PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

COMMISSIONER OF FISHERIES

FOR THE YEAR ENDED DECEMBER 31ST, 1931

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1932.

To His Honour JOHN WILLIAM FORDHAM JOHNSON,
Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

I beg to submit herewith the Report of the Provincial Fisheries Department for the year ended December 31st, 1931, with Appendices.

SAMUEL LYNESS HOWE,
Commissioner of Fisheries.

Provincial Fisheries Department,
Commissioner of Fisheries' Office,
Victoria, British Columbia, December 31st, 1931.

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FISHERIES COMMISSIONER'S REPORT FOR 1931.

VALUE OF CANADIAN FISHERIES AND THE STANDING OF PROVINCES, 1930.

The value of the fishery products of Canada for the year 1930 totalled $47,804,216. During that year British Columbia produced fishery products of a value of $23,103,302, or 48 per cent. of Canada's total.*

In 1930 British Columbia again led all the Provinces in the Dominion, as has been the case annually for twenty years, in the value of her fishery products. Her output exceeded in value that of Nova Scotia, the second in rank, by $12,692,100, and also exceeded that of all the other Provinces combined by $8,813,590.

The market value of the fishery products of British Columbia in 1930 was $827,390 less than in the previous year, 1929, due largely to a decline in the value of the salmon-pack, notwithstanding a pronounced increase in the size of the pack.

The capital invested in the fisheries of British Columbia in 1930 was $37,661,577, or 58¾ per cent. of the total capital employed in Canada. Of the $37,661,577 invested in the fisheries of British Columbia in 1930, $13,318,488 was employed in catching and handling the catches and $24,343,089 invested in canneries, fish-packing establishments, and fish-reduction plants.

The number of persons engaged in British Columbia fisheries in 1930 was 19,347, or 24 per cent. of Canada's total of 79,558. Of the 19,347 engaged in British Columbia, 12,000 were employed in catching and handling the catches and 7,347 in packing, curing, and fish-reduction. The total number engaged in the fisheries in 1930 was 1,088 less than in the preceding year.

The following statement gives in the order of their rank the value of the fishery products of the Provinces of Canada for the years 1926 to 1930, inclusive:—

Province.	1926.	1927.	1928.	1929.	1930.
British Columbia	$27,367,109	$23,264,342	$26,562,727	$23,930,692	$23,103,302
Nova Scotia	12,505,922	10,783,631	11,681,995	11,427,491	10,411,202
New Brunswick	5,325,478	4,406,673	5,001,641	5,935,635	4,853,575
Ontario	3,152,193	3,670,229	4,030,753	3,919,144	3,294,629
Quebec	3,110,964	2,736,450	2,996,614	2,933,339	2,502,998
Manitoba	2,328,803	2,039,738	2,240,314	2,745,205	1,811,962
Prince Edward Island	1,358,934	1,367,807	1,196,681	1,297,125	1,141,279
Alberta	749,076	712,469	725,050	732,214	421,258
Saskatchewan	444,288	503,609	563,533	572,871	234,501
Yukon Territory	17,866	12,090	51,665	24,805	29,510
Totals	$56,360,633	$49,497,038	$55,050,973	$53,518,521	$47,804,216

THE SPECIES AND VALUE OF FISH CAUGHT IN BRITISH COLUMBIA.

The total value of each of the principal species of fish taken in British Columbia for the year ended December 31st 1930, is given in the following statement:—

Salmon	$16,610,834
Halibut	2,446,775
Herring, oil, meal, etc.	1,222,303
Cod, ling, hake	338,172
Pilchard, oil, meal, etc.	1,589,609
Clams	155,857
Carried forward	$22,363,550

* As this report goes to press the Commissioner is in receipt of an advanced report of the value of the fisheries of the Province for the year 1931, issued by the Dominion Bureau of Statistics—R. H. Coats, Statistician—from which the following data are taken: The value of the fishery products of British Columbia for 1931 was $11,109,822; number of persons engaged, 13,267; and the capital employed, $20,250,427.

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

Brought forward	$22,363,550
Black cod	120,583
Crabs	29,177
Soles	46,217
Shrimps	20,426
Oysters	58,146
Abalone	3,500
Flounders, brill	20,268
Red cod, tomcod	24,667
Perch	15,447
Smelts	18,416
Sturgeon	5,778
Octopus	2,569
Skate	4,241
Oolachans	4,214
Whiting, shad, etc.	828
Trout	764
Whales	227,993
Fish-oils, grayfish, etc.	44,227
Fish-fertilizer, etc.	17,250
Fish-meals	61,272
Fur-seals	13,769
Total	$23,103,302

The above statement shows that the salmon-fisheries of the Province in 1930 produced $16,610,834, or 71 per cent. of her total fishery products.

The total halibut landings were marketed for $2,446,834, a decrease in production of 4,950,000 lb. and a decrease in value of $1,870,460 in comparison with 1929.

Herring-catches produced $1,222,303, a decrease in production of 93,705 cwt. and in value of $264,352.

The foregoing data are derived from the "Fishery Statistics of Canada" for 1930.

THE SALMON-PACK OF THE PROVINCE IN 1931.

The catches of salmon in the Province in 1931 produced a pack of 685,104 cases. It consisted of 291,464 cases of sockeye, 206,995 cases of pinks, 55,997 cases of chums, 76,879 cases of cohoe, and 27,147 cases of springs. It was the smallest pack made in the Province since 1921. There was a decrease in all districts. In all but the Fraser the decrease in the catches was due entirely to lack of demand and was not due to any lack of fish. The salmon runs in all districts, except the Fraser and the Nass, were exceptionally large. The spawning-bed reports from all districts, save the Fraser and the Nass, show an increased seeding.

THE SALMON-PACK BY DISTRICTS.

The Fraser River System.—The catches of salmon in the Provincial waters of the Fraser River system produced a total pack of but 73,067 cases. It was very much the smallest made there since the industry was established. It consisted of 40,947 cases of sockeye, 13,307 cases of pinks, 8,818 cases of cohoe, 9,740 cases of springs, and 251 cases of chum. Little effort was made to catch other than sockeye.

In addition to the above, the canneries on the Fraser packed 8,563 cases of sockeye and 2,549 cases of pinks from fish which were caught in the Rivers Inlet District and transported to the Fraser; also 7,618 cases of sockeye, 5,678 cases of pinks, 19,347 cases of cohoe, and 602 cases of springs, packed from fish caught in the Vancouver Island District. In the detailed pack reports attached hereto these cases have been credited to the pack at Rivers Inlet and that of Vancouver Island.

The catch of sockeye in Provincial waters of the Fraser River system, including the catches of sockeye made by the traps on the southern end of Vancouver Island, produced a pack of 40,947 cases. The catch of sockeye in the State of Washington waters of the Fraser River

system produced a pack of 83,777 cases. Combined they give a total sockeye-pack for the entire Fraser River system of 124,724 cases, of which 67 per cent. were packed in the State of Washington waters.

The Skeena River.—The catches of salmon made in the Skeena District produced a pack of 162,986 cases, of which 93,023 cases consisted of sockeye, 44,807 cases of pinks, 10,637 cases of cohoe, and 9,858 cases of springs. In addition to the above, the canneries on the Skeena packed 7,783 cases of sockeye, 8,500 cases of cohoe, and 1,603 cases of pinks from fish caught in the Nass River and transported to the Skeena. The Skeena River pack is also credited with 4,786 cases of pinks, which were transported to Outlying Districts canneries and tinned there.

Rivers Inlet.—The catches of salmon in the Rivers Inlet District produced a pack of 76,428 cases of sockeye, 5,089 cases of pinks, 6,571 cases of cohoe, and a few hundred cases of springs and chums—a total pack of 88,874 cases. As already stated, 8,563 cases of sockeye and 2,549 cases of pinks packed on the Fraser consisted of fish caught in Rivers Inlet and are included in the total accredited to the latter district.

The Nass River.—The catches of salmon in the Nass River District produced a total pack of 32,881 cases, of which 16,929 consisted of sockeye. Of that total, 7,783 cases were packed in canneries on the Skeena.

Vancouver Island District.—The salmon caught in the Vancouver Island District, with the exception of the sockeye caught in the traps on the southern end of the Island which are credited to the catches on the Fraser proper, produced a total pack of 175,541 cases—consisting of 22,199 cases of sockeye, 81,965 cases of pinks, 50,953 cases of cohoe and bluebacks, and 16,329 cases of chums. Of those totals, 7,618 cases of sockeye, 602 cases of springs, 19,347 cases of cohoe and bluebacks, 5,678 cases of pinks, and 697 cases of chums were packed in canneries on the Fraser.

Outlying Districts.—The catch of salmon in the outlying districts produced a total pack of 131,472 cases, of which 29,071 cases consisted of sockeye, 55,825 cases of pinks, and 34,570 cases of chums; of the foregoing, 7,130 cases of sockeye and 1,009 cases of cohoe were canned on the Skeena.

In the Appendix of this report will be found reports from the spawning-beds of the Fraser, Skeena, and Nass Rivers, and Rivers and Smith Inlets.

HALIBUT PRODUCTION.

Halibut landings in Provincial ports for the year 1931 totalled 18,200,500 lb., as against 25,479,600 lb. in 1930. The total landings on the North-west Pacific Coast totalled 43,879,322 lb., as against 50,471,632 lb. in 1930, a decrease of 13 per cent. In addition to the 13-per-cent. decrease in the year's total catch, the value of the landings was much less owing to a sharp decline in market value and disagreement as to prices during the first month or more of the fishing season.

Of the total catches in 1931, the American fleet is credited with 82.3 per cent. and the Canadian fleet 17.7 per cent. The decrease in the total landings in Provincial ports is largely due to relatively higher prices paid in Seattle for "chickens" and to the rate of exchange. Less important, perhaps, was the resentment aroused in American fishermen by the agitation in Prince Rupert during the season for the closure of that port to American vessel landings. The landings in Prince Rupert in 1931 totalled 16,775,700 lb., as against 23,961,700 lb. in 1930.

FISH OIL AND MEAL PRODUCTION.

Due to economic conditions, the total production of fish-oil on the Pacific Coast totalled but 8,443,165 gallons, as against 13,591,870 gallons in 1930, a decrease of 37.8 per cent.

The fish-oil production in the Province in 1931 totalled 2,904,406 imperial gallons, as against 3,972,600 gallons in 1930. Of the 2,904,406 gallons of fish-oil produced in the Province in 1931, 2,551,914 gallons consisted of pilchard-oil. The balance consisted of oil extracted from herring and fish-offal. No whale-oil was produced.

Fish-meal production in the Province in 1931 totalled 19,847 tons, as against 18,123 tons in 1930. Of the 19,847 tons produced, 14,200 tons consisted of pilchard-meal.

CONTRIBUTION TO THE LIFE-HISTORY OF THE SOCKEYE SALMON.

The seventeenth annual contribution to the series of papers on the life-history of the sockeye salmon, issued by this Department, which is contained in the Appendix of this report, is

again contributed by Drs. W. A. and Lucy S. Clemens. These detailed continuous records give the age-classes, sex, weight, and lengths of the sockeye in each of the runs to the principal salmon-producing waters of the Province for the last eighteen years. They constitute one of the longest detailed continuous records of any fishery. A digest of the present report is given in the following paragraphs.

The size of the sockeye-salmon runs to the four main river systems was up to expectancy for their respective cycles, and to that extent the situation may be said to be satisfactory. There are, however, reasons to believe that for at least three of the areas the packs were somewhat too large to provide for an adequate safety factor in conservation.

The reports on the spawning-beds of the Fraser show that the number of fish that reached them was relatively small. The prospect for 1935 is not bright.

The pack at Rivers Inlet was slightly above prediction and the report on the spawning-beds indicates a good escapement. It appears that the situation in respect to this cycle is encouraging, with some prospect of restoration to its former level of abundance.

On the Skeena the pack was slightly larger than predicted, and probably a somewhat smaller catch would have resulted in a nearer approach to what might be conceived as ideal conditions.

A very unsatisfactory state exists with respect to the Nass River. The pack was slightly above that of 1926, but the spawning-beds report states that the escapement was small, probably even smaller than that of 1928. The solution of the problem of this river must await international co-operation.

The Fraser River Sockeye Run of 1931.—The total pack of Fraser River sockeye in the season of 1931 amounted to 128,158 cases, of which 40,947 cases were packed in the Province of British Columbia and 87,211 cases in the State of Washington. The percentages for the two areas are 32 and 68 respectively. The reports from the spawning-beds indicate a small escapement and the most discouraging feature is the decrease in the run to the Birkenhead River.

Drs. Clemens draw attention to the history of this cycle, which is clearly shown in Table I. of their paper. They state that in 1895 there was a pack of 461,127 cases put up almost entirely in British Columbia. By 1897 fishing in Washington waters became intensive, and in 1899 the American equalled the Canadian catch and there was a total pack of 980,131 cases. There can be no question but that this was an excessive capture. The pack in 1903 was only one-third of that of 1899 and the packs in 1907, 1911, and 1915 approximately half that of 1903. The downward trend continued until 1923, when only 79,057 cases were packed. In 1927 there was a slightly larger run, but again the pack was too great, because in 1931 the escapement is poor and the pack less than that of four years ago. The runs of this cycle are now produced in that portion of the Fraser River below Hell's Gate Canyon. That they have not disappeared entirely may be attributed to the restrictions placed upon fishing operations in the mouth of the river and possibly in part to the operations of hatcheries in the three main spawning areas.

Drs. Clemens further state that in the light of our present knowledge of the life-history of the sockeye and of the history of the fishery, the cause of depletion lies clearly in the lack of adequate control of the fishing. "The need for international supervision is clearly demonstrated. Had there been an international convention whereby the pack of 1931 had been even limited to 100,000 cases, 350,000 additional fish would have reached the spawning-beds and approximately 700,000,000 more eggs would have been deposited. On the basis of returns determined in the Karluk River, Alaska, by the United States Bureau of Fisheries, approximately 1,000,000 fish might have been expected to return in 1935 from the additional escapement permitted in 1931.

"The history of the sockeye-salmon fishery of the Fraser River is remarkable in its completeness. The causes of the decline are evident and the necessary remedial measures are equally evident. In the face of the facts, the present condition of the fishery stands out as a great tragedy in the exploitation of a natural resource.

"The run of 1932 will be derived largely from the spawning of 1928. In the latter year an escapement of average extent was recorded for the lower Fraser area and a small one to the upper area. There was no marked increase over that of 1924. In each of the years 1916, 1920, 1924, and 1928, the packs have been approximately 100,000 cases. There is no indication of an increased run in 1932, and if this cycle is to be maintained a pack greater than 100,000 cases should not be taken."

The Rivers Inlet Sockeye Run of 1931.—In dealing with the sockeye run to Rivers Inlet in 1931, Drs. Clemens state that the pack was 76,428 cases, better by 10,000 cases than the packs of the two brood-years, 1926 and 1927, which produced it, and according to the spawning-bed reports the escapement showed a corresponding improvement. The only factor related to the size of the run over which there is control is the extent of the fishing. When the regulations remain constant and the size of the run increases or decreases in successive years of the same cycle, the explanation becomes an almost impossible task. When runs increase no doubt unusually favourable conditions existed, and when runs decrease adverse conditions must have existed. By accepting the theory that a five-year cycle predominates the run to Rivers Inlet, it is possible to arrange the packs and the relative proportion of the age-groups in fairly orderly sequence. When the four-year-old fish are in the majority, the packs are small. When the five-year-old fish are greatly in excess, packs of at least 120,000 cases are produced. The 1931 run belongs to the series in which there is little uniformity and relative percentages of four- and five-year-olds. In 1931 there were 54 per cent. of five-year-old fish and 46 per cent. of fours, and the pack totalled 76,428 cases. Comparing the percentages of this year with those of their immediate progenitors, there were 54 per cent. of fives and 46 per cent. of fours—against 40 and 83 per cent. respectively.

The run in Rivers Inlet in 1932, Drs. Clemens state, will be derived from seedings in 1927 and 1928, when the packs amounted to 64,461 and 60,044 cases respectively. The five-year-olds in the catch in 1927 numbered only 17 per cent., and in the run of 1928 only 18 per cent.; hence there is little ground for predicting anything above a fair return in 1932.

The Skeena River Sockeye Run in 1931.—The sockeye-pack on the Skeena in 1931 totalled 93,023 cases, and the reports from the spawning areas indicated a good seeding but that the escapement was below expectancy. In their report of 1930 Drs. Clemens suggested that the run in 1931 would produce a pack of 80,000 cases. It would appear that a pack of that size would have been nearer to the ideal relation as between catch and escapement.

The run to the Skeena in 1932, Drs. Clemens state, will be derived from the seedings of 1927 and 1928. In the former year the pack was 83,996 cases, of which 31 per cent. consisted of five-year-old fish. In the latter year the pack was 34,559 cases, the smallest on record, with the four-year-old fish furnishing 57 per cent. The reports from the spawning-beds in both those years state that the seeding in Babine Lake area was good, but that in the Lakelse area was very poor. All the indications are that the run to the Skeena in 1932 will be a small one and, in the interests of conservation, it is recommended that only a small catch be made.

The Sockeye Salmon Run to the Nass in 1931.—In dealing with the run of sockeye to the Nass River in 1931, Drs. Clemens state that, of the four river systems under consideration, the Nass is both the most interesting and at the same time the most unsatisfactory to study. It affords greater interest for two reasons: First, because the racial characteristics are so well defined; and, secondly, because there is a larger number of age-groups with considerable variety in the combinations of years spent in fresh and in salt water. It is unsatisfactory to study because there seems to be such a lack of correlation between the pack records and the size of the corresponding runs in successive years of the same cycle. Mediocre brood-years have resulted in excellent runs; and vice versa, splendid seedings have produced phenomenally poor runs. These apparently contradictory results may be due to the exceptional conditions prevailing during either the fresh- or salt-water periods which cannot be determined. On the other hand, these results may be explained by the fact that our knowledge of the runs is far from complete. Like the fishery of the Fraser River, that of the Nass is also international, but, unlike the Fraser, the American pack statistics of the Nass are not available and cannot be combined with the Canadian one to give the total pack for each year.

In addition, our knowledge of the spawning-grounds is extremely limited. The inaccessibility of the river-basin has made complete exploration such a difficult and costly task that at present the Meziadin Lake area is the only one of which we have reliable and adequate information. To what extent, if any, Bowser Lake serves as a spawning-ground is uncertain. Our knowledge of that lake is altogether too meagre. That there are other spawning-grounds in the river system is beyond doubt, but, until they are found and are inspected annually, information as to escapement will remain incomplete.

So far as predictions can be made, the outlook for 1932 is not good.

As stated, the report of Drs. Clemens, together with its thirty-three tabulations, will be found in the Appendix of this report. It is a valuable addition to the series.

PILCHARD AND HERRING INVESTIGATION.

The work of the joint Provincial and Dominion Governments' investigation of the pilchard and herring fisheries was continued during 1931 and considerable progress has been made. These investigations were conducted under the supervision of Dr. W. A. Clemens, of the Biological Board of Canada, and Mr. John Pease Babcock, Assistant to the Commissioner of Fisheries for the Province, and under the direction of Dr. J. L. Hart, who is assisted by a scientific and technical staff.

The effort to determine the exact age composition of the pilchard-catch begun in 1930 was continued in 1931. Although definite proof of the accuracy of the otolith or earstone method of age determination is still lacking, it indicates that, as was the case last year, over 90 per cent. of the pilchard-catch in 1931 was composed of fish in their fifth, sixth, and seventh years, the sixth-year group being the largest. In regard to the age composition of the catch, the pilchards caught in the neighbourhood of Barkley Sound and delivered to Ecoole were found to be essentially similar to those delivered to the Nootka plant in Nootka Sound. Otolith readings indicated that female pilchards grow faster than males. Every effort is being made by Mr. W. R. Whittaker, who is in charge of the otolith investigation, to standardize the methods and establish the accuracy of the determinations.

Sampling the pilchard population for length, weight, and sex is being continued to supplement the otolith studies. The general observations made on the pilchard population in 1929 and 1930 were repeated in 1931. Female pilchards were more numerous than males, constituting approximately 55 per cent. of the catch. They also averaged longer by about ⅕ inch and were more heavily built, as female pilchards usually weighed more than males of the same length. On the average, both male and female pilchards were shorter by about ⅕ inch in 1931 than they were in 1930.

The study of races in pilchards, designed to show whether or not the British Columbia pilchard is identical with the California sardine, is being continued in connection with the sampling programme. Unexpected results, difficult of interpretation, have been obtained, and it has accordingly been considered advisable to postpone drawing conclusions on this point until further data are collected.

The work done in 1930 on the possible effect of pilchard-plant effluent on marine life suggested that considerable quantities of valuable substances were being poured into the sea. Accordingly, a study of a pilchard plant was undertaken to determine from a monetary point of view the extent and nature of the losses taking place. This research, which was carried out by Mr. Desmond Beall, showed that the losses were indeed very considerable and might in an ordinary season's run amount to products valued at more than $8,000 for one plant. If adequate methods of eliminating this waste can be developed, a considerable saving might be made and any last suspicion of possible pollution could be removed.

Satisfactory progress has been made with the herring-work. In accordance with the investigation's policy of concentrating its effort on a few of the most crucial phases of the life-history of the species, special emphasis has been laid on the parts of the herring-work dealing with the age composition of the catch and the local races of herring in British Columbia. This part of the work has been undertaken by Mr. A. L. Tester.

The age composition for herring was determined from samples from Trincomali Channel, Nanoose Bay, Barkley Sound, Nootka Sound, Kyuquot Sound, Sydney Inlet, Jap Inlet, and Pearl Harbour. The catches in the first five named localities were chiefly made up of third-, fourth-, and fifth-year herring in order of importance, with a few second- and sixth-year fish. In Sydney Inlet fifth-year fish predominated, with most of the rest of the catch being comprised of fourth- and third-year fish. In the two northern districts, Jap Inlet and Pearl Harbour, the age distribution was considerably wider, as fish in their ninth and tenth years are not uncommon. Length composition of the catches in the various districts reflected the age composition, although the relationship was complicated by differences in growth-rate in the different localities.

As was the case in 1930–31, female herring in 1931 were found to be larger than males of the same age. The evidence indicates that the growth-rate was slower for herring at Jap Inlet and Pearl Harbour than for those from the more southern localities. Female herring were more numerous than males in west-coast localities and less numerous on the east coast of Vancouver Island.

A study of several racial characters of herring in the above-mentioned districts indicated that the herring from the two northern districts are certainly distinct from all the others, and further suggested very strongly that each of the districts investigated had its own herring population with its special racial characteristics.

A study of the natural mortality in the herring has been undertaken with particular attention being paid to the early stages in its life-history. Considerable material has been collected for this study and it is expected that this data may be reported upon soon.

A special chemical study was begun with the object of investigating the changes which take place in the condition of herring with changes in season. Information on this subject is applicable not only to the choice of curing methods, but also to fixing upon a general policy of exploiting the species. Considerable data were collected for this investigation, but it proved impossible to get sufficient funds to complete the research satisfactorily.

There will be found in the Appendix of this report the text of a bulletin on the "Food of the Pilchard," by Dr. J. L. Hart, Director of the Pilchard and Herring Investigation, and one of his assistants, Mr. G. H. Wailes, which gives the result of a study of food material taken from the digestive tract of fish taken on the west coast of Vancouver Island, B.C. The food and food-supply of the pilchards in Provincial waters is a matter of importance, from the fact that the pilchards fatten rapidly after their first appearance each season and the fact that they are more easily caught where the food is abundant. Because pilchards cannot be kept under observation or their food collected immediately after it is consumed, the latter must be taken after the fish have been brought to port. By that time it is partly digested and the more fragile forms of food not easily distinguished. While it cannot be assumed that the material collected is accurately representative of that usually consumed, it may be assumed that it is the food which so rapidly increases their oil content as the season advances.

The food of the pilchard, as shown by Dr. Hart's study, consists largely of plants and animals—very simple organisms having all their organs in one cell or compartment; and more complicated forms each divided into a large number of cells. For the most part the food consisted of the simple one-celled organisms—usually plants, termed "green food" by the fishermen. The balance consisted of the many-celled forms—usually animals, which fishermen call "red food." Many of these forms are described in detail in the text of this report.

HALIBUT INVESTIGATION.

(Created by the Halibut Treaty between Canada and the United States.)

The International Fisheries Commission was granted new and extensive powers by a new treaty signed May 9th, 1930. Ratifications were exchanged May 9th, 1931. The text of this treaty was published in the Report of the Commissioner for the year 1930. During 1931,* new regulations and the proper machinery for administration were developed, while the investigations were continued. A Conference Board from the halibut fleet was appointed, consisting of three members from Canada and three from the United States. After consultation with this Conference Board, public hearings were held in November and new regulations adopted on December 5th. These were approved in January as required by treaty and became law. These regulations have been published. They in brief divide the halibut banks into areas, specify the poundage to be taken from each such area, provide for the collection of proper statistics to enforce such limitations, close two small spawning-grounds, and define the annual closed season as from November 1st to January 15th.

The work at sea of the vessel chartered by the Commission from May to August, 1931, and the completed examination of the numerous net-hauls indicates an almost complete lack of eggs and larvæ in the waters off the coasts of British Columbia. It has also been shown by extensive drift-bottle experiments that the currents are adverse to any drift of the floating young southward from the Gulf of Alaska, where there are yet considerable numbers spawned. Finally, these young have been found by the Commission to drift inshore and settle in shallow water, those in the open sea vanishing from the net-hauls. These conclusions, when corroborated by work in progress, will make necessary immediate steps to preserve the spawning-schools on banks off the Canadian coast.

The Commission has continued to collect statistics as to the catches, showing the bank of origin of each landing. From these records it has proved that it is possible to rebuild the stock

* Pending passage on May 2nd, 1932, of the United States Enabling Act.

on the banks, the response of this stock to a given reduction in gear having been definitely measured. The Commission is therefore seemingly in a position to forecast the results of its regulations and to intelligently regulate the banks where the biological investigations show such regulation is necessary.

The biological investigations have been continued, including tagging experiments, determination of growth, races, and other phases necessary as a foundation for regulation.

THE FRASER RIVER SOCKEYE TREATY.

It is a matter of grave concern that the "Sockeye Salmon Fisheries Convention" between Canada and the United States "for the protection and extension of the sockeye-salmon fisheries of the Fraser River system"—signed in Washington May 26th, 1930; ratified by the Parliament of Canada; and transmitted to the Senate of the United States by the President of the United States with the request that it be approved—is still awaiting action by the Senate. This treaty, like the two previous ones, was drawn in compliance with the unanimous recommendations of no less than three international commissions appointed by Canada and the United States to investigate the condition of the sockeye-salmon fishery of the Fraser River system and to make recommendations to the two Governments of the measures necessary to support and maintain it.

The facts in this case are not questioned. Those commissions reported unanimously that:—

(1.) The fishery is an international fishery:

(2.) The sockeye salmon which frequent the Fraser River system are the product of the sockeye salmon that spawn in that river's basin in British Columbia; they spend the first year or more of their life in its waters, then migrate to sea and remain there until mature, when they seek to return to that river and basin to spawn, and after spawning die:

(3.) On their return from the sea the sockeye pass through United States waters in the State of Washington and Canadian waters in the Province of British Columbia, and are there intercepted by United States and Canadian fishermen:

(4.) In the last thirty years approximately 70 per cent. of the yearly catches have been made by United States fishermen:

(5.) The fishery has been so seriously depleted that it now produces but a fraction of its former abundance; and that it

(6.) Can only be restored by joint and uniform action by treaty between Canada and the United States.

Having fully established the above facts in this case, the two Governments have at various times drawn and signed three treaties. All three were ratified by the Parliament of Canada. All three were transmitted to the United States Senate by the President with the request that they be approved. The first two were withdrawn at the Senate's request, and the third is still in its hands awaiting action.

The failure of the Senate to ratify this treaty is a matter of grave concern in Canada. For years she has sought to maintain the sockeye-salmon fishery of the Fraser system by closely restricting the operations of her fishermen and by extensive hatchery operations. Notwithstanding her continuous efforts for the last thirty years, the fishery has steadily declined. She has failed to maintain it because of lack of support and assistance on the part of the United States. Her patience is close to exhaustion. Failing favourable action on the treaty now before the Senate, it is seriously proposed that Canada abandon further efforts to maintain the sockeye-salmon fisheries of the Fraser system and, in lieu thereof, collect all the sockeye-eggs obtainable in the Fraser River basin, transfer them to her hatcheries on the Skeena and Rivers Inlet, and liberate the resulting fry in these waters, over which she has complete control. The suggestion is entirely practical, because it has been repeatedly demonstrated that adult sockeye return to spawn in the fresh waters in which they spent the first year of their life.

APPENDICES.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON.

(No. 17.)

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

INTRODUCTION.

The runs of sockeye salmon to the four main river systems of British Columbia in 1931 were up to expectancy for their respective cycles. To this extent the situation may be said to have been satisfactory. However, for at least two of the areas the packs were too large to provide for an adequate safety factor in escapements.

The report on the spawning-beds of the Fraser River states that the number of fish reaching the spawning areas was relatively small. A smaller pack with a corresponding larger escapement would have meant an encouraging outlook for the future of the cycle. As it is, the prospect for 1935 is not bright.

The pack at Rivers Inlet was slightly above prediction and the report on the spawning-beds indicates a good escapement. It would appear that the situation in respect to this cycle is encouraging, with some prospect of restoration to its former level of abundance.

On the Skeena River, the escapement to the Lakelse area is reported as very good and to the Babine area as good. The overseer is of the opinion that there should have been a larger escapement, since considerably less gear was used in 1931 than in recent years. The pack was slightly larger than predicted and probably a somewhat smaller catch would have resulted in a nearer approach to what might be conceived as the ideal condition.

A very unsatisfactory state exists with respect to the Nass River. The pack was very slightly above that of 1926, but the spawning-bed report states that the escapement was small, probably even smaller than that of 1926. The solution of the problem of this river must await international co-operation.

DESIGNATION OF AGE-GROUPS.

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

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

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

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

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

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

1. THE FRASER RIVER SOCKEYE RUN OF 1931.

(1.) General Characteristics.

The total pack of Fraser River sockeye in the season of 1931 amounted to 128,158 cases, of which 40,947 cases were packed in the Province of British Columbia and 87,211 cases in the State of Washington (Table I.). The percentages for the two areas are 32 and 68 respectively. The reports from the spawning-beds indicate a small escapement and the most discouraging feature is the decrease in the run to the Birkenhead River.

The history of this cycle is clearly shown in Table I. In 1895 there was a pack of 461,127 cases put up almost entirely in British Columbia. By 1897 fishing in Washington waters became intensive, and in 1899 the American equalled the Canadian catch and there was a total pack of 980,131 cases. There can be no question but that this was an excessive capture. The pack in 1903 was only one-third of that of 1899 and the packs in 1907, 1911, and 1915 approximately half that of 1903. The downward trend continued until 1923, when only 79,057 cases were packed. In 1927 there was a slightly larger run, but again the pack was too great, because in 1931 the escapement is poor and the pack less than that of four years ago. The runs of this cycle are now produced in that portion of the Fraser River below Hell's Gate Canyon. That they have not disappeaered entirely may be attributed to the restrictions placed upon fishing operations in the mouth of the river and possibly in part to the operations of hatcheries in the three main spawning areas.

In the light of our present knowledge of the life-history of the sockeye and of the history of the fishery, the cause of depletion lies clearly in the lack of adequate control of the fishing. The need for international supervision is clearly demonstrated. Had there been an international convention whereby the pack of 1931 had been even limited to 100,000 cases, 350,000 additional fish would have reached the spawning-beds and approximately 700,000,000 more eggs would have been deposited. On the basis of returns determined in the Karluk River, Alaska, by the United States Bureau of Fisheries, approximately 1,000,000 fish might have been expected to return in 1935 from the additional escapement permitted in 1931.

The history of the sockeye-salmon fishery of the Fraser River is remarkable in its completeness. The causes of the decline are evident and the necessary remedial measures are equally evident. In the face of the facts, the present condition of the fishery stands out as a great tragedy in the exploitation of a natural resource.

The run of 1932 will be derived largely from the spawning of 1928. In the latter year an escapement of average extent was recorded for the lower Fraser area and a small one to the upper area. There was no marked increase over that of 1924. In each of the years 1916, 1920, 1924, and 1928, the packs have been approximately 100,000 cases. There is no indication of an increased run in 1932, and if this cycle is to be maintained a pack greater than 100,000 cases should not be taken.

(2.) Age-groups.

The material for this year's study consists of data and scales from 1,465 sockeye salmon selected at random from April 30th to September 18th in fifty samplings. The 4_2 age-group is represented by 1,158 individuals, or 79 per cent. of the total sample. The 5_2 age-group consists of 192 individuals, or 13 per cent. These two groups together comprise 92 per cent. of the run. The remaining age-groups constitute 8 per cent. and are represented as follows: 5_3, 19 individuals; 3_1, 29 individuals; 4_1, 29 individuals; 3_2, 37 individuals; and 4_3, 1 individual. The 6_2 age-group is not represented in the samplings of the run of this year (Tables II., III., and IV.).

Up to the end of June only representatives of the 4_2 and 5_2 age-groups occur in the samplings. The others appear during the height of the run from mid-July to the end of August.

(3.) Lengths and Weights.

The average lengths of the males and females of the 4_2 age-group are 23.4 and 22.8 inches respectively, which are slightly less than those of their progenitors and of the averages of the past ten years. The average lengths of both sexes of the 5_2 age-group are 25.6 and 24.6 inches respectively, which are practically identical with those of 1926 and of the averages of the past five years (Table V.).

The average weights in the 4_2 age-group are 5.8 and 5.2 lb. and in the 5_2 age-group 7.3 and 6.5 lb. respectively, and the statements made in regard to the lengths apply to the weights.

The average weights of the 3_1 age-groups (grilse) are exceptional, in that they are much below the average of the past ten years and, in fact, the lowest on record. The average weights of the males and females are 4.5 and 4.6 lb. respectively (Table VI.).

In the cases of both the 4_2 and 5_2 age-groups the smaller individuals appear earliest in the run. For example, the males of the 4_2 group up to the end of June average 20.7 inches in length and 3.7 lb. in weight, whereas during July and August they average approximately 24 inches in length and 6 lb. in weight.

(4.) Distribution of the Sexes.

The total number of males in the samplings is 704 and of females 761, percentages of 48 and 52 respectively. As usual, the females slightly exceed the males in number in the 4_2 age-group, but the males slightly outnumber the females in the 5_2 group.

Table I.—Fraser River Packs, 1895–1931, arranged in accordance with the Four-year Cycle.

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

Table II.—Fraser River Sockeyes, 1931, Vancouver Island Traps, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.														Total.
	4_2		5_2		5_3		3_1		4_1		3_2		4_3		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
16½		1									1	1			3
17	1	2													3
17½	4	1													5
18	1	2									5	2			10
18½	11	8									3	3			25
19	2	6									4	3			15
19½	10	7		1							3	3			24
20	6	6					3				1	1			17
20½	16	8	2	1								1		1	29
21	11	17		1				8		1	3	1			42
21½	6	34	1				2	3			1				47
22	15	68	3	6	1		1	5				1			100
22½	31	86	6	3			1	4		1					132
23	53	133	3	1	1	1	2			1					195
23½	94	112	1	5	1	3			1	4					221
24	111	69	6	4	1	2				6					199
24½	91	33	7	14	1	3			1	5					155
25	59	12	5	13	1	2			3						95
25½	15	4	11	18					3						51
26	7	2	13	10	1				2						35
26½	2		17	5	1				1						26
27	1		17	2											20
27½			9												9
28			5												5
28½			2												2
Totals	547	611	108	84	8	11	9	20	11	18	21	16		1	1,465
Average lengths	23.4	22.8	25.6	24.6	24.3	24.1	21.5	21.6	25.3	22.5	19.1	19.2		20.5	

Table III.—Fraser River Sockeyes, 1931, Vancouver Island Traps, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.														Total.
	4_2		5_2		5_3		3_1		4_1		3_2		4_3		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
2	2	2									1	1			6
2½	10	7									4	2			23
3	17	20		1							7	5			50
3½	19	22	1	1			2				4	4			53
4	32	57	2	4	1		2	6		1	3	2		1	111
4½	29	95	9	2			1	6			2	1			145
5	47	92	4	11	1		2	6	1	1		1			166
5½	83	119	5	2		1	1	2		3					216
6	101	92	11	9	3	5	1			5					227
6½	82	55	9	13		2			1	7					169
7	73	33	11	12	2	3			3	1					138
7½	32	14	7	15					2						70
8	15	3	10	10	1				2						41
8½	3		16	3					2						24
9	2		10	1											13
9½			6												6
10			6												6
10½															
11			1												1
Totals	547	611	108	84	8	11	9	20	11	18	21	16		1	1,465
Average weights	5.8	5.2	7.3	6.5	6.1	6.3	4.5	4.6	7.3	6.0	3.2	3.3		4.0	

Table IV.—Fraser River Sockeyes, Percentages of the Year-classes from 1920 to 1931.

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

Table V.—Fraser River Sockeyes, Average Lengths of Principal Classes from 1920 to 1931.

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

Table VI.—Fraser River Sockeyes, Average Weights of Principal Classes from 1922 to 1931.

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

2. THE RIVERS INLET SOCKEYE RUN OF 1931.

(1.) General Characteristics.

The pack of 1931 (76,428 cases) was better by 10,000 cases than the packs of the two brood-years, 1926 and 1927, which produced it, and, according to Overseer Stone, "the escapement to the spawning-beds showed a corresponding improvement." The only factor related to size of runs over which there is control is the extent of fishing. When the fishing regulations remain constant and the size of a run increases or decreases in successive years of the same cycle, the explanation becomes an almost impossible task. This is true because the other factors, such as temperature of the water, height of the water at the time of migration, abundance of food, reproductive capacity of the fish, and the like, upon which the success of a run depends, are uncontrollable and so interrelated that they cannot be separated. When runs increase, no doubt unusually favourable conditions existed, and when runs are impoverished, particularly adverse conditions must have abounded. In the case of this increased pack and run of 1931 there is an additional factor which should be mentioned. It is possible that the 20,000,000 eyed eggs and fry which the hatcheries planted in both 1926 and 1927 contributed in part to the improvement in 1931.

By accepting the theory that a five-year cycle predominates in Rivers Inlet, it is possible to arrange the packs and the relative proportions of the principal age-groups in fairly orderly sequence. In the two tables which follow, the data have been arranged in five-year series.

Table A.

Series 1.	1907, 87,874 cases;	1912, 112,884;	1917, 61,195;	1922, 53,584;	1927, 64,461.
Series 2.	1908, 64,652 cases;	1913, 61,745;	1918, 53,401;	1923, 107,174;	1928, 60,044.
Series 3.	1909, 89,027 cases;	1914, 89,890;	1919, 56,258;	1924, 94,891;	1929, 70,260.
Series 4.	1910, 126,921 cases;	1915, 130,350;	1920, 125,338;	1925, 159,554;	1930, 119,170.
Series 5.	1911, 88,763 cases;	1916, 44,936;	1921, 48,615;	1926, 65,581;	1931, 76,428.

Table B.

Series 1.	1912 (5 years)	79%	1917	67%	1922	18%	1927	17%
	(4 years)	21%		33%		82%		83%
Series 2.	1913	20%	1918	43%	1923	24%	1928	42%
		80%		57%		76%		58%
Series 3.	1914	65%	1919	54%	1924	56%	1929	19%
		35%		46%		44%		81%
Series 4.	1915	87%	1920	95%	1925	77%	1930	50%
		13%		5%		23%		50%
Series 5.	1916	76%	1921	51%	1926	40%	1931	54%
		24%		49%		60%		46%

In one case (Table A) the pack statistics are used as the basis and in the other (Table B) the percentages of the four- and five-year-old fish. Considering each series of both tables separately, Nos. 2, 3, and 4 show fair correlation both in size of pack and in relative proportions of the two age-groups. Considering Tables A and B together, three generalizations can be made: "(1) When the four-year-old fish are in the majority the packs are small, consisting of 50,000 to 65,000 cases (series 2); (2) when the five-year-old fish slightly exceed the fours, the packs amount to 85,000 to 95,000 cases (series 3); and (3) when the five-year-olds are greatly in excess, then a pack of at least 120,000 cases is produced (series 4)." The quotation is taken from the report of 1928, where a full discussion of these tables can be found.

The year 1931 belongs to series 5, in which there is little uniformity and a lack of correspondence between size of packs and relative percentages of the 4_2's and 5_2's. This year there are 54 per cent. of five-year-old fish and 46 per cent. of fours, and the pack amounts to 76,428 cases. The relation between the packs and age-groups most nearly approaches that of series 3 in which slight excess of five-year-olds is associated with mediocre packs.

Comparing the percentages of this year with those of their immediate progenitors, there are found 54 per cent. of 5_2's and 46 per cent. of 4_2's, against 40 and 83 per cent. respectively. On the one hand the five-year-olds are a little more abundant, and on the other hand the fours are present in greatly reduced numbers.

The run of 1932 will be derived from the seedings of 1927 and 1928. In summing up the inspections of these two seedings, Overseer Stone says, in 1927, that if freshets do not harm the spawning-beds the sockeyes observed "should produce a return equal in extent to that recorded this year"; and in 1928 he states, "I am of the opinion that a moderate run only may be expected from the results of the spawning this season." The packs of these brood-years amounted to 64,461 and 60,044 cases. If the theory that five-year-old fish produce five-year-olds is adopted, a large number of them cannot be expected in the run of 1932 because they comprised only 17 per cent. of the run in 1927 and 18 per cent. in 1922. As mentioned above, in this river system the runs in which five-year-old fish form a minor part are of fair size only and the packs mediocre. There seems to be no ground for predicting anything but a fair return in 1932.

(2.) Age-groups.

The total number of samples, taken at regularly spaced intervals during the period between June 30th and August 7th, was 1,699. The four age-groups characteristic of Rivers Inlet runs are found in the following distribution: 4_2's, 901; 5_2's, 756; 5_3's, 30; and 6_3's, 12. The two latter classes are always present but never become an important element of the runs. In 1931 these two age-groups together comprise only 3 per cent. of the entire run. Table VII. shows the extent of the fluctuation over a period of years in the relative abundance of the two dominant groups, the 4_2's and 5_2's.

(3.) Lengths and Weights.

Tables VIII. and IX. furnish the detailed information concerning the length and weight variations of the fish in this year's run, and Tables X. and XI. give the size comparisons with former years. The lengths and weights of both male and female 4_2's are the smallest on record. The discrepancy between these measurements and those of earlier years is so great that it would seem that the decrease should be interpreted as the result of some temporary condition which was unfavourable for this particular age-group. The males and females of the 5_2 class show for both length and weight a closer agreement with the averages previously recorded, although here too there is a slight reduction.

These 1931 measurements afford an example of a size relationship which is manifested only in this river system. It is the very close correspondence which exists between the measurements of the two sexes of an age-group. Occasionally this condition results in a second peculiarity—namely, that females are larger than males. The 4_2 age-group of this run of 1931 illustrates both points for both sexes and for both length and weight. The females are longer and heavier than the males by 0.1 per cent.

(4.) Distribution of Sexes.

In Table XII. it is shown that the sex distribution of 1931 is in accordance with former experience in so far as the 4_2 group contains more males than females and the 5_2 class has more females than males. Last year and the year before attention was drawn to the fact that the relative abundance of the two sexes of the 4_2's was showing a marked tendency toward equalization. The following figures bear this out: 1916–20, 75 per cent. males; 1921–25, 68 per cent.; and 1926–30, 61 per cent. The percentage for 1931 is 59. While this is greater than those for 1930 and 1929, it is at the same time less than the average percentage for the last five-year period just mentioned. As far as the 5_2 class is concerned, there is also a shifting of proportions. During the same five-year periods the percentages have changed as follows: 1916–20, 45 per cent. males; 1921–25, 35 per cent.; and 1926–30, 34 per cent. In 1931 the males comprise 33 per cent. of the group. In this class, then, the males have also become less abundant, but the decrease has not been as great as that among the 4_2's. As the proportion of males drops, of course that of the females rises. In 1930 we stated that only in the cycle of 1915–1920–1925–1930 had the total number of females exceeded that of the males. However, the year 1931 must now be added to the years just mentioned. The relative abundance of the two sexes is identical with that of 1930. The explanation of the fact that large packs are correlated with runs in which the total number of the 5_2's are greatly in excess is to be found in this matter of predominance of females in the 5_2 group. Runs in which the females outnumber the males are the more favourable because the potentialities of future runs become greater.

Table VII.—Percentages of 4_2 and 5_2 Age-groups, Rivers Inlet Sockeyes, in Runs of Successive Years.

Run of the Year.	Percentage Four and Five Years old.	Brood-year from which derived.
1912 (112,884 cases)	5 yrs. 79% 4 yrs. 21%	1907 (87,874 cases). 1908 (64,652 cases).
1913 (61,745 cases)	5 yrs. 20% 4 yrs. 80%	1909 (89,027 cases).
1914 (89,890 cases)	5 yrs. 65% 4 yrs. 35%	1910 (126,921 cases).
1915 (130,350 cases)	5 yrs. 87% 4 yrs. 13%	1911 (88,763 cases).
1916 (44,936 cases)	5 yrs. 76% 4 yrs. 24%	1912 (112,884 cases).
1917 (61,195 cases)	5 yrs. 67% 4 yrs. 33%	1913 (61,745 cases).
1918 (53,401 cases)	5 yrs. 43% 4 yrs. 57%	1914 (89,890 cases).
1919 (56,258 cases)	5 yrs. 54% 4 yrs. 46%	1915 (130,350 cases).
1920 (121,254 cases)	5 yrs. 95% 4 yrs. 5%	1916 (44,936 cases).
1921 (46,300 cases)	5 yrs. 51% 4 yrs. 49%	1917 (61,195 cases).
1922 (60,700 cases)	5 yrs. 18% 4 yrs. 82%	1918 (53,401 cases).
1923 (107,174 cases)	5 yrs. 24% 4 yrs. 76%	1919 (56,258 cases).
1924 (94,891 cases)	5 yrs. 56% 4 yrs. 44%	1920 (121,254 cases).
1925 (159,554 cases)	5 yrs. 77% 4 yrs. 23%	1921 (46,300 cases).
1926 (65,581 cases)	5 yrs. 40% 4 yrs. 60%	1922 (60,700 cases).
1927 (64,461 cases)	5 yrs. 17% 4 yrs. 83%	1923 (107,174 cases).
1928 (60,044 cases)	5 yrs. 42% 4 yrs. 58%	1924 (94,891 cases).
1929 (70,260 cases)	5 yrs. 19% 4 yrs. 81%	1925 (159,554 cases).
1930 (119,170 cases)	5 yrs. 50% 4 yrs. 50%	1926 (65,581 cases).
1931 (76,428 cases)	5 yrs. 54% 4 yrs. 46%	1927 (64,461 cases).

Table VIII.—Rivers Inlet Sockeyes, Run of 1931, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
19	1	....	....	....	....	....	....	....	1
19½	2	1	....	....	....	....	....	....	3
20	8	2	....	....	....	....	....	....	10
20½	35	12	....	....	....	....	....	....	47
21	83	47	....	1	....	....	....	....	131
21½	112	80	....	1	3	1	....	....	197
22	131	101	2	10	....	3	....	....	247
22½	60	62	1	8	2	3	....	....	136
23	49	38	13	35	2	1	....	....	138
23½	24	19	25	44	2	1	....	....	115
24	11	4	39	70	3	4	....	....	131
24½	11	3	23	67	1	1	....	....	106
25	2	....	27	94	....	1	....	1	125
25½	2	1	24	64	....	1	1	....	93
26	....	....	32	64	....	1	2	2	101
26½	....	....	16	29	....	....	1	1	47
27	....	....	23	14	....	....	1	1	39
27½	....	....	15	7	....	....	....	....	22
28	....	....	5	1	....	....	1	....	7
28½	....	....	1	....	....	....	1	....	2
29	....	....	....	....	....	....	....	....	.....
29½	....	....	1	....	....	....	....	....	1
Totals	531	370	247	509	13	17	7	5	1,699
Ave. lengths	21.9	22.0	25.2	24.8	23.0	23.4	26.8	26.1	.....

Table IX.—Rivers Inlet Sockeyes, Run of 1931, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
3	1	....	....	....	....	....	....	....	1
3½	26	7	....	....	....	....	....	....	33
4	165	109	....	3	1	1	....	....	279
4½	184	138	4	14	2	1	....	....	343
5	92	72	18	43	4	7	....	....	236
5½	41	32	43	77	3	3	....	....	199
6	12	10	38	97	2	2	....	....	161
6½	7	2	33	86	1	2	....	....	131
7	2	....	26	65	....	1	4	2	100
7½	1	....	34	71	....	....	....	2	108
8	....	....	25	30	....	....	....	....	55
8½	....	....	16	18	....	....	2	1	37
9	....	....	7	5	....	....	1	....	13
9½	....	....	2	....	....	....	....	....	2
10	....	....	1	....	....	....	....	....	1
Totals	531	370	247	509	13	17	7	5	1,699
Ave. weights	4.5	4.6	6.7	6.4	5.2	5.4	7.7	7.5	.....

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

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

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

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

Table XII.—Relative Numbers of Males and Females, Rivers Inlet Sockeyes, of the 4_2 and 5_2 Groups, 1915 to 1931.

Year.	Average Percentages.				Per Cent. Total Males.	Per Cent. Total Females.
	Four-year Males.	Four-year Females.	Five-year Males.	Five-year Females.		
1915	....	....	....	....	45	55
1916	74	26	40	60	52	48
1917	75	25	42	58	53	47
1918	74	26	49	51	66	34
1919	79	21	45	55	58	42
1920	74	26	48	52	49	51
1921	65	35	38	62	51	49
1922	66	34	38	62	61	39
1923	71	29	33	67	62	38
1924	74	26	31	69	50	50
1925	66	34	34	66	41	59
1926	63	37	32	68	51	49
1927	68	32	36	64	62	38
1928	63	37	30	70	51	49
1929	57	43	36	64	53	47
1930	56	44	37	63	47	53
1931	59	41	33	67	47	53

3. THE SKEENA RIVER SOCKEYE RUN OF 1931.

(1.) General Characteristics.

The pack on the Skeena River amounted to 93,023 cases. The report on the spawning-beds indicates a very good escapement to the Lakelse area and a good escapement to the Babine area. In regard to the latter, the Inspector is of the opinion that, taking all factors into consideration, there should have been a larger escapement. In the report of 1930 a pack of 80,000 cases was suggested for 1931, and it would appear that a pack of that size would have been nearer to the ideal relation as between pack and escapement.

The run of 1932 will be derived from the seedings of 1927 and 1928. In the former year the pack was 83,996 cases, with the five-year-old fish constituting 31 per cent. of the run. In the latter year the pack was 34,559 cases (the smallest on record), with the four-year-old fish forming 57 per cent. of the run (Table XIII.). The reports on the spawning-beds in these years state that the escapements to the Babine area were very good, but to the Lakelse area very poor. All indications are that the run of 1932 will be a small one and, in the interest of conservation, it is recommended that only a very small catch be made.

(2.) Age-groups.

Scales and length, weight and sex data are available from 1,769 fish collected from June 23rd to August 13th in sixteen random samplings. The 4_2 age-group is the most abundant, being represented by 715 individuals, or 40 per cent. The 5_2 age-group consists of 533 fish, or 30 per cent., and the 5_3 group of 491 fish, or 28 per cent. The number of 6_3 individuals is only 30, or 2 per cent. The outstanding feature of the run is the large number of fish of the 5_3 age-group. The percentage of 28 is the highest on record. These fish were derived from the spawning of year 1926 and had remained two years in the lake (Tables XIV., XV., and XVI.). The 5_3 age-group has never been considered in calculating the percentages of the four- and five-year-old fish in Table XIII. because it has usually constituted a small part of the run. In order to keep the record uniform it will be necessary to omit this group in the calculations of this year also.

(3.) Lengths and Weights.

The average lengths and weights of the two sexes in the various age-groups show no exceptional features. In all cases they are approximately similar to the averages for the past sixteen to twenty years. The average lengths and weights of the age-groups of importance are as follows:—

4_2 males, 23.5 inches, 5.4 lb.; females, 23.1 inches, 5.1 lb.
5_2 males, 25.7 inches, 6.8 lb.; females, 24.8 inches, 6.3 lb.
5_3 males, 23.8 inches, 5.5 lb.; females, 23.1 inches, 5.0 lb.
(*See* Tables XVII., XVIII., XIX., and XX.)

(4.) Proportions of the Sexes.

The females exceed the males in number in the total sampling, comprising 56 per cent. In the 4_2 age-group they constitute 57 per cent. and in the 5_2 age-group 61 per cent. In the 5_3 and 6_3 age-groups the numbers of males and females are approximately equal (Table XXI.).

Table XIII.—Percentages of 4_2 and 5_2 Age-groups, Skeena River Sockeyes, in Runs of Successive Years.

Run of the Year.	Percentage Four and Five Years old.	Brood-year from which derived.
1912 (92,498 cases)	5 yrs. 43% 4 yrs. 57%	1907 (108,413 cases). 1908 (139,846 cases).
1913 (59,927 cases)	5 yrs. 50% 4 yrs. 50%	1909 (87,901 cases).
1914 (130,166 cases)	5 yrs. 75% 4 yrs. 25%	1910 (187,246 cases).
1915 (116,553 cases)	5 yrs. 64% 4 yrs. 36%	1911 (131,066 cases).
1916 (60,923 cases)	5 yrs. 60% 4 yrs. 40%	1912 (92,498 cases).
1917 (65,760 cases)	5 yrs. 62% 4 yrs. 38%	1913 (52,927 cases).
1918 (123,322 cases)	5 yrs. 59% 4 yrs. 41%	1914 (130,166 cases).
1919 (184,945 cases)	5 yrs. 69% 4 yrs. 31%	1915 (116,553 cases).
1920 (90,869 cases)	5 yrs. 82% 4 yrs. 18%	1916 (60,923 cases).
1921 (41,018 cases)	5 yrs. 24% 4 yrs. 76%	1917 (65,760 cases).
1922 (96,277 cases)	5 yrs. 19% 4 yrs. 81%	1918 (123,322 cases).
1923 (131,731 cases)	5 yrs. 34% 4 yrs. 66%	1919 (184,945 cases).
1924 (144,747 cases)	5 yrs. 75% 4 yrs. 25%	1920 (90,869 cases).
1925 (81,146 cases)	5 yrs. 47% 4 yrs. 53%	1921 (41,018 cases).
1926 (82,360 cases)	5 yrs. 30% 4 yrs. 70%	1922 (96,277 cases).
1927 (83,996 cases)	5 yrs. 31% 4 yrs. 69%	1923 (131,731 cases).
1928 (34,559 cases)	5 yrs. 43% 4 yrs. 57%	1924 (144,747 cases).
1929 (78,017 cases)	5 yrs. 33% 4 yrs. 67%	1925 (77,784 cases).
1930 (132,372 cases)	5 yrs. 57% 4 yrs. 43%	1926 (82,360 cases).
1931 (93,023 cases)	5 yrs. 57% 4 yrs. 43%	1927 (83,996 cases).

Table XIV.—Percentages of the Principal Year-classes, Skeena River Sockeyes, from 1916 to 1931.

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

Table XV.—Skeena River Sockeyes, 1931, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
20	.....	.....	.....	1	.....	.....	.....	.....	1
20½	1	.....	.....	.....	.....	.....	.....	.....	1
21	8	9	.....	.....	1	3	.....	.....	21
21½	12	13	.....	.....	2	5	.....	.....	32
22	30	67	2	1	13	35	.....	.....	148
22½	23	49	.....	3	14	33	.....	1	123
23	61	115	3	13	42	82	.....	.....	316
23½	23	36	4	17	29	31	1	.....	141
24	71	82	15	61	84	33	.....	3	349
24½	25	14	10	42	24	9	1	3	128
25	44	18	41	77	32	4	3	3	222
25½	5	3	25	41	3	4	2	3	86
26	4	2	44	50	3	3	4	1	111
26½	.....	.....	20	11	1	.....	2	.....	34
27	.....	.....	26	8	1	.....	2	.....	37
27½	.....	.....	7	.....	.....	.....	1	.....	8
28	.....	.....	8	2	.....	.....	.....	.....	10
28½	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	.....	.....	1	.....	.....	.....	.....	.....	1
Totals	307	408	206	327	249	242	16	14	1,769
Ave. lengths	23.5	23.1	25.7	24.8	23.8	23.1	25.8	24.7	.....

Table XVI.—Skeena River Sockeyes, 1931, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
3½	2	3	.....	.....	.....	.....	.....	.....	5
4	18	37	.....	.....	8	21	.....	.....	84
4½	50	101	4	6	21	65	.....	1	248
5	64	109	8	26	55	81	1	1	345
5½	59	91	11	61	78	49	1	4	354
6	58	51	35	79	46	14	.....	3	286
6½	43	11	35	57	30	7	7	2	192
7	9	2	36	51	7	5	3	2	115
7½	3	3	37	34	4	.....	.....	1	82
8	1	.....	21	8	.....	.....	2	.....	32
8½	.....	.....	16	4	.....	.....	2	.....	22
9	.....	.....	2	1	.....	.....	.....	.....	3
9½	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	.....	.....	1	.....	.....	.....	.....	.....	1
Totals	307	408	206	327	249	242	16	14	1,769
Ave. weights	5.4	5.1	6.8	6.3	5.5	5.0	6.9	6.0	.....

Table XVII.—Average Lengths of Skeena River Sockeyes, 4_2 and 5_2 Age-groups, for Twenty Successive Years.

Year.	Four-year Males.	Four-year Females.	Five-year Males.	Five-year Females.
1912	24.6	23.5	26.4	25.2
1913	23.5	22.9	25.5	24.7
1914	24.2	23.4	26.2	25.1
1915	24.2	23.5	25.9	25.0
1916	23.9	23.6	26.2	25.0
1917	23.6	23.2	25.5	24.7
1918	24.1	23.3	25.9	25.0
1919	24.3	23.4	25.7	24.8
1920	23.8	23.2	26.2	25.3
1921	23.8	23.1	25.2	24.2
1922	23.6	23.2	25.3	24.4
1923	23.7	23.1	25.5	24.5
1924	24.1	23.3	26.2	25.2
1925	23.6	22.8	25.6	24.7
1926	23.8	23.4	25.6	24.8
1927	23.9	23.3	25.7	24.8
1928	23.3	22.8	25.3	24.7
1929	22.9	22.7	25.5	24.7
1930	23.1	22.7	24.7	23.9
Average lengths	23.8	23.2	25.7	24.8
1931	23.5	23.1	25.7	24.8

Table XVIII.—Average Lengths of Skeena River Sockeyes, 5_3 and 6_3 Age-groups, for Sixteen Successive Years.

Year.	Five-year Males.	Five-year Females.	Six-year Males.	Six-year Females.
1916	24.1	23.8	26.2	24.8
1917	23.9	23.8	25.4	25.0
1918	23.9	23.4	25.2	24.7
1919	24.3	23.4	25.8	24.7
1920	24.1	23.4	26.2	25.1
1921	24.2	23.4	24.9	24.2
1922	23.8	23.3	24.6	24.1
1923	23.9	23.2	25.6	24.4
1924	24.7	23.6	25.8	24.8
1925	24.1	23.3	25.8	24.8
1926	24.6	23.8	26.0	25.0
1927	24.1	23.5	25.2	24.9
1928	23.5	22.8	25.6	24.7
1929	23.8	22.8	25.5	24.3
1930	23.5	22.4	24.6	23.2
Average lengths	24.0	23.3	25.5	24.6
1931	23.8	23.1	25.8	24.7

Table XIX.—Average Weights of Skeena River Sockeyes, 4_2 and 5_2 Age-groups, for Eighteen Successive Years.

Year.	Four-year Males.	Four-year Females.	Five-year Males.	Five-year Females.
1914	5.9	5.3	7.2	6.3
1915	5.7	5.2	6.8	6.2
1916	5.4	5.1	7.1	6.3
1917	5.3	5.0	6.4	6.0
1918	5.8	5.3	6.9	6.4
1919	6.1	5.5	7.0	6.2
1920	5.6	5.1	7.2	6.4
1921	5.7	5.1	6.4	5.7
1922	5.4	5.1	6.5	5.7
1923	5.3	4.9	6.3	5.7
1924	5.6	5.0	7.0	6.3
1925	5.1	4.7	6.5	5.8
1926	5.3	5.1	6.5	5.8
1927	5.4	5.1	6.5	5.9
1928	5.0	4.6	6.4	5.8
1929	4.9	4.7	6.8	6.2
1930	5.4	5.1	6.7	6.0
Average weights	5.5	5.1	6.7	6.0
1931	5.4	5.1	6.8	6.3

Table XX.—Average Weights of Skeena River Sockeyes, 5_3 and 6_3 Age-groups, for Seventeen Successive Years.

Year.	Five-year Males.	Five-year Females.	Six-year Males.	Six-year Females.
1915	5.9	5.2	6.6	6.0
1916	5.8	5.4	7.1	5.9
1917	5.5	5.2	6.3	5.8
1918	5.7	5.3	6.6	6.1
1919	6.1	5.4	6.9	6.3
1920	6.3	5.1	7.3	6.3
1921	5.8	5.1	6.0	5.6
1922	5.5	5.1	6.2	5.7
1923	5.3	4.8	6.3	5.4
1924	5.9	5.1	6.6	5.8
1925	5.5	4.9	6.9	5.4
1926	5.9	5.2	6.9	6.2
1927	5.4	5.0	6.0	5.8
1928	5.0	4.6	6.5	5.8
1929	5.6	4.9	6.8	5.7
1930	5.6	5.0	6.8	5.8
Average weights	5.7	5.1	6.6	5.9
1931	5.5	5.0	6.9	6.0

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

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912	54	46	42	58	....	....	....	....
1913	69	31	47	53	....	....	....	....
1914	60	40	47	53	....	....	....	....
1915	55	45	45	55	....	....	....	....
1916	70	30	43	57	56	44	54	46
1917	65	35	48	52	65	35	58	42
1918	63	37	46	54	61	39	56	44
1919	53	47	46	54	52	48	45	55
1920	41	59	37	63	43	57	41	59
1921	44	56	44	56	50	50	43	57
1922	52	48	41	59	52	48	53	47
1923	60	40	37	63	56	44	40	60
1924	50	50	43	57	46	54	46	54
1925	57	43	42	58	45	55	47	53
1926	40	60	43	57	48	52	49	51
1927	45	55	41	59	47	53	56	44
1928	48	52	45	55	43	57	50	50
1929	50	50	46	54	65	35	57	43
1930	47	53	56	44	55	45	63	37
1931	43	57	39	61	51	49	53	47

4. THE NASS RIVER SOCKEYE RUN OF 1931.

(1.) General Characteristics.

Of the four river systems under consideration, the Nass is both the most interesting and at the same time the most unsatisfactory to study. It affords greatest interest for two reasons: First, because the racial characteristics are so well-defined; and, secondly, because there is a larger number of age-groups with considerable variety in the combination of years spent in fresh and salt water.

It is an unsatisfactory run to study because there seems to be such a lack of correlation between pack records and the size of the corresponding runs in successive years of the same cycle. Mediocre brood-years have resulted in excellent runs, and vice versa; splendid seedings have produced phenomenally poor runs. These apparently contradictory results may be due to exceptional conditions prevailing during either the fresh- or salt-water periods which cannot be discerned. On the other hand, these results may be explained by the fact that our knowledge of the runs is far from complete. Like the fishing of the Fraser River runs, that of the Nass is also international, but, unlike the Fraser, the American pack statistics of the Nass are not available and cannot be combined with the Canadian ones to give the total pack for each year.

In addition, knowledge of the spawning-grounds is extremely limited. The inaccessibility of the river has made complete exploration of the headwaters such a difficult and costly task that at the present time Meziadin Lake is the only area concerning which we have reasonably adequate information. To what extent, if any, Bowser Lake serves as a spawning-ground is uncertain. Our knowledge of the lake is altogether too meagre to make a positive statement. That there are other spawning-grounds in the river system is beyond doubt, but until they have been found and are inspected annually, information of escapement will remain incomplete. In view of the facts that the pack records do not represent the whole pack and that the seeding of the spawning-grounds of Meziadin Lake does not show the entire escapement, it is to be expected that discrepancies will arise between successive packs and escapements in the same cycle.

While the Nass River made a gratifying recovery in 1930, the pack for this year is again mediocre, amounting to 16,929 cases. Moreover, Inspector Hickman reports the conditions of the spawning-beds as "not at all favourable." However, using the available information as a basis for judgment, this pack of 1931 is all which could be expected, because the commercial yield of 1926, the principal brood-year, was only 15,929 cases and the seeding was unsatisfactory.

In so far as predictions can be made, the outlook for the year 1932 is not good. The pack of 1927 was only 12,026 cases, and Inspector Hickman, in speaking of Meziadin Lake, says: "I am of the opinion that the spawning-beds will not be amply seeded." In 1928, 30 per cent. of the run consisted of four-year-old fish and their progeny will be returning in 1932. Had 1928 been a productive year this age-group might materially augment the pack of 1932, but the yield was merely 5,540 cases, which is the smallest pack on record and cannot therefore form an important component of the run.

In connection with this small pack of 1928, we wish to repeat a statement which was made four years ago. It is this: that unless some very drastic measure is taken to allow a very large proportion of this cycle of 1918–23–28–33 to reach the spawning-beds, nothing but complete annihilation can be looked for in future years. As stated in the previous paragraph, the four-year-old fish constituted 30 per cent. of the run of 1928 and their descendants will mature in 1932. If some precaution is not taken in this year to increase the spawning reserve, further irreparable damage will be done to practically a third of a run which is already close to extermination.

(2.) Age-groups.

The great complexity of the Nass River run is one of its best marked racial peculiarities. Each year a portion of the young fish seeks the sea as soon as the fish become free-swimming and returns at maturity in the third or fourth year (3_1's and 4_1's). A second group, after spending one year in the lake, passes down to the salt water, where it remains three or four years, maturing at the ages of four and five (4_2's and 5_2's). A third group prolongs its fresh-water residence to two years and remains at sea until five or six years of age (5_3's and 6_3's). Still another group lives three years in the lake and three or four years in the ocean, reaching maturity in its sixth or seventh year (6_4's and 7_4's). There are thus in the Nass run eight

age-groups made up of individuals ranging between three and seven years of age. These groups are enumerated in Tables XXIV. and XXVI.

As these tables show, only seven of the usual age-classes are present. The missing group, the 7_4's, has never been composed of many individuals and since the year 1927 it has not contained a single representative. In addition, this year finds the 6_4 class made up of only five individuals. As stated in 1930, of late years these oldest fish are becoming more and more scarce. Their numbers are now so reduced that they can hardly be considered a real component of the runs. The recent scale-collections have been made as late in the season as in former years, so that these 6_4's and 7_4's should be represented were they present in the runs. Their disappearance cannot be accounted for at the present time.

The 1931 study is based on 1,758 individuals taken in fifteen random samplings at regular intervals during the period between June 29th and August 17th. In the Nass runs there are occasionally found single individuals representing age-groups other than the usual eight. This year, in addition to the 1,757 tabulated fish, there is to be recorded a male specimen with a length of 19½ inches and a weight of 3 lb. This sockeye spent two years in fresh water and matured after one year of ocean life and would therefore be designated as a 4_3.

Table XXII. is a compilation of the percentages of the principal age-groups over a period of years. In 1931 the following are found: 4_2's, 10 per cent.; 5_2's, 17 per cent.; 5_3's, 67 per cent.; and 6_4's, 6 per cent. In comparing these figures with those of the preceding three years, the most noticeable difference is a decrease of over 50 per cent. in the 4_2 group. At the same time, there has been an increase of a lesser degree in the 5_3's. Another five-year period has been added to Table XXIII. When these four five-year periods are perused, three features seem worthy of mention: (1) During the years 1922–26 the dominant age-group, the 5_3's, was considerably in excess of what appears to be its normal percentage; (2) during the last five-year interval the number of 4_2's has greatly increased; and (3) there is what appears to be a definite decrease in the numbers of the 5_2 class.

(3.) Lengths and Weights.

The statistics of length and weight for the various age-groups of 1931 are given in Tables XXIV. and XXVI., and the average measurements of the principal classes, together with similar averages for preceding years, are presented in Tables XXV. and XXVII. The 1931 fish are exceptionally large and heavy, the previous highest records being both equalled and exceeded. The 5_2 and 6_3 females set new high levels for length and weight and the 6_3 males for length only. Also the length and weight of the 5_2 males and the weight of the 6_3 males is equivalent to the greatest heretofore recorded.

The Nass River sockeyes have a specific racial characteristic correlated with size. In the other three river systems this character of size appears to be associated with the number of years spent in sea-feeding. Irregardless of the extent of fresh-water life, all fish which live three years in the ocean reach approximately the same size at maturity and likewise those which remain four years attain a similar size. In the Nass River, on the other hand, size is definitely linked with another factor—namely, ultimate age. In Tables XXVIII. and XXIX. the age-groups have been arranged in ascending series according to lengths and weights. Reading the sexes separately, it is seen that increase in age coincides with increase in size, the youngest fish are the smallest and the oldest fish are the largest. While age is obviously the factor which is most intimately allied with size, it is interesting to note the secondary influence which sea-feeding plays in the Nass River. There are two age-groups, each for the four-, five-, and six-year-old fish—namely, 4_2's and 4_1's for the fours; 5_3's and 5_2's for the fives; and 6_4's and 6_3's for the sixes. The two groups of each pair differ by one year of ocean life. In each case the group which had the additional year at sea has the greater length and weight.

(4.) Seasonal Changes during the Run.

Still another racial characteristic of the Nass is the seasonal succession of the various age-groups. The 5_3's, the dominant class, is present throughout the run, but with changing intensity. The 3_1's and 4_1's are confined to the early weeks of the run and the 6_4's and 7_4's are restricted to the later part. The 4_2's and 5_2's also occur during the entire run, but reach their greatest numbers during the middle and latter part of July. While this feature of seasonal succession has shown great constancy from year to year, occasionally there is a variation. Such

is the case in 1931. The 5_2's appear with maximum strength at the beginning of the run and maintain it through the month of July (Table XXX.).

(5.) THE MEZIADIN AND BOWSER SOCKEYE COLONIES.

In discussing the general characteristics of this river system, mention was made of the inaccessibility of the spawning-grounds for inspection and the limited knowledge concerning them. Each year Inspector Hickman makes the difficult trip into the Meziadin watershed in order to examine the spawning-beds and to gather additional data concerning the fish. As has been his experience occasionally in the past, this year he was unsuccessful in trying to intercept fish returning to the Upper Nass. Therefore the usual comparison between the Meziadin and Bowser Lake colonies cannot be made. But the data concerning the former colony are recorded in Tables XXXI. to XXXIII. In connection with these data there are two points to which attention should be directed. First, the entire sample, numbering fifty-one, is composed of fish which spent two years in the lake (Table XXXI.). Secondly, the average lengths of both males and females are high (Table XXXII.). This, of course, is in keeping with the findings of the general run to the Nass.

Table XXII.—Percentages of Principal Age-groups present in the Nass River Sockeye Run from 1912 to 1931.

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

Table XXIII.—Percentage of Principal Age-groups in Nass River Sockeye Run from 1912 to 1931 combined in Five-year Periods.

Year.	One Year in Lake.		Two Years in Lake.	
	Four Years old.	Five Years old.	Five Years old.	Six Years old.
1912–16	11	22	62	5
1917–21	13	15	65	7
1922–26	11	7	77	5
1927–31	20	11	65	4

Table XXIV.—Nass River Sockeyes, 1931, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.														Total.
	3_1		4_1		4_2		5_2		5_3		6_3		6_4		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
21½						1									1
22						2				2					4
22½	1	1		2	2	5				2					13
23	2			3	6	13		1	3	6					34
23½	2			3	12	25	1	1	2	15					61
24	1			4	19	17	3	10	12	54		1			121
24½	2		1	3	14	10	2	12	27	76		1			148
25	1		3	3	13	10	9	25	43	141		2			250
25½			3	1	8	2	21	22	81	148	4			2	292
26			1		6	2	22	25	105	124	2	2			289
26½			1		4		29	21	91	57	2	5	2		212
27					1		40	17	78	25	9	4			174
27½							12	3	33	5	3	1			57
28							9	3	13	2	10	9			46
28½							4		3		13	3	1		24
29							3		1		14	1			19
29½											6				6
30											4				4
30½											2				2
Totals	9	1	9	19	85	87	155	140	492	657	69	29	3	2	1,757
Ave. lengths	23.7	22.5	25.4	23.9	24.5	23.8	26.5	25.7	26.1	25.3	28.2	27.1	27.2	25.5	

Table XXV.—Nass River Sockeyes, Average Lengths of Principal Classes from 1912 to 1931.

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

Table XXVI.—Nass River Sockeyes, 1931, grouped by Age, Sex, Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.														Total.
	3_1		4_1		4_2		5_2		5_3		6_3		6_4		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
4½	1	.....	.....	1	.....	7	.....	.....	.....	4	.....	.....	.....	.....	13
5	2	1	.....	4	12	21	1	2	6	28	.....	.....	.....	.....	77
5½	2	.....	.....	5	18	30	1	5	29	129	.....	2	.....	1	222
6	3	.....	1	3	25	22	8	25	75	222	1	1	.....	1	387
6½	1	.....	5	6	17	7	15	31	106	166	4	2	.....	.....	360
7	.....	.....	1	.....	8	.....	31	40	131	80	1	5	2	.....	299
7½	.....	.....	2	.....	3	.....	48	25	104	18	9	10	.....	.....	219
8	.....	.....	.....	.....	2	.....	34	9	34	9	15	5	.....	.....	108
8½	.....	.....	.....	.....	.....	.....	13	1	4	.....	19	3	.....	.....	40
9	.....	.....	.....	.....	.....	.....	3	2	3	.....	13	1	.....	.....	22
9½	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	7	.....	1	.....	9
Totals	9	1	9	19	85	87	155	140	492	657	69	29	3	2	1,757
Ave. weights	5.5	5.0	6.7	5.7	6.0	5.5	7.4	6.8	6.8	6.2	8.3	7.4	7.8	5.7	.....

Table XXVII.—Nass River Sockeyes, Average Weights of Principal Classes from 1914 to 1931.

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

Table XXVIII.—Nass River Sockeyes, 1919–31, grouped by Age, Sex, and Average Lengths of Principal Age-groups.

Year.	Average Lengths in Inches in Groups.															
	Three Years old.		Four Years old.				Five Years old.				Six Years old.				Seven Years old.	
	3_1		4_2		4_1		5_3		5_2		6_4		6_3		7_4	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1919	.....	.....	24.9	24.1	26.1	25.1	26.5	25.8	26.2	25.2	28.2	26.5	27.9	26.7	27.2	28.0
1920	.....	.....	24.0	23.4	.....	.....	26.7	25.9	26.3	25.0	26.6	26.7	27.4	25.9	.....	.....
1921	23.1	22.4	24.3	23.5	24.2	23.6	26.2	25.6	25.5	24.3	26.9	26.5	27.9	26.2	.....	.....
1922	.....	.....	24.2	23.4	24.5	23.5	25.7	25.0	25.6	24.6	26.2	25.4	28.0	25.9	.....	.....
1923	.....	.....	24.3	23.7	25.5	24.3	26.2	25.5	25.9	25.3	26.1	25.5	27.2	26.5	.....	.....
1924	.....	.....	24.7	23.8	.....	.....	26.3	25.4	26.2	24.9	27.1	26.4	28.0	25.4	.....	.....
1925	.....	.....	24.4	23.8	.....	.....	25.9	25.0	25.9	24.7	26.3	25.3	26.9	25.4	.....	.....
1926	23.7	22.3	24.9	24.1	24.5	24.0	26.1	25.3	26.1	25.3	26.7	25.8	27.9	27.0	28.2	27.0
1927	23.4	23.5	24.9	24.2	25.6	24.1	26.3	25.9	26.3	25.2	26.8	27.0	27.6	26.5	29.0	.....
1928	23.7	22.4	24.3	23.5	25.1	23.6	25.5	24.6	26.0	25.1	25.5	24.6	28.1	26.2	.....	.....
1929	.....	.....	24.1	23.5	.....	.....	25.9	24.9	26.1	25.2	.....	.....	27.2	26.2	.....	.....
1930	.....	.....	24.5	23.7	25.8	24.3	26.4	25.3	26.5	25.4	.....	.....	27.9	26.8	.....	.....
Ave. lengths	.....	.....	24.5	23.7	25.2	24.1	26.1	25.4	26.0	25.0	26.6	26.0	27.6	26.2	.....	.....
1931	23.7	22.5	24.5	23.8	25.4	23.9	26.1	25.3	26.5	25.7	27.2	25.5	28.2	27.1	.....	.....

Table XXIX.—Nass River Sockeyes, 1919–31, grouped by Age, Sex, and Average Weights of Principal Age-groups.

Year.	Average Weights in Pounds of Groups.															
	Three Years old.		Four Years old.				Five Years old.				Six Years old.				Seven Years old.	
	3_1		4_2		4_1		5_3		5_2		6_4		6_3		7_4	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
1919	.....	.....	6.0	5.5	6.4	5.7	6.7	6.1	6.6	5.9	7.7	7.0	7.8	6.7	7.1	7.5
1920	.....	.....	5.6	5.2	.....	.....	7.4	6.7	7.4	6.3	7.6	6.9	7.9	7.0	.....	.....
1921	5.0	4.6	6.0	5.4	5.9	5.5	6.9	6.3	6.9	6.1	7.0	6.5	7.7	6.6	.....	.....
1922	.....	.....	5.9	5.4	6.1	5.5	6.8	6.3	6.8	6.2	7.5	6.3	8.1	6.6	.....	.....
1923	.....	.....	5.8	5.2	7.0	5.5	6.6	6.0	6.7	6.1	6.7	6.3	7.2	6.8	.....	.....
1924	.....	.....	5.9	5.4	.....	.....	6.8	6.1	7.2	6.1	7.3	6.5	8.0	6.5	.....	.....
1925	.....	.....	5.9	5.4	.....	.....	6.7	6.0	6.8	6.1	6.8	6.0	7.4	6.3	.....	.....
1926	5.5	4.5	6.0	5.4	5.9	5.7	6.7	6.0	6.9	6.2	6.8	6.2	7.8	7.1	7.7	7.3
1927	5.3	.....	6.2	5.8	6.8	5.6	6.9	6.2	7.1	6.3	7.0	7.2	7.8	7.0	9.0	.....
1928	5.4	4.7	5.6	5.0	6.9	5.5	6.2	5.5	7.0	6.2	6.3	5.4	8.1	6.6	.....	.....
1929	.....	.....	5.7	5.2	.....	.....	6.7	5.9	7.1	6.6	.....	.....	7.6	6.8	.....	.....
1930	.....	.....	5.9	5.2	6.8	5.8	7.1	6.1	7.3	6.5	.....	.....	8.2	7.2	.....	.....
Ave. weights	.....	.....	5.9	5.3	6.5	5.6	6.8	6.1	6.9	6.2	7.1	6.4	7.8	6.8	.....	.....
1931	5.5	5.0	6.0	5.5	6.7	5.7	6.8	6.2	7.4	6.8	7.8	5.7	8.3	7.4	.....	.....

Table XXX.—Number of Individuals of each Class of Nass River Sockeyes running at Different Dates in 1931.

Date.	4_2	5_2	5_3	6_3	3_1	4_1	6_4	4_3	Number of Individuals examined.
June 29	5	28	75	3	3	9	.....	.....	123
July 2	5	16	82	1	6	12	.....	.....	122
,, 6	6	31	80	2	1	4	.....	.....	124
,, 9	2	28	86	2	.....	3	.....	.....	121
,, 13	3	32	86	....	.....	.....	1	.....	122
,, 17	15	29	78	1	.....	.....	.....	.....	123
,, 20	16	31	75	3	.....	.....	.....	.....	125
,, 23	25	29	63	5	.....	.....	.....	.....	122
,, 27	18	20	67	16	.....	.....	1	.....	122
,, 31	29	18	70	6	.....	.....	.....	.....	123
Aug. 3	14	16	78	13	.....	.....	.....	.....	121
,, 6	10	10	82	10	.....	.....	.....	1	113
,, 10	8	3	93	16	.....	.....	.....	.....	120
,, 14	13	3	88	11	.....	.....	1	.....	116
,, 17	3	1	46	9	.....	.....	2	.....	61
Individuals	172	295	1,149	98	10	28	5	1	1,758

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

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

Table XXXII.—Average Lengths of the Meziadin and Bowser Lake Sockeyes for the Years 1924–31.

Year.	Meziadin Lake.		Bowser Lake.	
	M.	F.	M.	F.
1924	26.8	25.7	25.5	23.6
1925	.....	.....	23.8	23.3
1926	28.1	26.3	25.9	24.8
1927	27.1	25.8	24.7	23.7
1928	.....	.....	.....	.....
1929	27.0	25.3	.....	.....
1930	27.2	25.7	24.9	22.9
1931	27.9	26.3	.....	.....

Table XXXIII.—The Lengths of Individuals comprising the Meziadin Run in 1931.

Length in Inches.	Number of Individuals.	
	M.	F.
25	....	3
25½	....	5
26	3	3
26½	4	3
27	1	1
27½	7	1
28	4	3
28½	3	1
29	4	....
29½	3	....
30	2	....
Totals	31	20
Average lengths	27.9	26.3

THE SPAWNING-BEDS OF THE FRASER RIVER.

Hon. S. L. Howe,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit the following report of my twenty-ninth yearly inspection of the sockeye-salmon fishery and the spawning areas of the Fraser River system in 1931.

The total catches of sockeye made in the Fraser River system in 1931 produced a combined pack of 128,158 cases, of which 40,947 cases were made from fish caught in Provincial waters and 87,211 cases from State of Washington waters in that system. The combined catches produced 30,829 cases less than in 1927—the brood-year of the 1931 run. The catches in Provincial waters produced a pack of 40,947 cases, or 31.9 per cent. of the combined pack. It was 20,446 cases less than in 1927. Catches in State of Washington waters produced a pack of 87,211 cases, or 68.10 per cent. of the total packed in 1931. It was 10,383 cases less than in 1927.

The following table shows the Fraser system sockeye-packs, by months, in Provincial and State of Washington waters for the season 1931:—

	British Columbia.	State of Washington.	Total.
	Cases.	Cases.	Cases.
May	.....	36	36
June	.....	92	92
July	2,140	12,396	14,536
August	17,609	63,719	81,328
September	21,098	9,844	30,942
October	100	}	
November	.....	} 1,124	1,224
Totals	40,947	87,211	128,158

The above shows that the bulk of the catches were made in the months of August and September. The catches from September 21st to October 17th in British Columbia waters produced a pack of 13,544 cases, largely due to small late runs. It exceeded the July pack by 11,404 cases and was but 4,065 cases less than August. In this connection it is again to be noted that previous to depletion the greater proportion of the catch made in both Provincial and State waters of the system was made in July and early August. It is also to be noted that in 1927, the brood-year of the 1931 run, the catch made in Provincial waters in July produced 14,272 cases, as against 2,140 cases in 1931; and that the catches in October of 1927 produced a pack of 8,726 cases, as against 100 cases in 1931. In other words, the early and late runs in 1931 were far below those in 1927.

THE SPAWNING AREAS OF THE FRASER RIVER BASIN.

My personal inspection of the sockeye-spawning areas of the Fraser River was limited, due to the fact that the early runs which reached the river were so very small as to permit of but a very small escapement, and the reports that reached the Department through Major Motherwell, Chief Supervisor of Fisheries for the Dominion, showed that very few sockeye had reached any of the headwaters of the Fraser or its tributaries. In consequence I did not visit the Stuart, Quesnel, or Chilko Lakes section. Personal inspection was confined to Seton, Anderson, Lillooet, Harrison, and the Shuswap areas.

I am again greatly indebted to Major J. A. Motherwell for furnishing me with copies and excerpts from the detailed spawning-bed reports made him by his many assistants stationed throughout the Fraser River basin, many of whom have for years studied conditions in the principal lake areas. I am also indebted to many white and Indian residents in the Fraser basin for information of value.

As already shown, the run of sockeye to the Fraser system this year was so small that it is not surprising to note that the escapement was also small—so small in every section that little return can be expected four years hence.

Reliable reports from all sections, and my own observations, show that the total number of sockeye that spawned in the entire river-basin this year was one of the smallest ever recorded.

Only a few hundred sockeye were observed in any of the lakes tributary to the Nechako, the Quesnel, or the Chilcotin Rivers. Only a few hundred entered Seton-Anderson lakes. For the first time in many years there was a very noticeable decrease in the number of sockeye that reached the Birkenhead River, the main spawning area of the Harrison-Lillooet Lakes section. Egg-collections for the hatchery on the Birkenhead River totalled but 20,425,000, as against an average of 32,300,000 for the last ten years, notwithstanding that three-fifths of all the sockeye that reached there this season were caught and their spawn expressed—while in recent years the numbers which spawned naturally nearly equalled those taken for the hatchery. In only one other year since the hatchery was established has there been such a notable decrease in the annual run. The Birkenhead has for twenty-odd years been the only bright spawning prospect in the entire Fraser basin. There was no early run this year and the late run was most disappointing.

The number of sockeye that reached the Shuswap Lake area this year was also small. Experienced observers and myself, who have inspected the spawning areas of this section for many years, believe that the number which spawned there this year did not exceed the hundred thousand we estimated as spawning there in 1927—the brood-year of this year's run. Sockeye did not reach there until October. November arrivals were comparatively small. Other than in Adams River, sockeye in noticeable numbers were not seen in any other tributary of Shuswap Lake.

Water conditions throughout the season in the Fraser basin were favourable for the spawning. The flow at Hell's Gate and in the canyon above the mouth of Bridge River was above normal throughout the season. At neither point were the ascending fish delayed.

As already stated, the total number of sockeye that spawned in the entire Fraser River basin this year was the smallest in many years—so small that an increased run four years hence should not be anticipated.

I am indebted to Major J. A. Motherwell for the following statement giving the number of salmon-eggs collected from the Fraser and other waters this year and placed in the hatcheries:—

SALMON-EGG COLLECTIONS, BRITISH COLUMBIA HATCHERIES, 1931.

Hatchery.	Sockeye.	Springs.	Cohoe.	Pinks.	Total.
Anderson Lake, V.I.	6,249,000	9,000	.....	.....	6,258,000
Babine Lake, Skeena River	7,800,000	.....	.....	.....	7,800,000
Lakelse Lake, Skeena River	8,320,000	.....	.....	.....	8,320,000
Cowichan Lake, V.I.	.....	1,305,800	401,600	.....	1,707,400
Cultus Lake	39,307,310	.....	.....	.....	39,307,310
Kennedy Lake, V.I.	5,184,610	.....	99,505	.....	5,284,115
Pemberton	20,425,000	.....	.....	.....	20,425,000
Pitt Lake	2,700,000	.....	.....	.....	2,700,000
Rivers Inlet	20,288,600	485,250	.....	.....	20,773,850
Sproat River, V.I.	.....	356,100	.....	.....	356,100
Tlell, Q.C.I.	.....	.....	.....	1,200,142	1,200,142
Totals	110,274,520	2,156,150	501,105	1,200,142	114,131,917

Respectfully submitted.

JOHN PEASE BABCOCK,
Assistant to the Commissioner.

Victoria, B.C., December, 1931.

THE SPAWNING-BEDS OF RIVERS INLET.

Hon. S. L. Howe,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit my nineteenth annual report upon the inspection of the spawning-beds at Rivers Inlet for the year 1931.

The run of sockeye salmon to the Rivers Inlet watershed, in the extent of the pack, amounting to approximately 79,000 cases, and the escapement to the spawning-beds, measured up fully to what was anticipated from the very satisfactory seeding in the brood-years 1926–27. Figures kindly furnished me by Mr. Frank Tingley, Superintendent of the Dominion Hatchery, show that, following the collection of eggs made by them during the spawning in 1926, no less than 10,500,000 eyed eggs were planted the following spring, added to which 8,739,000 young fry were turned loose into the various tributaries. In 1927, following the collection of eggs made in that year, 12,025,000 eyed eggs were planted and 8,043,000 young fry turned loose. Notwithstanding the natural spawning was exceptionally good in the brood-years, we have to take into consideration climatic conditions which under abnormal rainfall have such a devastating effect upon the spawning-beds. In 1927 "freshets" occurred frequently during the spawning season, scouring out the gravel-bars and uncovering quantities of eggs already deposited by the salmon. To counteract the loss of eggs sustained in this manner, the assistance which the hatchery gives to the natural spawning by the employment of the above methods is manifest in a gratifying degree. Not only was the pack in excess of the returns both in 1926 and 1927, but the escapement to the spawning-beds showed a corresponding improvement.

Leaving Rivers Inlet Cannery for the Owikeno Lake on September 6th, I proceeded direct to the tributaries at the head of the lake, consisting of the Indian, Cheo, and Washwash Rivers. It is here where the early-running salmon return to spawn at least three weeks to a month earlier than the main run. Examining the Indian River first, comprising a spawning area of about half a mile in extent, it was satisfactory to note that the run of sockeye did not fall below that expected from the exceptional seeding in 1926 and 1927. The spawning-beds from the entrance to the falls contained their full quota of spawning salmon, many in the last stages of exhaustion; males and females appeared to be about equally represented. In size five-year fish were slightly in excess of the four-year cycle. Erosion of the right bank of the river a little way up from the entrance and close to the log-jam has had the effect of undermining several trees, which have been thrown across the stream since last year, adding to the size of the existing log-jam. The salmon have now to pass underneath in order to reach the spawning-beds above. This obstruction should be removed or it will in the course of time have the effect of curtailing the extent of the spawning area.

The Cheo River, having a spawning area of about 3½ miles in extent, contained a very fair run of sockeye, as was evidenced in the numbers spawning on all the gravel-bars up to the log-jam situated just below the falls. Between the log-jam and the falls the greatest showing of fish was in evidence, the spawning-beds being covered, many in an advanced stage of spawning. Four- and five-year fish were about equally divided, males outnumbering the females two to one.

It was at the Washwash River, lying over on the extreme right of the lake, that the greatest showing of salmon was observed. From the entrance up to the falls, a distance of about 2 miles, sockeyes in very large numbers covered the spawning-beds. Carcasses of dead fish littered the bars in all directions, testifying to the extensive run that had arrived prior to my visit. In size four- and five-year sockeye were about equally represented, males outnumbering the females two to one. Small grilse were in evidence, comprising about 2 per cent. of the entire run. Hatcherymen were busy collecting spring-salmon eggs some distance up and they experienced difficulty in obtaining them, since it meant hooking them out of the river and collecting the eggs in that way. The total number taken did not reach last year's collection by about 50 per cent., the run of this species of salmon having fallen off to that extent. The fine run of sockeye, however, measured fully up to what was expected from the very satisfactory seeding in 1926–27. The log-jam mentioned in my report last year as menacing the main flow of the river to a channel emptying into the Cheo has now been removed by the Dominion authorities, and, in addition to this, dams have been thrown across the head of this channel to divert the stream into the main river at high water. Due note must now be taken of a log-jam in the forming situated just below, consisting of a tree lying directly across the main river with a large tree-root jammed in the middle.

Although this tree is well above normal precipitation, at high water it may be a menace in the event of drift-logs being carried down to it. A stick of dynamite would clear this obstruction in a few minutes.

No sockeye had arrived at the spawning-beds at Sunday Creek, a small stream situated 5 miles from the head of the lake, nor was there any evidence of a run of fish to the spawning-beds at the Narrows. I therefore returned down the lake and had a look at Asklum River, which last year turned out such a failure. The fine showing of sockeye already spawning, and the exceptional numbers schooled up in the deep water near the entrance, presaged a run of unusual proportions, so I decided to thoroughly inspect this tributary on my return from the inspection of the spawning-beds at Smith Inlet.

On my return for the final inspection of the rivers on October 15th, I proceeded direct to the Sheemahant River and made camp. This fine spawning area, consisting of a series of rapids flowing down from the canyon 18 miles distant and miles upon miles of spawning-grounds, affords every facility to the spawning salmon. That they were making full use of them was evidenced in the exceptional numbers seen as I made my way up. The improvement in the run overcame in a marked degree the moderate return in 1926 and the failure recorded in 1927, the brood-years. Carcasses of dead fish covered the bars all the way up, testifying to a very big run of sockeye having arrived earlier. In size five-year fish dominated the run, males outnumbering the females two to one. Since the brood-years did not indicate that the return this year would be so satisfactory, we must attribute it to the assistance rendered by the hatchery, who have for some years replenished the streams, particularly the Sheemahant River, with millions of eggs and distribution of young fry.

The spawning-beds covering the large area of the lake, from the Indian smoke-house to the Second Narrows, contained a run of sockeye excelling in numbers any that I had seen before, and is a positive example of the effect extensive seeding and distribution of young fry has upon depleted spawning-beds. In size the greater proportion belonged to the five-year cycle, males outnumbering the females two to one. A few sockeye had reached the spawning-beds at Sunday Creek, but the numbers were so small that the run may be considered a failure.

Arriving at Genesee Creek, the overflow to Walkus Lake, no abatement was shown in the remarkable runs that have returned so consistently year by year. From the entrance up to the fence thousands upon thousands lined the beds, and as they reached the pens were quickly spawned out by the hatchery crew. In this way no less than 8,159,000 eggs were collected, excelling even the record of last year. Mr. McPhail, in charge of the camp, stated that no trouble would have been experienced in collecting as many as 10,000,000 eggs had they so desired. Evidence to this effect was very plainly seen in the black masses representing thousands of fish that lay schooled up outside near the entrance, waiting until they were in a sufficiently ripe stage to go on the spawning-beds later. Four- and five-year sockeye were about equally divided, males being slightly in excess of the females. Above the fence a few small grilse were seen intermingled with the other salmon, comprising about 1 per cent. of the run.

A fair run of sockeye had taken possession of the spawning-beds at the Machmell River, one of the largest tributaries of Owikeno Lake, but on account of its thick muddy condition it is difficult to arrive at an accurate estimate of the run. There was, however, not lacking evidence to show that the spawning-beds were well seeded, as indicated by the numbers spawning in the side-streams near the entrance. Farther up the gravel-bars all showed evidence of spawning fish, many in the last stages of exhaustion, while numerous carcasses of dead fish littered the bars. The run of sockeye to the Nechants River (or "Nookins," as it is generally termed) did not look so promising. This tributary empties into the Machmell River about half a mile from the entrance, and has generally been regarded as one of the most successful spawning-streams on the lake, but for some reason the run of sockeye did not measure up to the excellent showing noted on all the other rivers. A very fair number were seen spawning on the gravel-bars below Marble Creek, also in the main river up to the rough water, but Marble Creek, which usually takes care of the greater portion, was practically bare. In size the four- and five-year sockeye were about equally represented, males outnumbering the females two to one. No obstructions interfere with the ascent of the salmon up-stream.

Returning once more to examine Asklum River, which on my previous visit had shown such a promising outlook, conditions had greatly improved. The dense masses of sockeye that lay dormant near the entrance had come to life and were all busy spawning, covering every available foot of the river-bed up to the falls 5 miles distant. The improvement shown over the com-

parative failure of last year was most marked. Four- and five-year fish were about equally distributed, males outnumbering the females two to one. Small grilse comprised about 2 per cent. of the entire run. In comparing the return this year with the very excellent showing recorded in the brood-years 1926 and 1927, I have no hesitation in stating that it measures up fully to the high standard attained, if not excels the returns at that time.

For the first time in many years the hatchery crew at Quap River had completed the entire collection of eggs two weeks earlier than usual, due to the steady run of sockeye up the river to the fence, where they were quickly spawned out. That the run has not fallen behind in what was anticipated from the very exceptional seeding in 1926 and 1927 was amply demonstrated by the dense masses schooled up at the entrance and the thousands that lay dormant outside in the lake. From the entrance the spawning-beds up to the fence were literally covered with a living mass of fish all busy spawning, while schooled up at the side of the river in the deep water other thousands waited. The fence had been lifted to permit the salmon access to the spawning-beds above, and on examining this portion of the river up to the head, a distance of 5 miles, the same conditions prevailed, thousands lining every foot of the gravel-bars. Small grilse were observed intermingled with the main run and comprised about 1 per cent. of the run. In making a comparison of the return this year with the numbers that came back in the brood-years, I find that it measures up if not excels the excellent showing at that time. Five-year sockeye predominated the run, males outnumbering the females two to one.

Inspection of the Dalley River, situated directly opposite Quap, showed that the run of sockeye to this tributary came fully up to expectations and compared very favourably with the exceptional returns reported in the brood-years 1926 and 1927. Following the stream up to the falls 4½ miles distant, thousands of fish lined the spawning-beds, all busy spawning; carcasses of dead fish were scattered all over the bars; and upheaval of the spawning-beds testified to the enormous proportions of the run prior to my visit. It is a recurrence of scenes typical of this very fine spawning area. Four- and five-year fish were about equally divided, males outnumbering the females two to one.

I was disappointed with the run of sockeye to the Hatchery Creek. Beyond a few that had taken possession of the spawning-beds near the entrance, and a small school lying dormant in the deep water, there was entirely lacking in numbers the very fine run which returned last year. Sockeye of the five-year cycle comprised a greater proportion of the run, males being slightly in excess of the females.

The spawning-beds surrounding the Indian rancherie and those that lie along the upper portion of the Owikeno River contained a run of sockeye measuring up to the high standard attained in the brood-years. Indians who were smoking salmon at this point stated that they had no difficulty in obtaining all they required and had nearly completed filling the racks in their smoke-houses. Spring and chum salmon could be seen breaking water in all directions as we made our way down the river to the cannery.

In summing up the results of the inspection of the spawning-beds at Rivers Inlet for the year 1931, I am of the opinion that the very fine showing of sockeye that had possession of the tributaries of Lake Owikeno, with the exception of perhaps one or two, will result in a deposit of eggs equal if not in excess of the number deposited in the brood-years 1926 and 1927, and coupled with the assistance which the hatchery has given to the spawning-beds in planting millions of eggs and restocking the streams with young fry, I have every reason to believe that the return four and five years hence will be reflected in a run measuring up if not exceeding the magnificent proportions attained this year.

In conclusion, I wish to express my thanks and appreciation to Mr. Frank Tingley, Superintendent of the Dominion Hatchery, and the men at the various spawning camps for courtesies.

Respectfully submitted.

ARTHUR W. STONE,
Provincial Fishery Overseer.

Rivers Inlet, B.C., November 16th, 1931.

THE SPAWNING-BEDS OF SMITH INLET.

Hon. S. L. Howe,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit my eighteenth annual report upon the inspection of the spawning-beds at Smith Inlet for the year 1931.

Taking into consideration the very moderate pack put up by the canneries at Smith Inlet for this year, amounting to approximately 12,000 cases, and comparing it with the packs of 20,000 and 25,000 cases put up in the brood-years 1926 and 1927 respectively, the outlook did not seem very promising for a big return when it came to examining the spawning-beds later. Conditions, however, far from being unsatisfactory, were exceptionally good, and measured up fully to what was anticipated from the eggs deposited in the brood-years. The limited spawning-beds contained a run of sockeye of even greater proportions, as the result of the inspection will show. It may be of interest to recall that in 1926–27, over 550 gill-nets were distributed over the fishing-grounds, or about 40 per cent. more than were being fished this year, and this decrease in numbers, coupled with the general desire on the part of the fishermen to transfer their activities to Rivers Inlet before the fishing season was half over, may be the reason why so many fish reached the spawning-grounds.

Leaving for the spawning-beds at Long Lake on September 23rd, camp was made at the foot of the lake, and the Docee River (the overflow to the lake) was examined for spring salmon. The run of this species of fish did not reach the high standard reported on previous occasions, but fair numbers were seen spawning in the river, while a large school had reached the mouth of the lake. Others were noted breaking water along the shore-line at this point.

Proceeding up to Quay Creek, situated about 7 miles from the mouth of the lake, I am able to report that the run of sockeye to the limited spawning-beds compared in a very favourable light with the returns in 1926 and 1927. They could be seen spawning in fair numbers near the entrance, while numbers schooled up had reached the swift water near the log-jam situated at the foot of the falls. Four- and five-year sockeye were about equally distributed, males outnumbering the females two to one.

On arriving at the Geluch River (or "Smoke-house Creek," as it is generally known by) a preliminary survey of the lower portion of this river was taken that day. Sockeye salmon in very satisfactory numbers were coming in from the lake and others were seen spawning on the gravel-bars at each of the small mountain streams, all in an advanced stage of spawning. Carcasses of dead fish littered the bars in all directions, testifying to the large numbers that had arrived prior to my visit. Outside in the clear waters of the lake, black masses representing thousands of sockeye waited, presaging a run of unusual proportions to the spawning-beds later.

Fearing a "freshet" following the heavy downfall of rain at this time, I decided to examine the Delabah River, lying over on the east side of the lake about 2 miles from the head. This stream quickly responds to conditions of this kind and in a very short time becomes a raging torrent, when it is impossible to arrive at an accurate estimate of the run. I was fortunate to arrive before the full effect of the abnormal rainfall had asserted itself. The river was low and provided an uninterrupted view of the spawning-beds up to the falls. Wishing to determine whether at this stage of the water sockeye could surmount the falls, I followed the banks of the river and could clearly note many hugging the large boulders making desperate efforts to negotiate them, only to be thrown back beaten and helpless. That a great number were successful was evidenced in the numbers swimming around in the eddies below each fall for quite a distance up, but as there are no spawning-beds in this portion of the river it is evident they would drop back to the beds lower down. Under normal water conditions or at high water the ascent of the falls would be impossible. The erosion of the right-hand bank, the result of continual freshets, is responsible for the undermining of huge trees which have been thrown across the river, adding to the size of the existing log-jam. Since last year three of them have fallen in this way. The salmon pass underneath and reach the spawning-beds above, but the spawning area has become so restricted that where prior to 1924 thousands upon thousands of sockeye spawned, young alder-trees are now growing. Outside along the shore-line of the lake near the entrance, black masses representing thousands of fish were schooled up lying dormant, equalling in numbers the very fine return in the brood-years, and will, with the addition of the exceptional numbers already on the spawning-beds, provide a run four and five years hence equally as

prolific as this year. In size four- and five-year sockeye were about equally divided—males outnumbering the females two to one.

Unavoidable circumstances called me off the spawning-beds at this time, and it was not until October 10th that conditions covering the entire spawning area of Smith Inlet could be determined. By this time the large schools of fish that had been schooled up at the head of the lake had passed through on to the spawning-beds of the Geluch River, and were busy spawning right up to the falls, a distance of 4½ miles. Every available foot of spawning-ground had been called upon to take care of the exceptional seeding following the enormous run. Such a condition warrants the opinion that the return will be equal if not in excess of the runs that reached the spawning-beds in 1926 and 1927. Four- and five-year fish were equally represented, males outnumbering the females two to one.

Returning down the lake, cohoe salmon in large numbers could be seen breaking water in all directions. Arriving at the Docee River, I again examined this stream, but the number of spring salmon had not increased.

In summing up the result of the inspection of the spawning-beds at Smith Inlet for the year 1931, I am of the opinion that, provided the freshet which occurred during the spawning and after the spawning did not occasion any great damage to the eggs deposited by the exceptional run of sockeye that reached the spawning-beds, a very satisfactory return may be confidently looked for four and five years hence.

In conclusion, I wish to express my thanks and appreciation to Mr. Frank Nason, manager of the B.C. Packers' plant at Smith Inlet, for courtesies.

Respectfully submitted.

ARTHUR W. STONE,
Provincial Fishery Overseer.

Rivers Inlet, B.C., November 16th, 1931.

THE SPAWNING-BEDS OF THE SKEENA RIVER.

Hon. S. L. Howe,

Commissioner of Fisheries, Victoria, B.C.

SIR,—In obedience to your instructions, I beg to submit the following report on the spawning-beds of the Skeena River for the year 1931.

Leaving Prince Rupert on September 1st, I arrived at Lakelse Lake the following day. Lakelse Lake is the first important spawning area of the Skeena River and is approximately 12 miles from Terrace. A modern salmon-hatchery is situated about 2 miles from the lake. On my arrival at the hatchery I met Mr. C. T. Hearne, the Superintendent, to whom I am indebted for the following information: Artificial spawning commenced on August 3rd, and by August 17th the full complement of sockeye-eggs, approximately 8,000,000, were collected for the hatchery. Almost 6,000,000 were taken from Williams Creek and the remainder from Schullabuchan Creek. Granite, Hot Springs, Salmon, and Eliza are the other sockeye-creeks running into Lakelse Lake, but these were not interfered with in any way by the hatchery crew. There was a greater volume of water than usual in all the creeks at spawning-time, which would, barring freshets or an extra dry spell, have more beneficial results with the natural propagation. The sockeye, on the whole, were of a fair average in size, and there was scarcely a net-scarred fish to be seen. The males would be slightly in excess of the females in number. On inspecting the creeks I found a splendid showing of sockeye, particularly in regard to Williams and Schullabuchan Creeks, the two main sockeye-creeks on Lakelse. The run to Lakelse this year did not seem to be either earlier or later than usual. Lakelse River, at the outlet of the lake, was again teeming with pinks, although not so numerous as in 1929 and 1930.

In summing up the Lakelse spawning area, I would say that this area will be well seeded this year and will equal that of 1930, when conditions on the spawning-grounds were the best on record.

Leaving Lakelse, and after outfitting, etc., at Topley, I arrived at Topley Landing on Babine Lake on September 10th. The first creek visited was 15-Mile Creek, towards the head of the lake. This is a consistently good spawning-creek and is the best all-round spawning-creek for its size on Babine Lake. This year was no exception to the rule, and although there were not as many sockeye on the spawning-grounds as usual, there were, however, sufficient to amply seed this creek. In past years this creek has been overstocked, a situation which undoubtedly caused a bigger percentage of loss through wastage, etc. The showing of sockeye this year was more natural, and I venture to say that the percentage of loss will be almost negligible in comparison with other years. This creek has about half a mile of ideal spawning-grounds on the lower stretch, but beyond that the creek is a series of falls, and in addition the bed of the creek is rocky, with practically no gravel. A number of sockeye were seen above the lower spawning area, but their successful propagation is very problematical. The sockeye on the lower spawning area were of a medium size, with a preponderance of males. The "runts" would average about 5 per cent. Several Stuart Lake Indian families who had been fishing in the lake near the mouth of the creek had caught 600 sockeye between August 31st and September 3rd. A big school of sockeye were seen in the lake at the mouth of the creek, which indicated that the sockeye were still running to 15-Mile Creek.

At the mouth of Beaver River, at the head of the lake, from seven to twelve Indian families had caught 1,000 sockeye with their nets. The sockeye do not spawn in Beaver Creek, but go up through to Grizzly Creek, which flows into Beaver about 5 miles from the lake. Grizzly Creek has about 1 mile of fair spawning-grounds and is the earliest spawning-creek on Babine. The first sockeye caught by the Indians at the mouth of Beaver was on July 23rd. I did not go up Grizzly Creek, but was informed by the Fishery Guardian that there had been a good run of sockeye on Grizzly Creek. The sockeye were big in size and were evenly balanced.

Pierre Creek showed a decided falling-off in the sockeye run compared with other years. The run was by no means a failure, though, as there was a fair showing of sockeye all up the creek. This is an early spawning-creek and a number of dead and decaying fish were seen in the deep pools and on the bars. The sockeye were of a good average in size, the males and females being evenly proportioned.

Twin Creek and Tachek Creek were similar to Pierre Creek as regards conditions, there being fewer fish seen than usual in both creeks. Last year both these creeks were very much overstocked, the majority having died without spawning. As both creeks are small, better results will ensue this year with fewer sockeye on the spawning-beds.

I next visited Babine village, which is located at the outlet of the lake and is approximately 115 miles from the head of the lake. The outlet of the lake for the first 10 miles is where the Babine Indians, approximately seventy families, catch their yearly supply of sockeye. I was informed by the Fishery Guardian stationed at this point that the first sockeye seen here was on July 23rd. As the first sockeye was caught at the head of the lake on this date, it is quite evident that the sockeye arrived at Babine earlier than this. The Indians commenced fishing on August 1st, and by August 20th all the Indians were fishing, using 130 nets. The average catch of sockeye per family would be slightly over 500 and this would be exclusive of springs and pinks. It is estimated that 35,000 sockeye were caught by the Indians on this stretch alone. There would, in addition, be about 300 springs and numerous pinks on the drying-racks. The Indians claim that the pinks are too dry and thin for curing purposes and are practically useless for human food, although all right for dog-feed. I visited the swift water below this 10-mile stretch and found there was a splendid showing of pinks, with a scattering of springs and sockeye spawning here and there. On the return to Babine village a large number of sockeye were seen darting away on the approach of the boat. The sockeye were very numerous just immediately below the lake and had the appearance of being a fresh run. These sockeye were big in size, some fine big females being noted. The "runts" seen here would average about 10 per cent. This stretch will be well seeded and will easily compare with any previous good year.

Leaving Babine village, I then visited the Dominion Government Hatchery and met Mr. A. P. Hills, Superintendent, and Mr. Reid, his assistant. Hatchery Creek, about 2½ miles in length, flows from Morrison Lake and has considerable spawning area in Salmon Creek, at the head of Morrison Lake. The hatchery itself is ideally situated at the head of Hatchery Creek and at the outlet of Morrison Lake. At the time of my visit there was a good showing of sockeye in the creek. The fish were big in size, with a few "runts" seen here and there. The males appeared to be slightly in excess of the females and there were few net-marked fish seen. Mr. Hills informed me that the first sockeye was seen in the creek on August 5th, which is about one week later than usual. Although the showing of sockeye was good, it would appear to be around 25 per cent. less than previous good years.

Leaving the hatchery, I then inspected Fulton River, the largest river running into Babine Lake. Several Indian families were fishing in the lake at this point. Their smoke-houses were well stocked with sockeye and they appeared to be satisfied with their catch. Fulton River is practically the latest spawning-river on Babine, and in proof of this many sockeye were seen jumping in the lake and in the slough approach to the creek. Sockeye spawn right up the creek to the falls for a distance of about 5 miles, but the falls, with a 40-foot drop, is an effective barrier to further progress. There was more volume of water than usual in Fulton River, which made it difficult at times to properly estimate the run. By the number seen, though, I would consider the run in the creek this year very good and equal to any previous good year. Ten per cent. appeared to be "runts," but the remainder were of a medium average in size.

This being the last point of interest on Babine, I returned to Topley and thence to Hazelton.

Summary.—I found conditions on the spawning-grounds this year somewhat peculiar, in that the escapement of sockeye to the spawning-grounds was not in proportion to the large pack put up on the Skeena River. Considering that the canneries with 800 gill-net boats, approximately 300 less than usual, made a sockeye-pack of about 107,000 cases, it is hard to conceive how the escapement became less in proportion. The forty-eight hours of a weekly close season and fishing conditions in general were much similar to other years; yet it seems there should have been a larger escapement, particularly in regard to Babine. I am not making this comparison with a view of impressing that the spawning-beds were poorly seeded, but rather that there should have been more of an escapement according to the pack. Conditions on the spawning-beds at Lakelse I would consider and classify as very good and for Babine, good.

On my arrival at Hazelton I was reliably informed that the sockeye run both up the Bulkley and Skeena had been very good. There had also been a good run of pinks up the Kispiox River.

As this was the last point of interest, I left Hazelton and arrived at Prince Rupert on September 24th, 1931.

In conclusion, I wish to express my appreciation for the courtesies rendered by the Fishery Guardians and Hatchery Superintendents.

I have, etc.,

ROBERT GIBSON,
Fishery Overseer.

Prince Rupert, B.C., October 30th, 1931.

THE SPAWNING-BEDS OF THE NASS RIVER.

Hon. S. L. Howe,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit a report on my twenty-fourth annual inspection of the salmon-spawning areas of the Meziadin watershed of the Nass River.

The commercial pack of sockeye taken in the estuaries of the Nass River in 1931—namely, 16,876 cases—while not large, was about on a par with the brood-year of 1926, when 15,929 cases were packed. Reports on the spawning areas for that year were not encouraging and only a moderate return could have been expected.

Meziadin Lake.—On the trip in we had continual rain-storms which raised the lakes and rivers to a very high level. From the head of the lake we examined all the areas on the northerly and southerly shore-lines for a distance of 4 miles. Sockeye that run to the Meziadin watershed are all lake spawners, and the principal spawning-grounds are to be found on gravelly bottom in the shallow water along the shore-line at the head of the lake. We made a thorough examination of these areas and found a great scarcity of sockeye. Where we saw hundreds of fish last season there were only a few odd pair. They were fish in full spawning livery and of an early run. Conditions were not as favourable as in 1926, which was also a poor season.

On our journey down the lake we inspected Hanna River and McLeod Creek. The Hanna empties into Meziadin Lake from the north about 7 miles from its head, and McLeod Creek about half a mile farther down. Salmon do not enter these streams to spawn. A few sockeye were disporting themselves in the clear water where these streams enter the lake. Very few salmon were to be seen leaping in the lake.

McBride Rapids.—At the foot of McBride Rapids, about half a mile down the Meziadin River from the outlet of the lake, a considerable number of spawning spring salmon were in evidence. They were spawning in all suitable places, surrounded by hundreds of trout, which were taking their toll of the eggs. Spring salmon spawn in deeper water than sockeye where there is a strong flow of water passing over their beds. Below McBride Rapids the flow of current slows up, the river widens, resembling a small lake more than a river. These conditions hold for about 3 miles to another rapid. The water between the two rapids creates a splendid retaining area for young salmon. In this area in the late afternoon and evening myriads of salmon-fry are to be seen breaking water like a spray. The bottom is mostly mud and fine sediment with a large extent of vegetation which protects the fry from their enemies and furnishes them food. Authorities state that sockeye returning to this watershed are five and six years of age and that their young remain in their home waters for one, two, and even three years before making their seaward migration.

Meziadin Falls and Fishway.—Continuing down the river to the falls and the fishway on September 12th, we found very few sockeye. Only a few hundred were collected below the falls and very few were passing through the fishway. The largest numbers were congregated below the upper fall on the far side, leaping at an impossible barrier. They gradually worked their way over to the fishway side before our departure. Many of them were very fine fresh-run sockeye, some of the females measuring 28½ inches and males 30½ inches in length. During our stay until the 21st no appreciable arrival of fresh-run sockeye occurred. The stage of water was good, there being a large volume passing over the fall and through the fishway. Conditions were practically identical with those reported on for the year 1926, with the exception that the run of late sockeye was not as large. There were very few left to pass through the fishway at the time of our departure. Only a small number of cohoe were in evidence. It is probable that the run of this species improved later in the season, as they are taken quite late at the mouth of the Nass. The showing at the falls, however, was much below the average.

Conditions at the fishway were satisfactory; the cement-work in the walls and its basins is still in a splendid state of preservation. The cracks in the overhanging rock do not appear to be any worse than reported last year. After clearing away all growth from the crib we were able to give it a thorough examination. I have to advise that there is considerable dry-rot in the timbers. The crib is constructed of peeled jack-pine poles, which have now been in place for eight years. Many of the crib ties drop off with a slight blow of an axe. This is the result of rot taking place in the ties where they were notched to fit. The timbers were tested, many of them giving a hollow sound when struck, as though they were rotting from the centre. From

outward appearance they look to be sound. I am of the opinion that unpeeled logs would have a longer life than those with the bark stripped off. There is no sign that the weight of dirt behind is forcing out the crib timbers. It may hold in its present condition for a number of years; then, again, a wet season may have a tendency to start a movement in the dirt which the weakened timbers could not hold against. I have to recommend that the retaining-wall of the fishway be inspected in the near future by an engineer. Photographs of the structure were taken which are herewith submitted.

Scale Collections.—During our stay at Meziadin an effort was again made to obtain specimens of salmon which might be travelling farther up the Nass, by fishing a gill-net in the river above the mouth of the Meziadin. The net was fished night and day for a period of eight days without success. During this time we only caught one sockeye and three cohoe. Other seasons several sockeye and cohoe were usually taken, together with a few steelhead. We had an exceptionally fine set with the net this year and could not have failed to have taken more specimens had salmon been passing up in any numbers. Sockeye scales and measurements were taken from specimens below the falls in the Meziadin River.

After completing our work at the fishway we started on our return journey, arriving back in Stewart on September 25th. There was no improvement to be seen on the spawning-beds of the lake at the time of our return.

Summarizing the inspection of the Meziadin watershed, conditions were not at all favourable. In comparison with its brood-year, 1926, also a poor season, the early run of sockeye on the beds at the head of the lake was not as large. The number of sockeye collected below the falls in the Meziadin River was about on a par with 1926. At the time of our inspection little evidence of salmon migrating to waters above the junction of the Meziadin and Nass Rivers was obtained. It is probable that sockeye migrating to Bowser Lake are of an earlier run. The Meziadin sockeye-spawning beds were not well enough seeded to ensure a good return in five years' time. There was evidence to show that the run of spring salmon had been good, but the run of cohoe at the time of the inspection was not up to the average.

The fishway will soon need renovation in the crib-work. The slate rock in place at the side of the fishway is in about the same condition reported last year. The cement walls and basins are still in perfect condition. Water conditions were good, there being a larger flow than is usual at this time of the year.

Respectfully submitted.

C. P. Hickman,
Inspector of Fisheries.

THE FOOD OF THE PILCHARD, *Sardinops cærulea* (GIRARD), OFF THE COAST OF BRITISH COLUMBIA.*

By John Lawson Hart, Pacific Biological Station and Fisheries Department of the Province of British Columbia, and George Herbert Wailes.

INTRODUCTION.

In 1929 the Biological Board of Canada and the Fisheries Department of the Province of British Columbia undertook as a combined effort the investigation of factors influencing the abundance of pilchards. Understanding the causes of fluctuation in abundance of any species involves the consideration of a number of factors, such as fecundity, mortality at different stages, food, the influence of fisheries, etc. The present paper records the results of a preliminary investigation of the food of pilchards off British Columbia—an investigation the necessity of which is attested by the complete absence of literature on the subject.

MATERIALS AND METHODS.

Some two hundred and fifty food samples were obtained from pilchards of the commercial catch in the four summers 1927 to 1930. The collections of 1927 and 1928 were made at various places off the coast of Vancouver Island by Dr. H. Chas. Williamson. In these two years the digestive tracts were removed from the fish and preserved in formalin. The collections of 1929 and 1930 were made at Nootka, B.C. In these years the contents of the median cæca and cardiac stomachs were pressed into labelled vials and there preserved in weak formalin. The volume of the food collected in this way was between 3 and 15 cubic centimetres from each fish. More than 15 cubic centimetres of food was rarely found in any one cæcum and samples containing less than about 3 cubic centimetres were avoided wherever possible.

Microscopic analyses were made of the cæcal contents obtained by either of these means. The various organisms were identified and the proportion each formed of the total cæcal contents estimated by eye. This part of the work was done entirely by G. H. Wailes.

The results of a qualitative and quantitative analysis of the food of any species of fish made by the present method may be criticized for selectivity of several sorts. The possibility of errors due to selectivity should be considered in examining the results, as, indeed, it was in compiling the data.

In the first place, consideration should be given to the fact that the fish whose digestive tracts are examined are selected by the fishery on the basis of the depth at which they are swimming. That is to say, fish swimming at a depth of more than 2 or 3 metres are not seen by the fishermen and, accordingly, are not captured. For that reason the food analyses are likely to show a greater preponderance of surface forms than the real importance of such forms in the food would warrant. In consequence, there is the probability that more diatoms and fewer copepods are recorded than would be the case if the samples had been obtained from a true cross-section of the pilchard population.

Differential digestive rates result in another kind of distortion of the recorded data. Food organisms having heavy calcareous, siliceous, or chitinous parts are not digested beyond recognition as rapidly as more delicate species. Thus, it is to be expected that diatoms and those crustaceans having heavier carapaces will be recorded more frequently in proportion to the actual number of occurrences than more fragile species and groups.

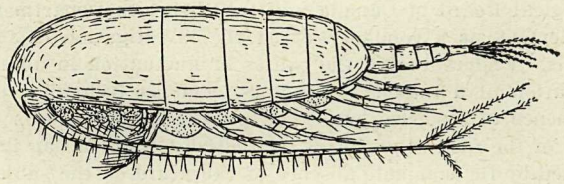
The chance selection of times for taking the samples may lead to some slight distortion of the results.

RESULTS.

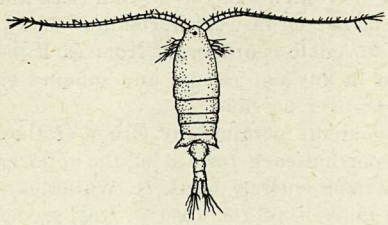
The results of the analyses are summarized in the accompanying table. In the first column of the table is a list of all the organisms found in any of the four seasons. For each of the seasons is given the number of stomachs sampled, the number of stomachs in which each organism occurred, and its average percentage in all the stomachs for that year. The absence of an organism in any season is indicated by a dash; percentages under 0.1 by x. Each of the important groups of food organisms has the average percentage for the group calculated and shown for each season. In marshalling related organisms no attempt is made to keep the groups of equal taxonomic significance. Convenience is the chief consideration.

* Reprinted with slight alterations from Contributions to Canadian Biology and Fisheries, Vol. VII., No. 19 (Series A, General, No. 16), pp. 247–254, 1932. The illustrations are reprinted from Progress Reports of Pacific Biological Station and Fisheries Experimental Station, No. 11, pp. 24–28, 1931.

It is usual to find that pilchards captured in the same haul have cæcal contents of very similar composition. Accordingly, to avoid unduly weighting the results in cases where a number of samples are available from fish of the same school, the average percentage of each food organism for all the fish of that day is calculated and the new values are regarded as representing the cæcal analysis of one fish in computing the food percentages for the year.

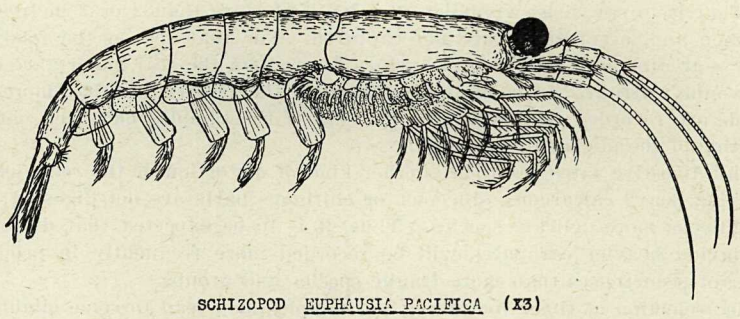


COPEPOD CALANUS FINMARCHICUS (X15)

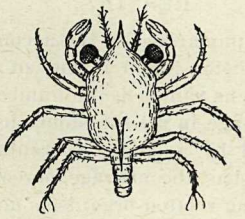


COPEPOD CENTROPAGES MCMURRICHI (X15)

CLADOCERA PODON POLYPHEMOIDES (X15)

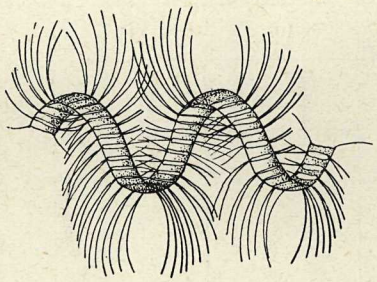


SCHIZOPOD EUPHAUSIA PACIFICA (X3)

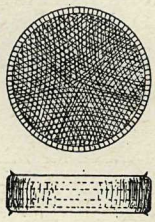


CRAB LARVA (X3)

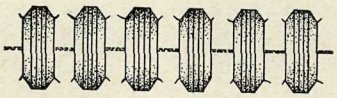
G.H.Wailes del. 1931



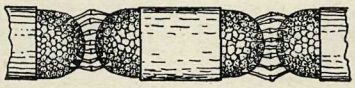
DIATOM (X250)
CHAETOCEROS DEBILIS



DIATOM (X250)
COSCINODISCUS EXCENTRICUS

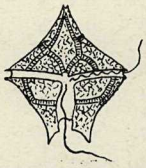


DIATOM (X250)
THALASSIOSIRA NORDENSKIOELDI

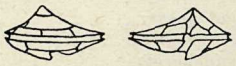


DIATOM (X250)
STEPHANOPYXIS PALMERIANA

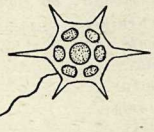
DINOFLAGELLATE (X250)
DINOPHYSIS ACUTA



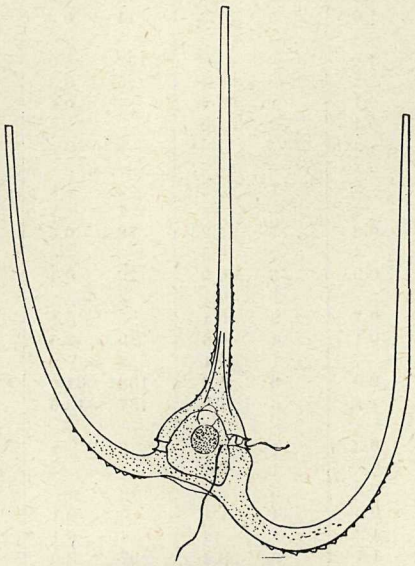
DINOFLAGELLATE (X250)
PERIDINIUM DIVERGENS



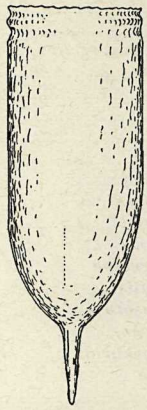
DINOFLAGELLATE (X250) SHELL ONLY
PERIDINIUM EXCENTRICUM



SILICOFLAGELLATE (X250)
DISTEPHANUS SPECULUM



DINOFLAGELLATE (X250)
CERATIUM MACROCEROS



TINTINNID (X250) SHELL ONLY
FAVELLA FRANCISCANA

G.H. Wailes del.

PILCHARD FOOD.

SEASON	1927.		1928.		1929.		1930.	
NUMBER OF STOMACHS EXAMINED	51.		10.		141.		83.	
Food Organisms.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.
DIATOMACEÆ.								
Actinoptycus undulatus	3	x	1	x	—	—	4	x
Asterionella japonica	2	x	—	—	1	x	—	—
Asteromphalus heptactis	2	x	—	—	1	x	2	x
Bacteriastrum delicatulum	1	x	1	x	2	x	—	—
Biddulphia arctica	2	x	1	x	—	—	—	—
Biddulphia lævis	6	x	1	x	—	—	1	x
Biddulphia longicruris	3	x	—	—	19	0.4	29	1.5
Cerataulina bergoni	2	x	—	—	—	—	1	x
Chætoceros approximatus	4	0.2	1	x	11	0.2	1	x
Chætoceros compressus	10	0.6	3	0.2	1	—	—	—
Chætoceros concavicornis	21	1.0	—	—	5	0.1	18	0.7
Chætoceros debilis	7	0.8	2	0.3	8	0.2	7	0.2
Chætoceros decipiens	2	x	2	0.2	9	0.2	7	x
Chætoceros didymus	—	—	1	x	4	x	2	x
Chætoceros laciniosus	3	0.1	—	—	5	0.2	6	x
Chætoceros lorenzianus	5	0.6	—	—	2	x	5	x
Chætoceros vanheurcki	5	0.3	—	—	6	0.2	24	1.3
Chætoceros spp.	12	3.0	4	0.7	45	0.5	25	2.5
Corethron hystrix	1	x	—	—	—	—	2	x
Coscinodiscus angsti	7	0.5	—	—	3	0.1	3	x
Coscinodiscus centralis var. *pacifica*	12	0.3	7	1.4	6	0.2	13	0.4
Coscinodiscus curvatulus	8	0.5	1	x	11	0.4	6	0.1
Coscindoiscus excentricus	16	1.0	5	1.1	123	5.4	27	0.4
Coscinodiscus grani	2	x	2	0.6	13	0.3	2	x
Coscinodiscus radiatus	26	1.0	5	1.3	11	0.3	27	0.4
Coscinodiscus stellaris	—	—	—	—	—	—	—	—
Coscinodiscus wailesi	18	1.0	—	—	132	8.0	35	0.8
Dactyliosolen mediterraneus	4	x	—	—	5	0.3	1	x
Ditylum brightwelli	11	0.1	1	x	4	0.1	23	0.2
Eucampia zodiacus	8	0.1	3	4.0	—	—	30	1.0
Melosira juergensi	4	x	—	—	—	—	—	—
Nitzschia closterium	3	x	—	—	—	—	—	—
Nitzschia closterium var. *recta*	4	x	1	x	2	x	1	x
Nitzschia delicatissima	7	x	—	—	1	x	1	x
Nitzschia seriata	13	0.8	7	5.2	79	0.6	52	7.8
Paralia sulcata	2	x	2	0.3	—	—	—	—
Rhizosolenia alata	9	0.2	5	0.9	29	0.4	18	0.2
Rhizosolenia habetata	—	—	1	0.1	2	x	2	x
Rhizosolenia semispina	4	0.1	2	0.1	5	0.1	14	0.1
Rhizosolenia stolterfothi	9	0.1	4	0.6	89	2.5	27	0.4
Rhizosolenia styliformis	—	—	1	0.1	2	x	—	—
Skeletonema costatum	27	2.0	9	1.6	138	31.0	20	0.3
Stephanopyxis palmeriana	13	x	6	1.9	137	13.0	37	1.0
Thalassiosira æstilvalis	—	—	—	—	—	—	10	0.3
Thalassiosira condensata	5	0.3	1	0.1	2	x	3	x
Thalassiosira decipiens	2	x	1	0.1	—	—	—	—
Thalassiosira nordenskiœldi	4	0.3	5	2.3	—	—	10	0.1
Thalassiosira pacifica	4	0.5	4	1.4	5	0.1	2	x
Thalassiosira rotula	4	1.2	1	x	4	0.1	—	—
Thalassiosira spp.	30	1.7	3	0.4	97	3.0	34	1.5
Thalassiothrix nitzschioides	26	1.1	7	2.9	14	0.1	17	2.0
Thalassiothrix longissima	12	0.3	6	4.9	8	0.1	36	4.6
Leptocylindricus danicus	—	—	—	—	—	—	15	0.4
Percentage of Diatomaceæ		20.2		32.9		68.9		29.5

PILCHARD FOOD—*Continued.*

SEASON	1927.		1928.		1929.		1930.	
NUMBER OF STOMACHS EXAMINED	51.		10.		141.		83.	
Food Organisms.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.
Other ALGÆ.								
Halosphæra viridis	2	x	—	—	—	—	2	x
Filamentous algæ	5	x	—	—	—	—	—	—
FORAMINIFERA.								
Orbulina universa	2	x	—	—	—	—	—	—
RADIOLARIA.								
Dicthyophimus histricosus	1	x	—	—	2	x	2	x
Lithomellissa setosa	—	—	—	—	2	x	1	x
DINOFLAGELLATA.								
Prorocentrum gracile	29	x	1	x	—	—	—	—
Gymnodinium sp.	—	—	—	—	—	—	2	x
Noctiluca scintillans	1	x	—	—	—	—	2	x
Phalacroma rotundata	12	x	1	x	6	x	3	x
Dinophysis acuminata	27	x	1	x	13	x	5	x
Dinophysis acuta	6	x	1	x	1	x	—	—
Dinophysis ellipsoides	12	x	—	—	1	x	8	x
Dinophysis hastata	—	—	—	—	3	x	—	—
Dinophysis lenticulata	2	x	—	—	2	x	4	x
Dinophysis norvegica	4	x	—	—	2	x	12	x
Dinophysis sphærica	9	x	—	—	—	—	—	—
Glenodinium danicum	7	x	—	—	5	x	6	x
Protoceratium reticulatum	5	x	1	x	11	x	4	x
Gonyaulax digitale	—	—	—	—	—	—	1	x
Gonyaulax spinifera	1	x	1	x	5	x	1	x
Peridiniopsis asymmetrica	—	—	—	—	7	x	4	x
Peridiniopsis rotunda	2	x	—	—	3	x	2	x
Diplopeltopsis minor	6	x	—	—	61	x	—	—
Peridinium thorianum	—	—	1	x	9	x	3	x
Peridinium monospinum	6	x	3	x	18	x	4	x
Peridinium minutum	—	—	—	—	1	x	2	x
Peridinium discoides	8	x	2	x	8	x	12	x
Peridinium excentricum	11	x	3	x	52	x	6	x
Peridinium conicoides	3	x	1	x	—	—	3	x
Peridinium conicum	8	x	—	—	67	x	14	x
Peridinium leonis	15	x	1	x	63	x	12	x
Peridinium pentagonum	2	x	—	—	17	x	7	x
Peridinium subinerme	3	x	2	x	4	x	1	x
Peridinium trochoideum	1	x	—	—	1	x	1	x
Peridinium depressum	30	x	2	x	54	x	38	x
Peridinium oblongum	12	x	2	x	18	x	15	x
Peridinium claudicans	2	x	—	—	14	x	2	x
Peridinium punctulatum	—	—	—	—	7	x	—	—
Peridinium subpunctulatum	—	—	—	—	5	x	5	x
Peridinium grani	9	x	—	—	5	x	2	x
Peridinium ovatum	2	x	—	—	12	x	4	x
Peridinium crassipes	1	x	—	—	5	x	4	x
Peridinium divergens	25	x	2	x	49	x	15	x

PILCHARD FOOD—*Continued.*

SEASON	1927.		1928.		1929.		1930.	
NUMBER OF STOMACHS EXAMINED	51.		10.		141.		83.	
Food Organisms.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.
DINOFLAGELLATA—*Continued.*								
Peridinium obtusum	2	x	—	—	13	x	7	x
Peridinium cerasus	—	—	—	—	—	—	2	x
Peridinium micrapium	22	x	3	x	82	x	20	x
Peridinium monocanthus	—	—	—	—	—	—	—	—
Peridinium asperum	—	—	—	—	1	x	—	—
Peridinium pallidum	2	x	—	—	—	—	10	x
Peridinium pellucidum	4	x	—	—	8	x	3	x
Pyrophacus horologicum	4	x	2	x	4	x	13	x
Oxytoxum diploconus var. *fusiformis*	1	x	—	—	—	—	—	—
Ceriatum fusus	17	x	1	x	128	x	32	x
Ceratium furca	8	x	—	—	30	x	18	x
Ceratium lineatum	4	x	1	x	24	x	3	x
Ceratium tripos var. *atlantica*	—	—	—	—	1	x	24	x
Ceratium macroceros	1	x	1	x	2	x	24	x
Ceratium azoricum	—	—	—	—	3	x	5	x
Ceratium pentagonum	—	—	—	—	2	x	5	x
Ceratium divaricatum	—	—	—	—	—	—	2	x
Percentage of Dinoflagellata		2.7		1.0		2.2		1.7
SILICO FLAGELLATA.								
Dictyocha fibula	3	x	—	—	5	x	2	x
Distephanus speculum	10	x	1	x	20	x	6	x
Distephanus speculum var. *octanarius*	—	—	—	—	4	x	2	x
Distephanus sp.	—	—	—	—	2	x	—	—
Ebria tripartita	4	x	—	—	1	x	2	x
TINTINNOINEA.								
Tintinnopsis wailesi	1	x	1	x	2	x	—	—
Stenosemella nivalis	2	x	1	x	1	x	2	x
Stenosemella ventricosa	2	x	—	—	1	x	2	x
Helicostomella subulata	5	x	—	—	6	x	7	x
Favella franciscana	15	0.5	2	x	133	2.5	19	x
Parafavella gigantea	—	—	—	—	23	0.5	2	x
Parafavella parumdentata	—	—	—	—	—	—	1	x
Ptychocylis urnula	2	x	1	x	—	—	—	—
Percentage of Tintinnoinea		0.6		0.4		3.0		0.2
POLYCHÆTA.								
Larvæ	1	x	—	—	—	—	—	—
ROTIFERA.								
Synchæta baltica	3	x	—	—	—	—	—	—
Trichocera marina	1	x	—	—	—	—	—	—

PILCHARD FOOD—*Continued.*

SEASON	1927.		1928.		1929.		1930.	
NUMBER OF STOMACHS EXAMINED	51.		10.		141.		83.	
Food Organisms.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.
OVA HISPIDA.								
Trochiscia brachiolatum	—	—	—	—	2	x	—	—
Trochiscia clevei	7	x	—	—	1	x	12	x
Trochiscia mœbiusi	1	x	—	—	—	—	1	x
Trochiscia multispina	4	x	—	—	1	x	1	x
Trochiscia spp.	4	x	—	—	—	—	—	—
OVA (unidentified).								
0.3–0.5 mm. diameter	5	x	—	—	2	x	8	x
0.1–0.3 mm. diameter	4	x	—	—	3	x	13	x
Under 0.1 mm. diameter	7	x	1	x	4	x	9	x
CLADOCERA.								
Podon sp.	8	x	—	—	42	x	50	x
Podon polyphemoides	4	x	—	—	11	x	15	x
Evadne nordmanni	3	x	—	—	12	x	15	x
Evadne turgestina	2	x	—	—	1	x	3	x
Percentage of Cladocera		4.6		—		4.0		0.3
COPEPODA.								
Calanus finmarchicus	—	—	—	—	—	—	11	x
Pseudocalanus elongatus	7	x	—	—	10	x	6	x
Paracalanus parvus	6	x	2	x	12	x	4	x
Microcalanus pusillus	—	—	1	x	1	x	2	x
Scolecithricella minor	—	—	—	—	1	x	—	—
Centropages mcmurrichi	10	x	2	x	14	x	30	x
Paralabidocera amphitrites	—	—	—	—	—	—	1	x
Acartia longiremis	3	x	—	—	4	x	9	x
Oithona helgolandica	—	—	—	—	2	x	1	x
Microsetella rosea	—	—	—	—	1	x	—	—
Corycæus affinis	—	—	—	—	1	x	1	x
Nauplii spp.	32	x	4	x	90	x	21	x
Juveniles spp.	22	x	5	x	38	x	14	x
Unidentifiable remains	44	x	8	x	127	x	53	x
Percentage of Copepoda		31.5		13.5		14.6		36.3
CIRRIPEDIA.								
Nauplii spp.	18	3.4	2	3.0	15	0.8	1	x
Cypris sp.	—	—	—	—	—	—	1	x
Percentage of Cirripedia		3.4		3.0		0.8		x

PILCHARD FOOD—*Continued.*

SEASON	1927.		1928.		1929.		1930.	
NUMBER OF STOMACHS EXAMINED	51.		10.		141.		83.	
Food Organisms.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.	Occurrences.	Percentage.
MYSIDACEA and EUPHAUSIDACEA.								
Euphausia pacifica	6	x	—	—	—	—	9	x
Thysanœssa spinifera	—	—	—	—	—	—	8	x
Mysis rayi var.	2	x	—	—	1	x	1	x
Unidentifiable remains	1	x	—	—	—	—	9	x
Percentage of Mysidacea and Euphausidacea		4.3		—		1.0		20.2
DECAPODA.								
Crab zœa	2	x	—	—	—	—	4	x
Crab megalopa	3	x	—	—	—	—	—	—
Shrimp larvæ	—	—	—	—	—	—	1	x
Percentage of Decapoda		2.0		—		—		1.5
PELECYPODA.								
Larvæ	10	x	—	—	1	x	1	x
APPENDICULARIIDÆ.								
Oikopleura spp.	7	x	—	—	9	x	7	x
PISCES.								
Ammodytes personatus ?	—	—	—	—	—	—	3	x
Digested material		27.7		46.1		2.8		5.0

DISCUSSION.

Among the Diatomaceæ the differentiation of species in some groups depends on the characters and disposition of the chromatophores; in a semi-digested state these distinctions are apt to be lost; hence, for example, some species of the genus *Chætoceros* may pass unrecognized or be recorded less frequently than they should in the list of food organisms. In other cases the breaking-up of chains of individuals into single units increases the difficulties of identification; in the genus *Thalassiosira* single cells may require special preparation and high powers of the microscope for their recognition. These have been grouped together in the list as *Thalassiosira* spp. This difficulty also has been experienced in the genus *Chætoceros*.

Since the character of the appendages is largely relied upon as a means of identification in the Crustacea, it is always difficult and often impossible to determine the relative numbers of such species as may be recognizable in the comminuted state in which they usually occur in a pilchard cæcum; smaller and more fragile species are especially liable to escape observation.

Mysis rayi var. represents a form of this genus as yet undescribed.

The proportion of unidentified material is high in the two years 1927 and 1928. This may be due to the method used in preserving the material in these two years, and would indicate the use of the other method in subsequent food studies.

There are two dominant types of food. These are Diatomaceæ and Crustacea, respectively referred to as "green feed" and "red feed" by the fishermen.

The number of years for which there are data and the degree of representativeness of the sampling make definite conclusions inadvisable. It is suggestive, however, that the year 1929 is notable both for the low oil production per ton of pilchards and, according to the present study, for the relatively high proportions of Diatomaceæ in the food. There is the possibility at least that the nature of the food taken by pilchards may be of economic importance and that the "red feed," which makes the process of reduction to oil and meal difficult, in the end leads to a higher production of oil.

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PACK OF BRITISH COLUMBIA SALMON, SEASON 1931.

SHOWING THE ORIGIN OF SALMON CAUGHT IN EACH DISTRICT.

District.	Sockeye.	Springs.	Steel-heads.	Cohoe.	Pinks.	Chums.	Grand Total (Cases).
Fraser River*	40,947	9,740	4	8,818	13,307	251	73,067
Skeena River†	93,023	9,858	768	10,637	44,807	3,893	162,986
Rivers Inlet	76,428	325	32	6,571	5,089	429	88,874
Smith Inlet	12,867	122	36	112	824	133	14,094
Nass River	16,929	1,439	.....	8,943	5,178	392	32,881
Queen Charlotte Islands	.....	854	.....	5,335	.....	.....	6,189
Vancouver Island	22,199	4,055	40	50,953	81,965	16,329	175,541
Outlying Districts‡	29,071	754	446	10,806	55,825	34,570	131,472
Totals	291,464	27,147	1,326	102,175	206,995	55,997	685,104

* 2,440 cases of sockeye packed at Esquimalt are credited to the Fraser; 8,563 cases of sockeye and 2,549 cases of pinks caught at and credited to Rivers Inlet were packed on the Fraser; 7,618 cases of sockeye, 602 cases of springs, 19,347 cases of cohoe, 5,678 cases of pinks, and 697 cases of chums caught at and credited to Vancouver Island were packed on the Fraser.

† 7,783 cases of sockeye, 8,500 cases of cohoe, and 1,603 cases of pinks caught at and credited to the Nass were packed on the Skeena; 7,130 cases of sockeye and 1,009 cases of cohoe caught in and credited to Outlying Districts were packed on the Skeena.

‡ 4,786 cases of pinks caught at and credited to the Skeena were packed at Outlying Districts.

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1916 TO 1931, INCLUSIVE.

Fraser River.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	40,947	103,692	61,569	29,299	61,393	85,689	35,385	39,743
Springs, Red	9,740	11,366	3,305	1,173	7,925	12,783	7,989	2,982
Springs, White	.....	9,761	6,699	3,909	10,528	20,169	25,701	4,648
Chums	251	68,946	144,159	193,106	67,259	88,495	66,111	109,495
Pinks	13,307	30,754	158,208	2,881	102,536	32,256	99,800	31,968
Cohoes	8,165	25,585	40,520	27,061	24,079	21,783	36,717	21,401
Bluebacks and Steelheads	657	27,879	12,013	795	10,658	13,776	5,152	1,822
Totals	73,067	277,983	426,473	258,224	284,378	274,951	276,855	212,059

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

Skeena River.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	93,023	132,372	78,017	34,559	83,996	82,360	81,146	144,747
Springs	9,857	7,501	4,324	6,420	19,038	30,594	23,445	12,028
Chums	3,893	5,187	4,908	17,716	19,006	63,527	74,308	25,588
Pinks	44,807	275,642	95,305	209,579	38,768	210,081	130,079	181,313
Cohoes	10,637	29,617	37,678	30,194	26,326	30,208	39,168	26,968
Steelhead Trout	768	58	13	241	582	754	713	214
Totals	162,986	450,377	220,245	298,709	187,716	407,524	348,859	390,858

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

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1916 TO 1931, INCLUSIVE—*Continued.*

Rivers Inlet.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	76,428	119,170	70,260	60,044	65,269	65,581	192,323*	94,891
Springs	325	434	342	468	608	685	496	545
Chums	429	492	989	3,594	1,122	11,727	11,510	4,924
Pinks	5,089	18,023	2,386	16,546	671	12,815	8,625	15,105
Cohoes	6,571	756	1,120	868	2,094	7,286	4,946	1,980
Steelhead Trout	32	105	29	7	9	11	.....	.....
Totals	88,874	138,980	75,126	81,527	69,773	98,105	217,900	117,445

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

Smith Inlet.†

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	12,867	32,057	9,683	33,442	22,682	17,921	33,764	11,435
Springs, Red	122	268	18	108	270	73	33	47
Springs, White	.....	22	60	178	79	39	22	.....
Cohoes	112	1,460	275	230	2,990	164	44	21
Pinks	824	16,615	853	167	732	689	134	273
Chums	133	1,660	113	19	2,605	31	1	.....
Bluebacks and Steelheads	36	103	12	6	8	.....	.....	.....
Totals	14,094	52,185	11,014	34,150	29,366	18,917	33,998	11,776

Nass River.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	16,929	26,405	16,077	5,540	12,026	15,929	18,945	33,590
Springs	1,439	1,891	352	1,846	3,824	5,964	3,757	2,725
Chums	392	3,978	1,212	3,538	3,307	15,392	22,504	26,612
Pinks	5,178	79,976	10,342	83,183	16,609	50,815	35,530	72,496
Cohoes	8,943	1,126	1,202	10,734	3,966	4,274	8,027	6,481
Steelhead Trout	.....	84	.....	36	96	375	245	1,035
Totals	32,881	113,460	29,185	104,877	39,828	92,749	89,008	142,939

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

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

† Previously reported in Queen Charlotte and other Districts.

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1916 TO 1931, INCLUSIVE—*Continued.*

Vancouver Island District.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	22,199	24,784	10,340	14,248	24,835	25,070	10,895	15,618
Springs	4,055	3,431	1,645	2,269	6,769	5,222	5,664	283
Chums	16,329	177,856	162,246	303,474	220,270	174,383	127,520	165,161
Pinks	81,965	89,941	74,001	41,885	52,561	86,113	51,384	63,102
Cohoes	26,310	30,206	35,504	23,345	58,834	51,551	59,747	30,593
Steelheads and Bluebacks	24,638	14,177	11,118	5,249	10,194	5,383	4,832	2,510
Totals	175,541	340,395	294,854	390,470	373,463	347,722	260,042	277,267

Queen Charlotte and other Districts.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Sockeyes	29,071	39,198	35,331	59,852	60,533	62,383*	49,962	40,926
Springs	1,608	1,852	1,020	2,806	7,826	3,650	5,002	4,245
Chums	34,570	143,781	111,263	341,802	252,230	348,682	305,256	195,357
Pinks	55,825	600,986	136,758	438,298	36,481	380,243	120,747	141,878
Cohoes	16,141	61,418	56,938	58,455	47,433	47,183	40,269	26,031
Steelheads and Bluebacks	446	1,204	575	609	973	973	1,520	497
Totals	137,661	848,439	341,873	901,822	405,476	844,114	522,756	408,934

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

Total Packed by Districts in 1916 to 1931, inclusive.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Fraser	73,067	277,983	426,473	258,224	284,378	274,951	276,855	212,059
Skeena	162,986	450,377	220,245	298,709	187,716	407,524	348,859	390,858
Rivers Inlet	88,874	138,980	75,126	81,527	69,773	98,105	217,900	117,445
Smith Inlet	14,094	52,185	11,014	34,150	29,366	18,917	33,998	11,776
Nass River	32,881	113,460	29,185	104,877	39,828	92,749	89,008	142,939
Vancouver Island	175,541	340,395	294,854	390,470	373,463	347,722	263,904	277,267
Other Districts	137,661	848,439	341,873	901,822	405,476	844,139*	522,756	604,745
Grand totals	685,104	2,221,819	1,398,770	2,035,629	1,360,634	2,065,190	1,719,282	1,745,315

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Fraser	226,869	140,570	107,650	136,661	167,944	210,851	402,538	127,472
Skeena	338,863	477,915	234,765	332,787	398,877	374,216	292,219	223,158
Rivers Inlet*	132,274	79,712	59,272	157,522	80,367	103,155	95,302	85,383
Smith Inlet	11,979	5,862	.....	.....	.....	.....	.....	.....
Nass River	99,580	124,071	51,765	81,153	97,512	143,908	119,495	126,686
Vancouver Island	191,252	185,524	69,528	84,170	267,293	389,815	325,723	.....
Other Districts	352,839	278,144	80,568	395,223	381,163	404,793	294,597	432,366
Grand totals	1,341,677	1,285,946	603,548	1,187,616	1,393,156	1,626,738	1,557,485	995,065

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

STATEMENT SHOWING THE SOCKEYE-PACK OF THE ENTIRE FRASER RIVER SYSTEM FROM 1894 TO 1931, INCLUSIVE.

	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.
Fraser River, B.C.	363,967	395,984	356,984	860,459	256,101	480,485	229,800	928,669
State of Washington	41,781	65,143	72,979	312,048	252,000	499,646	228,704	1,105,096
Totals	405,748	461,127	429,963	1,172,507	508,101	980,131	458,504	2,033,765

	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Fraser River, B.C.	293,477	204,809	72,688	837,489	183,007	59,815	74,574	585,435
State of Washington	339,556	167,211	123,419	837,122	182,241	96,974	170,951	1,097,904
Totals	633,033	372,020	196,107	1,674,611	365,248	156,789	245,525	1,683,339

	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.
Fraser River, B.C.	150,432	58,487	123,879	719,796	198,183	91,130	32,146	148,164
State of Washington	248,014	127,761	184,680	1,673,099	335,230	64,584	84,637	411,538
Totals	398,446	186,248	308,559	2,392,895	533,413	155,714	116,783	559,702

	1918.	1919.	1920.	1921.	1922.	1923.	1924.	1925.
Fraser River, B.C.	19,697	38,854	48,399	39,631	51,832	31,655	39,743	35,385
State of Washington	50,723	64,364	62,654	102,967	48,566	47,402	69,369	112,023
Totals	70,420	103,200	111,053	142,598	100,398	79,057	109,112	147,408

	1926.	1927.	1928.	1929.	1930.	1931.		
Fraser River, B.C.	85,689	61,393	29,299	61,569	103,692	40,947	.....	.....
State of Washington	44,673	97,594	61,044	111,898	352,194	87,211	.....	.....
Totals	130,362	158,987	90,343	173,464	455,886	128,158	.....	.....

STATEMENT SHOWING THE SOCKEYE-PACK OF THE PROVINCE, BY DISTRICTS, 1916 TO 1931, INCLUSIVE.

	1931.	1930.	1929.	1928.	1927.	1926.	1925.	1924.
Fraser River	40,947	103,692	61,569	29,299	61,393	85,689	35,385	39,743
Skeena River	93,023	132,372	78,017	34,559	83,996	82,360	81,146	144,747
Rivers Inlet	76,428	119,170	70,260	60,044	65,269	65,581	192,323	94,891
Smith Inlet	12,867	32,057	9,683	33,442	22,682	17,921	33,764	11,435
Nass River	16,929	26,405	16,077	5,540	12,026	15,929	18,945	33,590
Vancouver Island	22,199	24,784	10,340	14,248	24,835	25,070	14,757	15,618
Other Districts	29,071	39,198	35,331	26,410	37,851	44,462	16,198	20,579
Totals	291,464	477,678	281,277	203,542	308,052	337,012	392,518	369,603

	1923.	1922.	1921.	1920.	1919.	1918.	1917.	1916.
Fraser River	31,655	51,832	39,631	48,399	38,854	19,697	148,164	32,146
Skeena River	131,731	96,277	41,018	89,064	184,945	123,322	65,760	60,923
Rivers Inlet	116,850	53,584	48,615	125,742	56,258	53,401	61,195	44,936
Smith Inlet	11,864	.....	.....	.....	.....	.....	.....	.....
Nass River	17,821	31,277	9,364	16,740	28,259	21,816	22,188	31,411
Vancouver Island	12,006	15,147	6,936	6,987	6,452	6,243	9,639	9,223
Other Districts	12,720	47,107	18,350	64,473	54,677	51,980	32,902	36,150
Totals	334,647	295,224	163,914	351,405	369,445	276,459	339,848	214,789

STATEMENT SHOWING THE PILCHARD INDUSTRY OF THE PROVINCE, 1920 TO 1931, INCLUSIVE.

Year.	Total Catch.	Canned.	Used in Reduction.	Oil.	Meal.	Bait.
	Cwt.	Cases.	Cwt.	Gals.	Tons.	Bbls.
1920	88,050	91,929	.....	.....	.....	9,937
1921	19,737	16,091	.....	.....	.....	4,232
1922	20,342	19,186	.....	.....	.....	3,125
1923	19,492	17,195	.....	.....	.....	3,625
1924	27,485	14,898	.....	.....	.....	923
1925	318,973	37,182	220,000	495,653	2,083	4,045
1926	969,958	26,731	940,000	1,898,721	8,481	2,950
1927	1,368,582	58,501	1,310,000	2,610,120	12,145	1,737
1928	1,610,252	65,097	1,560,000	3,997,656	14,502	2,149
1929	1,726,851	98,821	1,654,575	2,856,579	15,826	1,538
1930	1,501,404	55,166	1,468,840	3,204,058	13,934	926
1931	1,472,085	17,336	.....	2,551,914	14,200	1,552

PRODUCTION OF FISH OIL AND MEAL, 1920 TO 1931 (OTHER THAN FROM PILCHARD).

Year.	From Whales.			From other Sources.	
	Whalebone and Meal.	Fertilizer.	Oil.	Meal and Fertilizer.	Oil.
	Tons.	Tons.	Gals.	Tons.	Gals.
1920	503	1,035	604,070	466	55,669
1921	.....	.....	.....	489	44,700
1922	326	230	283,314	911	75,461
1923	485	910	706,514	823	180,318
1924	292	926	645,657	1,709	241,376
1925	347	835	556,939	2,468	354,853
1926	340	666	468,206	1,752	217,150
1927	345	651	437,967	1,948	250,811
1928	376	754	571,914	3,205	387,276
1929	417	780	712,597	3,626	459,575
1930	273	581	525,533	3,335	243,009
1931	.....	.....	.....	5,647	352,492

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