....	1	....	....	....	....	....	1
10½	....	....	....	....	....	....	....	....	....
11	....	....	1	....	....	....	....	....	1
Totals	423	171	59	129	15	2	1	....	800
Averages	5.0	4.8	6.5	5.9	5.2	4.8	7.5	....	....

(3.) DISTRIBUTION OF THE SEXES.

In the runs of 1921 and 1922, both four-year and five-year males were in less than their normal numbers for the Rivers Inlet race. The four-year males were 65 and 66 per cent. of the total four-year group, as compared with 75 per cent., the average for the five years preceding. The five-year males were in each of the two years 38 per cent. of their group, as compared with an average of 45 per cent. for the five years preceding. In no previous year that has come under our observation has there been such a falling-off in number of males below what is usual in the Rivers Inlet colony.

In the run of 1923 the same tendency continues, less marked among the four-year fish, and still further emphasized in the five-year group, in which there were two females to one male. As the four-year fish constituted 76 per cent. of the entire run, there were still many more males than females on the spawning-beds, the percentage of males in the entire run being 62. We have elsewhere called attention to the fact that this is an undesirable condition to which the Rivers Inlet race is peculiarly liable because of the wide disparity of the sexes in four- and five-year fish, and the wide diversity in different years in the representation of these two year-classes.

Table XIV.—Relative Numbers of Males and Females, Rivers Inlet Sockeyes, One-year-in-lake Type, 1916 to 1923.

	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.
Average percentages—								
Four-year males	74	75	74	79	74	65	66	71
Four-year females	26	25	26	21	26	35	34	29
Five-year males	40	42	49	45	48	38	38	33
Five-year females	60	58	51	55	52	62	62	67
Percentage total males	52	53	66	58	49	51	61	62
Percentage total females	48	47	34	42	51	49	39	38

3. THE SKEENA RIVER SOCKEYE RUN OF 1923.

(1.) GENERAL CHARACTERISTICS AND THE YEAR-CLASSES.

The Skeena River sockeye-pack of 1923 was the fourth to the largest in the history of the industry, and it had for its two brood-years 1918, which produced a pack almost equally large,

and 1919, which stands second in rank among the largest packs. So far as pack records can be relied upon, therefore, we had good reason to anticipate a successful season for 1923.

The run of 1923 was composed as usual almost wholly of four- and of five-year fish. Fifty-six per cent. of the entire run was made up of four-year fish, derived from eggs laid down in 1919, while 37 per cent. were in their fifth year and were developed from eggs deposited in 1918. The remainder of the run (7 per cent.) was composed of six-year fish, with 1917 as their brood-year.

The five-year fish were of two classes, one of which had remained in their native lake for a single year before passing down to the sea, in which they had spent four years, while the other class had remained in fresh water for two years and had spent three years at sea. The first of these two classes is always far more numerous than the second in the Skeena watershed, while the reverse is the case in the Nass.

As there was no inspection of the spawning-beds of the Skeena River in 1918 or 1919, we have no direct evidence as to the size of the spawning colonies in those two years. We can only infer from the size of the packs that there were good runs in both years, with the probability of large spawning escapements, that of 1919 being probably the largest. This inference is borne out by the results of our analysis of the run, for we find it to be composed more largely of four-year fish than is customary in this river-basin. In Table XVI. it is shown that the four-year fish for a period of seven consecutive years averaged 46 per cent. of the total run and the five-year fish of the two classes averaged 48 per cent. In 1923 the four-year component of the run made 56 per cent. and the five-year portion 37 per cent. Evidently 1919 was extraordinarily successful on the spawning-grounds, doubtless because of the magnitude of the run with a generous spawning escapement.

Table XV.—Percentages of Four- and Five-year Skeena River Sockeyes that spent One Year in Lake, in Runs of Successive Years.

Run of the Year.	Percentage, Four and Five Years old.	Brood-years from which derived.
1912 (92,498 cases)	5 yrs. 43% 4 yrs. 57%	1907 (108,413 cases). 1908 (139,846 cases).
1913 (52,927 cases)	5 yrs. 50% 4 yrs. 50%	1909 (87,901 cases).
1914 (130,166 cases)	5 yrs. 75% 4 yrs. 25%	1910 (187,246 cases).
1915 (116,553 cases)	5 yrs. 64% 4 yrs. 36%	1911 (131,066 cases).
1916 (60,923 cases)	5 yrs. 60% 4 yrs. 40%	1912 (92,498 cases).
1917 (65,760 cases)	5 yrs. 62% 4 yrs. 38%	1913 (52,927 cases).
1918 (123,322 cases)	5 yrs. 59% 4 yrs. 41%	1914 (130,166 cases).
1919 (184,945 cases)	5 yrs. 69% 4 yrs. 31%	1915 (116,553 cases).
1920 (90,869 cases)	5 yrs. 82% 4 yrs. 18%	1916 (60,923 cases).
1921 (41,018 cases)	5 yrs. 24% 4 yrs. 76%	1917 (65,760 cases).
1922 (100,667 cases)	5 yrs. 19% 4 yrs. 81%	1918 (123,322 cases).
1923 (131,731 cases)	5 yrs. 34% 4 yrs. 66%	1919 (184,945 cases).

Table XVI.—Percentages of the Principal Year-classes, Skeena River Sockeyes, from 1916 to 1923.

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
Averages, 1916 to 1922	46	39	9	6

(2.) LENGTHS AND WEIGHTS.

In the following tables, XVII. to XXIII., are given length and weight frequencies for over 2,000 individuals of the 1923 run, taken at random without selection on a number of dates spaced throughout the season. The average size of each year-class is given, and also data for comparing the 1923 run with those of former years. In 1922 we noted that the Skeena run of that year averaged smaller than usual in each age-group, and that this was true also for the sockeyes of Rivers Inlet and the Nass. We have to record a similar tendency in the run of 1923. In Table XX. it is shown that each year-group was slightly below the normal length for the race, as determined by averages over a term of ten years. The condition was very similar to that existing in 1922, but the reduction in length was possibly a trifle less. In Table XXII. a similar comparison is made, using average weights of the age-groups instead of the lengths. The results are the same as those obtained from a consideration of the lengths. The average weight of each age-group is distinctly less than the average for former years. They are even smaller than for 1922.

It is interesting to note that in 1923, as in 1922, the dwarfing in the Skeena was accompanied by similar decrease in size in other rivers. Other sections of this report show that each group of sockeyes averaged smaller in 1923 than is usual in the Fraser River and in Rivers Inlet. The Nass was the only exception to this among the larger sockeye-streams of British Columbia.

Table XVII.—Skeena River Sockeyes, 1923, grouped by Age, Sex, and Length.

Length in Inches.	Number of Individuals.								
	One-year-in-lake Type.				Two-years-in-lake Type.				Total.
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
19	1	....	....	....	....	....	....	....	1
19½	1	....	....	....	....	....	....	....	1
20	1	....	....	....	....	....	....	....	1
20½	1	....	....	....	1	....	....	....	2
21	8	2	....	....	....	1	....	....	11
21½	16	12	....	....	2	2	....	....	32
22	28	43	....	2	3	3	....	1	80
22½	50	78	1	4	5	17	....	3	158
23	90	121	....	18	15	17	....	6	267
23½	145	104	7	39	11	19	....	9	334
24	152	65	15	71	20	9	5	14	351
24½	104	22	23	90	20	4	5	17	285
25	65	4	35	71	14	3	9	22	223
25½	21	2	43	50	3	....	8	7	134
26	6	1	40	16	....	....	14	2	79
26½	....	....	24	6	....	....	8	....	38
27	....	....	15	1	....	....	2	....	18
27½	....	....	12	....	....	....	....	....	12
28	....	....	....	....	....	....	1	....	1
28½	....	....	....	....	....	....	....	....	....
29	....	....	....	....	....	....	1	....	1
Totals	689	454	215	368	94	75	53	81	2,029
Ave. lengths	23.7	23.1	25.5	24.5	23.9	23.2	25.6	24.4	23.7

Table XVIII.—Average Lengths of Skeena River Sockeyes, One Year in Lake, for Twelve Successive Years.

	1912	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.
Four-year males	24.6	23.5	24.2	24.2	23.9	23.6	24.1	24.3	23.8	23.8	23.6	23.7
Four-year females	23.5	22.9	23.4	23.5	23.6	23.2	23.3	23.4	23.2	23.1	23.2	23.1
Five-year males	26.4	25.5	26.2	25.9	26.2	25.5	25.9	25.7	26.2	25.2	25.3	25.5
Five-year females	25.2	24.7	25.1	25.0	25.0	24.7	25.0	24.8	25.3	24.2	24.4	24.5

Table XIX.—Average Lengths of Skeena River Sockeyes, Two Years in Lake, for Eight Successive Years.

	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.
Five-year males	24.1	23.9	23.9	24.3	24.1	24.2	23.8	23.9
Five-year females	23.8	23.8	23.4	23.4	23.4	23.4	23.3	23.2
Six-year males	26.2	25.4	25.2	25.8	26.2	24.9	24.6	25.6
Six-year females	24.8	25.0	24.7	24.7	25.1	24.2	24.1	24.4

Table XX.—Average Lengths of Skeena River Sockeyes, 1923, compared with General Averages, 1912 to 1921.

	Average Lengths, 1923.	Averages, 1912 to 1921.
One year in lake—		
Four-year males	23.7	24.0
Four-year females	23.1	23.3
Five-year males	25.5	25.8
Five-year females	24.5	24.9
Two years in lake—		
Five-year males	23.9	24.1
Five-year females	23.2	23.6
Six-year males	25.6	25.7
Six-year females	24.4	24.8

Table XXI.—Skeena River Sockeyes, 1923, grouped by Weight, Age, Sex, and by their Early History.

Weight in Pounds.	Number of Individuals that spent								
	One Year in Lake.				Two Years in Lake.				Total.
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
2½	1	....	....	....	....	....	....	....	1
3	2	....	....	....	....	....	....	....	2
3½	8	3	....	....	1	1	....	....	13
4	32	47	2	2	4	9	....	2	98
4½	113	138	4	25	16	26	1	8	331
5	194	171	27	72	21	27	4	20	536
5½	171	78	20	115	27	10	9	22	452
6	127	14	46	93	15	2	11	21	329
6½	34	2	49	49	10	....	12	7	163
7	7	1	36	9	....	....	11	1	65
7½	....	....	20	3	....	....	2	....	25
8	....	....	7	....	....	....	2	....	9
8½	....	....	4	....	....	....	1	....	5
Totals	689	454	215	368	94	75	53	81	2,029
Ave. weights	5.3	4.9	6.3	5.7	5.3	4.8	6.3	5.5	5.4

Table XXII.—Average Weights of Skeena River Sockeyes for Ten Successive Years.

	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.	1923.
One year in lake—										
Four-year males	5.9	5.7	5.4	5.3	5.8	6.1	5.6	5.7	5.4	5.3
Four-year females	5.3	5.2	5.1	5.0	5.3	5.5	5.1	5.1	5.1	4.9
Five-year males	7.2	6.8	7.1	6.4	6.9	7.0	7.2	6.4	6.5	6.3
Five-year females	6.3	6.2	6.3	6.0	6.4	6.2	6.4	5.7	5.7	5.7
Two years in lake—										
Five-year males	....	5.9	5.8	5.5	5.7	6.1	6.3	5.8	5.5	5.3
Five-year females	....	5.2	5.4	5.2	5.3	5.4	5.1	5.1	5.1	4.8
Six-year males	....	6.6	7.1	6.3	6.6	6.9	7.3	6.0	6.2	6.3
Six-year females	....	6.0	5.9	5.8	6.1	6.3	6.3	5.6	5.7	5.4

Table XXIII.—Average Weights of Skeena River Sockeyes, 1923, compared with General Averages, 1915 to 1921.

	Average Weights, 1923.	Averages, 1915 to 1921.
One year in lake—		
Four-year males	5.3	5.7
Four-year females	4.9	5.2
Five-year males	6.3	6.8
Five-year females	5.7	6.2
Two years in lake—		
Five-year males	5.3	5.9
Five-year females	4.8	5.2
Six-year males	6.3	6.7
Six-year females	5.4	6.0

(3.) PROPORTIONS OF THE SEXES.

In the Skeena River race there is never such wide inequality between the numbers of males and females in the different age-groups as we find in Rivers Inlet, and, on the other hand, it is much more marked than in the fish belonging to the Fraser River colony. In the Skeena, as in Rivers Inlet, the four-year males outnumber the females, and the five-year females of the one-year-in-lake group are correspondingly more numerous than the males. On the other hand, the five-year group that spent two years in the lake before passing down to the sea, and which at maturity agrees in size with the four-year fish of the one-year-in-lake type, agrees with the latter also in the proportions of the sexes represented. The males are more numerous than the females.

The material examined in 1923 consisted of 2,029 individuals. Of these, 1,051 were males and 978 were females. The slight excess of males is due to the unusual percentage of four-year fish, in which the males always predominate.

Table XXIV.—Percentages of Males and Females in each of the Different Year-groups, Skeena River Sockeyes, in a Series of Years.

Year.	One Year in Lake.				Two Years in Lake.			
	Four Years old.		Five Years old.		Five Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1912	54	46	42	58	....	....	....	....
1913	69	31	47	53	....	....	....	....
1914	60	40	47	53	....	....	....	....
1915	55	45	45	55	....	....	....	....
1916	70	30	43	57	56	44	54	46
1917	65	35	48	52	65	35	58	42
1918	63	37	46	54	61	39	56	44
1919	53	47	46	54	52	48	45	55
1920	41	59	37	63	43	57	41	59
1921	44	56	44	56	50	50	43	57
1922	52	48	41	59	52	48	53	47
1923	60	40	37	63	56	44	40	60
Averages before 1923	57	43	44	56	54	46	50	50

4. THE NASS RIVER SOCKEYE RUN OF 1923.

(1.) GENERAL CHARACTERISTICS.

The Nass River sockeye run of 1923 again registers a decline from its former high average of production. The commercial pack was 17,821 cases, a smaller yield than during any season of the twelve-year period from 1908 to 1919. The smallest pack for this twelve-year period was 21,816 cases, the largest was 39,349 cases, and the average for the period was 29,827 cases. When we compare with this record the packs for the past four years—16,740, 9,364, 31,277, and 17,821—a basis is evident for uneasiness concerning the future of the Nass run. As we stated in 1922: "In previous reports we have advanced certain reasons for fearing that the Nass River run is declining in size. The phenomenal run of 1922 is not conclusive of this question. An exceptionally favourable season in a declining run is not an unusual occurrence, but the experience of the next two or three years should demonstrate beyond doubt the truth of the matter."

The principal brood-year for 1923 was 1918, as nearly 80 per cent. of the run were in their fifth year. The pack of 1918 was 21,816 cases, this being the smallest of the twelve-year period from 1908 to 1919. We have no report from the Nass River spawning-grounds for the year 1918, and are thus without information concerning the size of the spawning escapement.

(2.) THE AGE-GROUPS.

The great complexity of the Nass River run is one of the best-marked characteristics of the race. In each year a portion of the young pass down to the sea immediately after they absorb the yolk and become free-swimming, returning at maturity in their third or fourth year. A second group remain in the lake for one year after hatching, and after spending three or four years at sea mature in their fourth or fifth year. A third group spend two years in the lake and remain at sea until five or six years of age. Still a fourth group postpone their descent to the sea until after spending three years in fresh water, and return to their native stream after maturing in their sixth or seventh year. In accordance with this history, we find individuals in the run ranging from three to seven years of age and belonging to any one of the eight different year-classes above indicated.

These eight year-classes were all represented in the 1923 run, and, in addition, a single individual was present in our samples belonging to a ninth year-class, heretofore unreported. This was a male specimen, 27 inches long and weighing 8 lb., which had spent two years in the lake and five years at sea, returning to the spawning-beds in its seventh year. Another large male was also in its seventh year, having spent three years in the lake and four at sea, but this type has been previously noted in the Nass.

As in all previous years, the two-year-in-lake group in 1923 greatly outnumbered all the others, comprising 77 per cent. of the run, while the one-year-in-lake group made 16 per cent., the three-years-in-lake group 6 per cent., and the sea-type 1 per cent. Disregarding their early history in fresh water, and considering only their final age as indicative of the brood-year from which they were derived, we find that 12 per cent. were in their fourth year and were derived from the spawning run of 1919, 77 per cent. were in their fifth year and came from the 1918 spawning, and 11 per cent. were in their sixth year, the progeny of the spawning run of 1917. In addition, one individual was in its third year and two were in their seventh.

In Table XXV. the percentages of only the principal age-groups are given for comparison over a term of years. From this it appears that the percentages of the total four-, five-, and six-year fish of these groups were identical in 1923 with the averages of the past eleven years. The only difference concerns the relative numbers of the two five-year classes, those that had spent two years in fresh water and three in the sea being unusually numerous at the expense of the class that had spent one year in fresh water and four in the sea. As this last-mentioned class always exceeds the former in size of individuals, the poor representation in 1923 was a detriment to the run.

Table XXV.—Percentage of Principal Age-groups present in the Nass River Sockeye Run from 1912 to 1923.

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	8	27	63	2
1913	15	12	71	2
1914	4	41	45	10
1915	19	14	59	8
1916	9	17	66	8
1917	10	15	71	4
1918	30	16	45	9
1919	7	22	65	6
1920	8	14	72	6
1921	10	7	75	8
1922	6	2	91	1
1923	11	6	77	6
Averages, 1912 to 1922	11	17	66	6

(3.) LENGTHS AND WEIGHTS.

In the following tables are given the lengths and weights of 1,379 samples taken at a number of different dates throughout the run, and believed to furnish a reliable index to the constitution of the run. Tables XXVII. and XXXI. give average sizes of the different year-classes in 1923 for comparison with runs of previous years. It will be noted that the 1923 lengths compare very closely with the general past averages, while the 1923 weights were in each year-class below the average. This is most unusual, as weights and lengths usually agree in their tendency in the same material. But in Rivers Inlet in 1922 we found a like disparity; only in that case the reverse of the above was true, the lengths being well below the average and the weights were conspicuously above. In neither of these cases have we any reason for doubting the reliability of our material. The lengths are taken with steel tapes and the weights with spring-balances which are tested as to their accuracy.

We have omitted from Table XXVI. the records of three individuals, each of which is the sole representative of a year-class. A three-year fish of the sea-type is a female, 22½ inches long, and weighs 4½ lb. A seven-year specimen, of the two-years-in-lake type, is 27 inches long and weighs 8 lb.; and a seven-year individual of the three-years-in-lake type is 28½ inches long and weighs 7½ lb.

Table XXVI.—Nass River Sockeyes which ran in 1923, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.												Total.
	One-year-in-lake Type.				Two-years-in-lake Type.				Three-years-in-lake Type.		No Year in Lake (Sea-type).		
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		Six Years old.		Four Years old.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
21	....	....	....	....	....	....	1	....	....	....	....	....	1
21½	1	1	....	....	1	1	....	....	....	....	....	....	4
22	2	5	....	....	....	2	....	....	....	....	....	....	9
22½	1	5	....	....	....	2	....	....	....	....	....	....	8
23	6	21	2	1	5	18	1	....	....	....	....	2	56
23½	5	14	....	3	5	17	1	1	....	....	....	1	47
24	13	17	3	4	12	44	1	....	1	1	....	5	101
24½	11	6	....	3	18	30	....	2	....	....	....	4	74
25	16	7	7	11	39	123	1	4	....	4	....	3	215
25½	5	1	4	10	48	68	2	2	3	6	1	....	150
26	2	3	5	9	97	125	1	4	7	23	....	1	277
26½	....	2	4	1	86	46	3	2	4	6	....	....	154
27	....	....	4	3	86	41	7	7	9	6	....	....	163
27½	1	....	2	....	37	3	5	4	4	2	....	....	58
28	....	....	1	1	19	4	13	3	1	2	....	....	44
28½	....	....	3	....	3	....	4	....	....	....	....	....	10
29	....	....	....	....	1	....	2	1	1	....	....	....	5
29½	....	....	....	....	....	....	2	....	....	....	....	....	2
30	....	....	....	....	....	....	....	....	....	....	....	....	.....
30½	....	....	....	....	....	....	1	....	....	....	....	....	1
Totals	63	82	35	46	457	524	45	30	30	50	1	16	1,379
Average lengths	24.3	23.7	25.9	25.3	26.2	25.5	27.2	26.5	26.6	26.1	25.5	24.3	25.6

Table XXVII.—Nass River Sockeyes, Average Lengths of Principal Classes from 1912 to 1923.

	One Year in Lake.				Two Years in Lake.			
	Four Years old.		Five Years old.		Five Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1912 (inches)	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	26.6	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	26.3	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

Table XXVIII.—Average Lengths of Principal Classes of Nass River Sockeyes, 1923, compared with General Averages of 1912 to 1921.

	Average Lengths, 1923.	General Averages, 1912 to 1921.
One year in lake—		
Four-year males	24.3	24.3
Four-year females	23.7	23.5
Five-year males	25.9	26.0
Five-year females	25.3	24.9
Two years in lake—		
Five-year males	26.2	26.2
Five-year females	25.5	25.5
Six-year males	27.2	27.1
Six-year females	26.5	25.8

Table XXIX.—Nass River Sockeyes which ran in 1923, grouped by Age, Sex, and Weight and by their Early History.

Weight in Pounds.	Number of Individuals.												Total.
	One-year-in-lake Type.				Two-years-in-lake Type.				Three-years-in-lake Type.		No Year in Lake (Sea-type).		
	Four Years old.		Five Years old.		Five Years old.		Six Years old.		Six Years old.		Four Years old.		
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.	
3½	....	....	....	....	....	....	1	....	....	....	....	....	1
4	1	2	....	....	....	2	....	....	....	....	....	....	5
4½	4	20	2	1	1	12	....	....	....	....	....	....	40
5	8	23	2	6	9	62	2	....	....	1	....	5	118
5½	19	24	2	9	43	123	1	4	3	9	....	8	245
6	15	8	7	10	70	131	1	2	7	17	....	1	269
6½	10	5	6	10	122	128	5	7	6	12	....	2	313
7	4	....	5	7	131	55	11	8	6	9	1	....	237
7½	2	....	4	2	60	9	11	9	6	1	....	....	104
8	....	....	5	1	20	1	7	....	....	1	....	....	35
8½	....	....	2	....	1	1	4	....	2	....	....	....	10
9	....	....	....	....	....	....	1	....	....	....	....	....	1
9½	....	....	....	....	....	....	1	....	....	....	....	....	1
Totals	63	82	35	46	457	524	45	30	30	50	1	16	1,379
Average lengths	5.8	5.2	6.7	6.1	6.6	6.0	7.2	6.8	6.7	6.3	7.0	5.5	6.2

Table XXX.—Nass River Sockeyes, Average Weights of Principal Classes, from 1913 to 1923.

Year.	One Year in Lake.				Two Years in Lake.			
	Four Years old.		Five Years old.		Five Years old.		Six Years old.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1913 (pounds)	5.5		6.3		6.5		6.7	
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

Table XXXI.—Average Weights of Principal Classes of Nass River Sockeyes, 1923, compared with General Averages of 1914 to 1921.

	Average Weights, 1923.	General Averages, 1914 to 1921.
One year in lake—		
Four-year males	5.8	5.9
Four-year females	5.2	5.3
Five-year males	6.7	7.0
Five-year females	6.1	6.3
Two years in lake—		
Five-year males	6.6	7.0
Five-year females	6.0	6.3
Six-year males	7.2	7.8
Six-year females	6.8	6.6

In our report in this series for the season of 1922, we show on page 24 and in Table XIV. that the different year-groups in the Fraser River attain approximately the same size when they have spent the same number of years at sea, irrespective of the length of time they may in their early history have spent in fresh water, and without reference to their age at maturity. Their stature is determined almost altogether by the length of time they have spent in rapid growth on the rich feeding-grounds of the sea. This is generally true of other sockeye races which inhabit the various streams of British Columbia and Alaska. Neither age nor fresh water growth in themselves affect the final size. For convenience of reference, and for comparison with the very different habit of growth which characterizes the Nass River colony of sockeyes, we repeat below the Fraser River table.

Table XXXII.—Fraser River Sockeyes, 1922, grouped by Number of Years spent on Sea-feeding Grounds.

Age.		Males.	Females.
	Two Years at Sea.	Inches.	Inches.
3	One-year-in-lake type	19.0	.....
4	Two-years-in-lake type	19.2	16.5
	Three Years at Sea.		
3	Sea-type	23.0	22.6
4	One-year-in-lake type	24.0	23.0
5	Two-years-in-lake type	23.5	22.7
	Four Years at Sea.		
4	Sea-type	25.5	24.2
5	One-year-in-lake type	25.8	24.1
6	Two-years-in-lake type	25.4	24.3

As seen in Table XXXIII., the growth-habit in the Nass River race forms a striking exception to that universally observed elsewhere, and forms a strongly marked racial peculiarity. The number of years spent in feeding in the sea no longer solely determine the size to be attained. Another factor enters in, that of age, associated with longer or shorter periods spent in fresh water before migrating downwards to the sea. The vigorous growth, on reaching the sea, of those groups which spend a longer period in fresh water is shown on comparing the five-year group that has spent two years in the lake with the five-year group that spent only one year in the lake. The two-year-in-lake group had spent only three years at sea, while the one-year-in-lake group had spent four years at sea, yet the former averages larger than the latter.

Table XXXIII.—Nass River Sockeyes, 1923, grouped by Number of Years spent on the Sea-feeding Grounds.

Age.		Males.	Females.
	Three Years at Sea.	Inches.	Inches.
3	Sea-type (from 1921 material)	23.1	22.4
4	One-year-in-lake type	24.3	23.7
5	Two-years-in-lake type	26.2	25.5
	Four Years at Sea.		
4	Sea-type	25.5	24.3
5	One-year-in-lake type	25.9	25.3
6	To-years-in-lake type	27.2	26.5

(4.) THE BOWSER AND MEZIADIN LAKE SOCKEYE COLONIES.

In our report for 1922 (page 47) we note the examination of fifteen specimens from the Bowser Lake spawning-grounds and ten from the Meziadin, and state that while the material was wholly inadequate to produce conclusive evidence, it apparently indicated that separate sockeye colonies populated these two tributaries, distinguished in part by the fact that the young of the Meziadin colony spent more years in the lake before seeking the sea than did the young of the Bowser Lake colony. Of the ten Meziadin specimens, none had remained but a single year in the lake, 80 per cent. had spent two years, and 20 per cent. had spent three years. Of the fifteen Bowser Lake specimens, 40 per cent. had remained a single year in the lake, 60 per cent. had remained two years, and none had remained three years.

In 1923 Inspector of Fisheries C. P. Hickman again inspected the spawning-grounds of the Nass for the Department and brought back from the two tributaries more extensive material, there being sixty-three specimens from the Meziadin Lake and forty-one from the Bowser Lake, the latter being procured at the mouth of the Bowser River as the fish were entering.

Examination of the new material verifies in general the differences previously pointed out as distinguishing the two colonies, and establishes certain other differences of undoubted significance, sufficient to warrant us in asserting the substantial independence of the two races, with the necessary corollary that the members of each race return at maturity to the same tributary in which they were hatched. This distinctness of tributary races has been demonstrated as yet in comparatively few watersheds, but the present instance is a clear-cut one and is worthy of being placed on record.

It is very difficult to procure from spawning fish the data required for racial discrimination. The differences between the races of sockeyes are found largely in habits of growth and development, including differing percentages of the various year-classes present, and the average sizes of these classes. But data of this kind can be procured only in connection with the microscopic examination of the scales, as used in the determination of age. Unfortunately, in the spawning fish, the scales have suffered such extensive erosion about the margins that age-determination is impossible, and the segregation of the year-classes cannot be made. In the Meziadin and Bowser Lake material the age could not be ascertained in a single specimen.

The only data which these imperfect scales can furnish are those derived from an examination of the central or nuclear area of the scales, which records growth as fry and fingerling during their life in fresh water. Outside this nuclear area was found a portion of the scale still preserved sufficiently to furnish a record of the first and sometimes the second year's growth in the ocean, but in no case was the margin of the scale left intact at any point, and it was thus impossible to ascertain how much of the total record had been destroyed.

The record of the growth in fresh water is, however, of high value for our purpose, and is not infrequently sufficient in itself to establish the complete differentiation of races. The nuclear area of the scale enables us to determine the length of time the individual remained as a resident of its native lake, whether one, two, or three years, or whether it belonged to the sea-type, which descends to the ocean as soon as free-swimming. The proportions in which individuals of these different classes are found in a colony constitute racial peculiarities which are relatively constant from year to year, as is abundantly shown in this series of reports in our analyses of the runs to the four principal sockeye-streams of British Columbia, from 1912 to 1923.

From the nuclear area of the scale we can also ascertain the relative size attained by the fingerlings at the time they reach the sea. This may vary widely in the different sockeye strains, and is frequently so diagnostic that members of two races can be distinguished at a glance on inspection of the centres of the scales.

The Bowser and Meziadin Lake colonies exhibit differences belonging to both of these categories. They differ with regard to the average number of years they spend in fresh water before descent to the sea, and they differ in the size the young attain during their fresh-water sojourn. As has been shown in previous reports in this series, the relative size attained by fingerlings can be reliably inferred from the number of nuclear rings in the central area of the scales.

No specimen in our material belonged to the sea-type. All had spent as fingerlings either one, two, or three years in the native lake before seeking the sea. We give below in Table XXXIV. the percentage of individuals belonging to these two colonies which had spent either one, two, or three years in fresh water:—

Table XXXIV.—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
Bowser, 1922	40	60	....	15
Bowser, 1923	33	64	3	41

Considering the limited amount of material available, the correspondence in the two years is remarkably close and displays well the differing constitution of the runs to the two tributaries. A very large majority of the Meziadin fish belong to the two-years-in-lake type, while the Bowser race contains also a liberal percentage of one-year-in-lake fish.

As regards the size attained by the fingerlings of the two races, and the picture of the nucleus of the scale presented by the two, the difference was sufficiently striking to attract immediate attention. A cursory examination of the scales was sufficient to convince of the complete distinctness of the two colonies. As the two-years-in-lake type is the only one possessing in our samples from the two colonies sufficient material for comparison, we confine our attention to that type.

In the Meziadin specimens we find in the nuclear area of the scale a remarkable uniformity, as though all individuals were made in close conformity to the same pattern. The young made a uniform vigorous growth in each of the two years in the lake, there are no subsidiary checks during the growing season, testifying to the occurrence of unfavourable conditions, and the annuli, or normal winter-checks, are unusually well defined.

The Bowser Lake nuclei are much less regular in appearance, by no means giving the impression of being constructed after the same pattern, but suggesting rather the possibility of representing the progeny from a number of spawning-streams. The growth was less constant, there are more subsidiary checks, and the total growth attained is distinctly less. These differences are brought out in the following table, which gives the number of concentric rings or circuli in the nuclear region of the scale. The number of rings in the Meziadin nuclei in the two years average 8.3+13.9; in Bowser nuclei, 6.7+10.1.

Table XXXV.—Frequency Distribution of Nuclear Rings in Scales of Meziadin and Bowser River Races, Two-years-in-lake Type, 1923.

Number of Nuclear Rings.	Number of Individuals.			
	First Year in Lake.		Second Year in Lake.	
	Meziadin.	Bowser.	Meziadin	Bowser.
4	1	2	....	....
5	1	2	....	....
6	7	6	....	....
7	7	7	....	1
8	15	4	....	4
9	10	3	....	5
10	4	....	1	5
11	2	....	3	3
12	3	....	3	2
13	....	....	12	1
14	1	....	15	2
15	....	....	12	....
16	....	....	3	....
17	....	....	4	....
Number of specimens	51	23	51	23
Average number of rings	8.3	6.7	13.9	10.1

THE SPAWNING-BEDS OF THE FRASER RIVER.

Hon. William Sloan,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit the following report of an inspection of the salmon-fishing and salmon-spawning areas of the Fraser River system during the season of 1923:—

The catch of all species of salmon from Provincial waters of the Fraser River system in 1923 produced a total pack of 226,869 cases, as against 140,570 cases in 1922. It was the largest pack from our waters since 1917. The gain is due to a great increase in the pack of chums and pinks. The pack consisted of 31,655 cases of sockeye, 8,133 cases of springs, 20,173 cases of cohoe, 63,645 cases of pinks, 103,248 cases of chums, and 15 cases of steelhead trout. The catch of sockeye in Provincial waters of the Fraser was the smallest since 1918, the previous low record, and was 20,177 cases less than in 1922. The catch of sockeye made by the traps in Juan de Fuca Strait, Vancouver Island, which in this Department's reports is credited to the Fraser, was the smallest ever made there.

The season's catch of sockeye in the State of Washington waters of the Fraser River system was the smallest ever made and produced a pack of 47,402 cases, as against 48,566 in 1922 and 102,967 in 1921. The total catch of sockeye in all the waters of the Fraser River system in 1923 produced a pack of 79,057 cases. For the first time the catch produced a pack of less than 100,000 cases. The Fraser, which formerly produced more sockeye than any other watershed in the world and outranked all our other sockeye-producing waters combined, now ranks a poor third even in Provincial waters.

I made my twenty-first annual inspection of the principal salmon-spawning area of the Fraser River basin in August, September, and October, and am again indebted to Chief Inspector of Fisheries Major J. A. Motherwell and to local residents, both white and Indian, scattered over the watershed, for much information of value.

As a result of the season's investigations I am of the opinion that the number of sockeye that spawned in the waters above Hell's Gate Canyon was less than in any previous year. In no section above that canyon were sockeye found in sufficient numbers to be worthy of notice. In many of the northern sections, where in earlier years large numbers spawned annually, not a sockeye was seen this year.

The number of sockeye observed at Hell's Gate throughout the season was less than in any former year. Water conditions in the canyon were unusually favourable for the passage of all the fish that reached there. None were delayed there this year even for a day or two, as has commonly been the case.

Indians resident in the Fraser basin were again permitted to catch salmon for their own use, but the combined catch of those that fished at Hell's Gate, Bridge River Canyon, the Chilcotin River, and all the other stations did not equal in number 1 per cent. of those caught at any one of them ten or twelve years ago. The Chilcotin Indians' catch did not exceed 200 sockeye this year, as against 30,000 to 50,000 a decade ago. No Indians fished at Chimney Creek or at Soda Creek this season. I did not see a single sockeye in the Bowron Lake District, or in Quesnel Lake or its principal tributary, the Horsefly River, and could not find a resident on the banks of that river, from its mouth to the wood-jam, some miles above Harpers Camp, who had seen one.

Dominion Fisheries Officers report that a few hundred sockeye reached tributaries of Shuswap Lake. None were seen at Seton or Anderson Lakes.

The number of sockeye which now reach the waters of the Fraser above Yale is so insignificant as to make a hunt for them fruitless.

It is again a pleasure to record that the number of sockeye which this year reached the spawning-beds of the Birkenhead River, at the head of the Harrison-Lillooet Lakes section, equalled those seen there in any one of the last twenty-one years with which I am familiar. The run to this section shows no decrease. It is the only section in the Fraser basin to which the run has not very materially decreased. As already stated, the run to all sections above Hell's Gate Canyon has been virtually destroyed, and the run to all the waters below Hell's Gate, with the notable exception of the Birkenhead, has been greatly diminished.

The family of sockeye in the Birkenhead apparently enter the Fraser in August and have to run the same gauntlet of traps, gill and purse nets employed by fishermen as all other salmon have to do. Why the escapement of the Birkenhead sockeye is so much greater than the run to any other section is not therefore manifest. One cannot study present conditions in the Fraser without being impressed with the fact that the present run of sockeye largely consists of fish spawned in the Birkenhead.

Over 30,000,000 sockeye-eggs were collected for the hatchery on the Birkenhead, known as the Pemberton Hatchery, and the natural spawning-beds of that section were abundantly seeded.

The collection of eggs from the Harrison Lake section, including Cultus and Pitt Lakes, totalled 25,895,000. It is of interest to note than 4,000,000 sockeye-eggs were collected from adult fish which sought entrance to the retaining-pond on the lake-side, close to the hatchery. These fish manifestly were from fry liberated from the hatchery-ponds.

For the first time since the fatal blockade of 1913 a few pink salmon were noted at Hell's Gate; several were found in Lake Creek at the outlet of Seton Lake, and others in tributaries of the Thompson.

Respectfully submitted.

JOHN PEASE BABCOCK,
Assistant to the Commissioner.

THE SPAWNING-BEDS OF THE SKEENA RIVER.

Hon. William Sloan,
Commissioner of Fisheries, Victoria, B.C.

SIR,—In obedience to your instructions, I beg to submit the following report on the spawning-beds of the Skeena River for the year 1923:—

I left Prince Rupert on September 3rd and arrived at Donald's Landing on Babine Lake on September 6th. The following day I visited 15-Mile Creek, which is approximately 100 miles from the mouth of the lake. Five Indian families from Stuart Lake were fishing in the lake near the mouth of the creek and were apparently satisfied with their catch of sockeye, their smoke-houses and racks being well filled. The Dominion authorities have a guardian stationed here during the sockeye run to prevent the Indians molesting the fish in the creek. This creek has only about half a mile of spawning-grounds; beyond that it is of a rocky nature and unsuitable for spawning. The spawning area was, however, in excellent condition, being full of sockeye of a good average size, the males and females being about equal in number. A deep pool at the head of the spawning area was literally swarming with sockeye, some fine specimens being noticed. In former years this creek had the largest percentage of "runts" or undersized sockeye, for the size of the creek, of any creek on the Skeena watershed, but this year there were few to be seen. This creek will be well seeded and from all reports easily up to the average of any good year. This is the second year that the Stuart Lake Hatchery did not collect sockeye-eggs from 15-Mile Creek and Pierre Creek, Babine Lake. Considering that between 4,000,000 and 5,000,000 sockeye-eggs were taken annually from these two creeks for Stuart Lake Hatchery and the fry liberated in the Fraser River basin, and also the fact that these creeks do not show any noticeable deficiency, one cannot but wonder whether the yearlings, when liberated on the Fraser, did not return four or five years later to their place of origin—the Skeena watershed.

I returned to Donald's Landing that night and the following morning set out for Babine River at the mouth of the lake, but owing to stormy weather did not reach there till the night of the 10th.

On the morning of the 11th I proceeded down Babine River a distance of about 12 miles, as far as one can safely go with a boat. It is on this stretch of water that the Babine Indians, approximately 100 families, catch their winter supply of fish, those on the upper stretch catching mostly sockeye and those on the lower mostly humpbacks and springs. There are thirty smoke-houses on either side of the river, with from two to five families using each smoke-house. All the smoke-houses were well filled with fish, and although the younger Indians were not satisfied with their catch, the older ones were contented. On the trip down the river, and for a distance of about 3 miles where the water was shallow, large numbers of sockeye were seen darting away at the approach of the boat. The Babine River will be well seeded this year, comparing favourably with former years. In the Babine River proper, 12 miles from the outlet of the lake, there was an exceptional run of humpbacks, and quite a few sockeye were to be seen among them.

Next morning I set out on horseback for the head of Salmon River, a distance of 8 miles from Babine Village and about 17 miles from the hatchery. This is a good-sized creek about 5 miles in length, which flows into the head of Morrison Lake, 12 miles from the hatchery. The creek was in good condition, there being no log obstructions or falls to impede the sockeye. I went down this creek some distance and saw a great many sockeye in the numerous shallow gravelly patches and in the pools. They were large on an average, the males, if anything, predominating. This was my first visit to Salmon Creek. Each year there appears to be some fresh point of interest, and any one who has not been there could scarcely imagine the extent of the country and the difficulties to contend with in getting from place to place.

Returning to Babine Village again, I arrived at Hatchery Creek on the 13th. One Indian family from Babine Village were fishing near the mouth of the creek and had their smoke-house full of sockeye. Hatchery Creek, which is about 3 miles in length, was in splendid shape, being free from all obstructions. There were not many sockeye to be seen at the lower end, but at about a third of the way up the creek they began to make an appearance, and all the

rest of the way they increased in numbers. At the mouth of the lake where the hatchery is situated there are fences and pens erected for corralling the fish for spawning purposes, and these were simply teeming with sockeye. I met Mr. Hearne, the Superintendent of the hatchery, who was supervising the digging of several new retaining-ponds. He informed me that the first sockeye were not noticed until July 29th, as the water was very high. He began erecting the fences and pens on July 24th, but they were not complete until August 8th. Up to that date the water was very high and a large number of sockeye went into Morrison Lake and right through to Salmon Creek. Mr. Hearne intended to commence spawning the following day, and, judging by the pens at his disposal, which were full of fish, he should not have much difficulty in obtaining his quota—8,000,000 eggs. Hatchery Creek is the most important and best all-round sockeye-creek of the Skeena watershed, the fish being of a higher average in size than in any other creek.

Leaving early the following morning, I called in at Tachek or Fulton River, and was agreeably surprised at the large number of sockeye seen. The entrance to the creek resembles a slough for some distance, the water being deep and muddy. It is a large creek with about 3 miles of spawning area, falls 4 miles from the mouth of the creek, preventing the sockeye going farther. Going 2 miles up the creek I found it well seeded, being much better than former average years. It is one of the latest spawning-creeks in Babine, and at the time of my visit there were still large schools of sockeye in the lake at the mouth of the creek.

Calling in at Pierre Creek that afternoon, I found it much similar to Tachek, only on a smaller scale. There were no obstructions in the creek, which was in good condition. This is an early-spawning creek and a number of dead sockeye could be seen on the bars all along the creek. There were many sockeye spawning on the gravelly patches, the fish being of a good size, the males and females being about equal in number.

Returning to Donald's Landing, I visited Beaver Creek on the 15th. This is the earliest sockeye-spawning creek on Babine and also the farthest, being approximately 120 miles from the entrance to the lake. The creek for the first 3 miles is a slough, the water being very dark and muddy. It is a slow-running creek with many log-jams, but not sufficient to retard the sockeye. There were not many live sockeye to be seen, but the number of dead fish made an unbearable stench. The sockeye were of an average size, the males and females being in proportion. This creek was well seeded and up to the average of former years.

The following day, by making a detour of 9 miles, I visited Grizzly Creek, which runs into Beaver Creek about 7 miles from the lake. This is a small creek, having about half a mile of spawning-ground, but is an exceptionally good place for sockeye. Very few live sockeye were seen here, the majority having spawned. This creek was as well seeded this year as last year and on a par with any previous year.

On the way back to Donald's Landing I called in at 4-Mile Creek and 6-Mile Creek, two small creeks, 4 and 5 miles respectively from the head of the lake. These creeks were well seeded, judging by the number of dead sockeye in the pools and on the bars. This being the last point of interest on Babine, I returned to Burns Lake on the 18th.

Summing up the Babine area, I found the spawning-grounds as well seeded as last year and on a par with any previous average year, Fulton River surpassing any recent year.

I arrived at Hazelton on the 20th and visited Awillgate Canyon on the Bulkley River. For many years the Hazelton and neighbouring Indians have gathered at this canyon during the sockeye run to catch their winter supply of fish. In late years, however, this practice has been gradually decreasing, as these Indians, unlike the Babine Indians, do not now consider fish their chief food-supply. Six or eight decrepit structures bear testimony to former years of activity when these same structures were good-sized smoke-houses. There are still a few Indians, however, who visit the canyon each year during the run and catch around 2,000 fish with dip-net and spear. I was informed that the run of sockeye up the Bulkley was exceptionally good and compared favourably with 1918. Kispiox River, which enters the Skeena above Hazelton and is noted as a never-failing humpback-creek, was again up to expectations, the creek being one teeming mass of this variety.

I arrived at Terrace on the 21st and proceeded to Lakelse the following day. Lakelse Lake is 12 miles from Terrace. The hatchery-men were busy at the time, spawning in Williams Creek. This is the most important sockeye-creek on Lakelse, being a swift-running creek over 20 miles in length and flowing into the head of the lake. The sockeye were first noticed here

about June 16th, which is earlier than last year. Spawning operations for the hatchery commenced on August 5th, the same as last year, and 8,000,000 eggs had been collected by September 1st. All fences and pens were removed on September 1st, but were replaced on September 15th, as an order had been given to collect 2,000,000 eggs for planting. Williams Creek will be well seeded this year, as a great many sockeye passed up the creek before the fences were put in and after they were taken out. The sockeye were of a good size, scarcely any runts being noticed among them, the males and females being about equal in number.

Schullabuchan was the next creek visited, but there were only a few live sockeye to be seen. Many dead fish were in the creek, which should be well seeded, comparing favourably with former years.

Two small branches of Granite Creek will be well seeded, as quite a number of sockeye had worked their way up both creeks. Lakelse River, another important humpback-river, will be well seeded this year, as the river was full of this species.

As this was the last point of interest, I returned to Terrace and arrived in Port Essington on September 23rd.

I wish to express my thanks and appreciation to the Hatchery Superintendents and men, also the Dominion Guardians, for the information supplied and hospitality shown.

I have, etc.,

ROBERT GIBSON,

Fishery Overseer.

THE SPAWNING-BEDS OF THE MEZIADIN LAKE AND BOWSER LAKE WATERSHEDS OF THE NASS RIVER.

Hon. William Sloan,
Commissioner of Fisheries, Victoria, B.C.

SIR,—In compliance with instructions from the Department to inspect the salmon-spawning areas of the Meziadin and Bowser Lake watersheds of the Nass River, I beg to submit the following report:—

On my arrival at the town of Stewart I met Mr. Young, who accompanied me on the trip in the interests of the Dominion Fisheries Department.

We were all prepared to make a start from Stewart on September 4th, but owing to excessive rains, which had flooded the valleys, we had to delay starting until the 7th instant. We left Stewart with two saddle and three pack horses, and experienced great difficulty in travelling up the Bear River and over the Bear River Glacier owing to several wash-outs and slides. We had to practically make a new trail on the far side of the glacier to enable us to get the horses over safely. We arrived on the far side of the glacier on Sunday evening, September 9th, and there met two men, T. Williams and D. McPhee, with whom it had been previously arranged would make the trip with us. On the 10th we continued down the Beaver River, and upon our arrival at Surprise River found that the bridge had been washed out. This bridge was built a year ago, and was raised another 3 feet this summer, in an effort to make it safe in case of freshet, but the torrents were too strong.

When we arrived in the interior beyond the Coast range of mountains the weather greatly improved. Upon our arrival at the cabin at the head of Meziadin Lake we used one of the Dominion Fisheries Department's canvas canoes for the inspection of Meziadin Lake and the falls. The waters of the lake were very high, considerably over the average. We took the northerly shore going down the lake, and in visiting places on the lake-shore where usually numbers of spawning sockeye are to be seen, very few were in evidence. There were no sockeye to be seen disporting themselves around the mouths of the Hanna River and McLeod Creek.

On leaving the lake and entering the Meziadin River, we come to the MrBride Rapids. At the foot of these rapids there is a fine spring-salmon-spawning ground, and while it was possible to observe many spawning spring salmon, they were not as plentiful as I have seen them in the past.

On reachcing the fishway we made an inspection of the upper and lower fall. There were very few sockeye at the upper fall and hardly any passing through the fishway. There were more congregated at the lower fall, but in no great numbers. Conditions improved a little at the lower fall before we left, as there appeared to be a fresh run of sockeye coming in. We experienced quite a lot of trouble in obtaining sockeye-scales for examination owing to there being so few of them, but succeeded in getting specimens from over sixty, and were fortunate in being able to take the majority of the scales without injury to the fish.

The Dominion Fisheries Department has made extensive repairs to the fishway this summer, having torn out all of the old crib-work and replaced it with a new one. The new crib is drift-bolted to the rock, is a complete crib, being 8 feet in width, and is protecting the whole of the bank in the form of a straight crib for the length of the basins, with wings at each end. The Department also sloped the bank at the back of the fishway for a considerable distance and cleaned out all of the basins. This has greatly improved conditions and has restored the fishway to its original form. The work done appears to be of a high class as to durability and neatness, and should stand up for a considerable number of years without further repairs. I am submitting some photos of the new work which will explain more fully.

After finishing our inspection of the fishway and falls we returned to the cabin at the head of the lake, taking the southerly shore-line. From a point about 4 miles down from the head of the lake we saw a few spawning sockeye at several likely places, the best location being near the head of the lake, where a small spring-water stream comes in. There were not as many sockeye to be seen at these places as in the past and very few were leaping in the lake.

After completing the work of inspection of the Meziadin Lake watershed we re-outfitted at the cabin and started in for Bowser Lake. We packed two horses with our outfit and one with

the folding canvas canoe owned by the Dominion Fisheries Department. This made rather an unwieldy pack over a crude trail, but we were successful in landing it safely at our destination. We were the first parties to take a pack-train through this country, and owing to the short time that the men had to brush it out we had many difficult places to overcome, and at one place we had a hard time in saving a horse from breaking his leg. On our arrival at the junction of the Cottonwood and Bowser Rivers we made camp, and then had to cut a trail to pasture the horses. We then went down the river below the junction towards the Nass River. The distance to the Nass from this point is about 2½ miles, the river being swift, with rapids in places, but no falls or other obstacles until it reaches the Nass. I was informed by Indians that there is a canyon in the Nass River below the Cottonwood, but was not able to get there.

We launched the canoe at the junction and started up the river towards Bowser Lake. The distance from the junction to the outlet of the lake is about 3½ miles, with only a short distance of swift water to navigate. The canvas canoe, which is 16 feet long, was very adaptable for our work. The water in Bowser Lake was high and very dirty, making it impossible to observe any fish-life. We made a thorough inspection of the lake-shore for its whole distance, and in trying to obtain scales from sockeye salmon we placed a net in several likely places, but were not successful in taking one salmon. At a place where I caught fifteen sockeye last year we met with no results. There are no creeks emptying into Bowser Lake where sockeye ascend for spawning purposes. We found the canoe of great benefit on the lake, as we were able to get a thorough idea of the whole of its shore-line, its bays and indentations. After making an examination of the lake, and fishing the net in numerous places without results, we returned to the camp at the junction. Immediately above the rapids here we fished the net for three days, and were fortunate in taking over forty sockeye for scale-collecting. Some Indians arrived here for the winter trapping on the day we were breaking camp, and they informed us that no sockeye came into this lake, stating that they thought the water was too cold, but that later on large numbers of cohoe came in. We did not inform them that we had taken sockeye, as they would have commenced fishing for them without delay. It is possible that had we remained a few days longer we could have taken some more sockeye, but as the weather was bad, and the snow nearly down on the bottoms, we decided to return. After finishing our work here we packed up the canoe and cached it for future use.

On the return journey we experienced very wet weather, which made travelling slow. The rivers were all high, nearly taking the horses off their feet when crossing them.

We arrived back in Stewart on October 3rd, having been twenty-seven days out on the trip.

SUMMARY.

Meziadin Lake.—In comparing the run of sockeye to the Meziadin Lake watershed for 1923 with former years, I have to submit that the run was far less than that of 1922, and with very little improvement over that of 1921. There was not much activity at the falls and fishway, but some improvement was noticeable at the lower fall the day we left. Owing to our having to make the long trip into Bowser Lake, the time of our inspection at the falls was about one week earlier than is usual. No cohoe salmon had arrived at the falls at the time we left there. I was informed by men who were working at the fishway that the first sockeye made their appearance at the falls on July 17th. After cleaning out the basins of the fishway they reopened it on August 1st. While the fishway had been closed a large number of sockeye had collected below, and when it was opened they passed up freely.

The fishway is now in splendid condition and is a credit to those who did the work. The crib is 8 feet in width, drift-bolted to the solid rock, and filled with ballast. It should now hold for at least twenty years without further repairs unless some unforeseen occurrence takes place.

Bowser Lake.—In considering this watershed as an important sockeye-spawning ground we have very little more information to present than we have submitted in past. The water of the lake was high and, being glacier-fed, was greatly discoloured. It has been in this condition on each of the times that I have been here. In our efforts to obtain data with a net in the lake we were not successful, but we still demonstrated that sockeye do enter this watershed as proved by our taking sockeye in the river below the outlet of the lake. If there were any great number of sockeye here I am sure we would have had better results in our endeavour to get them. The Indians informed me that cohoe salmon frequent these waters in considerable numbers at a later date than the time of our inspection. While we cannot overlook the fact that

it is difficult to make observations owing to the dirty state of the water, and there being no place in this watershed where salmon are held back by falls or rapids so that you can see them, I am of the opinion that the Bowser Lake watershed is not an important sockeye-spawning area. It is possible that more light may be given us by the examination of the scales taken there and comparing them with scales taken at other places in the Nass system.

Respectfully submitted.

C. P. HICKMAN,
Inspector of Fisheries.

New Westminster, B.C., October 17th, 1923.

THE SPAWNING-BEDS OF SMITH INLET.

Hon. William Sloan,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit the following report on the inspection of the spawning-grounds at Smith Inlet for the year 1923:—

Following the exceptionally big run of sockeye salmon to the inlet during the fishing season, it was with a feeling of optimism that the inspection was made this year.

Leaving Rivers Inlet Cannery for Smith Inlet on October 9th, and arriving at our destination next day, I engaged Indians and departed for the spawning-beds at Long Lake, which is situated about 4½ miles from salt water. The Docee River (the overflow to the lake) engaged my attention first; it is swift-flowing and very difficult to surmount, and it was necessary to pack our outfit over the trail to the lake. Making camp here, I examined the river, and am able to report that the run of spring salmon was equal in numbers to any recorded in past years. In the clear water they could be seen in very large numbers making their way up, and many were observed schooled up along the gravel shore at the mouth of the lake. Cohoe salmon were also to be seen, although in not very large numbers. We were again delayed in proceeding up the lake owing to the extremely rough weather; eventually reaching Quay Creek, camp was made and an inspection conducted at this point. The spawning-beds both outside and inside the creek contained a run of sockeye closely resembling the conditions recorded in 1919. They were about evenly distributed between males and females and a fair average in size.

On arrival at the Geluch River, camp was made and the inspection continued. It is situated at the head of the lake and extends for about 3½ miles, where falls preclude further advance of the fish up-stream; tributary to it are a number of small mountain streams, all of which contribute their quota of spawning sockeye. In making our way up through the rapids spawning sockeye in dense masses were encountered, while at the head the spawning-beds contained a run equal in proportion to any recorded since 1914. It was interesting to watch their efforts to surmount the falls, only to be hurled back beaten and broken. Indians camped at the entrance to the river were busy cutting up fish preparatory to smoking them, and expressed the opinion that no such run had been experienced since 1914. From my own personal observation of the run that year I believe they are correct. The small mountain streams, all of which contained an exceptional run of spawning sockeye, were a favourite resort of the Indian children, who were having a great time hooking them out. Even the vast numbers already encountered did not represent the full extent of the run, as schools of fish were seen at the entrance and in the clear waters of the lake close inshore. No log-jams or other obstructions prevented the salmon making full use of the spawning-beds; the male sockeye outnumbered the females in the proportion of three to one, while in size they represented a fair average.

The Delebah River, situated about 2 miles from the head of the lake, although restricted in size, again showed up remarkably well. The spawning-beds, which extend for about 1½ miles, were literally covered with a seething mass of spawning fish, while dense masses schooled up at the entrance and outside in the lake revealed conditions similar to those recorded in 1914. The Indians, not content with catching fish at the Geluch, were busy filling their canoes from this stream, using a spear in preference to hauling them out by means of a net.

Returning down the lake, cohoe salmon were seen breaking water in all directions, and on arrival at the mouth schools of these fish were observed going up the Docee River, bearing out reports that the run of this species of salmon to the inlet this year was exceptionally big.

Summing up the results of my inspection of the spawning-beds of the Smith Inlet salmon run, I am of the opinion that the escapement this year was even greater than that I recorded in 1919 and equalled in numbers the great run of 1914. The run to Smith Inlet this year was the result of the spawnings of 1918 and 1919. As the beds were poorly seeded in 1918 and abundantly seeded in 1919, it is concluded that the bulk of the run this year consisted of fish hatched from the seeding of 1919. The abundant seeding of 1923 should eventually give a big return.

I have, etc.,
A. W. STONE,
Fisheries Overseer.

Rivers Inlet, B.C., November 14th, 1923.

THE SPAWNING-BEDS OF RIVERS INLET.

Hon. William Sloan,
Commissioner of Fisheries, Victoria, B.C.

SIR,—In pursuance of instructions from the Department to make an inspection of the spawning-beds at Rivers Inlet, I have the honour to submit my report for 1923.

With a view of ascertaining the extent of the runs at different periods of the spawning season, I varied the time of inspection by examining the early-running salmon-streams situated at the head of Owikeno Lake first.

Leaving the cannery at Rivers Inlet on September 18th, the first indication of a big run of fish to the lake was noted by the exceptional numbers breaking water at the entrance to the lake and in the river below. Staying overnight at the hatchery, I departed for the head next day and made camp. The three rivers comprising the Indian, Cheo, and Washwash in the year 1918 all failed to show productive seeding, but in 1919 contained a big run of sockeye; it was therefore interesting to see if the spawning-beds would fulfil expectations following the exceptionally big run of sockeye salmon to Rivers Inlet during the fishing season. The Washwash, situated on the extreme right of the lake, was examined first and again showed signs of the havoc wrought by the freshets. The channel which formerly passed to the left had been forced over to the right, opening up spawning-beds in which the sockeye were not slow to take advantage. The Dominion Department of Fisheries had at one time contemplated building a cribbing to effect just such a purpose, but will not have to do so, provided the channel remains as it is now. It was feared that further inroads into the left bank would eventually result in the river overflowing into the Cheo.

The spawning-beds were literally covered with sockeye, in great contrast to the poor runs experienced in the past two years. The run is a fair average in size, the males outnumbering the females in the proportion of three to one; small grilse in exceptional numbers were also to be seen. The run corresponds closely to that of 1919 and is very much greater than that recorded in 1918, two years responsible for the conditions noted here.

The Indian River, situated directly opposite, although restricted in size, contains some of the finest spawning-beds on the lake. Unhindered by log-jams or other obstructions, the fish are permitted full use of the beds. The run of sockeye was exceptionally early and few spawning fish were seen, but countless numbers of dead bodies covered the bars. Bodies of spring salmon were also noted, showing that this species of fish travel to the head streams to spawn. In estimating the extent of the run, I find that it compares very favourably with 1919.

The Cheo River, situated between the Washwash and the Indian, extends for about 20 miles, but only that portion below the falls can be utilized for spawning purposes. If the falls, which extend for about 500 yards, could be surmounted, the extra mileage, comprising as it does some of the finest spawning-beds, would be opened up to the salmon. At certain stages of the river cohoe salmon have been known to pass through, but only on rare occasions. It was again satisfactory to note so many fish on the spawning-beds. In the clear water near the entrance and above each riffle sockeye in very large numbers were encountered, while the spawning-beds situated between the log-jam and the falls contained a run of sockeye equal in numbers to the run in 1920, the year of the big run to Rivers Inlet; such a condition warrants the opinion that a big run of fish will return from this season's spawning. With the exception of the log-jam referred to, no obstruction interfered with the free movement of the salmon up-stream. Seagulls must be considered an element of destruction to the salmon spawn, as a great number were observed eagerly pouncing upon the eggs as they floated down-stream.

The satisfactory conditions at the head of the lake were not sustained on arrival at Sunday Creek, a small stream situated just north of the narrows; few sockeye were to be seen, but this may have been accounted for by my early visit. At the narrows and close to the Indian house a big run of both cohoe and sockeye salmon was encountered, the spawning-beds showing up remarkably well. Indians located here were able to catch all they required for present use. The inspection of the Sheemahant River is a difficult matter at any time, extending for 18 miles through a succession of rapids to the falls. On this occasion, however, it was favourable to canoe-work. Passing up the river, a few sockeye were observed hugging the shore on each side,

but the water was too discoloured to estimate the full extent of the run. Judging from the absence of fish in the small tributary 12 miles from the entrance, which usually contains its full quota when a big run enters the Sheemahant, and from the evidence of Indians who had been unsuccessful in catching many sockeye from this river, it is apparent that the spawning-beds will be indifferently seeded unless a big run enters later on; such a condition did not take place, so I am given to understand by the Indians, who were compelled to get their supply of salmon for winter's use from Jeneesee Creek.

Learning that the run of sockeye salmon to the lower tributaries of the lake had not yet commenced, I deemed it advisable to postpone the inspection until after my return from the spawning beds at Smith Inlet. On my return four weeks later, I made camp at Jeneesee and inspected the tributaries at this section of the lake. The Markwell, or Machmell, as it is generally termed, again frustrated all efforts to determine the extent of the run owing to the discoloration of the water. It has been the cause of great anxiety to the Dominion Fisheries Department, because during extreme high water it sometimes overflows the banks and, pouring into Jeneesee Creek, does considerable damage to the spawning-beds. In an effort to divert the channel the Department is considering the advisability of constructing a cribbing, but in the meantime is trying out the experiment of felling trees to force the direction of the water into a channel which at great expense was cut some years ago. If it succeeds further danger to Jeneesee Creek will be eliminated.

The Nookins River, a tributary to the Machmell, was next examined. In making our way up through the rapids to the rough water numerous sockeye in an advanced stage of spawning were seen, but the extent of the run could not be determined, as I arrived too late. From the evidence of Indians and others who had been up earlier, it is not considered that the run was an exceptionally large one. In the side-streams schools of sockeye could be discerned in the clear water, evidently belonging to a later run, as they appeared to be in no hurry to commence spawning. Dead bodies of the fish littered the bars and could also be seen lying on the bed of the river at the entrance. No log-jams interfered with the movement of the fish up-stream.

In 1918 a very small run of sockeye was recorded at Jeneesee Creek, and it was feared that if steps were not taken to counteract the diminution in the runs year by year serious conditions would result. To prevent such an occurrence the Department in the spring of 1919 cleared the creek from all obstructions, supplementing this by planting 2,062,000 young fry by means of a fry-float. The result of its efforts is clearly demonstrated by the remarkable numbers which returned to spawn this year. The creek was swarming with sockeye salmon, reminding me of the big runs recorded in 1913 and 1914. The hatchery-men failed to make an early collection owing to a freshet which damaged the fence, permitting the first big run of fish to pass through, but the prolific numbers both inside and outside the creek below the fence were more than sufficient to fulfil the requirements of the hatchery. Retaining-ponds which were constructed last year had been washed out during high water, but having been restored contained a large number of small fry, all in a healthy state. It is hoped that by the introduction of this system, not only Jeneesee creek, but other tributaries that have shown signs of depletion, may be restored to fertility. A collection of 2,758,000 eggs was taken from Jeneesee this year from only a small portion of the entire run, while in 1919, although the collection for that year amounted to 2,457,000 eggs, the entire run of fish had to be utilized for that purpose. It is a striking illustration of the size of the run this year.

Ten miles farther down lies the Asklum River, considered to be one of the most productive salmon-streams of the lake. In 1918, it will be recalled, very unsatisfactory conditions prevailed, but in 1919 the spawning-beds were full of sockeye. With a view of still augmenting the supply for that year, the hatchery liberated about 687,000 young fry into the river, the result of which is shown this year. The spawning-beds right up to the rough water contained a vast number of sockeye, while out in the lake and close to the entrance schools of sockeye were waiting. The Indians describe the conditions as the best they had encountered in years.

Quap River, from which the Dominion Hatchery collects the greater proportion of eggs, was again a scene of activity. A big run of sockeye had congregated below the fence and, finding their way into the pen, were quickly spawned. The low stage of the lake was the cause of the main run hanging back, but with the advent of rain and consequent rise of the lake, a mad rush was made for the river, which soon presented a picture similar in all respects to that noted in the past two years. For some unaccountable reason the run in 1918 was a failure,

but in 1919 proved productive. The Department of Dominion Fisheries, not satisfied with the fine showing of fish in the latter year, supplemented the supply by planting no less than 7,116,000 young fry. In addition, it turned its attention to the obstructions in the river, clearing them out and opening up the spawning-beds. This action, combined with its efforts to restock the beds, is now reflected in the magnitude of the run which returned this year. A total collection of 10,360,000 was taken from the Quap.

Crossing to the Dalley River, the spawning-beds right up to the falls, 4½ miles distant, were covered with sockeye all in an advanced stage of spawning, while the bars contained dead and putrid bodies in thousands. The run in my opinion exceeded even the fine showing of fish in 1919. No log-jams or other obstructions interfered with the sockeye as they made their way up-stream.

The small creek in close proximity to the hatchery contained one of the largest runs known in years, and permitted the hatchery-men to collect no less than 2,261,000 eggs, a condition that is highly significant when it is learned that at the time of the construction of the hatchery no sockeye had been known to come into the creek. Four years later they commenced to arrive, and have done so in increased numbers year after year until now it is recognized as one of the best egg-collecting streams.

The spawning-beds situated at the head of the Owikeno River (the overflow to the lake) and encircling the old town rancherie contained the biggest run of sockeye known in many years. Some of the Indians, in preference to collecting their winter's supply of salmon from other tributaries of the lake, remained here. They stated that it was only necessary to throw out a small piece of net and commence hauling immediately to fill it right up, showing in a striking manner the magnitude of the run. Spring and other species of salmon were seen breaking water in all directions as we made our way down through the rapids to the cannery.

In summarizing the results of the inspection of the spawning-grounds of Rivers Inlet run of salmon, I am able to record a highly satisfactory run of sockeye to all tributaries. With the possible exception of Sunday Creek, the Sheemahant and Nookins Rivers, all of them contained a run of fish which in my opinion exceeded the run in 1919. Since the spawning-beds in 1918 were found to be in such an unsatisfactory state, it must be assumed that the return of adult sockeye this year is due in a great measure to the spawn deposited in 1919, or composed mainly of four-year fish. Whether such is the case can only be determined when the results are published of tests made of the sockeye-scales collected throughout the fishing season, which data are now in the hands of the Department. Other factors responsible for the big run are due in a great measure to the clearance of obstructions in the rivers, which in past years badly needed attention; to the extension of the weekly close season; and to the extension of the closed fishing area at the head of Rivers Inlet.

In conclusion, I wish to express my appreciation for the courtesy received from G. C. Johnston, Manager of Rivers Inlet Cannery; Weldon R. Reid, Superintendent of the Dominion Hatchery; and the men at the various spawning camps.

I have, etc.,

A. W. STONE,

Fisheries Overseer.

Rivers Inlet, B.C., November 14th, 1923.

PACK OF BRITISH COLUMBIA SALMON, SEASON 1923.

COMPILED FROM DATA FURNISHED THE DEPARTMENT BY THE B.C. SALMON CANNERS' ASSOCIATION.

Names.	Sockeyes.	Red Springs.	Pink and White Springs.	Bluebacks and Steelheads.	Cohoes.	Pinks.	Chums.	GRAND TOTAL (Cases).
Fraser River District.								
B.C. Fishing & Packing Co., Ltd.	13,752	2,641	2,590	9	4,997	15,116	3,335	42,440
J. H. Todd & Sons, Ltd.	2,090	64	174	.....	1,651	3,149	5,309	12,437
Gosse-Millerd, Ltd.	4,865	155	1,308	6	2,591	6,245	17,093	32,263
M. DesBrisay & Co.	1,198	19	.....	.....	373	2,473	253	4,316
Canadian Fishing Co., Ltd.	963	.....	.....	.....	5,449	27,753	41,393	75,558
Great West Packing Co., Ltd.	2,285	79	95	.....	1,222	3,981	2,750	10,412
Glenrose Canning Co., Ltd.	4,166	892	78	.....	2,346	2,054	2,071	11,607
Somerville Cannery Co., Ltd.	104	4	34	.....	1,544	2,874	31,044	35,604
J. H. Todd & Sons, Ltd. (Esquimalt)	2,232	.....	.....	.....	.....	.....	.....	2,232
Totals	31,655	3,854	4,279	15	20,173	63,645	103,248	226,869
Skeena River District.								
B.C. Fishing & Packing Co., Ltd.	28,882	4,677	1,117	59	9,556	32,851	3,887	81,029
J. H. Todd & Sons, Ltd.	10,102	.....	.....	.....	13,075	12,114	2,527	37,818
Anglo-B.C. Packing Co., Ltd.	16,518	2,739	445	.....	1,328	13,997	52	35,079
Gosse-Millerd, Ltd.	12,857	284	101	267	3,064	22,044	1,269	39,886
Kildala Packing Co., Ltd.	9,748	431	115	.....	576	8,406	195	19,471
Northern B.C. Fisheries, Ltd.	14,501	86	414	15	1,425	14,060	374	30,875
Wallace Fisheries, Ltd.	16,893	302	481	.....	536	12,213	253	30,678
Cassiar Packing Co., Ltd.	9,459	.....	.....	33	735	9,640	271	20,138
Canadian Fish & Cold Storage Co., Ltd.	8,771	.....	525	.....	1,232	15,693	7,498	33,719
Maritime Fisheries, Ltd.	4,000	344	186	44	440	4,955	201	10,170
Totals	131,731	8,863	3,384	418	31,967	145,973	16,527	338,863
Rivers Inlet District.								
B.C. Fishing & Packing Co., Ltd.	35,387	174	128	.....	219	574	.....	36,482
J. H. Todd & Sons, Ltd.	8,961	.....	.....	.....	237	3,336	139	12,673
Provincial Canning Co., Ltd.	8,711	.....	.....	.....	334	2,821	69	11,935
Anglo-B.C. Packing Co., Ltd.	10,254	.....	82	.....	172	1,775	153	12,436
Gosse-Millerd, Ltd.	8,770	.....	69	.....	79	90	11	9,019
Kildala Packing Co., Ltd.	9,464	56	25	.....	.....	2	.....	9,547
Wallace Fisheries, Ltd.	18,939*	.....	52	.....	58	223	10	19,282
Canadian Fishing Co., Ltd.	11,864	.....	13	.....	78	24	.....	11,979
Northern B.C. Fisheries (Namu)	4,500	.....	.....	.....	.....	.....	.....	4,500
Standard Packing Co., Ltd.	.....	.....	.....	.....	349	1,212	2,860	4,421
Totals	116,850	230	369	.....	1,526	10,057	3,242	132,274

* Including 9,676 cases caught in Smith Inlet.

PACK OF BRITISH COLUMBIA SALMON, SEASON 1923—*Continued.*

COMPILED FROM DATA FURNISHED THE DEPARTMENT BY THE B.C. SALMON CANNERS' ASSOCIATION—*Continued.*

Nass River District.

Names.	Sockeyes.	Red Springs.	Pink and White Springs.	Bluebacks and Steelheads.	Cohoes.	Pinks.	Chums.	GRAND TOTAL (Cases).
B.C. Fishing & Packing Co., Ltd.	3,152	2,314	382	70	497	7,316	516	14,247
Anglo-B.C. Packing Co., Ltd.	5,635	.....	189	217	762	7,200	465	14,468
M. DesBrisay & Co.	2,936	59	13	.....	1,160	9,890	13,793	27,851
Northern B.C. Fisheries, Ltd.	4,347	114	176	55	669	8,343	2,541	16,245
Somerville Cannery Co., Ltd.	1,751	35	32	253	4,806	11,416	8,476	26,769
Totals	17,821	2,522	792	595	7,894	44,165	25,791	99,580

Vancouver Island District.

B.C. Fishing & Packing Co., Ltd.	4,490	.....	.....	.....	2,936	7,791	3,129	18,346
J. H. Todd & Sons, Ltd.	*	.....	.....	.....	13,554	8,001	5,258	26,813
Nootka Packing Co., Ltd.	.....	.....	43	.....	575	.....	22,798	23,416
Clayoquot Sound Canning Co., Ltd.	4,482	17	.....	.....	1,227	.....	5,091	10,817
Quathiaski Canning Co., Ltd.	2,882	78	.....	7,097	395	11,438	363	22,253
Wallace Fisheries, Ltd.	112	.....	.....	.....	.....	.....	6,000	6,112
Gosse-Millerd, Ltd.	3	.....	.....	.....	960	.....	14,668	15,631
Lummi Bay Packing Co., Ltd.	.....	.....	.....	.....	1,031	.....	24,983	26,014
Nanaimo Canners & Packers, Ltd.	37	.....	.....	.....	349	2,919	24,181	27,486
Deep Bay Packing Co., Ltd.	.....	.....	.....	.....	315	.....	14,049	14,364
Totals	12,006	95	43	7,097	21,342	30,149	120,520	191,252

* Included in Fraser River District.

Other Districts.

B.C. Fishing & Packing Co., Ltd.	8,338	1,635	488	97	8,084	12,446	6,965	38,053
Anglo-B.C. Packing Co., Ltd.	2,956	.....	83	.....	5,524	12,011	8,357	28,931
Gosse-Millerd, Ltd.	3,252	17	14	42	4,691	32,155	43,485	83,656
Northern B.C. Fisheries, Ltd.	3,507	30	126	300	3,435	30,871	35,445	73,714
Kildala Packing Co., Ltd.	1,619	40	25	293	1,031	5,154	6,566	14,728
Canadian Fishing Co., Ltd.	2,845	.....	.....	.....	1,342	49,585	30,034	83,806
Wm. Hickey & Son, Ltd.	2,067	253	.....	.....	5,035	4,389	7,078	18,822
Lockeport Cannery Co., Ltd.	.....	.....	.....	.....	.....	332	10,797	11,129
Totals	24,584	1,975	736	732	29,142	146,943	148,727	352,839
Grand totals	334,647	17,539	9,603	8,857	112,044	440,932	418,055	1,341,677

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1908 TO 1923, INCLUSIVE.

FRASER RIVER.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Sockeyes	31,655	51,832	39,631	48,399	38,854	19,697	148,164	32,146
Springs, Red	3,854	10,561	11,360	10,691	14,519	15,192	10,197	17,673
Springs, White	4,279	6,300	5,949	4,432	4,296	24,853	18,916	11,430
Chums	103,248	17,895	11,233	23,884	15,718	86,215	59,973	30,934
Pinks	63,645	29,578	8,178	12,839	39,363	18,388	134,442	840
Cohoes	20,173	23,587	29,978	22,934	39,253	40,111	25,895	31,330
Bluebacks and Steelheads	15	817	1,331	4,522	15,941	4,395	4,951	3,129
Totals	226,869	140,570	107,650	136,661	167,944	208,857	402,538	127,472

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Sockeyes	91,130	198,183	719,796	123,879	58,487	150,432	585,435	74,574
Springs, Red	23,228	11,209	3,573	15,856	7,028	1,018	1,428	1,903
Springs, White	5,392	15,300	49	9,826	6,751	8,925	.....	2,263
Chums	18,919	74,826	22,220	12,997	47,237	52,460	}	
Pinks	138,305	6,272	20,773	574	142,101	128	} 8,687	415
Cohoes	43,514	43,504	16,018	36,190	39,740	35,031	27,919	33,270
Bluebacks and Steelheads	31	.....	.....	.....	.....	.....	.....	.....
Totals	320,519	349,294	782,429	199,322	301,344	247,994	623,469	112,425

SKEENA RIVER.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Sockeyes	131,731	96,277	41,018	89,364	184,945	123,322	65,760	60,293
Springs	12,247	14,176	21,766	37,403	25,941	22,931	16,285	20,933
Chums	16,527	39,758	1,993	3,834	31,457	22,573	21,516	17,121
Pinks	145,973	301,655	124,457	177,679	117,303	161,727	148,319	73,029
Cohoes	31,967	24,699	45,033	18,068	36,559	38,759	38,456	47,409
Steelhead Trout	418	1,050	498	1,218	2,672	4,994	1,883	3,743
Totals	338,863	477,915	234,765	332,887	398,877	374,306	292,219	223,158

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Sockeyes	116,533	130,166	52,927	92,498	131,066	187,246	87,901	139,846
Springs	15,273	11,740	26,436	23,833	17,942	9,785	12,469	13,842
Chums	5,769	8,329	.....	504	70	.....	}	
Pinks	107,578	71,021	66,045	97,588	81,956	13,473	} 28,120	45,404
Cohoes	32,190	16,378	18,647	39,835	23,376	11,531	12,249	10,085
Steelhead Trout	1,798	.....	.....	.....	.....	.....	.....	.....
Totals	279,161	237,634	164,055	254,258	254,410	222,035	140,739	209,177

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1908 TO 1923, INCLUSIVE—*Continued.*

RIVERS INLET.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Sockeyes	116,850	53,584	48,615	125,742	56,258	53,401	61,195	44,936
Springs	599	323	364	1,793	1,442	1,409	817	1,422
Chums	3,242	311	173	1,226	7,089	6,729	16,101	20,144
Pinks	10,057	24,292	5,303	25,647	6,538	29,542	8,065	3,567
Cohoes	1,526	1,120	4,718	2,908	9,038	12,074	9,124	15,314
Steelhead Trout	.....	82	97	.....	.....	.....	.....	.....
Totals	132,274	79,712	59,272	133,248	80,367	103,155	95,302	85,383

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Sockeyes	130,355	89,890	61,745	112,884	88,763	126,921	89,027	64,652
Springs	1,022	566	594	1,149	317	383	587	454
Chums	5,387	5,023	.....	3,845	288	.....	.....	.....
Pinks	2,964	5,784	2,097	8,809	5,411	19	.....	479
Cohoes	7,115	7,789	3,660	11,010	6,287	2,075	1,400	9,505
Steelhead Trout	.....	.....	.....	.....	.....	.....	.....	.....
Totals	146,838	109,052	68,096	137,697	101,066	129,398	91,014	75,090

NASS RIVER.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Sockeyes	17,821	31,277	9,364	16,740	28,259	21,816	22,188	31,411
Springs	3,314	2,062	2,088	4,857	3,574	4,152	4,496	3,845
Chums	25,791	11,277	2,176	12,145	24,041	40,368	24,938	11,200
Pinks	44,165	75,687	29,488	43,151	29,949	59,206	44,568	59,593
Cohoes	7,894	3,533	8,236	3,700	10,900	17,061	22,180	19,139
Steelhead Trout	595	235	413	560	789	1,305	1,125	1,498
Totals	99,580	124,071	51,765	81,153	97,512	143,908	119,495	126,686

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Sockeyes	39,349	31,327	23,574	36,037	37,327	30,810	28,246	27,584
Springs	3,701	3,385	3,151	6,936	3,759	1,239	2,337	3,263
Chums	11,076	25,569	2,987	3,245	5,189	351	3,589	.....
Pinks	34,879	25,333	20,539	12,476	11,467	895	.....	6,612
Cohoes	15,171	9,276	3,172	12,468	7,942	6,285	6,818	8,348
Steelhead Trout	113	.....	.....	.....	.....	140	.....	1,101
Totals	104,289	94,890	53,423	71,162	65,684	39,720	40,990	46,908

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1908 TO 1923, INCLUSIVE—*Continued.*

VANCOUVER ISLAND DISTRICTS.*

	1923.	1922.	1921.	1920.	1919.	1918.
Sockeyes	12,006	15,147	6,936	6,987	6,452	6,143
Springs	138	886	3,230	29,211	36,013	29,324
Chums	120,520	108,478	34,431	12,591	128,013	251,266
Pinks	30,149	36,943	10,660	14,391	43,186	57,035
Cohoes	21,342	18,575	11,120	20,555	53,629	40,752
Bluebacks	7,097	5,495	3,151	.....	.....	.....
Totals	191,252	185,524	69,528	74,170	267,293	389,815

OTHER DISTRICTS.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Sockeyes	24,584	47,107	18,350	64,473	54,677	51,980	32,902	45,373
Springs	2,711	4,988	4,995	15,633	14,766	8,582	6,056	11,423
Chums	148,727	80,485	21,412	30,946	165,717	90,464	112,364	160,812
Pinks	146,943	113,824	14,818	247,149	110,300	201,847	112,209	143,615
Cohoes	29,142	31,331	18,203	33,807	35,011	42,331	30,201	70,431
Steelheads and Bluebacks	732	409	2,790	3,721	702	1,009	865	712
Totals	352,839	278,144	80,568	395,728	381,163	404,793	294,597	432,366

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Sockeyes	98,600	87,130	149,336	79,464	67,866	70,506	49,832	48,367
Springs	9,488	7,108	7,246	22,837	12,659	7,439	2,196	6,439
Chums	40,849	70,727	52,758	37,734	39,167	5,551	.....	.....
Pinks	83,626	111,930	83,430	128,296	64,312	20,098	6,148	23,538
Cohoes	48,966	43,254	28,328	65,806	42,457	19,460	13,532	20,709
Steelheads and Bluebacks	985	.....	.....	.....	.....	.....	.....	36
Totals	313,894	320,168	285,898	334,187	226,461	123,054	71,708	99,089

TOTAL PACKED BY DISTRICTS IN 1908 TO 1923, INCLUSIVE.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Fraser	226,869	140,570	107,650	136,661	167,944	210,851	402,538	127,472
Skeena	338,863	477,915	234,765	332,787	398,877	374,216	292,219	223,158
Rivers Inlet	132,274	79,712	59,272	157,522	80,367	103,155	95,302	85,383
Nass River	99,580	124,071	51,765	81,153	97,512	143,908	119,495	126,686
* Vancouver Island	191,252	185,524	69,528	84,170	267,293	389,815	325,723	.....
Other Districts	352,839	278,144	80,568	395,223	381,163	404,793	294,597	432,366
Grand totals	1,341,677	1,285,946	603,548	1,187,616	1,393,156	1,626,738	1,557,485	995,065

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Fraser	320,519	349,294	782,429	199,322	301,344	247,994	623,469	112,425
Skeena	279,161	237,634	164,055	254,258	254,410	222,035	140,739	209,177
Rivers Inlet	146,838	109,052	68,096	137,697	101,066	129,398	91,014	75,090
Nass River	104,289	94,890	53,423	71,162	65,684	39,720	40,990	46,908
* Vancouver Island	.....	.....	.....	.....	.....	.....	.....	.....
Other Districts	313,894	320,169	285,898	334,187	226,461	123,054	71,708	99,089
Grand totals	1,164,701	1,111,039	1,353,901	996,626	948,965	762,201	967,920	542,689

* Previously the Vancouver Island pack was shown in Outlying Districts pack.

STATEMENT SHOWING THE SOCKEYE-PACK OF THE FRASER RIVER SYSTEM FROM 1908 TO 1923, INCLUSIVE.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Fraser River, B.C.	31,655	51,832	39,631	48,399	38,854	19,697	148,164	32,146
State of Washington	47,402	48,566	102,967	62,654	64,346	50,723	411,538	84,637
Totals	79,057	100,398	142,598	111,053	103,200	70,420	559,702	116,783

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Fraser River, B.C.	91,130	198,183	719,796	123,879	58,487	150,432	585,435	74,574
State of Washington	64,584	335,230	1,673,099	184,680	127,761	248,014	1,097,904	170,951
Totals	155,714	533,413	2,392,895	308,559	186,248	398,446	1,683,339	245,525

STATEMENT SHOWING THE SOCKEYE-PACK OF THE PROVINCE, BY DISTRICTS, 1908 TO 1923, INCLUSIVE.

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Fraser River	31,655	51,832	39,631	48,399	38,854	19,697	148,164	32,146
Skeena River	131,731	96,277*	41,018	89,064	184,945	123,322	65,760	60,923
Rivers Inlet	116,850	53,584	48,615	125,742	56,258	53,401	61,195	44,936
Nass River	17,821	31,277	9,364	16,740	28,259	21,816	22,188	31,411
Vancouver Island†	12,006	15,147	6,936	6,987	6,452	6,243	9,639	9,223
Other Districts	24,584	47,107	18,350	64,473	54,677	51,980	32,902	36,150
Totals	334,647	295,224	163,914	351,405	369,445	276,459	339,848	214,789

	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.
Fraser River	91,130	198,183	719,796	123,879	58,487	150,432	585,435	74,574
Skeena River	116,553	130,166	52,927	92,498	131,066	187,246	87,901	139,846
Rivers Inlet	130,350	89,890	61,745	112,884	88,763	126,921	89,027	64,652
Nass River	39,349	31,327	23,574	36,037	37,327	30,810	28,246	27,584
Other Districts	98,660	87,130	149,336	79,464	67,866	70,506	49,832	48,367
Totals	476,042	536,696	972,178	444,762	383,509	565,915	840,441	335,023

* 4,390 cases deducted from Skeena for 1922, Alaska sockeye.
† Vancouver Island's pack not previously segregated.

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