PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

COMMISSIONER OF FISHERIES

FOR THE YEAR ENDING DECEMBER 31ST, 1920

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1921.

To His Honour WALTER CAMERON NICHOL,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I beg to submit herewith a report reviewing the operations of the Provincial Fisheries Department for the year ending December 31st, 1920, with Appendices.

WILLIAM SLOAN,

Commissioner of Fisheries.

Provincial Fisheries Department,

Commissioner of Fisheries' Office,

Victoria, British Columbia, March 31st, 1921.

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FISHERIES COMMISSIONER'S REPORT FOR 1920.

Value of Canadian Fisheries and the Standing of Provinces.

The value of the fishery products of Canada for the year 1919 totalled $56,508,479, as against $60,250,514 for the preceding year, a decrease of $3,764,935.

During the year 1919 British Columbia produced fishery products of a total value of $25,301,607, or 44.7 per cent. of the total for the Dominion.

British Columbia again led all the Provinces of the Dominion in the value of her fishery products. Her output in 1919 exceeded that of Nova Scotia by $10,129,678, and exceeded that of all the other Provinces combined by $9,267,654.

The following statement gives in the order of their rank the value of the fishery products of the Provinces for the years 1918 and 1919, together with the amount of the increase or the decrease:—

Value of Fisheries by Provinces, 1918 and 1919, with Increase or Decrease.

Province.	1918.	1919.	Increase or Decrease compared with 1918. (Inc.+; Dec.—.)
British Columbia	$27,282,223	$25,301,607	—$1,980,616
Nova Scotia	15,143,066	15,171,929	+ 28,863
New Brunswick	6,298,990	4,979,074	— 1,319,916
Quebec	4,568,773	4,258,731	— 310,042
Ontario	3,175,111	3,410,750	+ 235,639
Prince Edward Island	1,148,201	1,536,844	+ 388,643
Manitoba	1,830,435	1,008,717	— 821,718
Saskatchewan	447,012	475,797	+ 28,785
Alberta	318,913	333,330	+ 14,417
Yukon	37,820	8,800	— 29,020
Totals	$60,250,544	$56,485,579	—$3,764,965

The Species and Value of Fish caught in British Columbia.

The total value of each species of fish taken in British Columbia for the year ending December 31st, 1919, is given in the following statement:—

Salmon	$17,537,166
Halibut	4,617,484
Herring	1,109,870
Whales	648,868
Pilchards	371,871
Cod	368,838
Black cod	116,580
Flounders, brill, plaice, etc.	130,940
Soles	90,848
Crabs	55,102
Clams and quahaugs	47,754
Red cod	39,413
Oysters	38,659
Perch	19,808
Grayfish	17,822
Shrimps	17,528
Smelts	14,682
Octopus	6,760
Carried forward	$25,249,993

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

Brought forward	$25,249,993
Sturgeon	5,636
Skate	3,126
Oolachans	2,045
Fur-seals	1,294
Shad	667
Tomcod	498
Hake and cusk	475
Bass	336
Whiting	284
Eels	222
Fish-oil	35,097
Fish-offal	450
Fish scrap and fertilizer	19,306
Total	$25,319,429

THE SALMON-PACK OF 1920.

The salmon-pack in the Province for the year 1920 totalled 1,187,616 cases. It was 205,540 cases less than in 1919 and 428,541 cases less than in 1918, the year of the high record pack in the Province. The pack of chum salmon for the season totalled but 84,626 cases, as against 372,035 cases in 1919 and 527,615 cases in 1918, the decrease being due to a lack of market for this grade. There was a large carry-over of the pack of 1919.

The catch of sockeye from all the waters of the Province totalled 351,405 cases, as against 369,445 cases in 1919 and 276,459 cases in 1918, the decrease of 1920 being due to a light run of sockeye on the Skeena.

The catch of red, white, and pink spring salmon totalled 118,301 cases as against 100,551 cases in 1919 and 107,354 cases in 1918. The pack of pink salmon totalled 520,856 cases, as against 346,639 cases in 1919 and 527,745 cases in 1918.

THE 1920 SALMON-PACK BY DISTRICTS.

The Fraser River.—The total pack of all grades of salmon in the Fraser River District of the Province in 1920 totalled 136,661 cases, as against 163,123 cases in 1919, 276,459 cases in 1918, and 330,209 cases in 1917, the total pack being the smallest made on the Fraser since 1916. The catch of sockeye in Provincial waters of the Fraser River system shows a gain over the two preceding years, with a total of 48,399 cases, as against 34,068 cases in 1919 and 19,697 cases in 1918.

The season's pack of sockeye in the State of Washington waters of the Fraser River system in 1920 totalled 62,654 cases, as against 64,346 cases in 1919.

The total pack of sockeye in the entire Fraser River system in 1920 was 111,053 cases, as against 116,783 cases in the fourth preceding year, 1916—the brood-year of the 1920 run—showing that for the first time in several cycles of the lean years in the system there was but a small decrease.

The Salmon-catch in Northern Waters.

The Skeena River.—The salmon-catch in the Skeena River in 1920 produced a total pack of 332,887 cases, as against 398,877 cases in 1919 and 374,306 cases in 1918. There was a marked falling-off in the run of sockeye in comparison with the runs in the two preceding years, the catch producing a total pack of but 89,364 cases, as against 184,945 cases in 1919 and 123,322 cases in 1918.

Since the run of sockeye to the Skeena this year must be credited to propagation in the years 1915 and 1916, it is of importance to note that the run of 1915 produced a pack of 116,553 cases and that of 1916 but 60,923 cases, because it shows that the run this year was the product of the spawning of two years, one of which gave a pack greater than the average for the last eight years and the other a pack much below the average for that period. Only by resorting

to averages of catches for a period of years can it be ascertained with a degree of certainty whether the supply is on the whole diminishing or increasing. The average of the catch of sockeye on the Skeena in four-year cycles from 1903 to 1919 is shown in the following statement:—

	Cases.
Average pack from 1903 to 1906	78,868
" " 1907 to 1910	130,851
" " 1911 to 1914	101,664
" " 1915 to 1919	91,477

Considering that the pack of 1920 is less than that of the average for the four preceding years and very much below that from 1907 to 1914, and the fact that the number of canneries and the amount of fishing-gear employed on the Skeena was relatively constant up to 1918, also that in both 1918 and 1919 the amount of gear was greatly increased and the price paid fishermen was also increased, it must be conceded that conditions on the Skeena are not satisfactory and call for careful and conservative treatment. The records there indicate unmistakably that fishing for sockeye should be diminished and not increased.

Rivers Inlet.—The catch of salmon at Rivers Inlet for 1920 produced a total pack of 133,248 cases. It was the greatest since the high record pack of 1915. The sockeye-catch in 1920 produced a pack of 125,742 cases. It was but 5,000 cases less than the largest pack of sockeye ever made at that inlet. The catch of sockeye made there this year, as usual, consisted of both 4- and 5-year-old fish, and in consequence must be credited to the hatches from the spawnings of the years 1915 and 1916. The run in 1915, which produced the record pack at the inlet, consisted of 87 per cent. of 5-year-old fish, and the catch of 1916, which gave the smallest pack on record, contained 76 per cent. of 5-year-old fish. The run this year was therefore derived from both the biggest and the smallest runs recorded, and both of those runs consisted very largely of 5-year-old fish. The catch this year again demonstrates, as Dr. Gilbert pointed out last year, that the 5-year-old group has nearly always been in the majority in the Rivers Inlet run, the average for the last eight years being 39 per cent. of the 4-year class and 61 per cent. of the 5-year class.

Fishery Overseer A. W. Stone, who has for the past nine years annually inspected the spawning area of Rivers Inlet run, reports the fish found there in 1920 compared favourably, both in numbers and in size, with those of any former year—again demonstrating that the seasons of large catches usually show a large escapement and an abundant seeding of the spawning areas.

The Nass River.—The salmon run to the Nass River this year was again distinctly disappointing, the total pack of 81,150 cases being less than the average for the last seven years. Previous to that time the pack consisted almost wholly of sockeye. The run of sockeye was much the smallest yet recorded there. It produced a pack of but 16,740 cases, as against 28,259 cases in 1919, 21,816 cases in 1918, 22,188 cases in 1917, and 31,411 cases in 1916. The catch of sockeye on the Nass from 1909 to 1920 produced an average pack of 28,917 cases. Conditions there are distinctly alarming and call for most conservative action. If conditions are not radically changed the Nass River must be classed in the list of depleted streams. Fishing for sockeye has been more extensive than the run to that river will stand. The drain is far too heavy.

The Vancouver Island Section.

The salmon-pack on Vancouver Island totalled but 84,170 cases, as against 276,519 cases in 1919 and 206,023 cases in 1918. The decrease is to be attributed to the lack of demand for the fall-running species. There being little demand for chums resulted in a pack of but 12,591 cases, as against packs of 128,013 cases in 1919, 251,266 cases in 1918, and 240,000 cases in 1917. The catch of sockeye made by the traps on Vancouver Island is, as usual, credited to the Fraser District, because the fish taken were bred in that river and were seeking its waters when caught. The catch of sockeye in the traps produced a pack of only 3,801 cases, the smallest on record. The pack of all other species was small.

Trolling for salmon on the west coast of Vancouver Island was vigorously prosecuted by a large fleet of power-boats, but owing to rough weather the catch was less than in recent years. Most of the fish caught were shipped in a fresh state.

REPORTS FROM THE SALMON-SPAWNING AREAS OF THE PROVINCE IN 1920.

Following the custom of former years since 1901, the Department conducted investigations of the spawning areas of the Fraser, Skeena, and Nass Rivers and Rivers and Smith Inlets. Detailed reports from each section will be found in the Appendix of this report.

The Fraser River.—The spawning-grounds of the Fraser River basin were again inspected by John P. Babcock, Assistant to the Commissioner. He was assisted by Inspector of Fisheries C. P. Hickman. In Mr. Babcock's report it is shown that the number of sockeye that reached Hell's Gate Canyon, in the Fraser above Yale, was larger than in any recent lean year and compared favourably with the number that reached there in the big year 1917. The fish appeared there in larger numbers in July than for a number of years, and the run in August was also larger.

During August sockeye were seen passing up the Thompson, the first lean year in many years that their presence in that great tributary of the Fraser has been noticed. Several arrests of Indians for taking salmon from that river were made in August, one Indian having taken upwards of 100 sockeye. The Department again attempted to collect data from the sockeye run in that river, but, not anticipating that any number could be taken there, the gill-nets were set too late to produce sufficient data to be of value. Notwithstanding that the sockeye run up the Thompson was noticeably better than in recent years, the Department was unable to show that any considerable number reached any one of the tributaries of Shuswap Lake, at the head of the Thompson River. There are many large tributaries of that great lake, in which the sockeye formerly spawned in great numbers, which offer extensive areas for spawning, but in none of them could sockeye be found in considerable numbers.

The Skeena River.—The spawning-beds of the Skeena, which were inspected by Fishery Overseer R. Gibson in September, apparently were not as well seeded as usual. The number of sockeye that spawned in several tributaries of Babine and Lakelse Lakes was much less. The run to most sections is reported to have been no larger than in 1916, which was the poorest year on record. Owing to freshets which damaged the weirs placed in streams by hatchery officials, the total sockeye-egg collection at the hatchery on the Skeena was less than in recent years, the eggs collected totalling but 7,734,000.

The Nass River.—The sockeye-spawning beds of the Meziadin watershed of the Nass River were again inspected by Inspector of Fisheries C. P. Hickman in September. As in former years, the extreme upper sections of the Nass River basin, which include Lake Bowser, were not visited owing to their extreme inaccessibility. In a summary of the results of his inspection this year Mr. Hickman states: "I am of the opinion that the run of sockeye to the Meziadin section of the Nass was not as large as in any former year of record, with the possible exception of 1919. The run of spring salmon was good and there appeared to be a greater number of cohoe in the watershed than were found in my former inspection."

Referring to the condition of the fishway at the falls on the Meziadin River, Mr. Hickman states that the salmon have no difficulty in entering or passing through the fishway. The channel of the river approaching the entrance to the fishway has been considerably improved by Dominion officers, but is far from satisfactory, being still partly obstructed with rubble-rock deposited there during the great flood of 1917–18. The removal of all that rock—the entire clearing of the channel below the fishway—is most desirable.

It has been suggested that a fishway should be constructed on the right bank of the falls. Mr. Hickman comments on the suggestion and states that the building of an additional fishway would be a good thing, but "from what I know of conditions before and after the present fishway was built and up to 1918, I am of the opinion that if all the rubble-rock is removed from the channel below the entrance to the present fishway an additional fishway is unnecessary. Following the years that the fishway was in its original condition, there certainly was no assembly of salmon below the falls on the right bank. It must be appreciated that it is most difficult to do any work at the falls, because they are most difficult of access. The trail over the Bear River Glacier has virtually been destroyed. There are now no bridges over Bear or Beaver Rivers or Surprise Creek. No one can get in with pack-horses. There are no residents, either whites or Indians. When the present fishway was built the trail was open and the streams bridged, and the powder, cement, tools, and food for the men, which were all taken in, passed over the trail on pack-horses. At present everything must be packed in by men unless a seaplane is used."

Smith Inlet.—The spawning-beds of the Smith Inlet sockeye run were again inspected by Fishery Overseer A. W. Stone. Importance was attached to this inspection this year since it would demonstrate the effects of the closing of Qualla Creek to net-fishing. The wisdom of preventing fishing in that entrance to the spawning area is fully demonstrated by Mr. Stone's report. There was a very substantial increase in the number of sockeye found on the beds this year over those found in the brood-years of this year's run, 1915 and 1916.

Rivers Inlet.—Fishery Overseer A. W. Stone again inspected the sockeye-salmon spawning-beds of the Rivers Inlet run. His report is of a most reassuring character. He states:—

"As a summary of the result of my inspection of all the tributaries of Owikeno Lake, which furnish the spawning-beds to the Rivers Inlet run of sockeye, I submit that all the tributaries were as well, if not better, stocked than in any year of record, and very much better stocked than in any year since 1915. Notwithstanding that the catch of sockeye at Rivers Inlet this year produced a pack of over 125,000 cases, sufficient fish escaped capture to adequately stock all the beds. The majority of the sockeye found there this year were exceptionally large and consisted of 5-year-old fish. Conditions on the beds this year were as satisfactory as in 1915, the brood-year of the 5-year-old fish that ran this year. It will be recalled that in 1915 I reported that the beds were better seeded than in any former year of record. The great run this year unquestionably is due to the exceptional seeding of 1915."

Salmon Data from the Sockeye Run to the Fraser.

The Department collected the usual data of the runs of salmon to Provincial waters during the year. It was again submitted to Dr. C. H. Gilbert. Before he could complete his examination and forward a report he met with a physical disability which compelled him, temporarily, to discontinue the work. Dr. Gilbert, however, had previously forwarded a partial report on the 1920 sockeye run to the Fraser, dealing with the appearance in the run of 1920 of grilse and showing its relation to the 1921 run, which is reproduced in the Appendix of this report and which will be found of especial value to those interested in the Fraser fishery, as it is in the nature of a forecast as to the size of the run in 1921.

Fishermen and canners on the Fraser have known for a considerable period that the sockeye run in the year before "the big runs" was made conspicuous by the occurrence of large numbers of greatly undersized individuals, which constituted a class apart from the main run, and that in the small years of each cycle they were rarely present. These fish—undersized, all males, and their flesh pale in colour and poor in oil—were, by discriminating canners, packed separately as an inferior grade. In consequence it was possible to compare their abundance in the years of their occurrence with the runs of four, or eight, or twelve years previous. The relative number of undersized sockeye found in the run previous to the big year furnished some basis for forecasting the size of the run in the big year. The reason for such possible direct relation between the two years became apparent in Dr. Gilbert's investigation of the age of salmon. He demonstrated that whereas the usual run of sockeye to the Fraser matured in the fourth year of their age, the undersized males, or grilse, as they are termed, matured in their third year and therefore made their appearance in the run one year earlier than the 4-year-old fish which resulted from the same spawning. If the spawning of the previous big year had been an unusually successful one, it might be expected to result in an exceptionally large run of grilse three years afterwards, and an equally exceptionally large run of 4-year fish in the following year. Dr. Gilbert began his investigations of the life of the sockeye on the Fraser in 1911. Since then he has annually determined the component parts of each run. In consequence he has shown the proportion of grilse in the runs of 1912, 1916, and 1920. In the first of these, 1912, the grilse had developed from eggs laid down in 1909. In the latter year the catch produced a pack of over 1,500,000 cases and the spawning-beds were abundantly seeded. The grilse then of 1912 came from a successful season and the proportion which they formed of the 1912 run could be accepted as an approximate statement for the corresponding years of the previous cycles. Tests made throughout that season indicated that about one fish in five of the total run was a grilse. The run in 1912 was followed in 1913 by a run of the first magnitude. It produced a pack of 1,400,000 cases. With this data Dr. Gilbert approached the run of 1916. The grilse that ran that year were developed from the eggs deposited in 1913, the year of the fatal blockade in the Hell's Gate Canyon, which cut off the run to the upper spawning-beds. His examination of the 1916 run showed but one-fourth as many grilse as the 1912 run, and it is equally a matter

of record that the pack of 1917, compared with that of 1913, showed an equal reduction. To determine the run in 1921 the same two lines of evidence are available—that derived from the poorly seeded spawning-beds in 1917 and that derived from the number of grilse that were found in the run of 1920. The reports from the spawning-beds in 1917 showed that they were less seeded than in 1913. The numbers of spawning sockeye throughout the up-river district in 1917 were less numerous than in many lean years and far less numerous than in 1913, and in consequence could not be expected to produce as good a run. The material to establish the number of grilse in the 1920 run was collected with care at close intervals throughout the season, and consisted of scales for age-determination and data as to length and sex of 1,900 fish. By microscopic examination of the scales Dr. Gilbert determined the age of each of this complete series. In the entire collection but three grilse were found. In 1912 one fish in five was a grilse and in 1916 they were but one-fourth as numerous. "In so far, then, as the number of grilse can be considered an index of the size of the run in the following year," Dr. Gilbert concludes, "the evidence from the 1920 run wholly agrees with that derived by Mr. Babcock from the condition of the up-river spawning-beds of the Fraser in 1917. From both of these lines of evidence the conclusion is forced upon us that 1921 will range itself definitely with the lean years of the Fraser, which for three years of the previous cycle produced an average pack for each year of 265,000 cases, and for the corresponding three years of the present cycle an average pack each year of 90,000 cases."

The evidence submitted by Dr. Gilbert forces the conclusion that "the big year" of the Fraser must be recognized "wholly a thing of the past," and that "any method which might be successful in re-establishing it would be equally successful in raising the traditional lean years of the Fraser from their present low estate to an equality with the old-time 'big years,' when untold millions of spawning sockeyes fought their way through the rapids of the Yale Canyon and distributed themselves over the unequalled spawning areas of the upper river."

THE HALIBUT-FISHERY.

The catch of halibut landed at ports of the Province in 1920 totalled 22,089,035 lb., as against 19,198,565 lb. in 1919 and 16,697,000 lb. in 1918. The landings at Provincial ports in 1920 were over 44 per cent. of the total landing at all Pacific ports in that year. Prince Rupert again led in the landings, with a total of 18,941,035 lb. to Vancouver's 3,148,000 lb.

The total landings of halibut at all Pacific ports in 1920 totalled 49,816,950 lb., as against 43,534,195 lb. in 1919 and 39,212,564 lb. in 1918. The gain in the catch of the last two years over that of 1918 is the result, to a large extent, of the taking of a greatly increased quantity of undersized fish known to the trade as "chickens." These small fish, as was shown in the Department's reports for 1915 and 1916, are immature. Halibut do not spawn until their eleventh year. The fact that the fishermen bring in these small fish, for which they get a much smaller price than for adults, is evidence that they cannot now, as formerly, make a catch of adult fish. The gain in the total catch of the last two years over that of the low record year 1918 has been made at the expense of the future. It has been an overdrain that the stock on the banks cannot long endure.

Car shortage and the rate of exchange diverted many halibut cargoes from Prince Rupert to Seattle. The bulk of the catches were made by independent fishing-vessels, many of the company boats being laid up for most of the season owing to the cost of operation.

WHALES.

The whaling-stations at Kyuquot, Rose Harbour, and Naden Harbour, in the Province, were operated in 1920. A total of 493 whales were taken, as against 432 in 1919. The stations produced 604,070 gallons of oil, 1,033 tons of fertilizer, and 320 tons of whalebone and meal.

Ten whaling-stations were operated on the Pacific Coast of America in 1920. A total of 1,763 whales were taken, of which 170 were belugas taken in Alaska which have not heretofore been utilized. The production of whale-oil on the Coast in 1920 totalled 2,129,956 gallons.

COLD-STORAGE OF FISH.

Owing to a lack of market for trawl-caught fish and the cost of operating, the trawling companies withdrew their vessels early in the season. A total of only 13,786,000 lb. of fish were placed in cold storage in the Province in 1920, as against 17,157,000 lb. in 1919. It is difficult

to understand why the public does not more commonly avail itself of the sole, flounders, brill, etc., that are offered at a much less price than halibut and salmon. They are abundant in our waters and are equal in food value to any fish on the market.

The following statement of the salmon-eggs placed in the hatcheries of the Province in 1920 is furnished by Major J. A. Motherwell, Chief Inspector of Fisheries for the Dominion:—

STATEMENT SHOWING TOTAL NUMBER OF EGGS PLACED IN VARIOUS HATCHERIES IN BRITISH COLUMBIA, 1920.

Name of Hatchery.	Sockeye.	Cohoe.	Springs.	Chums.
Anderson Lake	10,142,450	.....	.....	.....
Babine Lake	5,000,000	.....	.....	.....
Cowichan Lake	1,171,000	2,464,000	569,500	2,108,000
Cultus Lake	.....	880,000	.....	.....
Harrison Lake	4,936,000	83,000	3,922,000	3,619,000
Kennedy Lake	9,577,000	.....	.....	.....
New Westminster	.....	205,000	100,000	.....
Pitt Lake	4,360,000	234,000	.....	.....
Pemberton	26,000,000	.....	.....	.....
Rivers Inlet	12,077,000	.....	.....	.....
Stuart Lake	4,370,000*	.....	.....	.....
Skeena River	7,734,000	.....	.....	.....
Totals	85,367,450	3,866,000	4,591,500	5,727,000

* Collected from Skeena River basin.

APPENDICES.

THE SPAWNING-BEDS OF THE FRASER RIVER.

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

SIR,—I have the honour to submit the following report of my annual inspection of the salmon-fishing and the salmon-spawning area of the Fraser River system during the season of 1920:—

The catch of all species of salmon from the Provincial waters of the Fraser River system this season produced a total pack of 136,661 cases, as against 163,123 cases in 1919, 276,459 cases in 1918, 330,209 cases in 1917, and 127,472 cases in 1916. The pack consisted of 48,399 cases of sockeye, 22,934 cases of cohoe, 24,123 cases of spring, and 23,884 cases of chum. The catch of sockeye in the Provincial waters of the system shows a gain over that of the preceding year, and was 16,253 cases greater than that made in those waters in the fourth preceding year. The catch of sockeye made by the traps in Provincial waters of Juan de Fuca Strait, which are credited to the Fraser, was the smallest ever made there, producing a pack of but 3,801 cases. The catch of sockeye made in the Gulf of Georgia and the Fraser River proper was greater than in any recent lean year. The fish ran earlier than usual, one-quarter of the entire season's catch being made in July.

The season's catch of sockeye in the State of Washington waters of the Fraser River system produced a pack of 62,654 cases, as against 84,637 cases in the preceding fourth year, a decrease of 21,983 cases.

The total catch of sockeye in the waters of the entire Fraser River system in 1920 produced a pack of 111,053 cases, as against 116,783 cases in its brood-year—(1916), showing that for the first time in several cycles of lean years there was but a slight decrease in the catch. As has been pointed out in previous reports, minor fluctuations in the catch in the lean years do not come as a surprise and are not of importance in view of general conditions on the Fraser. Slight increases in the pack over that of preceding years would be without significance, since fluctuations are bound to occur in all streams where a general decline in the catch is shown.

Though the number of men engaged and the amount of fishing-gear used in the entire district was the smallest for many years, the catch was made at the highest cost on record.

I made my seventeenth annual inspection of the principal salmon-spawning area of the Fraser River basin during July, August, September, and October. I was assisted by Inspector of Fisheries C. P. Hickman, and am indebted to Dominion Fishery Officers and to local residents both whites and Indians, scattered over the basin, for much information of value.

As a result of the season's investigations I am of the opinion that more sockeye reached the upper section of the area of the Fraser this year than in any recent lean year, but in no district of the upper river were sockeye found in sufficient numbers to produce a future run of importance. The number of sockeye that reached the headwaters of the Harrison-Lillooet Lakes section, as will be shown later, was greater than in any previous year of which there is a record.

The number of sockeye that passed through Hell's Gate Canyon, above Yale, was unquestionably greater than in any recent lean year. Fishery Officer Scott, of the Dominion service, who has patrolled that canyon of the Fraser for a number of years, expressed the opinion that as many sockeye passed through Hell's Gate Canyon this year as in the last big year (1917). Sockeye in numbers reached the canyon early in July, more being in evidence there during that month than in many recent years; and they were in evidence there during August and September. Owing to unusually favourable water conditions throughout the year the fish at no time had any real difficulty in passing through the rapids at Hell's Gate. None were delayed there this year. The Indians, who have commonly fished for salmon at Hell's Gate, were not permitted to do so this year.

For the first time in many years sockeye were seen passing up the Thompson River between Lytton and Spences Bridge. Several Indians who caught sockeye from the Thompson in August

were arrested for doing so by Dominion officers. One of the Indians had caught upwards of 100 sockeye.

The sockeye that passed up the Thompson are believed to have spawned in the Shuswap-Adams Lake section, but an inspection of the principal tributaries of those lakes failed to disclose in any one of them sockeye in sufficient numbers to produce results of importance. Small numbers were, however, found in some of the tributaries where none have been reported for a number of years.

During July and throughout August and early September sockeye were observed passing through the canyon in the Fraser's channel above the mouth of Bridge River. The water there throughout the entire season was much higher than usual, with the result that the salmon had no difficulty in passing through the rapids. They were not delayed there this year. Notwithstanding the Dominion's order prohibiting the Indians from taking salmon above the commercial fishing limits at Mission Bridge, a considerable number of sockeye were taken by them in the canyon. As soon as their operations were reported to the Dominion fishery officials an officer was placed there, and thereafter all fishing ceased. The number of sockeye taken by the Indians could not be ascertained with any degree of certainty, but it is asserted that they caught more than in recent lean years when they were permitted to fish throughout the season.

Because the Indians living on the Chilcotin River were not permitted to fish for salmon, and because the waters of that river are always so discoloured by a chalky silt, it was impossible to establish the extent of the run of sockeye there this year. From statements made to me by Indians, who did fish in a small way at night, notwithstanding the prohibition, I concluded that sockeye ran up that river for at least two weeks in August. Indians living at the head of Chilko River, just below Chilko Lake, reported that more sockeye reached there this year than in any recent lean year, but that they were at no time so numerous as to have permitted their catching any considerable number had they been permitted to do so. The fish secured by them, like those taken by the Indians on the lower river, were consumed in a fresh state.

Less than 500 sockeye were recorded as entering Quesnel Lake this year. The watchman stationed there by the Department reports that the first sockeye reached there on September 2nd, and that the last to arrive passed through the fishway on September 17th. There was a scattered run between those dates.

The watchman at Quesnel Lake also reports that at least 400 spawning salmon passed through the fishway this year, a greater number than has been reported since the fishway was built by the Province in 1903.

The run of sockeye to the tributaries of the Nechako River, which enters the Fraser at Prince George and which drains Stuart and Fraser Lakes, was not sufficiently large to be of importance, but it is interesting to note that a few sockeye were reported from some minor streams in that section where their presence has not been recorded in recent years.

The number of sockeye that are known to have passed up the South Fork of the Fraser is small, though more are reported to have reached Bear Lake section than for some years.

The watchman stationed at Seton Lake reports that no sockeye, and very few other spawning salmon, entered that lake this year. The hatchery there was not operated.

The number of sockeye that reached the Birkenhead River, at the head of the Harrison-Lillooet Lakes section, this season was greater than in any year since that section came under our observation in the fall of 1902. Conditions there this year were most satisfactory and promised to produce a good return. The run of sockeye to this section in each of the last two years is believed to have been considerably greater than in any year since 1902. With the exception of the years 1917 and 1918, the run of sockeye to that section has shown no indication of diminishing. It is the only section in the entire watershed of the Fraser River basin, with the possible exception of Cultus Lake, that has not shown a steady and alarming decline in the run of sockeye. Year after year the run to the head of Lillooet Lake has been satisfactory, with the exception of the two years 1917 and 1918. Furthermore, the Lillooet Lake section is the only one in the Fraser basin, where hatchery operations have been conducted, in which the run of sockeye has been maintained. The number of sockeye that spawn in that section has not declined; on the contrary, there is evidence that it has increased. The question then naturally arises, why has the sockeye run to that section been maintained while the runs to all other sections have declined? The annual appearance of undiminished numbers of sockeye in the Lillooet Lake section must apparently be attributed to one of two causes: Either it is due

to the successful operation of the hatchery, or the races of sockeye that spawn there have not been subject to the great drain made on all the other races that spawn in the Fraser by the traps and nets on the fishing-grounds. Since it has not been shown that the sockeye that spawn in the Lillooet Lake section enter the Fraser before the fishing season opens on July 1st, it is not apparent why they should be less subject to the heavy drain by fishing than those that spawn in other sections. Fishing for sockeye in the Fraser before July 1st has not been permitted for over thirty years. It is a matter of record that when fishing for sockeye was permitted in May and June good catches were made in those months. Alex. Ewen, in the early days of the canning industry, packed as high as 10,000 sockeye in the month of May. Canning was not at that time extensively conducted, and those engaged in the industry found it more profitable to operate later in the season when the run was more extensive. There may still be runs of sockeye in May and June. The fact that sockeye have not been observed in the river at Hell's Gate until July does not prove that none enter the river much earlier, because earlier runs could easily pass into the tributaries of the Fraser below the canyon. Sockeye may still enter the Fraser in May or June and turn from the Fraser into the Harrison River en route to the waters of Lillooet Lake and the Birkenhead River. If such is the case it is obvious that such a run would not be subject to the drain of the traps and nets, and in consequence would easily maintain itself. It therefore becomes a matter of importance to establish when the runs to that section enter the Fraser. The Department hopes to do this during the coming year.

Sockeye reached the headwaters of Lillooet Lake and entered the Birkenhead River early in September. By the 17th of that month over 5,500,000 eggs had been collected and placed in the hatchery. The sockeye-egg collection for the season totalled 26,000,000. It is believed that many additional millions could have been secured had the operators desired to take them. They preferred, however, to let the fish spawn naturally. The weirs were therefore removed from the river and the fish permitted to pass to the natural spawning-beds of the Upper Birkenhead, which were abundantly seeded.

There were less sockeye in the lower reaches of the Fraser basin than in any recent year, and the egg collections for the hatcheries there were consequently much less than the average for that district. Owing to a smaller run and freshets the sockeye-egg collection for the hatchery at Harrison Lake totalled but 5,000,000, as against last year's take of 7,500,000. Owing to a very light run of sockeye to Cultus Lake but 1,250,000 eggs were secured, as against 10,500,000 collected last year.

I am indebted to Major J. A. Motherwell, Dominion Inspector of Fisheries for the Province, for the following statement, giving the salmon-egg collection made this year at all the hatcheries in the Province, which totalled 99,553,000:—

STATEMENT OF SALMON-EGGS COLLECTED, 1920.

Name of Hatchery.	Sockeye.	Cohoe.	Springs.	Chums.
Anderson Lake	10,142,450	.....	.....	.....
Babine Lake	5,000,000	.....	.....	.....
Cowichan Lake	.....	2,464,300	569,500	.....
Cultus Lake	1,171,000	880,000	.....	2,108,000
Kennedy Lake	9,577,500	.....	.....	.....
Harrison Lake	4,936,000	83,000	3,922,000	3,619,000
New Westminster	.....	205,000	100,000	.....
Pemberton	26,000,000	.....	.....	.....
Pitt Lake	4,360,500	234,000	.....	.....
Rivers Inlet	12,077,000	.....	.....	.....
Skeena River	7,734,000	.....	.....	.....
Stuart Lake	4,370,000	.....	.....	.....
Totals	85,368,450	3,866,300	4,591,500	5,727,000

Respectfully submitted.

JOHN PEASE BABCOCK,
Assistant to the Commissioner.

Victoria, B.C., December 15th, 1920.

THE SPAWNING-BEDS OF RIVERS INLET.

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

SIR,—I have the honour to submit my report upon the inspection of the spawning-beds conducted at Rivers Inlet for the year 1920.

Leaving Rivers Inlet Cannery on October 7th, I proceeded to the Owikeno Lake with the intention of going through to the head, but weather conditions compelled me to stop at Asklum River, situated 12 miles up, so commenced the inspection at this point first. The sockeye seen here were in great abundance, and as the river was low no difficulty was experienced in forming an accurate estimate of the run in comparison with the brood-years 1915 and 1916. The run was equal to 1915 and greatly exceeded that in 1916.

I wish to draw attention to a log-jam which has formed at the mouth, requiring removal at the earliest opportunity, as if permitted to remain it will cause a serious menace to future runs of fish up the river.

On arrival at the head of the lake camp was made and an examination conducted at Cheo River, one of the three tributaries situated at this point, all early-running salmon-streams. The numbers spawning on the beds right up to the falls, 4½ miles distant, equalled those seen there in 1915. Large numbers of fish in an advanced stage of spawning were observed just below the falls, having passed under the log-jam without difficulty; spawned-out salmon and dead bodies lying on the river-bed and the bars testified to the very large run which had prior to my visit come in. With the exception of the log-jam referred to, no other obstructions interfered with the movement up-stream.

The run of sockeye salmon to the Indian River shows a great improvement in comparison with the number seen on the beds in 1915 and 1916. The gravel-bars right up to the falls, half a mile distant, contained big numbers of spawning fish, while many were observed in a dying condition lying helpless on the bars; dead bodies covered the river-bed at the entrance, evidence that the run here earlier in the season had been exceptionally large.

An inspection of the Washwash River, on the extreme right of the lake, revealed conditions testifying only too plainly the necessity of continued effort each year to counteract the evil influence of the freshets, which have undone the good work of the Department of Fisheries to keep the spawning-beds open to the salmon. The clearance which the Dominion officials effected here in the spring of last year is again closed by a log-jam that blocks the entrance and will be a serious menace to future runs if attention is not given to it. This freshet continued its work of destruction by breaking through and opening up a new channel about a quarter of a mile from the entrance, laying bare all that portion of the river situated below, including the stream at the right of the Washwash. As it was in this part that a great proportion of the run last year had spawned, and which I had commented upon so favourably in my report, it is a matter that must be given due consideration in estimating the run which will return as the result of the 1919 spawning. If the freshet took place prior to the hatching of that year's brood, it will have had a corresponding effect upon the extent of the run. The course of the present channel is a scene of great chaos, huge trees having been felled and log-jams cover every portion, constituting a grave danger to the future run of salmon.

The number of sockeye in evidence in the Washwash this year was very gratifying; from the entrance to the falls, 3 miles distant, countless numbers were observed spawning on the beds, a large proportion having safely passed through the obstructions referred to above. The run approaches very closely the number seen on the beds in 1915 and greatly exceeded the run in 1916. In size the fish were again noted to be exceptionally large and to average much above the runs in recent years.

The number of spawned-out fish and dead bodies lying all over the bars approximated very closely in numbers to those seen on the beds of Cheo and Indian Rivers.

Sunday Creek, situated near the mouth of the Sheemahant flats, showed a great improvement in comparison with previous years; the gravel-beds at the entrance were covered with spawning sockeye of exceptionally large size, reminding me of the run of fish in 1915.

Numerous sockeye were breaking water in the Narrows, indicating that the spawning-beds at this section will receive a plentiful supply of eggs.

An examination of the Sheemahant River, the largest and one of the most productive salmon-streams of the lake, did not appear to have received so many sockeye as has been evidenced in other big years, but the run was very good and compared favourably with the number on the beds in 1915. At the entrance the fish were observed in considerable numbers scattered over the gravel-bars; as each riffle was encountered on our way up the river sockeye in large numbers were seen, while in the deep water below the fish could be detected hugging the banks, avoiding as much as possible the swift current. No log-jams or other obstructions interfered with the movement of the salmon up-stream.

On arriving at Jeneesee Creek I was informed by the hatchery officials that the Machmell River had broken through to this creek during a freshet and had carried away the trap and fence used by them for trapping the fish; the result was many had escaped capture before a new fence could be erected. It is from this creek that eggs for the hatchery have been collected in previous years, and it was hoped that some would be obtained this year, but the run was poor, only a very small number being obtained. An examination of the stream up to the falls was a great disappointment; few adult salmon were in evidence. A peculiar feature attached to this run is the abnormal number of small grilse that had entered, comprising 80 per cent. of the total number of fish on the spawning-beds; a few years ago these fish were looked upon with a degree of curiosity. A steady increase in the number each year for the past three or four years has been noted. I examined several to find the proportion of males and females, but they were all males. There is nothing to prevent the fish taking full advantage of the spawning-beds, as the clearance which was made in the spring of last year to open up these beds is still very effective. In making comparison with the number reaching here in 1915 and 1916, I find no improvement shown in the poor runs recorded for those years.

The Machmell River, as usual, constituted a difficulty in arriving at a proper estimate of the run of sockeye owing to the discoloration of the water, but in going farther up a few salmon were observed in the shallows, indicating that a certain number will seed the beds. As this river closely resembles the Sheemahant in size, it is a matter of regret that the full extent of the run cannot be determined.

The Nookins, a tributary to the Machmell, situated on the extreme right about half a mile from the entrance, was seen under favourable circumstances. In the still waters for about half a mile dead bodies of sockeye salmon covered the river-bed, testifying to a very big run earlier in the season. On reaching the rapids they were noted in large numbers spawning on the beds, and the farther we proceeded up-stream the greater the number seen. It represented a close parallel to the number recorded in 1915; the individual size was of high average and should produce a fine run of sockeye from this season's spawning.

The next river to receive attention was the Dalley, situated about 6 miles from the mouth of the lake. It is of peculiar interest, in that it represents an early-running salmon-stream although located so near the mouth of the lake. In the clear still waters above the rapids dead bodies were lying scattered all over the river-bed, having gradually drifted down-stream earlier in the season. As each successive riffle was encountered on our way through to the falls 4½ miles distant, the sockeye in an advanced spawning stage were observed in thousands on the gravel-beds, while the bars all the way up were covered with dead fish, from which the stench was overpowering. Here again the salmon represented a high average in size, comparing with those seen at the other tributaries of the lake. The high record attained in 1915 was again reproduced in the numbers that returned to spawn this year; the males and females were equally represented.

Crossing to Quap River, situated directly opposite the Dalley, the spawning-beds here were examined under very favourable circumstances. The surrounding waters of the lake were alive with jumping fish, and on close inspection sockeye in dense masses could be discerned in the deep pools waiting at the entrance; inside the entrance the same conditions were observed. The milling mass of sockeye is without precedent in all the years of my inspection, and is proof of the value of the hatchery in maintaining the runs year by year by the means adopted to liberate the fry into this river. If this could only be applied to the other tributaries of the lake there would be little fear of poor runs such as have taken place in recent years.

The spawning-beds up to the fence and beyond were covered with countless numbers of fish; here the Indians were catching salmon for their winter's use and had already smoked a great

number. It was their intention to put up about 3,000 salmon, so they informed me. Samples of the sockeye examined at random showed a very high average in size—viz., 8 to 9 lb. in weight.

Out of the full complement of sockeye-eggs received at the hatchery, I am courteously informed by W. J. Reid, Superintendent of the Dominion Hatchery, that 12,000,000 eggs were collected from Quap, 1,000,000 from the Hatchery Creek, and 500,000 from Jeneesee Creek. The failure of the latter is significant and bears out the poor reports recorded in 1915 and 1916, the brood-years from which the present run resulted.

As the high water which frequently occurs at the Hatchery Creek would not permit a fence to be erected right across, only part of it was undertaken, but even with this handicap a fair number had been collected, as will be noted from the above figures. The beds contained a large number of sockeye of exceptional size and in numbers compared very favourably with other years. The gravel-bars at the entrance also contained their proportion of sockeye, from the results of which the beds should be bountifully seeded.

The spawning-beds surrounding the rancheries and along the shore-line at the head of the Owikeno River were alive with fish jumping in every direction, testifying to a very big run to this section.

Spring salmon were again observed in large numbers occupying the spawning-beds of the Owikeno river, while many in the last stage of exhaustion and spawned out were seen at low tide lying on the beach near the mouth. Both cohoe and dog salmon were noted in exceptional numbers here, indicating that the beds will be extensively seeded from this species of salmon.

As a summary of the result of my inspection of all the tributaries of Owikeno Lake, which furnish the spawning-beds to the Rivers Inlet run of sockeye, I submit that all the tributaries were as well, if not better, stocked than in any year of record, and very much better stocked than in any year since 1915. Notwithstanding that the catch of sockeye at Rivers Inlet this year produced a pack of over 125,000 cases, sufficient fish escaped capture to adequately stock all the beds. The majority of the sockeye found there this year were exceptionally large and consisted of 5-year-old fish. Conditions on the beds this year were as satisfactory as in 1915, the brood-year of the 5-year-old fish that ran this year. It will be recalled that in 1915 I reported that the beds were better seeded than in any former year of record. The great run this year unquestionably is due to the exceptional seeding of 1915.

Another interesting feature is the exceptionally high average in size the run of sockeye attained this year.

In conclusion, I wish to express my appreciation for the kindness extended by G. L. Johnston, Manager of Rivers Inlet Cannery; W. J. Reid, Superintendent of the Dominion Hatchery, and his assistants, to whom I am indebted for a very successful trip.

I have, etc.,

Arthur W. Stone,

Fisheries Overseer.

Rivers Inlet, B.C., November 8th, 1920.

THE SPAWNING-BEDS OF SMITH INLET.

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

SIR,—I have the honour to submit the following report of the inspection of the spawning-beds at Smith Inlet for the year 1920:—

Considerable interest was attached to this inspection, as it permitted me to observe for the first time the full effect that the withdrawal of the drag-seines had upon the run of sockeye salmon to the spawning-beds at Long Lake. Formerly the seines were operated at Qualla Creek, situated inside the gill-net boundary, and took toll of an immense number after they had escaped capture from the gill-nets distributed over the fishing-grounds at Smith Inlet.

It was long contended they were a serious menace to conservation, and if permitted to remain as a contributive factor to the salmon-pack would eventually work to the detriment of the salmon run each year; the Department of Dominion Fisheries, realizing the situation, took measures finally to counteract this danger by eliminating them from the fishing-grounds entirely, with the result that the fish are now permitted to reach the spawning-beds unmolested.

The effect of such a measure was clearly demonstrated by the substantial increase in the number that had reached the spawning-beds this year in comparison with the run in 1915, and greatly exceeded the run of 1916, the brood-years from which the present run resulted.

The low tides prevented access to the spawning-beds for a couple of days, so the opportunity was taken to examine the run of cohoe and dog salmon at the head of Smith Inlet; both species were in great abundance.

After accomplishing the ascent of the Docee River (the overflow to the lake) camp was made for the night. An examination of this river showed that the run of spring salmon had not fallen off in comparison with former years, but is well up to the average; in the clear water above the rapids they were seen in very large numbers and of exceptional size; many were also observed breaking water along the shore-line at the mouth of the lake. No cohoe salmon were in evidence at this time.

Proceeding to Quay Creek the next day, I was impressed by the considerable number of sockeye which were making full use of the gravel-beds at the entrance, and outside the fish could be seen breaking water in all directions. The restricted spawning-beds inside the creek were covered with spawning fish and at the foot of the falls many were making futile efforts to surmount them, but were hurled back helpless to die unspawned.

Last year I pointed out the disadvantage under which the fish laboured in finding suitable spawning-ground here, and suggested that if a fish-ladder could be constructed over the falls and the log-jams removed from the creek leading direct to a lake half a mile inland, some valuable spawning-beds could be opened up. I have no doubt if these measures were adopted it would add greatly to the value of this tributary as a contributing factor to the run of salmon.

The Delabah River, situated about 2 miles from the head of the lake, was exceptionally well stocked with sockeye and reminded me of the remarkable numbers recorded here in 1914; a considerable improvement was shown in comparison with the 1915 run, and is entirely due, I believe, to the steps taken to conserve the run of salmon to the spawning-beds this year. The river-bed from the entrance to the falls, 1½ miles distant, was literally covered with spawning fish; schooled up in the deeper parts thousands were seen waiting until ready to deposit the eggs; dead bodies lying on the river-bed and on the bars were observed in thick masses and created a most offensive odour. In the bay outside the sockeye were breaking water all over, and on close inspection could be detected in the clear waters of the lake schooled up in thousands, testifying to the exceptionally big run here. The outlook is exceedingly bright for a big return as the results of this season's spawning. A noticeable feature in connection with the run this year is the high average in size attained by the fish, and is in marked contrast to the runs which have returned in recent years.

The run of sockeye salmon to the fine spawning-beds of the Geluch River, situated at the head of the lake, exceeded the numbers recorded in 1915. The 3½ miles of spawning-ground ending at the falls was crowded with a seething mass of fish, while the inspection of the small mountain streams which empty into this river showed that the beds will receive their full proportion of salmon spawn from the very large number in evidence there. This situation is

only manifest during the years of the big runs, as on former occasions, when the run has been a small one, few salmon, if any, were seen in these streams.

No log-jams or other obstructions were encountered; consequently the fish were permitted to utilize every portion of the beds for spawning; the males and females were fairly evenly distributed.

The gravel-bars that cover the entrance to the Geluch and along the shore-line at the head of the lake contained their full quota of salmon, no falling-off being noted in comparison with other big years. In the surrounding waters of the lake salmon could be seen jumping in every direction.

Returning once more to the mouth of the lake, the Docee River was again closely inspected for signs of the Cohoe salmon, but none were in evidence.

In summing up the results of the inspection of this watershed, I am of the opinion that the improvement which is evident in the increased number of sockeye salmon on the spawning-beds is entirely due to the timely action of the Dominion authorities in preventing the operations of the drag-seines.

The size of the pack, amounting, I am reliably informed, to 20,000 cases this year, is in striking contrast to the big pack of 35,000 cases put up in 1915, one of the brood-years from which the present run resulted, and clearly demonstrates the value of conserving the run of fish to the spawning-beds.

The falling-off in the run of salmon to the spawning-beds in 1915, and mentioned in my report for that year, has, I am glad to say, been fully restored, and should result in a very big run of sockeye salmon to this section from this season's spawning.

In conclusion, I wish to express my appreciation for the courtesy extended by Mr. Blakey, caretaker of the Smith Inlet Cannery.

I have, etc.,

ARTHUR W. STONE,

Fisheries Overseer.

Rivers Inlet, B.C., November 8th, 1920.

THE SPAWNING-BEDS OF THE SKEENA RIVER.

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

SIR,—In obedience to your instructions, I beg to submit the following report on the inspection of the spawning-beds of the Skeena River for the season 1920:—

I arrived at Donald's Landing, on Babine Lake, on September 4th, and proceeded the following day to 15-Mile Creek, where I met Mr. Karnock, the assistant to Mr. Crawford, of the Stuart Lake Hatchery. Mr. Karnock informed me that they had not commenced spawning in 15-Mile Creek, as they were then busy spawning in Pierre Creek, but they would do so later in an effort to get their full complement of eggs for the Stuart Lake Hatchery, a total of 6,500,000 eggs. At the time of my visit there were about 2,500,000 eggs in the baskets which had been spawned by Mr. Crawford in Pierre Creek, and he had gone back to Pierre Creek for as many more eggs as he could get without seriously interfering with the natural propagation in that creek. There were very few sockeye in 15-Mile Creek, and Mr. Karnock said it was much similar to that of 1916, which was one of the poorest years on record so far as the spawning-grounds are concerned. For about a quarter of a mile from the lake this creek is an ideal spawning-bed, but beyond that there is a succession of rock-obstructions and many waterfalls which prevent the salmon going farther up the creek. In average seasons this is considered one of the best spawning-creeks on Babine Lake, and I am informed that a hatchery with a 10,000,000-egg capacity will be built on this creek next year. A peculiar feature of this creek was the large number of undersized male sockeye in comparison with the others of average size, especially those that had gone through the fence or barricade erected for spawning purposes. A good many of these undersized sockeye, or "runts," as they are commonly called, would not exceed 10 inches in length. These "runts" are all males, but are not used for artificial spawning, although I am informed they give in proportion to their size as much milt as the average adult male. There were no Indians at the mouth of this creek catching or putting up fish, which was proof of the scarcity of the sockeye this year. As there is now an off-year in the cycle of the sockeye-run, it is evident that some restrictions will require to be imposed in the years 1924, 1928, and so on, during the sockeye-fishing season in order that the sockeye may regain the average of the other three years. Should a hatchery be built at this creek next year as is contemplated, it will increase the run considerably, especially to the upper end of the lake, and will offset the taking of the eggs for Stuart Lake Hatchery and planted in the Fraser.

I called in at 4-Mile Creek the same day, but this creek is too small to be of any importance, as one can jump across it almost anywhere. There was not a single live salmon in the creek, but I should judge a few sockeye had gone up a month earlier when the water was high, and since spawned, as was evident by the ten or twelve dead sockeye in the little pools in the creek.

The following morning I proceeded on to Beaver Creek, at the head of the lake, where there were two Stuart Lake Indian families fishing with nets near but not obstructing the mouth of the creek. While I was there the Indians overhauled their nets, but only caught two sockeye, although the nets had been out all night. Their smoke-houses and racks had a fair supply of fish, so evidently they had been more successful in catching salmon the previous three weeks. I went up Beaver Creek in a boat for a distance of about 3 miles. This creek for the first 3 miles has practically no current, is discoloured, and has a muddy bottom resembling a slough, making it almost impossible to see whether there are any sockeye in that particular stretch. On going farther up the creek I met with many log-jams and beaver-dams which would entail considerable expense to clear, but the current was more noticeable. A few sockeye were seen in the pools and gravel patches between the log-jams, but it was impossible to estimate the number owing to the darkness of the water.

It is apparent that only a limited number of sockeye can get over these obstructions while the water is high earlier in the season. A number of dead sockeye were seen between and above the log-jams, but as this creek is considered one of the earliest spawning-creeks in Babine Lake, there were evidently not a great number of sockeye successful in overcoming the obstacles. On returning to the mouth of the creek and patrolling round the head of the lake, there was only an occasional sockeye seen, although the head of the lake is considered a fine spawning-ground, the water being shallow for some distance from the shore with a fine sand and gravel bottom.

On September 7th I visited Pierre Creek and was agreeably surprised at the large number of sockeye seen. The creek had been cleared of all the big rocks and logs by Mr. Crawford, the Superintendent of Stuart Lake Hatchery, and was in splendid condition for spawning. I did not see Mr. Crawford here, but from the number of dead salmon near where the barricade had been I should judge that he had been successful in obtaining the majority of his complement of eggs for Stuart Lake Hatchery. Although there were a few undersized sockeye to be seen, the majority were of an average size and in good condition, the males and females being evenly balanced. In the lake around the mouth of the creek there were a large number of sockeye plainly seen spawning in the fine gravel and sand that had been washed down from the creek. This creek will be exceptionally well seeded, and to the knowledge of the hatchery and Dominion officials it will be far in excess of any previous year. There were no Indians at the mouth of this creek, so apparently there will be nothing to disturb the sockeye in their natural propagation. Pierre Creek is the earliest creek on Babine Lake for sockeye spawning, and I am informed by the Dominion Guardian that the first sockeye were seen in this creek on July 21st. From all reports the sockeye are running much later than last year, from no apparent reason unless it is attributed to the exceptionally high water in June and July.

On September 9th I arrived at Salmon or Hatchery Creek and proceeded up the creek to the hatchery, a distance of about 3 miles. This creek was also in fine shape, being free from any obstruction, with large numbers of sockeye clearly visible in the many big pools and many spawning in the numerous shallow gravel patches. The sockeye in this creek were of an exceptionally good size and should, in my opinion, average in the neighbourhood of 8 lb., a good many being nearer 11 lb. in weight. At the hatchery I met Mr. Gibbs, the Superintendent, who informed me that during the high water in July his barricades had been washed away and an unknown number of sockeye had escaped into Morrison Lake, at the head of the creek. This would naturally cause artificial spawning to be later than usual, as the ripe sockeye are generally found near the barricades. Mr. Gibbs did not expect to get as many eggs spawned as last year, but he thought that the number would not be much below the average of former years. There were a large number of sockeye jumping at and trying to get through the barricades, but sacks of hay all along the foot of the barricades prevented the fish from being injured when they fell back. In the creek the males and females were evenly balanced, but near the barricades the males predominated. Mr. Gibbs informed me that last year he spawned 8,760,000 eggs and commenced to liberate 7,924,000 young sockeye-fry in the month of May this year. Although this hatchery has a 10,000,000-egg capacity, Mr. Gibbs believes that better results are obtained with a less amount, as it allows more room for the young fry. This hatchery has been in operation for a good many years, and as proof of the results it is stated that in previous years the eggs for this hatchery were obtained entirely from Babine and other creeks; whereas, without exception, the eggs are now all obtained in this creek, and, incidentally, right at the door of the hatchery. The reason for this is the run is now changed, the fish, as is well known, returning to their place of origin. Illustrative of this point, I may say that while I was there ten or twelve sockeye had made their way through the intake-pipe into the hatchery and were spawning in the retaining pond. There were four Babine Indian families at the mouth of this creek and their smoke-houses and racks were fairly well filled.

On September 10th I arrived at Fort Babine and the following morning I went down the Babine River a distance of about 10 miles. It is on this stretch of water that the Babine Indians (approximately a hundred families) catch the bulk of their fish, and their smoke-houses and racks are scattered here and there along the shores. All their smoke-houses and racks had a good proportion of fish, but on questioning a few of the Indians as to the general run of the sockeye, they would say: "No fish." With the Indians it is either a case of lots of fish or no fish; they apparently never get a "fair" catch. There are good spawning-grounds in this stretch of water, especially near the bridge at Babine, but there were very few sockeye to be seen. In the vicinity of the old barricade-site on Babine River the Indians were catching a fair amount of spring salmon in addition to the sockeye. The following day, September 12th, I visited Fulton or Tachek Creek, where there were four Babine Indian families putting up their winter's supply of fish. Their smoke-houses and racks were also fairly well filled. On questioning these Indians as to the run of sockeye, they complained of not getting enough fish owing to the poor run. I went up the creek a considerable distance, and although there are fine spawning-beds for at least 2 miles there were very few sockeye to be seen. As this is the last point of interest on

Babine Lake, I may say that, with the exception of Pierre Creek and Hatchery Creek, the sockeye run in the Babine District was very poor, the number of sockeye on the spawning-beds being much below the average and on par with the year 1916. Hatchery Creek was well up to the average of former years and Pierre Creek better seeded than in any previous year.

I returned to Burns Lake and arrived in Hazelton on the 19th, and on the following day visited Awillgate Canyon, on the Bulkley River, where the Hazelton and Awillgate Indians catch their winter's supply of fish, chiefly by means of basket traps. The Indians do not now catch many fish at this point, as they are more industrious than the Babine Indians and do not make fish their sole winter food. Although there are a number of smoke-houses at the canyon, only two had been in use this summer. The Dominion Guardian at this point informed me that the water had been exceptionally high in July and it was impossible to estimate the run of sockeye. He was of the opinion, however, that the run was retarded by the high water and was below the average of former years.

I left Hazelton on September 21st and arrived at Lakelse Hatchery on the 23rd and there met Mr. Catt, the Superintendent. This is a new hatchery with a 10,000,000-egg capacity, and although the dwelling-houses are not yet completed the hatchery is in operation. The hatchery is situated on Granite Creek, about 2 miles from Lakelse Lake and almost at the other end of the lake, where the old hatchery was at the junction of Coldwater Creek and Lakelse River. Judging by the results Mr. Catt has obtained this year, the off-year of the cycle, the success of this hatchery is assured. At the time of my visit there were a little over 7,500,000 sockeye-eggs in the hatchery that had been spawned from Schallabuchan, Williams, and the branches of Granite Creek. Mr. Catt also had the regrettable experience of having his barricades washed away during the high water in July, and but for this loss of the early run of sockeye he could have obtained his full complement of sockeye-eggs. To make up his full complement, Mr. Catt has spawned 2,000,000 pinks and cohoes and he fully expects to have 8,000,000 sockeye-eggs by the time he is through spawning. The two principal sockeye-creeks on Lakelse Lake are Schallabuchan and Williams Creek, where the majority of the spawn is obtained.

Schallabuchan is a slow-running creek with a good sand and gravel bottom for some considerable distance from the lake. As this is the earliest-spawning creek in the lake, there were very few live sockeye to be seen, Mr. Catt informing me that he had commenced spawning here on August 1st.

Williams Creek is a big swift-running creek of great length which becomes broad and shallow near its mouth. The sockeye do not appear to go very far up the creek, preferring to spawn in the shallow sand and gravel patches near the lake. There were numbers to be seen spawning here, and also in the lake at the mouth of the creek, where spawning conditions are ideal. Granite Creek branches off below the hatchery in five different streams on its downward course to the lake. Each of the little streams is too small to be of any importance for spawning, although the sockeye try to make their way up. If Granite Creek was cleared of the rock and log obstructions below the hatchery it could be made to continue its way in one channel to the lake instead of five different streams as at present. This would enable the sockeye to go up the creek in large numbers and afford better protection from the bears that abound in this vicinity. All the sockeye seen were of average size and in good condition, and although Mr. Catt informed me that the males and females were evenly balanced at the beginning of the run, the males predominated towards the end of the run.

Blackwater Creek is quite close to Williams Creek, but although I went up this creek a considerable distance there were few live sockeye to be seen. This is also an early-spawning creek, but from the number of dead salmon seen it was poorly seeded and much below the average. On September 25th I visited Lakelse River and Coldwater Creek, which were both literally swarming with spawning pink salmon. Lakelse River is the only outlet of Lakelse Lake and joins the Skeena River some 12 miles distant. Sockeye do not spawn in Lakelse River, but go right through to the lake. There were a few spring salmon to be noted among the pinks in Coldwater Creek, but there was no evidence of any sockeye, and I am informed by Mr. Catt that the sockeye do not go up this creek.

In summing up the Lakelse spawning area, I may say that, with the exception of Williams Creek, which was near the average of other years, the spawning-beds will be sparsely seeded and below the average of previous years, although, from all reports, a little more hopeful than that of 1916.

As this was the last point of interest, I returned to Terrace and arrived in Port Essington on September 26th.

I wish to express my thanks to the Hatchery Superintendents and men, also Stuart Norrie, Dominion Fishery Overseer, to whom I am indebted for information supplied and hospitality shown.

I have, etc.,
R. GIBSON,
Fisheries Overseer.

Port Essington, B.C., October 1st, 1921.

THE SPAWNING-BEDS OF THE NASS RIVER.

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

SIR,—I have the honour to submit the following report in respect to conditions existing on the spawning-beds of the Meziadin watershed of the Nass River:—

I left the town of Stewart on September 15th with two Indian packers, and after a very strenuous journey owing to the inclemency of the weather—encountering heavy rain and snow when crossing the Bear River Glacier—we arrived at the head of Meziadin Lake in the evening of September 19th, where I was fortunate in being able to hire an Indian canoe, which saved the trouble of making rafts, to journey down the lake to the fishway.

On making an inspection of the upper part of the lake, I did not observe as many sockeye on the spawning-beds as in former years and there were not as many to be seen leaping in the lake. It will be recalled that the run of sockeye to the Meziadin Lake was very poor in 1919. Conditions there this year did not compare favourably even with 1919.

On the journey down the lake I inspected the Hanna River and McLeod Creek. Only a few sockeye were to be seen at the mouth of these streams.

After leaving the lake and entering its outlet, Meziadin River, we shot the McBride Rapids. Below these rapids are the principal spawning-grounds of spring salmon in the Meziadin Lake watershed. The run of spring salmon to this point must have been good this year, as there was evidence in abundance that these grounds were well seeded. The only bad feature of these spawning-grounds is the great number of enemies to the spawning salmon. The pools below these rapids simply abound with rainbow trout, Dolly Vardens, and a species of whitefish. We fished from the canoe for only a short while and landed seventy large rainbow trout and many whitefish and char. When thrown into the canoe they disgorged spring-salmon eggs in great numbers, which proves that they do an enormous amount of damage to the spring salmon. I have called attention to this matter in previous reports, and I again suggest that something should be done to try and lessen the number of these, the natural enemies of the salmon. From an angler's point of view I do not see that there could be any very serious objection, as this place is very difficult to get to and very rarely visited.

We arrived at the cabin at Meziadin Falls in the evening of September 21st.

On September 22nd and 23rd I made a thorough inspection of the river at both the upper and lower falls. There were a fair number of salmon congregated below the falls this season, one noticeable feature being the larger number of cohoe salmon than is usual to be observed there. The channel of the fishway is little changed from last year. The fish which enter it have no difficulty in passing through it. Numbers were passing through at the time of inspection. The condition within the fishway itself is much the same as reported upon last year. The Dominion Fisheries Department has done some temporary repairs, putting in a number of extra braces to hold up the crib-work, and has also removed some of the rubble-rock from the river at the entrance to the fishway. This temporary work should hold the bank and crib-work in place until some permanent work is done, provided it is not left too long. Quite a lot of rock has fallen into the three lower pockets, but this does not seem to interfere with the salmon going right through when once they enter the fishway. But the channel approaching the entrance is far from satisfactory, being partly obstructed with rubble-rock deposited there during the flood of 1917–18 and the high waters since then. Dominion Fishery Overseer Collison, with the means at his disposal, did some excellent work there this year, and the approach to the entrance is considerably better than it was last season, but, in my judgment, is still not entirely satisfactory and will not be until the old channel is fully restored.

During the great flood of 1917–18 a great mass of broken rock formed a reef in the channel between the main fall and the entrance to the fishway, that projects some yards below, and which diverts many salmon from the natural channel leading to the fishway. Many of the fish that approach the falls along the left bank of the river—their natural approach to the falls—are diverted from the channel leading to the fishway by the reef of rock mentioned. Many pass to the left of the reef and thence reach the water immediately below the fall. From that place they cannot enter the fishway or pass over the falls. This was evidenced by seeing some of the fish pass that way and by the fact that salmon were to be seen in all the waters just below

the fall and clear across the channel, more being assembled at the right side of the falls than at other points. Having worked their way over to that side, they did not appear to be working back again. It will be recalled that during the several years before the fishway was constructed it was demonstrated that almost the entire run of sockeye in the Meziadin River in approaching the falls passed up the channel close to the left bank of the stream, and that the channel there was the easiest and most direct approach to the falls, also that few fish passed up in the channel along the right bank. After the fishway was built it was demonstrated that the run continued up the left bank and passed without diversion into the fishway. The floods of 1917–18 deposited the rock that now constitutes the reef and also partly obstructed the channel leading to the fishway. The fish no longer are naturally led to the entrance, many, as stated, being diverted by the reef of rock. If this reef was partly removed and the rocks in the channel immediately below the fishway were entirely removed, former conditions would be restored. It is not, in my judgment, necessary to remove all of the reef. If a 10-foot opening is made in the reef at a point just below its union with the right wall of the fishway, the fish that are now diverted from the channel will pass from the foot of the fall into the fishway. It was noticed that the fish which reached that point rested there. If the opening suggested is made, the fish will be naturally drawn that way and thus reach the fishway. The rock constituting the reef is broken and can be easily removed.

The further removal of rock from the channel directly below the fishway and between the reef and the left bank of the falls is most desirable. I am very certain that conditions below the fishway can be made as satisfactory as they were before the damage caused by the big flood of 1917–18, and at comparatively small cost.

In Stewart I had a conversation with Dominion Fishery Officer Collison, who had just come in from a visit to Meziadin falls. He told me of conditions there. He informed me that when he arrived at the fishway he found that the entrance was practically cut off, and that he and his men cleared the channel as far as they were able at the time. Mr. Collison favours the building of an additional fishway on the right bank of the falls, and I understand that he is recommending its construction to the Department. There can be no doubt but that the construction of a fishway at that point would be a good thing for such fish as attempt to pass up on that side. The fish that now reach there cannot make the ascent of the falls on that side. But from what I know of conditions after the present fishway was constructed and up to the big flood of 1917–18, I am of the opinion that, if the changes are made below the entrance to the fishway which I have already suggested and which I understand Mr. Collison advocates in his report, all the sockeye, with few exceptions, that reach the falls will be able to ascend them and pass on up to the lake. Following the years that the fishway was in its original condition there certainly was no assembly of fish below the falls on the right bank.

It must be appreciated that it is most difficult to do any work at the falls, because they are most difficult of access. The trail over the Bear River Glacier has been virtually destroyed. There are now no bridges over Bear or Beaver Rivers or Surprise Creek. One cannot get in with pack-horses. Everything in the way of food and materials must be packed in on the backs of men. There are no residents, either Indians or whites. When the present fishway was built the trail from Redcliffe to Meziadin Lake was open, and the powder, cement, tools, and food for the men employed, which were all taken in, passed over the trail. Now everything has to be packed in by men over the glacier and down the lake, unless a seaplane is used. It is a difficult job to get in any considerable load. There is little chance that the old trail will be restored for some years to come.

Attached hereto find a set of photographs taken at the falls this year. They are not good owing to weather conditions.

We left the Meziadin Falls on the return journey on the morning of September 25th. On the way up the Meziadin River we were fortunate in seeing two fine moose. They took to the water and swam across to the opposite bank. On the night of September 26th we reached the cabin on the interior side of the Bear River Glacier. Here we were held up until the morning of the 28th on account of a heavy rain and snow-storm on the glacier, it being too dangerous to attempt to cross. We arrived back in Stewart in the evening of September 29th.

In making a summary of my trip of inspection, I am of the opinion that the run of sockeye to the Meziadin section of the Nass was not as large as in any former year of record, with the possible exception of 1919. The run of spring salmon was good, and there appeared to be a

greater number of cohoe salmon in this watershed than were found on my former inspection. I would once more like to emphasize the importance of getting rid of the natural enemies of the salmon at the particular place mentioned in my report—viz., foot of McBride Rapids. The trout are practically confined in a small area and a large number could be taken with a net or some other method.

I have, etc.,
C. P. HICKMAN,
Inspector of Fisheries.

WILL THERE BE A LARGE SOCKEYE RUN TO THE FRASER RIVER IN 1921?

BY DR. CHARLES H. GILBERT.

It may be assumed that any indication of the probable size of the sockeye-salmon run to the Fraser River in 1921 will be received at this time with lively interest. Fishermen and salmon-packers and all who are concerned with the salmon situation are aware that 1921 is a lineal descendant of those "big years" on the Fraser which, prior to 1917, occurred without fail in every fourth season, and brought such incredible hordes of salmon to the fishing-grounds and into the river. Even after the depletion of the river had become pronounced for the three "small years" of each cycle, still the quadrennial big years remained unimpaired. And they would probably have maintained themselves until now but for the accidental blockade of the Yale Canyon in 1913, precisely in time to intercept the spawning run of that big year.

The coincidence was most unfortunate. Had the blockade occurred a year earlier or a year later, comparatively little damage would have resulted. There would have been time to apprehend the seriousness of the situation, and to remove the barrier—as was subsequently done—before a big year should come round. But in 1913 the catastrophe had become irreparable before adequate measures of relief could be taken. The canyon was already full of struggling salmon destined for up-river spawning-grounds, trying in vain to force the blockade. Myriads of them subsequently weakened and died, still retaining their spawn, and they formed decaying masses on the bars and shores of the river below Hell's Gate. Thus the up-river spawning-grounds in 1913, for the first time in any big year, were left relatively bare of fish.

These facts were fully set forth by J. P. Babcock in the Report of the Commissioner of Fisheries of British Columbia for 1913, and their bearing on the unfavourable prospects for 1917 was plainly stated. As the season of 1917 approached interest in this problem became intense. The question was much debated whether the immemorial big year on the Fraser would again repeat itself, or whether the warnings of the experts would be justified in the event. Some of the packers took counsel of their hopes rather than their fears and made preparations for the usual pack of a big year. The result is still painfully fresh in our minds. By most strenuous exertions and an intensity of gleaning never before witnessed a pack of 560,000 cases was produced; little more than one-fifth the pack of the big year of the previous cycle.

Two entirely independent lines of evidence had pointed to a greatly decreased run in 1917. One of these we have already mentioned, based on the insufficient seeding of the up-river spawning-beds in 1913. The other method forms an interesting side-line of prophecy, which could not be developed in that cycle until 1916, the year before the season which so anxiously was being awaited. We shall proceed to discuss that second method more in detail, inasmuch as it is now equally applicable to the year 1921.

It is known to all packers and fishermen that the year before the big run was always made conspicuous by the occurrence of large numbers of greatly undersized individuals, which evidently constituted a class apart from the main body of the run, and in the small years of each cycle were rarely encountered. They were not only undersized, but they were all male fish, and their flesh was relatively pale in colour and poor in oil. Being thus of small value to the trade, they were not very welcome visitors. The canners who were jealous of the quality of their pack put them up separately as an inferior grade, and were thus in position to compare their abundance in the year of their occurrence with that four or eight or twelve years previously. From observations made in this manner, it came to be currently believed that whenever the number of small fish was relatively large, then the big year which followed would be correspondingly increased in comparison with other big years. It was believed that some basis for forecasting the size of the big run was furnished by the relative numbers of undersized sockeyes that were included in the run of the previous year.

The reason for such possible direct relation between the two became apparent in the course of our investigations of the ages of salmon. It then became known that whereas the usual run of sockeyes to the Fraser were maturing in the fourth year of their age, these undersized males —or *grilse*, as we call them—were maturing in their third year, and they would therefore make their appearance in the run one year earlier than would the 4-year fish which resulted from the same spawning. If then, the spawning of the last big year had been an unusually successful one, this might be expected to result in an exceptionally large run of grilse three years thereafter,

and an equally exceptional run of the 4-year fish which would constitute the big run of the following year. The number of 3-year grilse in the year before the big year might well, therefore, give a clue to the probable size of the big year itself.

Our investigations for the Provincial Fisheries Department of the Fraser River sockeyes began in 1911, and have permitted us but three opportunities to witness this run of grilse—in 1912, in 1916, and now during the last season, 1920. In the first of these, 1912, the big years were still undisturbed, for the grilse of that year had developed from eggs laid down in 1909, when the pack of sockeyes of the Fraser River had totalled over 1,500,000 cases. The 1912 grilse came from a successful season, and the proportion which they formed of the 1912 run could be accepted as an approximate statement for the corresponding years of previous cycles. Tests made throughout the season indicated that about one fish in five of the total run was a grilse. This condition in 1912 was followed in 1913 by a big year of the first magnitude, resulting in a pack of well over 2,000,000 cases.

It was with these data in our possession concerning the relation of grilse to big-year runs that we approached the season of 1916. The grilse that would run that year would have developed from eggs deposited in the year of the blockade in the Yale Canyon. Should they show a decided reduction in numbers compared with 1912, their condition would reinforce the argument from the impoverished spawning-beds of 1913, and a dismal outlook would be presented for 1917. It is a matter of record that the grilse of 1916 were only about one-fourth as numerous as in 1912, and it is equally a matter of record that the pack of 1917, compared with that of 1913, suffered an equal reduction.

For the year 1921 the same two lines of evidence are available—that derived from the condition of the spawning-grounds in 1917 and the independent evidence to be derived from the numbers of grilse that made their appearance in the run of 1920. As to the condition of the spawning-grounds, we have again the testimony of Mr. Babcock, and from this the prospect seems gloomy indeed. Not only was no improvement found over the conditions which had produced the curtailed run of 1917; the situation, on the contrary, had become definitely worse. The spawners throughout the up-river district seemed scarcely more numerous than in many of the lean years of past cycles and could be expected to produce nothing better in their turn.

Material to establish the numbers of grilse to be found in the run of 1920 was collected with great care under the supervision of Mr. Babcock. Collections of scales for age-determination, accompanied by data concerning the length and sex of the fish, were obtained at frequent intervals throughout the season. When the receipts of the cannery were small the entire catch was examined. At other times liberal samples were obtained, taken at random as the fish lay on the cannery floor. Secured in this manner, the 1,950 individuals which we have examined can be safely accepted as presenting a reliable cross-section of the entire run.

We have now, by microscopic examination of the scales, determined the ages represented in this complete series. In the early part of the investigation, as first tens, then hundreds of individuals passed under our observation without a single 3-year grilse appearing, it seemed that this group must be entirely absent from the run. But our 355th specimen, taken June 28th, proved to be a 3-year male; a second, the 515th fish to be investigated, appeared in the catch of July 5th; and a third, which had been taken August 16th, was the 1,666th sockeye of our series. Thus, in 1,950 sample sockeyes taken throughout the fishing season, but three grilse were included. In 1912 an equal number of samples contained approximately 200 grilse, and in 1916 an equal number, collected in the same manner, and including the entire run, contained 63 grilse.

In so far, then, as the number of grilse can be considered an index of the size of the run in the following year, the evidence from the 1920 run wholly agrees with that derived by Mr. Babcock from the condition of the up-river spawning-beds of the Fraser in 1917. From both of these lines of evidence the conclusion is forced upon us that 1921 will range itself definitely with the lean years of the Fraser, which for the three years of the previous cycle produced an average pack for each year of 265,000 cases, and for the corresponding three years of the present cycle an average pack each year of 90,000 cases.

The "big year" of the Fraser River, it seems, must now be reckoned wholly a thing of the past. Any methods which might be successful in re-establishing it would be equally successful in raising the traditional lean years of the Fraser from their present low estate to an equality with the old-time "big years," when untold millions of spawning sockeyes fought their way through the rapids of the Yale Canyon and distributed themselves over the unequalled spawning areas of the upper river.

PACK OF BRITISH COLUMBIA SALMON, SEASON 1920.

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 Totals (Cases.)
Fraser River District—								
B.C. Packers' Association	21,555	9,816	3,509	3,867	7,261	101	1,186	47,293
J. H. Todd & Sons, Fraser River	4,081	1,348	71	99	5,427	.....	3	11,029
Gosse-Millerd Packing Co., Ltd.	4,802	1,414	708	20	2,078	3	1,829	10,854
M. DesBrisay & Co.	1,463	364	73	.....	79	.....	11	1,990
St. Mungo Canning Co., Ltd.	2,425	1,729	.....	.....	3,477	.....	815	8,446
Great West Packing Co., Ltd.	4,205	1,520	33	368	1,985	.....	115	8,226
Glen Rose Canning Co., Ltd.	4,051	2,439	.....	.....	1,897	.....	413	8,800
Canadian Fishing Co., Ltd.	2,016	1,061	.....	168	730	12,735	19,512	36,222
J. H. Todd & Sons (Esquimalt)	2,247	.....	.....	.....	.....	.....	.....	2,247
Sooke Harbour Fg. & Pk. Co., Ltd.	1,554	.....	.....	.....	.....	.....	.....	1,554
Totals	48,399	19,691	4,432	4,522	22,934	12,839	23,884	136,661
Skeena River District—								
B.C. Packers' Association	15,388	13,245	1,096	205	5,543	36,990	265	72,732
Anglo B.C. Packing Co., Ltd.	11,897	3,708	1,083	48	859	32,187	19	49,801
J. H. Todd & Sons	6,420	6,071	891	.....	6,051	11,093	.....	30,526
Kildala Packing Co., Ltd.	5,041	1,178	222	257	336	11,299	663	18,996
B.C. Canning Co., Ltd.	8,995	1,808	603	38	1,585	8,302	34	21,365
Northern B.C. Fisheries, Ltd.	8,042	3,343	319	341	1,596	15,404	5	29,050
Cassiar Packing Co., Ltd.	6,500	1,653	578	32	345	10,594	126	19,828
Wallace Fisheries, Ltd.	10,607	2,108	.....	.....	566	17,649	.....	31,230
Can. Fish & Cold Storage Co., Ltd.	6,078	2,734	345	.....	409	12,586	1,205	23,352
Gosse-Millerd Packing Co., Ltd.	9,222	1,106	140	259	742	18,265	1,418	31,161
Maritime Fisheries, Ltd.	874	449	40	38	36	3,310	99	4,846
Totals	89,064	37,403	5,321	1,218	18,068	177,679	3,834	332,887
Rivers Inlet District—								
B.C. Packers' Association	33,489	123	33	.....	212	4,721	39	38,617
Anglo B.C. Packing Co., Ltd.	12,683	.....	82	.....	41	1,074	43	13,923
J. H. Todd & Sons	8,724	.....	12	.....	2,316	4,225	718	15,995
Provincial Canning Co., Ltd.	8,679	1,271	87	.....	271	3,519	57	13,884
B.C. Canning Co., Ltd.	15,428	24	21	.....	.....	1,884	.....	17,357
Kildala Packing Co., Ltd.	12,468	40	19	.....	22	1,356	8	13,913
Gosse-Millerd Packing Co., Ltd.	14,322	31	3	.....	8	2,422	79	16,865
Wallace Fisheries, Ltd.	13,255	33	14	.....	38	6,446	282	19,768
Northern Fisheries (Namu)	6,694	.....	.....	.....	.....	.....	.....	6,694
Totals	125,742	1,522	271	.....	2,908	25,647	1,226	157,522
Nass River District—								
B.C. Packers' Association	2,991	1,134	370	207	351	1,556	661	7,270
Anglo B.C. Packing Co., Ltd.	3,947	148	240	164	223	10,300	1,757	16,788
Northern B.C. Fisheries, Ltd.	3,722	2,075	510	126	1,227	12,341	3,213	23,214
M. DesBrisay & Co.	3,974	199	.....	.....	1,620	15,171	5,287	26,251
Western Salmon Packers, Ltd.	2,106	30	151	63	279	3,774	1,227	7,630
Totals	16,740	3,586	1,271	560	3,700	43,151	12,145	81,153
Vancouver Island District—								
J. H. Todd & Sons	.....	4,517	2,178	.....	4,435	51	2,910	14,091
Wallace Fisheries, Ltd.	462	3,697	3	.....	2,005	24	.....	6,191
Quathiaski Canning Co., Ltd.	785	482	60	.....	4,195	8,115	5,551	19,188
Clayoquot Sound Canning Co., Ltd.	4,711	1,481	138	.....	469	.....	1,572	8,371
Redonda Can. & Cold Stor. Co., Ltd.	15	165	.....	435	186	1,357	28	2,186
Nootka Packing Co., Ltd.	.....	7,539	551	.....	2,283	.....	196	10,569
Gosse-Millerd Packing. Co., Ltd.	.....	6,689	505	.....	781	.....	137	8,112
Sooke Harbour Fg. & Pk. Co., Ltd.	.....	1,072	96	....	2,449	69	1,525	5,211
Western Packers, Ltd.	1,014	38	.....	.....	3,752	4,775	672	10,251
Totals	6,987	25,680	3,531	435	20,555	14,391	12,591	84,170
Outlying Districts—								
B.C. Packers' Association	22,802	2,527	2,785	3,208	12,180	28,500	855	72,857
Anglo B.C. Packing Co., Ltd.	1,888	972	2,928	.....	4,985	27,508	133	38,414
Gosse-Millerd Packing Co., Ltd.	3,116	606	5	21	3,984	32,365	18,017	58,303
Kildala Packing Co., Ltd.	3,207	411	218	186	140	7,078	1,641	12,881
Wallace Fisheries, Ltd.	7,211	30	.....	.....	79	53,154	.....	60,474
Northern B.C. Fisheries, Ltd.	5,336	1,161	991	306	5,713	58,314	4,078	75,899
Western Packers, Ltd.	20,913	15	.....	.....	1,953	14,956	5,815	43,652
Maritime Fisheries, Ltd.	.....	1,524	143	.....	.....	12,584	358	14,609
Preston Packing Co., Ltd.	.....	855	462	.....	4,773	12,690	49	18,829
Totals	64,473	8,101	7,532	3,721	33,807	247,149	30,946	395,223
Grand Totals	351,405	95,983	22,318	10,456	101,972	520,856	84,626	1,187,616

STATEMENTS SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1905 TO 1920, INCLUSIVE.

FRASER RIVER.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Sockeyes	48,399	38,854	19,697	148,164	32,146	91,130	198,183	719,796	123,879	58,487	150,432	585,435	74,574	59,815	183,007	837,489
Springs, Red	10,691	14,519	15,192	10,197	17,673	23,228	11,209	3,573	15,856	7,028	1,018	1,428	1,903	3,448	7,523	5,507
Springs, White	4,432	4,296	24,853	18,916	11,430	5,392	15,300	49	9,826	6,751	8,925	.....	2,263	557	.....	.....
Chums	23,884	15,718	86,215	59,973	30,934	18,919	74,826	22,220	12,997	47,237	52,460	8,687	415	63,530	15,543	3,304
Pinks	12,839	39,363	18,388	134.442	840	138,305	6,272	20,773	574	142,101	128					
Cohoes	22,934	39,253	40,111	25,895	31,330	43,514	43,504	16,018	36,190	39,740	35,031	27,919	33,270	35,766	34,413	30,836
Steelhead Trout	34	328	4,395	4,951	3,129	31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Blue Backs	4,488	15,613	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	136,661	167,944	208,857	402,538	127,472	320,519	349,294	782,429	199,322	301,344	247,994	623,469	112,425	163,116	240,486	877,136

SKEENA RIVER.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Sockeyes	89,364	184,945	123,322	65,760	60,293	116,533	130,166	52,927	92,498	131,066	187,246	87,901	139,846	108,413	86,384	84,717
Springs	37,403	25,941	22,931	16,285	20,933	15,273	11,740	26,436	23,833	17,942	9,785	12,469	13,842	10,378	20,138	14,598
Chums	3,834	31,457	22.573	21,516	17,121	5,769	8,329	.....	504	70	.....	28,120	45,404	25,217	38,991	7,523
Pinks	177,679	117,303	161,727	148,319	73,029	107,578	71,021	66,045	97,588	81,956	13,473					
Cohoes	18,068	36,559	38,759	38,456	47,409	32,190	16,378	18,647	39,835	23,376	11,531	12,249	10,085	15,247	16,897	7,247
Steelhead Trout	1,218	2,672	4,994	1,883	3,743	1,798	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	332,887	398,877	374,306	292,219	223,158	279,161	237,634	164,055	254,258	254,410	222,035	140,739	209,177	159,255	162,420	114,085

RIVERS INLET.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Sockeyes	125,742	56,258	53,401	61,195	44,936	130,355	89,890	61,745	112,884	88,763	126,921	89,027	64,652	87,874	122,631	82,771
Springs	1,793	1,442	1,409	817	1,422	1,022	566	594	1,149	317	383	587	454	450	181	351
Chums	1,226	7,089	6,729	16,101	20,144	5,387	5,023	.....	3,845	288	.....	.....	.....	.....	.....	.....
Pinks	25,647	6,538	29,542	8,065	3,567	2,964	5,784	2,097	8,809	5,411	19	....	479	700	.....	.....
Cohoes	2,908	9,038	12,074	9,124	15,314	7,115	7,789	3,660	11,010	6,287	2,075	1,400	9,505	5,040	66	.....
Totals	133,248	80,367	103,155	95,302	85,383	146,838	109,052	68,096	137,697	101,066	129,398	91,014	75,090	94,064	122,878	83,122

NASS RIVER.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Sockeyes	16,740	28,259	21,816	22,188	31,411	39,349	31,327	23,574	36,037	37,327	30,810	28,246	27,584	17,813	22,166	24,462
Springs	4,857	3,574	4,152	4,496	3,845	3,701	3,385	3,151	6,936	3,759	1,239	2,337	3,263	1,288	921	3,340
Chums	12,145	24,041	40,368	24,938	11,200	11,076	25,569	2,987	3,245	5,189	351	3,589	.....	.....	.....	.....
Pinks	43,151	29,949	59,206	44,568	59,593	34,879	25,333	20,539	12,476	11,467	895	.....	6,612	5,957	3,450	1,840
Cohoes	3,700	10,900	17,061	22,180	19,139	15,171	9,276	3,172	12,468	7,942	6,285	6,818	8,348	6,093	5,997	3,083
Steelhead Trout	560	789	1,305	1,125	1,498	113	.....	.....	.....	.....	140	....	1,101	681	.....	.....
Totals	81,153	97,512	143,908	119,495	126,686	104,289	94,890	53,423	71,162	65,684	39,720	40,990	46,908	31,832	32,534	32,725

Vancouver Island Districts.*

	1920.	1919.	1918.	1917.
Sockeyes	6,987	6,452	6,143	9,639
Springs	29,211	36,013	29,324	19,509
Chums	12,591	128,013	251,266	240,381
Pinks	14,391	43,186	57,035	49,156
Cohoes	20,555	53,629	40,752	31,733
Totals	74,170	267,293	389,815	325,723

Outlying Districts.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Sockeyes	64,473	54,677	51,980	32,902	45,373	98,600	87,130	149,336	79,464	67,866	70,506	49,832	48,367	40,159	45,481	51,224
Springs	15,633	14,766	8,582	6,056	11,423	9,488	7,108	7,246	22,837	12,659	7,439	2,196	6,439	9,977	3,581	4,563
Chums	30,946	165,717	90,464	112,364	160,812	40,849	70,727	52,758	37,734	39,167	5,551	.....	.....	.....	.....	.....
Pinks	247,149	110,300	201,847	112,209	143,615	83,626	111,930	83,430	128,296	64,312	20,098	6,148	23,538	23,300	7,964	1,303
Cohoes	33,807	35,011	42,331	30,201	70,431	48,966	43,254	28,328	65,806	42,457	19,460	13,532	20,709	25,754	11,759	3,292
Steelhead Trout	3,721	702	1,009	865	712	985	.....	.....	.....	.....	.....	.....	36	2	.....	.....
Totals	395,728	381,163	404,793	294,597	432,366	313,894	320,168	285,898	334,187	226,461	123,054	71,708	99,089	99,192	68,785	60,392

Total packed by Districts in 1905 to 1920, inclusive.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Fraser	136,661	167,944	210,851	402,538	127,472	320,519	349,294	782,429	199,322	301,344	247,994	623,469	112,425	163,116	240,486	877,136
Skeena	332,787	398,877	374,216	292,219	223,158	279,161	237,634	164,055	254,258	254,410	222,035	140,739	209,177	159,255	162,420	114,085
Rivers Inlet	157,522	80,367	103,155	95,302	85,383	146,838	109,052	68,096	137,697	101,066	129,398	91,014	75,090	94,064	122 878	83,122
Nass River	81,153	97,512	143,908	119,495	126,686	104,289	94,890	53,423	71,162	65,684	39,720	40,990	46,908	31,832	32,534	32,725
*Vancouver Island	84,170	267,293	389,815	325,723	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Outlying Districts.	395,223	381,163	404,793	294,597	432,366	313,894	320,169	285,898	334,187	226,461	123,054	71,708	99,089	99,192	68,785	60,392
Grand totals	1,187,616	1,393,156	1,626,738	1,557,485	995,065	1,164,701	1,111,039	1,353,901	996,626	948,965	762,201	967,920	542,689	547,459	627,103	1,167,460

STATEMENTS SHOWING SALMON-PACK OF PUGET SOUND, BY SPECIES, FROM 1905 TO 1920.

	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	1907.	1906.	1905.
Sockeyes	62,654	64,346	50,723	411,538	84,637	87,465	357,374	1,665,728	201,572	140,529	234,437	1,005,120	162,228	96,974	182,241	837,122
Cohoes	24,502	210,883	235,860	114,276	155,832	180,799	151,135	49,150	149,977	244,208	154,077	139,297	95,863	111,611	98,206	89,636
Puget Sound Pinks	4,669	421,215	6,605	1,121,884	1,887	589,780	909	788,789	708	1,038,136	.....	365,156	.....	448,730	.....	71,490
Chums	48,849	525,541	267,538	216,285	427,878	410,687	280,070	50,176	63,132	111,143	148,810	52,251	51,186	51,840	155,221	49,047
Totals	140,520	1,221,985	560,726	1,863,983	670,234	1,268,731	780,488	2,553,843	415,389	1,534,016	537,324	1,561,824	309,277	709,155	435,668	1,047,295

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