PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

PROVINCIAL FISHERIES DEPARTMENT

FOR THE YEAR ENDED DECEMBER 31ST, 1944

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1945.

To His Honour Colonel W. C. WOODWARD,
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, 1944, with Appendices.

GEORGE SHARRATT PEARSON,
Commissioner of Fisheries.

Provincial Fisheries Department,
Commissioner of Fisheries' Office,
Victoria, B.C.

Honourable George S. Pearson,
Commissioner of Fisheries, Victoria, B.C.

SIR,—I have the honour to submit herewith the Annual Report of the Provincial Fisheries Department for the year ended December 31st, 1944, with Appendices.

I have the honour to be,
Sir,
Your obedient servant,

GEORGE J. ALEXANDER,
Assistant Commissioner.

TABLE OF CONTENTS.

REPORT OF THE PROVINCIAL FISHERIES DEPARTMENT FOR 1944.

	PAGE.
Value of Canadian Fisheries and the Standing of the Provinces in 1943	7
Value of British Columbia's Fisheries in 1944	8
Capital, Equipment, and Employees	9
The Canned-salmon Pack for British Columbia for 1944	9
British Columbia's Canned-salmon Pack by Districts	10
Review of British Columbia's Salmon-canning Industry, 1944	19
Other Canneries (Pilchard, Herring, and Shell-fish)	20
Mild-cured Salmon	20
Dry-salt Salmon	20
Dry-salt Herring	21
Pickled Herring	21
Tuna Fish	21
Halibut Production	22
Fish Oil and Meal	22
Net-fishing in Non-tidal Waters	24
Condition of British Columbia's Spawning-grounds	24
Contributions to the Life-history of the Sockeye Salmon (Digest). (No. 30.)	25
Herring Investigation	26
Shell-fish Investigation	27
International Fisheries Commission, 1944	28
A Preliminary Report on a Fishery Survey of Teslin Lake, British Columbia	30

APPENDICES.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON. (No. 30.) By Wilbert A. Clemens, Ph.D., Department of Zoology, The University of British Columbia, Vancouver, B.C. 32

REPORT ON PILCHARD-TAG RECOVERY, 1944–45. By John Lawson Hart, Ph.D., Pacific Biological Station, Nanaimo, B.C. 44

TAGGING OF HERRING (*Clupea pallasii*) IN BRITISH COLUMBIA: INSERTIONS AND RECOVERIES DURING 1944–45. By Albert L. Tester, Ph.D., Pacific Biological Station, Nanaimo, B.C. 45

BIOLOGICAL INVESTIGATIONS OF COMMERCIAL SHELL-FISH. By Ferris Neave, Pacific Biological Station, Nanaimo, B.C. 64

REPORT ON INVESTIGATIONS OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR 1944. By B. M. Brennan, Director 68

A PRELIMINARY REPORT ON A FISHERY SURVEY OF TESLIN LAKE, BRITISH COLUMBIA. By W. A. Clemens, R. V. Boughton, and J. A. Rattenbury 70

SALMON-SPAWNING REPORT, BRITISH COLUMBIA, 1944. By Major J. A. Motherwell, Chief Supervisor of Fisheries 76

STATISTICAL TABLES 82

REPORT OF THE PROVINCIAL FISHERIES DEPARTMENT FOR 1944.

VALUE OF CANADIAN FISHERIES AND THE STANDING OF THE PROVINCES, 1943.

The value of the fisheries products of Canada for the year 1943 totalled $85,857,690. During that year British Columbia produced fisheries products to the value of $32,477,964, or 37.7 per cent. of Canada's total.

British Columbia in 1943 led all the Provinces in the Dominion in respect to the production of fisheries wealth. Her output exceeded that of Nova Scotia, the second in rank, by $10,824,031.

The market value of the fisheries products of British Columbia in 1943 was $5,581,595 less than in the year previous. There was a decrease in the value of salmon amounting to $7,679,583.

The capital invested in the fisheries of British Columbia in 1943 was $31,704,610, or 51.3 per cent. of the total capital employed in fisheries in all of Canada. Of the total invested in the fisheries of British Columbia in 1943, $12,800,020 was employed in catching and handling the catches and $18,904,590 invested in canneries, fish-packing establishments, and fish-reduction plants.

The number of persons engaged in British Columbia fisheries in 1943 was 17,914, or 23 per cent. of Canada's total fishery-workers. Of those engaged in British Columbia, 11,903 were employed in catching and handling the catches and 6,011 in packing, curing, and in fish-reduction plants. The total number engaged in the fisheries in British Columbia in 1943 was 1,241 less than in the preceding year.

The following statement gives in the order of their rank the value of fishery products of the Provinces of Canada for the years 1939 to 1943, inclusive:—

Province.	1939.	1940.	1941.	1942.	1943.
British Columbia	$17,698,980	$21,710,167	$31,732,037	$38,058,559	$32,477,964
Nova Scotia	8,753,548	9,843,326	12,634,832	15,297,446	21,653,933
New Brunswick	5,082,393	4,956,618	6,484,831	7,088,302	11,128,864
Ontario	3,007,315	3,035,100	3,518,402	4,194,092	5,292,268
Quebec	2,010,953	2,002,053	3,233,115	4,103,345	5,927,125
Manitoba	1,655,273	1,988,545	2,842,041	3,577,616	4,564,551
Prince Edward Island	950,412	714,870	952,026	1,639,539	2,860,946
Saskatchewan	478,511	450,574	440,444	585,782	1,154,544
Alberta	430,724	403,510	414,942	492,182	795,000
Yukon	4,867	4,994	6,652	3,056	2,495
Totals	$40,072,976	$45,118,757	$62,258,872	$75,040,919	$85,857,690

SPECIES AND VALUE OF FISH CAUGHT IN BRITISH COLUMBIA.

The total marketed value of each of the principal species of fish taken in British Columbia for the years 1939 to 1943, inclusive, is given in the following table:—

Species.	1939.	1940.	1941.	1942.	1943.
Salmon	$12,994,812	$13,757,091	$20,879,104	$22,419,881	$14,740,298
Halibut	1,305,542	1,397,999	1,650,731	1,985,705	2,517,038
Halibut-livers	193,148	172,999	470,958	243,113	244,062
Carried forward	$14,493,502	$15,328,089	$23,000,793	$24,648,699	$17,501,398

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

Species.	1939.	1940.	1941.	1942.	1943.
Brought forward	$14,493,502	$15,328,089	$23,000,793	$24,648,699	$17,501,398
Herring	2,198,912	4,426,390	4,665,260	8,223,754	7,809,630
Pilchard	100,693	632,393	1,781,876	2,016,607	2,756,416
Cod, ling	357,990	359,798	398,316	676,903	978,973
Clams	50,937	77,944	98,970	155,965	148,226
Black cod	79,419	132,822	189,527	193,840	399,923
Crabs	61,633	80,628	83,253	104,021	34,743
Soles	39,826	46,866	30,470	42,670	49,320
Shrimps	12,246	16,354	8,115	7,222	10,417
Oysters	59,976	60,596	116,111	57,862	82,318
Abalones	1,340	2,002	.....	.....	1,600
Flounders	5,934	27,851	14,555	24,829	72,619
Red cod	10,693	14,574	15,832	51,375	150,551
Perch	3,752	3,235	3,095	8,042	9,792
Smelts	4,388	7,491	5,920	2,552	736
Sturgeon	2,459	2,460	3,675	1,965	3,526
Octopus	441	555	986	390	271
Skate	3,026	3,452	2,478	5,235	5,932
Oolachans	1,792	3,887	1,492	8,960	9,504
Whiting	32	88	25	7	21
Sardines	.....	.....	47,086	.....	.....
Trout	.....	.....	.....	.....	.....
Grayfish, etc.—					
Fresh	.....	.....	13,117	.....	.....
Livers	.....	.....	29,328	23,250	18,982
Liver-oil	.....	.....	531,355	1,178,242	2,028,875
Body-oil	.....	.....	29,569	31,135	16,756
Oil	44,072	146,112	.....	.....	.....
Meal	36,322	63,210	69,062	60,872	41,857
Whales	.....	137,624	298,349	178,667	92,890
Fur-seals	1,465	.....	.....	.....	.....
Miscellaneous	77,515	14,050	61,686	68,040	56,216
Anchovies	10,417	119,035	162,159	80,295	11,483
Tuna	40,198	567	804	.....	5,760
Shark-livers	.....	2,094	44,860	42,194	21,045
Shark-liver oil	.....	.....	23,913	165,966	158,184
Totals	$17,698,980	$21,710,167	$31,732,037	$38,059,559	$32,477,964

VALUE OF BRITISH COLUMBIA FISHERIES SHOWS SUBSTANTIAL INCREASE.*

The value of the fisheries of British Columbia in 1944 amounted to $34,900,990, an increase of $2,422,358 or 7 per cent. as compared with 1943. The salmon-fishery, the most important single fishery in the Dominion, showed a decrease of 138,495 cwt., or 11 per cent. in the quantity caught. Higher prices accounted for a slight increase in the landed value. The increase in total marketed value of this fish was $822,925 or 6 per cent. Salmon accounted for almost 45 per cent. of the total marketed value of the fisheries of the Province.

Herring registered an increase of over 2 per cent. in the quantity landed and one of nearly 2 per cent. in landed value. The marketed value, at $6,758,626, was lower by 13 per cent., owing largely to the smaller quantity canned.

Grayfish advanced to third place, as compared with fifth in 1943, with a marketed value of $3,751,460, the main factor being the increased production of vitamin oil from the livers of this fish.

* NOTE.—These figures are taken from the Advance Report on British Columbia Fisheries, Dominion Department of Statistics, Department of Trade and Commerce.

Halibut recorded an increase in the quantity landed, but the landed value was lower than in 1943. The total marketed value was $2,934,885, an increase of over 6 per cent.

The total quantity of fish taken, including shell-fish, was 4,583,226 cwt., a decrease of 647,310 cwt. from the 5,230,536 cwt. taken in 1943 and the value to fishermen at the point of landing was $17,333,347, an increase of 10 per cent. from the previous year.

CAPITAL, EQUIPMENT, AND EMPLOYEES.

Capital.—The value of the capital invested in the fisheries in 1944 was $33,550,302, an increase of 6 per cent. over the 1943 figure of $31,704,610. The amount invested in vessels and gear required for landing operations was $14,483,292, and that in fish-processing establishments was $19,067,010.

Employees.—There were 12,426 persons engaged in primary and 6,150 in secondary operations in 1944, a total of 18,576 for the industry. There were 523 more persons engaged in catching and landing the fish and 139 more persons in the processing end of the industry.

THE CANNED-SALMON PACK FOR BRITISH COLUMBIA FOR 1944.

The total canned-salmon pack put up in British Columbia in 1944 amounted to 1,097,557 cases, according to annual returns submitted by the licensed canners to the Provincial Fisheries Department. This was the smallest pack of canned salmon produced in British Columbia since the depression years of 1931 and 1932. In 1931 the total pack amounted to 685,104 cases, while in 1932 the pack was 1,081,031 cases. The salmon-packs in these two years, however, are no criteria as the small packs recorded were due entirely to economic conditions. In 1944 the smallness of the pack was entirely due to a shortage of fish, as every effort was put forth by the canners to pack as much salmon as possible owing to the Government's demand for a high protein food for war purposes.

The 1944 pack of canned salmon was 160,664 cases less than the pack of the previous year, which was considered a very small pack. In 1944 the pack was 488,440 cases less than the average for the previous five years and was 510,447 cases below the ten-year average. The canned-salmon pack in 1944 consisted of 247,714 cases of sockeye, 19,362 cases of springs, 3,926 cases of steelheads, 181,546 cases of cohoes, 389,692 cases of pinks, and 255,316 cases of chums. In each instance half-cases have been dropped.

An examination of the breakdown of the pack figures shows that the sockeye-pack of 1944, amounting to 247,714 cases, while slightly higher than the 164,889 cases packed in the year previous, was, however, a pitifully small pack, the smallest, in fact, since 1928. The 1944 pack was 132,460 cases less than the five-year average, including the small pack of 1943, and 123,215 cases less than the annual average pack for the previous ten-year period. A breakdown of the total sockeye-pack figures for 1944 will be found in the section of this report dealing with British Columbia's canned-salmon pack by districts.

There were 19,362 cases of spring salmon packed in 1944, which was 8,704 cases more than were canned in 1943, but was slightly less than the five-year average for this species. The spring-salmon pack, however, is not indicative of the quantity of this species caught as spring salmon find their principal outlet in the fresh, frozen, and mild-cure markets.

Steelhead trout are not salmon, but a few are caught and canned incidental to salmon fishing and canning operations each year and are accordingly mentioned in the pages of this report. In 1944, 3,926 cases of steelheads were canned compared with 3,095 cases canned in 1943.

The cohoe-pack in 1944, amounting to 181,546 cases, was slightly less than the 186,043 cases canned in the year previous, but was considerably below the annual pack

of this species for a number of years. The 1944 pack was 65,206 cases less than the average for the previous five years and 55,921 cases below the annual average for the preceding ten-year period.

In 1944 there were 389,692 cases of pink salmon canned in British Columbia. This figure is compared with 530,189 cases of this species canned in 1943. While the 1944 pack of pinks was somewhat larger than the packs for 1940 and 1942, the cycle-years, it was 28,929 cases below the average pack for this cycle in recent past years.

The 1944 pack of chum salmon of 255,316 cases was most disappointing. Not since 1931, at the depth of the depression, has the chum-salmon pack been so small, in spite of the fact that every effort was made to can as large a pack as possible. It is understood that a slightly larger percentage of chum salmon caught in 1944 was frozen than in 1943. Nevertheless, the 1944 pack, when compared with the packs for previous years, was definitely not encouraging. The 1944 pack of chums was 309,232 cases less than the annual average for the previous five years and was 265,284 cases below the annual average for the ten-year period immediately preceding. If chum salmon are considered to have a four-year cycle, the 1944 pack was considerably below the average pack for this cycle-year for this species.

The reader is referred to the next section of this report for a breakdown of the figures for the different species by districts.

BRITISH COLUMBIA'S CANNED-SALMON PACK BY DISTRICTS.

Fraser River System.

In 1944 Canadians packed 130,883 cases of all varieties of salmon from fish caught and credited to the Fraser River. This was 4,342 cases more than in 1943. The 1944 pack consisted of 88,515 cases of sockeye, 12,577 cases of springs, 293 cases of steelheads, 15,564 cases of cohoes, 130 cases of pinks, and 13,803 cases of chums. The year 1944 was an "off-year" for pinks and probably the other outstanding disappointment in the 1944 pack was the small production of chum salmon.

Sockeye Salmon.—The 1944 total pack of canned sockeye salmon produced from Fraser River caught fish by Canadian and American canners amounted to 126,024 cases. Canadian fishermen caught 88,515 cases, while American fishermen took 37,509 cases. The catch percentages of fishermen of the two countries are 70.23 per cent. for the Canadian fleet and 29.77 per cent. for the American fleet, according to figures supplied by the Department of Fisheries for the State of Washington. For convenience the percentages for the Fraser River sockeye-catch by American and Canadian fishermen are tabulated below:—

	American. Per Cent.	Canadian. Per Cent.
1930	78.00	22.00
1931	68.00	32.00
1932	55.00	45.00
1933	71.00	29.00
1934	72.00	28.00
1935	47.00	53.00
1936	25.00	75.00
1937	38.00	62.00
1938	42.00	58.00
1939	44.50	55.50
1940	37.50	62.50
1941	39.30	60.70
1942	37.20	62.80
1943	37.42	62.58
1944	29.77	70.23

The Canadian pack of sockeye on the Fraser River in 1944 was somewhat disappointing in view of the size of the packs for the past two cycles. It was thought that the Fraser River would produce a pack in the neighbourhood of 100,000 cases as was the case in 1940, the immediately preceding cycle-year. In 1936 the Canadian pack was 184,854 cases, although previous to that time this cycle had not been producing large packs for some years.

Except for the escapement to the Chilko Lake spawning area, the sockeye escapement to the various districts of the Fraser River watershed was not particularly encouraging in 1944, in spite of the comparatively light pack. The escapement to the Shuswap Lake district was particularly disappointing. While there was some improvement in the Prince George area, the increase of the immediately preceding cycle-year was not evinced on the spawning-beds in 1944.

Spring Salmon.—The Fraser River pack of spring salmon in 1944 amounted to 12,577 cases, which was the largest pack since 1941, when 34,038 cases of spring salmon were canned. In comparing the figures for the spring-salmon pack on the Fraser River, it should be remembered that spring salmon find a market in the fresh- and frozen-fish trade and, therefore, the size of the canned pack is not necessarily indicative of the size of the run.

Cohoe Salmon.—In 1944 the cohoe-salmon catch on the Fraser River was sufficient to fill 15,564 cases. This figure is compared with 8,809 cases in 1943, 10,542 cases in 1942, 28,265 cases in 1941, and 13,028 cases in 1940.

Pink Salmon.—Pink salmon make their appearance on the Fraser River every alternate year, the runs coinciding with the odd-numbered years. There was no run of pink salmon to the Fraser River in 1944.

Chum Salmon.—The 13,803 cases of chum salmon canned in 1944 from Fraser River caught fish was most disappointing. The 1944 pack was the smallest pack of chums on the Fraser River since 1935, when 8,227 cases were canned. The 1944 pack, however, cannot be compared with the pack of chum salmon on the Fraser River in the pre-war years because large quantities of Fraser River caught chum salmon were then salted and, also, the demand for canned chum salmon was not as great as during the war years. In 1944 every effort was made to can as much as possible of the Fraser River catch and, while it is true more chum salmon were frozen in 1944 than in the immediately preceding war years, nevertheless the run was evidently much below what was expected. The reports from the spawning-grounds indicate that the escapement of this species was particularly disappointing.

In considering the canned-salmon pack as an indication of the size of the run it is important that the escapement to the spawning areas of the particular river system should also be considered. The reader is referred to the report of the Federal Department's Chief Supervisor of Fisheries on the salmon-spawning beds of the Province which is published in full in the Appendix to this report.

Skeena River.

The total canned-salmon pack of all varieties of salmon caught on the Skeena River in 1944 amounted to 149,948 cases and is compared with 133,589 cases in the previous year. The Skeena River pack in 1944 was composed of 68,197 cases of sockeye, 1,500 cases of springs, 2,481 cases of steelheads, 20,191 cases of cohoes, 48,837 cases of pinks, and 8,741 cases of chums.

Sockeye Salmon.—The 68,197 cases of sockeye salmon canned on the Skeena River in 1944, while considerably larger than the 28,268 cases of this species canned in 1943, was, nevertheless, disappointing when compared with the packs for the previous four-year cycles of 1940 and 1936, when 116,507 cases and 81,973 cases respectively were canned. The catch of Skeena River sockeye in any year is the product of the spawning

of four and five years previous. In other words, the fish comprising the Skeena River run are four- and five-year-old fish. The run of 1944 was derived from the spawning of 1939 and 1940. In 1939 the pack was 68,485 cases and in that year the escapement to the spawning-beds was reported to have been particularly good. The catch in 1940 produced 116,507 cases and the escapement in that year was reported as being a "very heavy one."

In reporting on the escapement in 1944, the Chief Supervisor stated that the seeding of sockeye was comparable with that of the cycle-year 1940, which was good. In view of the size of the packs of sockeye on the Skeena in 1939 and 1940 and information on the escapement, it was reasonable to expect a sockeye-pack in 1944 of at least 85,000 cases.

In the pages of this report for previous years the writer has remarked on the generally falling production of sockeye for the Skeena River, and the comparatively small pack in 1944 is a further indication that this fishery requires strong remedial measures to be taken if production is to be restored to something like this river's demonstrated capacity to produce. Figure 1 indicates graphically the gradual decline in the Skeena River sockeye fishery. The broken line represents the annual pack in cases from 1914 to 1943, inclusive. The unbroken line indicates the trend and is derived by smoothing twice by moving averages of five. It will be noted that the average decline in annual pack amounts to about 37,000 cases for the period under review. Expressed another way it may be said that the Skeena River is presently producing 35.5 per cent. less than formerly, in spite of the fact that greater incentive and effort are expended with more efficient gear in order to obtain the smaller pack. The Federal Department of Fisheries has instigated a biological investigation with a view to ascertaining the cause and it is hoped that not too much time will elapse before sufficient information will be at hand to indicate measures of conservation which will have the desired result.

Spring Salmon.—The spring-salmon pack on the Skeena River in 1944, amounting to 1,500 cases, is compared with 1,783 cases in 1943. The 1944 pack was the smallest pack of spring salmon canned on the Skeena River for the past ten or twelve years, but as spring salmon find their principal outlet in the fresh- and frozen-fish trade the canned-salmon pack figures are not necessarily indicative of the size of the run.

Cohoe Salmon.—There were 20,191 cases of cohoe salmon canned on the Skeena River in 1944, compared with 40,479 cases of this species in 1943 and 50,605 cases in 1941, the cycle-year for this species. While cohoe also find an outlet to some extent in the fresh- and frozen-fish trade, there is no information reaching this Department which indicates that the small size of the pack in 1944 was caused by a diversion of fish to other outlets. We can only conclude, therefore, that the small size of the pack was due to lack of fish.

Reports from the spawning-grounds indicate that the escapement was satisfactory.

Pink Salmon.—The Skeena River in 1944 produced a pack of 48,837 cases of pink salmon compared with 52,767 cases in the cycle-year. In view of the fact that the packs of recent cycle-years have been between 45,000 and 50,000 cases, the 1944 pack may be considered as having been reasonably satisfactory. One should, however, not lose sight of the fact that this cycle has produced, on the Skeena River, as high as 275,000 cases of pink salmon in 1930 and 126,000 cases in 1934.

Chum Salmon.—The pack of chum salmon on the Skeena River is never large and 1944 was no exception, there having been canned 8,741 cases of this species. This is compared with 6,597 cases in 1943, 11,421 cases in 1942, 10,707 cases in 1941, and 4,682 cases in 1940.

In using the catch figures for the various salmon-streams in British Columbia as a means of indicating the size of the run to the individual streams, the reader is

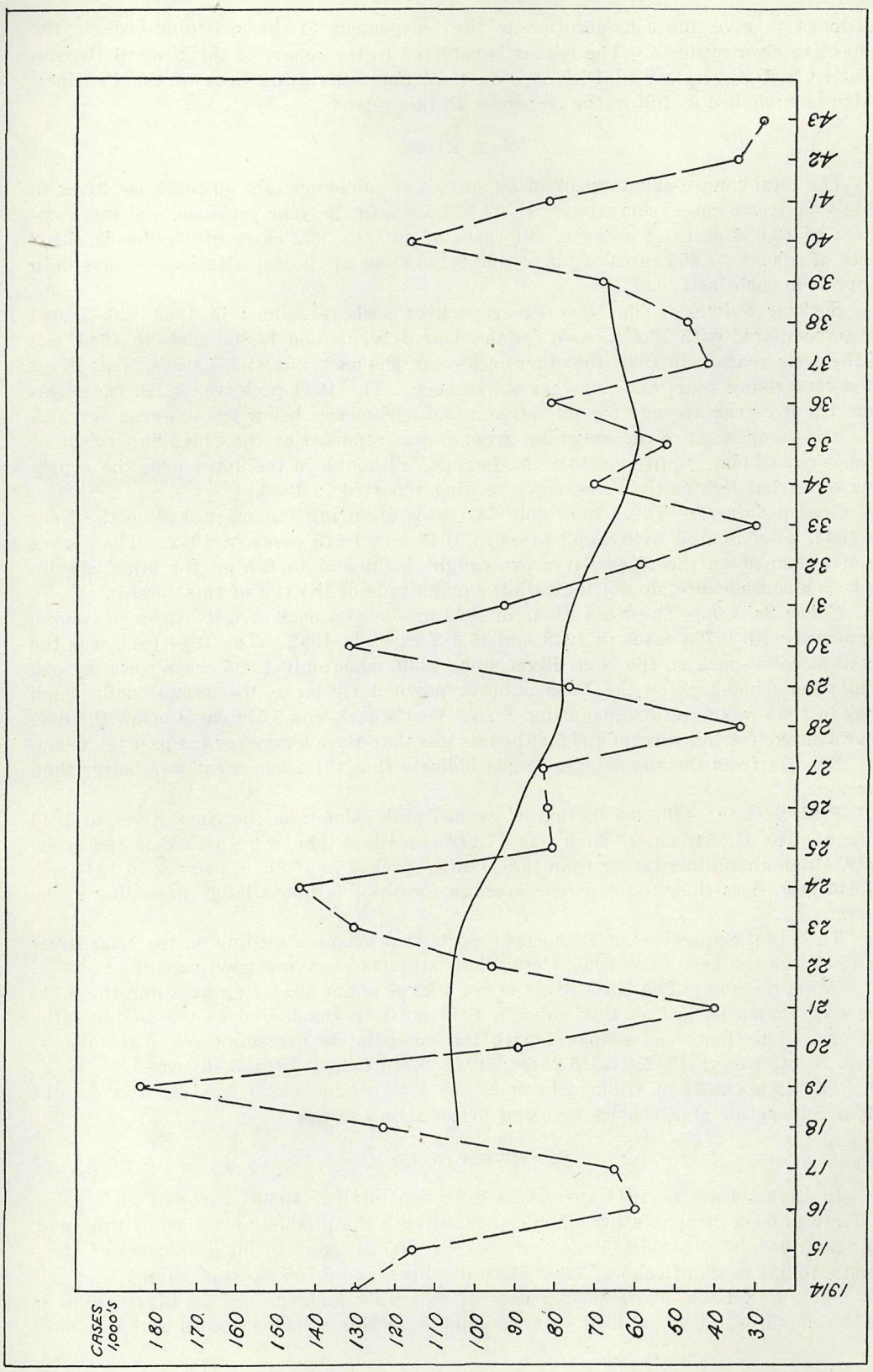


Fig. 1. Graph showing Skeena River sockeye-packs from 1914–43. The broken line shows the actual annual packs, while the unbroken line shows the trend and is smoothed twice by moving averages of five.

cautioned to give due consideration to the escapement to the spawning-beds in the respective river systems. The reader is referred to the report of the Federal Department's Chief Supervisor of Fisheries on the salmon-spawning beds of the Province, which is published in full in the Appendix to this report.

Nass River.

The total canned-salmon pack of all species of salmon caught on the Nass River in 1944 was 61,096 cases, compared with 52,333 cases in the year previous, and was composed of 13,083 cases of sockeye, 681 cases of springs, 232 cases of steelheads, 6,102 cases of cohoes, 31,854 cases of pinks, and 9,143 cases of chums. Half-cases have been dropped in each instance.

Sockeye Salmon.—The Nass River pack of sockeye salmon in 1944 was 13,083 cases, compared with 13,412 cases for the year previous and 13,809 cases in 1940, one of the cycle-years. In 1939, the other cycle-year, the pack was 24,357 cases, Nass River runs comprising four- and five-year-old sockeye. The 1944 pack was 4,170 cases less than the five-year average for this stream and 6,009 cases below the ten-year average.

The escapement to the spawning-grounds was reported by the Chief Supervisor of Fisheries as being "quite good to satisfactory," although in the upper area the supply was somewhat lighter than the heavy seeding reported in 1939.

Spring Salmon.—There were only 681 cases of spring salmon packed on the Nass in 1944, as compared with 1,002 cases in 1943 and 1,515 cases in 1942. The spring salmon canned on the Nass River are caught incidental to fishing for other species and, as a consequence, do not indicate the magnitude of the run of this species.

Cohoe Salmon.—The Nass River in 1944 produced a pack of 6,102 cases of cohoes, compared with 9,768 cases in 1943 and 15,487 cases in 1942. The 1944 pack was the smallest cohoe-pack on the Nass River since 1939, when only 1,996 cases were packed. While the cohoe-pack on the Nass is never particularly large, the exceptionally small pack in 1944 was most disappointing. That year's pack was 5,511 cases below the five-year average for this stream and 5,891 cases less than the average for the past ten years.

Reports from the spawning-grounds indicate that the escapement was better than average.

Pink Salmon.—The production of canned pink salmon on the Nass River in 1944 amounted to 31,854 cases, which was 17,149 cases less than were packed in the cycle-year, although slightly larger than the quantity packed in 1940. The pack in 1944 was 17,646 cases less than the five-year average for the five immediately preceding cycle-years.

The Chief Supervisor of Fisheries reports that the pink seeding on the Nass River in 1944 was the best since 1936, the various streams receiving good supplies.

Chum Salmon.—The Nass River is not a large chum producing area and the 9,143 cases of chums packed on this river in 1944 must be considered as reasonably satisfactory. This figure is compared with the immediately preceding years as follows: 1943, 10,146 cases; 1942, 12,518 cases; 1941, 6,246 cases; 1940, 5,461 cases.

The escapement of chum salmon to the spawning-grounds was reported by the Chief Supervisor of Fisheries as being better than average.

Rivers Inlet.

In Rivers Inlet in 1944 there was packed a total of 59,391 cases of all species, which was most disappointing when compared with the production record of this inlet. The pack consisted of 36,582 cases of sockeye, 805 cases of springs, 88 cases of steelheads, 13,921 cases of cohoes, 5,289 cases of pinks, and 2,705 cases of chums.

Sockeye Salmon.—The 36,582 cases of sockeye salmon packed on Rivers Inlet in 1944 was the smallest pack of sockeye salmon on this inlet on record and was most

disappointing. The sockeye run to Rivers Inlet is composed of four- and five-year-old fish. The pack in 1940 was 63,469 cases while that of 1939 was 54,143 cases.

In 1939 the escapement was reported to be at least an average one and practically on a par with 1934. In 1940 the Chief Supervisor reported "Notwithstanding a most disappointing commercial catch of sockeye, conditions on the spawning-grounds were found to be excellent. Possibly the seeding was not as good as the splendid conditions obtaining in 1935 and 1936, but decidedly satisfactory." In view of these reasonably optimistic reports of escapements for the two cycle-years, and the fact that every effort has been made during the war years to produce as much canned salmon as possible, there would appear to be factors at work which have caused a decided reduction in the size of the run of sockeye salmon to this inlet which could have been reasonably expected in 1944.

The 1944 sockeye-pack on Rivers Inlet was 27,464 cases less than the average for the previous five-year period and 36,271 cases less than the average annual pack for the previous ten-year period.

The Chief Supervisor of Fisheries reports that the escapement of sockeye salmon, while in some rivers was up to normal, in others the escapement was reported as being below normal. On the whole the escapement was reported as light.

Spring Salmon.—Spring salmon are caught and canned in Rivers Inlet only incidental to fishing for other varieties and, on this account, the pack is never large. The 805 cases of spring salmon packed on the inlet in 1944 is compared with 765 cases in 1943, 985 cases in 1942, and 1,692 cases in 1941.

Cohoe Salmon.—Rivers Inlet produced a pack of canned cohoes in 1944 amounting to 13,921 cases. This must be considered as reasonable as the average for the previous five years was 13,723 cases and for the previous ten-year period 11,738 cases, although the escapement was reported as being only fairly satisfactory.

Pink Salmon.—Pink salmon do not frequent Rivers Inlet in large numbers, although some pinks are caught each year incidental to sockeye-fishing. In 1944 there were canned 5,289 cases of pinks on Rivers Inlet, compared with 8,347 cases in 1943 and 954 cases in 1942.

Chum Salmon.—Since 1935 Rivers Inlet has produced a pack of chum salmon between 5,000 and 16,000 cases, the average being in the vicinity of 9,500 cases. The production in 1944 of 2,705 cases of chum salmon was most disappointing. While no doubt some of the chum salmon caught in Rivers Inlet in 1944 were frozen, the canned pack, nevertheless, was quite disappointing. If chum salmon are considered to be a four-year fish, the cycle-year 1940 produced a pack of 9,025 cases, while the average annual pack of this species in Rivers Inlet for the previous five years amounted to 10,891 cases. Apparently the escapement to the spawning-grounds was good.

Smith Inlet.

Smith Inlet is primarily a sockeye producing area, although other species are caught and canned incidental to sockeye-fishing. The total pack of all species in Smith Inlet in 1944 was 6,194 cases, composed of 3,165 cases of sockeye, 66 cases of springs, 343 cases of cohoes, 498 cases of pinks, and 2,122 cases of chums.

Sockeye Salmon.—The 3,165 cases of this species caught in Smith Inlet in 1944 was the smallest pack of Smith Inlet caught sockeye on record. The average annual pack for the previous five years was 16,311 cases and for the previous ten years the average annual pack amounted to 20,297 cases. Notwithstanding the small pack, the Chief Supervisor reports that the spawning, while a decided improvement over the five-year cycle of 1939, was not entirely satisfactory.

Spring Salmon.—In Smith Inlet, as in Rivers Inlet, spring salmon are caught incidental to sockeye-fishing. In 1944 Smith Inlet produced 66 cases of springs com-

pared with 118 cases in the year previous, while in 1942 only 8 cases of spring salmon were packed. The spring-salmon catch is not indicative of the run of this species.

Cohoe Salmon.—Smith Inlet is not particularly a cohoe-fishing area and, consequently, cohoe are never taken in large numbers here. The catch in 1944 was no exception, there having been produced 343 cases. This figure is compared with 541 cases for 1943, 1,813 cases for 1942, 1,955 cases in 1941, and 1,102 cases in 1940. Seeding was reported as being fair.

Pink Salmon.—Pink salmon are also caught in Smith Inlet only incidental to fishing for sockeye. In 1944 there were canned 498 cases, compared with 556 cases in 1942, 527 cases in 1943, 749 cases in 1941, and 755 cases in 1940.

Chum Salmon.—In recent past years some seine fishing for chum salmon has been carried on in Smith Inlet in the fall of the year. This is not a large fishery, however, and the pack of Smith Inlet caught chum salmon in 1944 amounted to 2,122 cases, compared with 5,693 cases in 1943 and 5,490 cases in 1942. The catch in 1941 produced 7,741 cases, while 6,015 cases were canned in 1940. The escapement was reported as having been fair.

QUEEN CHARLOTTE ISLANDS.

Salmon-fishing in the Queen Charlotte Islands, with the exception of trolling, is confined almost exclusively to seine fishing for pinks and chums, incidentally taking some cohoes. The other varieties listed as canned from fish caught in this district are incidental to fishing for the above-named species. Chum salmon are taken in the Queen Charlotte Islands each year but the pink-salmon runs to the streams on these islands occur only every alternate year, the runs coinciding with the even-numbered years. The year 1944 was a "pink year."

The catch of Queen Charlotte Islands caught fish in 1944 produced a total pack of 192,702 cases of all varieties. Of this total 90,993 cases were pinks, 81,916 cases were chums, and 19,615 cases were cohoes.

Pink Salmon.—The 90,993 cases of pink salmon canned from Queen Charlotte Islands caught fish in 1944 was the largest pack of pink salmon caught in the Queen Charlottes since 1930, although the 1944 pack exceeded the immediately preceding cycle-year's pack by only 7,664 cases. The average bi-annual pack for the previous five cycle-years for this species was 73,319 cases. It would appear from the reports from the spawning areas that the supplies of pink salmon on the spawning-grounds in 1944 were quite satisfactory. It is hoped that by proper conservation measures the Queen Charlotte Islands pink-salmon run might be again built up to something of its former production, although on account of the numerous reports of heavy damage to the spawning-streams by logging operations, it is doubtful whether the desired result might be attained in the immediate future.

Chum Salmon.—The Queen Charlotte Islands area produced a chum-salmon pack of 81,916 cases in 1944, which was the largest pack of chums caught in this area since 1940, when 164,911 cases were produced. The 1944 pack was 1,368 cases greater than for the previous five-year period and 10,173 cases above the average annual pack for this species for the previous ten-year period.

The escapement to the spawning-beds in the northern area was reported as being a failure and, while in certain areas in the south islands the chum seeding was reported as satisfactory, in other areas the seeding was poor.

Cohoe Salmon.—The Queen Charlotte Islands produced a pack of canned cohoe amounting to 19,615 cases in 1944, which figure is compared with 14,488 cases of this species canned from Queen Charlotte Islands caught fish in 1943. The canned pack in 1942 amounted to 16,935 cases, while 27,421 cases were canned in 1941. The supplies of cohoe salmon on the spawning-grounds were reported as having been satisfactory.

CENTRAL AREA.

For statistical purposes the Central Area comprises all the salmon-fishing areas off the coast of British Columbia between Cape Calvert and the Skeena River, except Rivers Inlet. The total pack of all varieties of salmon canned from fish caught in this area in 1944 amounted to 303,626 cases, comprising 32,715 cases of sockeye, 643 cases of springs, 666 cases of steelheads, 25,823 cases of cohoes, 162,986 cases of pinks, and 80,793 cases of chums.

Sockeye Salmon.—The principal sockeye-fishing grounds in the Central Area are Fitzhugh Sound, Burke and Dean Channels, while some sockeye are also taken in the vicinity of Banks Island and Principe Channel, and a small sockeye gill-net fishery is conducted in Gardner Canal. No attempt is made to report separately on these widely scattered areas. The 32,715 cases of sockeye produced in the Central Area in 1944 were 7,889 cases above the average for the previous five-year period and is compared with 32,042 cases packed in 1940, the cycle-year for most of these runs. The 1944 pack of Central Area caught sockeye was also 5,073 cases above the average pack of this species in this area for the past ten years.

The reader is referred to the spawning-grounds report for details of the escapement.

Spring Salmon.—Spring salmon are caught and canned in this area but, as in other districts, the catch is incidental to fishing for other varieties and also much of the spring salmon caught in this district finds a market in the fresh, frozen, and mild-cured trades. Consequently, the canned-salmon pack figures do not indicate the size of the catch.

In 1944 there were 643 cases of spring salmon canned from fish caught in this district. This figure is compared with 547 cases for 1943, 723 cases for 1942, 460 cases for 1941, and 15,018 cases for 1940.

Cohoe Salmon.—The cohoe-salmon pack of the Central Area in 1944 amounted to 25,823 cases. This is compared with 26,645 cases in 1943 and 31,274 cases in 1942, while in 1941, the cycle-year for this species, there were 45,218 cases of cohoe canned. The 1944 pack was 9,946 cases below the five-year average and 13,442 cases below the average for the previous ten-year period.

Pink Salmon.—The Central Area has always been considered a large producer of pink salmon, although for a few years, principally 1940, 1941, and 1942, the runs to the various streams in this area were most disappointing. In 1943 there was a particularly large run of pink salmon intercepted by the fleet on its way to the Bella Coola district. Largely as a result of this run, the catch in that year jumped to 288,109 cases. In 1944, the year under review, the pink-salmon pack in the Central Area amounted to 162,986 cases. This figure is compared with a pack of 69,434 cases in 1942, the cycle-year for this species, which would indicate particularly favourable conditions of spawning and survival. The 1944 pack was 34,759 cases above the average for the previous five-year period and was 26,950 cases more than the average for this area for the previous ten years.

Reports indicate that the escapement of this species to the various spawning-areas was reasonably satisfactory.

Chum Salmon.—The Central Area produced 80,793 cases of chum salmon in 1944, which figure was 22,494 cases below the average for this species for the previous five years and was less than the average for the previous ten-year period by 25,101 cases. If chums are considered a four-year fish, the 1944 run, as gauged by the pack, was considerably less than the run in the cycle-year when 135,802 cases were canned.

VANCOUVER ISLAND.

The total pack of canned salmon credited to Vancouver Island in 1944 amounted to 193,459 cases, composed of 5,288 cases of sockeye, 3,068 cases of springs, 165 cases of steelheads, 79,813 cases of cohoes, 49,092 cases of pinks, and 56,029 cases of chums. The 1944 pack was 154,251 cases less than the pack for this area in the year previous and was the smallest pack credited to Vancouver Island since 1931, at the depth of the depression when canning activities were drastically curtailed.

Sockeye Salmon.—The 5,288 cases of sockeye credited to Vancouver Island in 1944 were 1,897 cases below the exceedingly low pack for the year previous and 19,401 cases below the ten-year average.

Spring Salmon.—Large quantities of spring salmon are caught in the waters off Vancouver Island each year. Most of these fish, however, are taken by troll and find a market in the fresh- and frozen-fish trade. The amount of spring salmon canned from Vancouver Island caught fish consists principally of spring salmon taken in the seines while fishing for other varieties. Consequently, the pack figures are not indicative of the size of the catch. In 1944 there were 3,068 cases of spring salmon canned, while in 1943 the amount was 2,937 cases. In 1942 the figure was 5,407 cases and in 1941 the pack amounted to 8,038 cases.

Cohoe Salmon.—Vancouver Island produced a pack of canned cohoes in 1944 amounting to 79,813 cases. This is compared with 73,846 cases of this species in 1943 and 81,837 cases in 1942. The 1944 pack, while slightly above that of 1943 was, nevertheless, 19,444 cases less than the average for the previous five years and was 15,925 cases less than the ten-year average.

Pink Salmon.—The 49,092 cases of pink salmon canned from Vancouver Island caught fish in 1944 were 81,733 cases less than were canned in the year previous but were 34,618 cases greater than in the cycle-year 1942. The 1944 pack of pinks was 32,201 cases below the five-year average and less than the ten-year average by 91,221 cases.

Chum Salmon.—In 1944 there were canned from Vancouver Island caught chum salmon 56,029 cases, compared with 132,843 cases in the year previous. In commenting on the small pack of chum salmon credited to Vancouver Island in 1943, it was stated that "Compared with the record for previous years, the 1943 pack constitutes almost a failure." Certainly the 56,029 cases packed in 1944 must be considered as having been a failure for all practical purposes. The chum-salmon pack credited to Vancouver Island for recent past years is listed herewith for comparison:—

	Cases.
1943	132,843
1942	383,005
1941	593,016
1940	279,064
1939	212,949
1938	266,566
1937	203,900
1936	347,954

In comparing Vancouver Island pack figures for recent past years with the pack figures for this area for pre-war years, due consideration must be given to the fact that since the outbreak of hostilities the Provincial Government has declined to issue licences for salmon dry-salteries and the Federal Government has only permitted the export of chum salmon under permit. These actions were taken for the purpose of diverting as much as possible of the Vancouver Island chum-salmon catch to the canners. Another fact which must be considered in comparing the 1944 pack with the packs of recent past years is the amount of chum salmon which was frozen. It is

understood that somewhat larger quantities of chum salmon from Vancouver Island were frozen in 1944 than in recent past years. Notwithstanding this latter consideration, however, the 1944 chum-salmon catch for Vancouver Island was most disappointing.

In all cases where not specifically mentioned, the reader is referred to the report on the spawning-areas issued by the Chief Supervisor of Fisheries for the Federal Government, which is published in full in the Appendix to this report.

REVIEW OF BRITISH COLUMBIA'S SALMON-CANNING INDUSTRY, 1944.

The Provincial Fisheries Department licensed thirty-one salmon-canneries for operation in British Columbia in 1944, although only thirty of these actually operated. It is understood that arrangements were made, after the licence was taken out, for this non-operating cannery to combine operations with another cannery. Actually, the same number of canneries operated in 1944 as in 1943. The operating canneries were located as follows:—

Queen Charlotte Islands	1
Skeena River	8
Central Area	4
Rivers Inlet	1
Johnstone Strait	2
Fraser River and Lower Mainland	10
West coast of Vancouver Island	3
Nass River	1

While the same number of canneries operated in 1944 as in 1943 the locations of the various canneries were slightly different from the latter year. In 1943 there were no operating canneries on the Nass River, while in 1944 one cannery operated in this district. In 1944 there was one less cannery operating on the Fraser River and Lower Mainland than in 1943; otherwise the distribution of operating canneries was the same in 1944 as in the year previous.

Since the beginning of the war the number of canneries operating in the Province has been consistently less than before the war. The shortage of labour generally, and particularly the shortage of technical help, has forced a consolidation of operations in many cases. Not only have companies been forced to close down one or more of their operating canneries and consolidate their own operations, but in several instances different companies have been forced to come to working agreements to can each other's fish. These consolidations and joint operations have been entirely voluntary on the part of the companies, brought about principally by the shortage of labour.

Again in 1944, as in previous war years, the Federal Government made arrangements with the British Ministry of Food which resulted in the entire pack of British Columbia canned salmon being taken over by the Federal Government for Great Britain. Later on, however, it was announced that 250,000 cases of the 1944 pack would be made available for domestic consumption. This amount, of course, was not nearly enough to satisfy Canadian needs, but the distribution of even this small amount in Canada had the effect of keeping the canners' labels before the public.

In order that as much as possible of the salmon-catch would be canned, certain restrictions upon the disposal of salmon were again in effect in 1944 as in 1943 and 1942. The Provincial Government again refused to permit the operation of salmon dry-salteries and the Federal Government also placed an embargo on the export of fresh salmon in certain categories, except under export permit. These measures, no doubt, were the means of diverting considerable quantities of salmon to the canneries which might have found an outlet in other markets had these regulations not been in effect. It is understood that in 1944 a considerably larger quantity of salmon was frozen than in the year previous.

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

Pilchard.—The pilchard-fishery of British Columbia is conducted largely off the shores of the west coast of Vancouver Island and most of the catch is reduced to meal and oil. However, previous to the war there was a growing demand for canned pilchards and the accelerated requirements for protein foods during the war has increased the demand for canned pilchards along with other protein foods. The quantity of pilchards canned in any one year is not necessarily indicative of the demand for this product, nor does it indicate the size of the catch. Pilchards for canning are selected from the total catch, and, because of conditions inherent in the fishery, there is not always available a sufficient quantity of pilchards of suitable quality to meet the requirements of the canners.

In 1944 there were seven pilchard-canneries licensed, although only six operated. All of these but one were located on the west coast of Vancouver Island. The six operating pilchard-canneries utilized 2,824 tons of pilchards and produced therefrom 78,772 cases of canned pilchards. In the year previous five pilchard-canneries operated in British Columbia, producing a pack of 94,512 cases.

Herring.—Herring have been canned in British Columbia for a number of years. Previous to the war herring-canning was not conducted on a very large scale, the annual pack amounting to around 25,000 cases. This small pack was due in a large measure to the limited market for canned herring. Immediately upon the outbreak of hostilities the demand for canned herring increased enormously, due to the heavy requirements of a war-time economy for high protein foods. The herring-canning industry immediately jumped from a rather unimportant branch of British Columbia's fishery to one of major proportions. In 1939 the industry produced 418,021 cases of canned herring and since then the annual pack has been over 1,000,000 cases.

In 1944 twenty-two herring-canneries were licensed but only twenty-one actually operated. These twenty-one canneries utilized 56,055 tons of herring and produced 1,190,762 cases of canned herring. In the year previous twenty-two herring-canneries operated and the pack in that year was 1,198,632 cases. Practically the whole of the herring-pack is each year taken over by the Federal Government for the account of the British Ministry of Food.

Shell-fish.—Shell-fish, particularly clams and oysters, are canned in British Columbia to some extent. The operation is not large and the production fluctuates considerably. In 1944 four shell-fish canneries were licensed to operate, although only two actually got under operation. The shell-fish pack amounted to 10,457 cases in 1944 compared with 17,463 cases canned in 1943 by three operating canneries.

MILD-CURED SALMON.

There were six tierced-salmon plants licensed to operate in British Columbia in 1944 and all six operated in various degrees. The six operating plants produced 2,300 tierces of mild-cured salmon in 1944, compared with a production of 856 tierces in 1943 by three operating plants.

DRY-SALT SALMON.

In each year previous to 1939 there have been varying amounts of chum salmon dry-salted for shipment to the Orient. In some years the production of dry-salt salmon has reached fairly large proportions and in recent past years this industry has been controlled and regulated by the British Columbia Salt-fish Board, which Board is a scheme set up under the "Natural Products Marketing (British Columbia) Act." Chum salmon, normally, are fished in quantity in the fall of the year. There is, however, a considerable pack of canned chum salmon put up during the summer and early

autumn months. Due to the increased demand occasioned by the war for inexpensive protein foods, such as canned salmon, the Provincial Government declined to issue salmon dry-saltery licences in 1939. For similar reasons the licences covering salmon dry-salteries were again refused by the Provincial Government in 1940. In 1941, 1942, and again in 1943, the demand of the British Government for a very large portion of the British Columbia salmon-pack made it imperative that as much as possible of the salmon-catch be diverted to the canneries. For this reason the Provincial Government again refused to issue licences covering salt-salmon operations, and, as a consequence, no salmon were legally dry-salted in British Columbia in 1944.

For the above-noted reasons the British Columbia Salt-fish Board was again inoperative during the 1944 season and, on that account, no report of the British Columbia Salt-fish Board appears in this report.

DRY-SALT HERRING.

Previous to the 1941 season, production of dry-salt herring was, in latter years, regulated by the British Columbia Salt-fish Board under the "Natural Products Marketing (British Columbia) Act." The total production of dry-salt herring in British Columbia was formerly shipped to the Orient, particularly to Japan, and from there quantities were re-exported to Manchukuo and China. Conditions in the Orient in recent years have reduced the quantity of dry-salt herring shipped to the Orient very considerably. Since 1940 the British Columbia Government has refused to issue herring dry-saltery licences in order to divert as much as possible of the herring-catch to the herring-canneries, which were all operating on British war orders for this commodity. There have been no herring dry-salteries operated in British Columbia since 1940.

PICKLED HERRING.

During World War I. the business of pickling herring in British Columbia attained fairly large proportions, particularly in Scotch-cured herring. After the armistice in 1918, however, the demand for pickled herring dropped off rapidly and for many years no pickled herring was produced in British Columbia. This industry has again been revived since the beginning of World War II., due largely to the fact that the source of supply of this commodity, which is in Europe, was cut off and the markets in Canada and the United States have had to look elsewhere for this product.

Since 1940 the production of pickled herring in British Columbia, while not assuming the proportions of a major industry, has, nevertheless, been considerable. The production for the years since 1940 was as follows: 1940, 5,500 barrels; 1941, 3,095 barrels; 1942, 2,240 barrels; 1943, 2,928 barrels. The production in these years apparently was greater than the market could absorb because in 1944, while five plants were licensed, only two of these operated. These two plants produced 125 barrels of pickled herring. It is understood that the small production in 1944 was due entirely to lack of demand and, while it is possible that some pickled herring may be produced in the immediate post-war years, the outlook for this industry is not bright.

TUNA FISH.

In 1944 one cannery was operated in an experimental way in the production of canned tuna fish. In the last couple of years some tuna fish have been caught off Vancouver Island by Canadian fishermen. These have usually been shipped to the United States for processing. The pack of this cannery was quite small.

HALIBUT PRODUCTION.

The halibut-fishery on the Pacific coast of North America is regulated by the International Fisheries Commission and is shared in by the nationals of both Canada and the United States. The Commission regulates the fishery on a quota basis and on that account there is very little fluctuation in the amount of halibut landed from year to year. For the purpose of regulation the coast is divided into four areas, the principal areas, from the standpoint of production, being Areas Nos. 2 and 3. Area No. 2 comprises the waters off the Washington and British Columbia coasts from the approximate vicinity of Willapa Harbour in the south to Cape Spencer in the north. Area No. 3 comprises the waters from the northern boundary of Area No. 2 to the Aleutians. The other two areas, Nos. 1 and 4, from which production is very small, comprise the waters south of Area No. 2 and the Bering Sea respectively.

In 1944 the catch-limits set by the International Fisheries Commission were: For Area No. 2, 23,500,000 lb. and for Area No. 3, 27,500,000 lb.—a total of 51,000,000 lb. and an increase of 500,000 lb. over the quota for 1943. These quotas are exclusive of that quantity of halibut which is permitted to be taken incidental to fishing for other species under permit in Area No. 2 after that area's closure and before the closure of Area No. 3. This is the third year in succession in which the International Fisheries Commission has increased the catch-limits. In doing so the Commission has pointed out that the action has been taken purely on account of the exigencies caused by the war and that there is a distinct possibility of the quotas being lowered when the nations' need for protein food is less demanding at the conclusion of hostilities. In addition to the quota of 51,000,000 lb. allowed by the International Fisheries Commission, permits are issued which allow vessels to land halibut up to a certain percentage caught incidental to fishing for other species in Area No. 2 when that area is closed to halibut-fishing while Area No. 3 is still open.

The total landings of halibut by all vessels in all ports in 1944 amounted to 52,935,000 lb. Of this amount 25,616,000 lb. were caught in Area No. 2 and 26,856,000 lb. were taken in Area No. 3. There were 463,000 lb. caught in Area No. 1. The total landings by all vessels in Canadian ports in 1944 amounted to 18,698,000 lb. Of this amount 11,284,000 lb. were reported to have been caught in Area No. 2 and 7,414,000 lb. in Area No. 3.

Canadian vessels landed in all ports 13,308,000 lb. Of this amount the Canadian catch landed in Canadian ports amounted to 13,262,000 lb. while 46,000 lb. of the Canadian catch was delivered to American ports. Of the total Canadian catch 11,079,000 lb. were reported as having been caught in Area No. 2, while 2,229,000 lb. of the Canadian catch was reported to have been taken in Area No. 3. American vessels landed in Canadian ports a total of 5,436,000 lb.

The figures for the average prices of halibut usually quoted in this section are unavailable this year, as are the figures for halibut-livers.

The statistical information furnished above is supplied by the International Fisheries Commission and is gratefully acknowledged.

FISH OIL AND MEAL.

Fish-oil and edible fish-meal have been produced in British Columbia for a number of years and, previous to the war, this branch of the industry was an important part of British Columbia's fisheries. Pilchard and herring have been the principal species used for the production of oil and meal but, since the outbreak of the war and the demand for natural sources of vitamins, other species have been found to yield oils of high vitamin content and the sharp demand for these products has increased activity in this field. Dogfish and dogfish-livers, shark-livers, codfish-livers, cannery waste, and

the viscera of a number of species are all utilized for the production of fish-liver oils, much of which finds a market in the pharmaceutical field. In addition to the medicinal oil produced, British Columbia fish-oils of the lower vitamin potencies find an outlet in many manufacturing processes, such as the production of soaps, paints, linoleums, printer's ink, etc., while large quantities are also sold for the feeding of poultry and live stock.

Fish-liver Oil.—Since the outbreak of the war in Europe there has been an ever-increasing demand for a natural source of Vitamin A. It has been known for some time that the livers and viscera of certain Pacific fishes were a valuable source of vitamins. Because of its vitamin content fish-liver oil has been in greatly increased demand since the beginning of hostilities.

Since 1942 the Provincial Fisheries Department has required licences for the operation of fish-liver reduction plants. In 1944 eight fish-liver oil plants were licensed to operate. These eight plants processed 8,284,000 lb. of fish-livers and produced 545,736 imperial gallons of oil. The oil production from eight plants operated in 1943 was 433,575 imperial gallons. This production of high-vitamin oil finds an outlet almost exclusively for pharmaceutical purposes and has gone a long way toward meeting the vitamin requirements of the United Nations.

Pilchard Reduction.—The pilchard-fishery in British Columbia is conducted principally off the west coast of Vancouver Island and, while the bulk of the pilchard-catch is taken well offshore, in latter years the fishing-vessels have been proceeding farther south to meet the run of pilchards on its northern migration from California waters. In 1944 seven pilchard-reduction plants were licensed to operate. These seven plants produced 1,675,090 imperial gallons of oil and 8,435 tons of meal. These figures are compared with the production of nine plants operated in 1943 when 2,238,987 imperial gallons of oil and 15,209 tons of meal were produced. In comparing these figures it should be remembered that the catch of pilchards in 1943 was one of the largest in recent past years.

Herring Reduction.—The reduction of herring to meal and oil in British Columbia has become an important branch of our winter fishery. Herring are caught from October to March and, while heretofore the industry was conducted largely on the west and south-east coasts of Vancouver Island and in the vicinity of Prince Rupert, later, particularly during the war years, the industry has spread and now practically covers the entire coast of British Columbia.

In 1941 and subsequent war years, the demand for a high-protein food at low cost to meet the exigencies of war caused the Government to take such action as would divert as much as possible of the herring-catch from the reduction plants to the canneries. The Provincial Government in 1942, 1943, and again in 1944 licensed herring-reduction plants on the west coast of Vancouver Island on the distinct understanding that no herring caught on the east coast would be utilized for reduction in west coast plants, while reduction plants operated on the east coast were licensed on the distinct understanding that no herring caught on the east coast of Vancouver Island would be used for reduction purposes except that portion of the catch unsuitable for canning. The Provincial Government's regulations were supplemented by further regulations of the Federal Government which prohibited the delivery of east coast caught herring to any one except a licensed herring-cannery. As a result of the steps taken by the Federal and Provincial Departments of Fisheries, and the desire of the canners to can as much as possible of the herring-catch, the reduction plants produced less than would otherwise have been the case.

In 1944 eleven herring-reduction plants were licensed to operate but only ten actually got into production. These ten herring-reduction plants produced 717,655 imperial gallons of oil and 9,539 tons of meal. These figures are compared with the

production in the year previous when eleven operating plants produced 512,516 imperial gallons of oil and 7,662 tons of meal.

Whale Reduction.—Whale reduction has been fairly consistent in recent past years in British Columbia waters, but in 1944 there was no whaling conducted by Canadian plants in British Columbia waters.

Miscellaneous Reduction.—Dogfish and fish-offal reduction plants are licensed to operate each year in British Columbia. These plants produce meal and oil from cannery waste and from the carcasses of dogfish. The oil from the dogfish carcasses is not to be confused with dogfish-liver oil which is reported in another section of this report. In 1944 ten plants operated on this source of material and produced 301,038 imperial gallons of oil and 2,721 tons of meal.

NET-FISHING IN NON-TIDAL WATERS.

Under section 23 of the Special Fishery Regulations for British Columbia, fishing with nets in certain specified non-tidal waters within the Province is permissible under licence from the Provincial Commissioner of Fisheries. This fishery is confined almost exclusively to the residents living within reasonable distance of the lakes in the Interior of the Province. This fishery has been in the past of a very minor nature and for that reason has not been mentioned heretofore in this report. As the number of licences issued has been increasing, and as statistics are now available covering the catch for recent past years, it was deemed advisable that this information should be contained in the annual report of the Provincial Fisheries Department. There will be found in the Appendix to this report a table showing the name and number of lakes in which net-fishing has been permitted, together with the number and approximate weight of the various species of fish taken from each lake.

It will be noted from the statistical data that there are three different kinds of fishing licences issued for net-fishing in the non-tidal waters of the Province—namely, fur-farm, ordinary, and sturgeon. Licensed fur-farmers, under subsection (10) of section 23 of the Special Fishery Regulations for British Columbia, are permitted to take coarse fish by the use of nets of suitable mesh in the non-tidal waters of the Province under licence from the Commissioner of Fisheries.

There were thirty-six licences issued to fur-farmers in the 1944–45 season. This was the same number as were issued in the year previous. The coarse fish so taken under these licences are used as food for fur-bearing animals held in captivity. Ordinary licences permit the licence-holder to use a specified number of pieces of net to take fish, other than salmon, trout, or sturgeon, in the non-tidal waters of the Province for the licensee's own use, or in certain specified cases the product may be sold. During the 1944–45 season there were seventy-one ordinary fishing licences issued. This number is compared with sixty-nine ordinary licences issued in the year previous. In the 1944–45 season fifty-two of these seventy-one licences were for Okanagan Lake, whereas in the year previous forty-six licences were issued for Okanagan Lake. In the case of licences issued for Okanagan Lake, these permit the use of a dip-net only and for the express purpose of catching kokanee. One sturgeon-fishing licence was issued in the 1944–45 season, as was the case in the year previous.

In 1944–45 there was a total of 108 non-tidal fishing licences issued. This is compared with 106 licences for the previous year.

The reader is referred to the table in the Appendix to this report for a detailed account of the catch of fish taken by licensed nets in the non-tidal waters of the Province during the 1944–45 season.

CONDITION OF BRITISH COLUMBIA'S SPAWNING-GROUNDS.

Owing to this Department having discontinued making inspections of the various salmon-spawning areas of the Province, we are indebted to Major J. A. Motherwell,

Chief Supervisor of Fisheries, and the officers of his Department who conducted the investigations, for furnishing us with a copy of his Department's report. His courtesy in supplying us with this report is gratefully acknowledged.

Major Motherwell's report on the condition of British Columbia's salmon-spawning grounds will be found in full in the Appendix to this report.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON (DIGEST). (No. 30.)

There will be found in the Appendix to this report another paper, No. 30, in the series "Contributions to the Life-history of the Sockeye Salmon." Paper No. 30 is again contributed by Dr. W. A. Clemens, Department of Zoology, University of British Columbia.

In the introduction to paper No. 30 Dr. Clemens comments on the comparatively small packs of sockeye salmon on Rivers Inlet, the Skeena River, and the Nass River in 1944. In connection with the Rivers Inlet pack Dr. Clemens says, "The small return to Rivers Inlet is a matter of concern. As stated in the report for 1943, it is evident that provision must be made for larger escapements if the run to this area is to be maintained." Dr. Clemens then goes on to predict that, unless exceptionally favourable conditions prevail for the period of the life-history of the 1944 spawning, the returns of adult salmon in 1948 and 1949 will be small. In connection with the Rivers Inlet run Dr. Clemens also points out that, since the sockeye salmon comprising these runs mature at four and five years of age, reduction of the stock in 1944 will affect the returns in 1948 and 1949 and subsequently in 1952, 1953, and 1954; also, that if reduction of stock occurs in two successive years, the subsequent results are doubly effective in certain years. For example, the effects of poor returns in 1943 and again in 1944 will be superimposed in 1948 when both the four- and five-year-old fish will be involved and, similarly, again in 1952 and 1953. It is obvious that if this run is to survive and continue to produce an average pack, it is very important that a margin of safety be maintained.

The Rivers Inlet pack in 1944, amounting to 36,852 cases of sockeye salmon, was the smallest pack on record for this area and was accompanied by a light escapement. Dr. Clemens is not prepared to essay any explanation at this time. It would appear, however, from the evidence presented that the condition of the sockeye-salmon runs to Rivers Inlet is such as to warrant qualified scientific investigation.

In connection with the Skeena River sockeye-salmon run in 1944, which produced a pack of 68,197 cases, Dr. Clemens suggests that, while this may be considered a pack of medium size, and as the escapement to the spawning-grounds was reported as good, it would seem to indicate a reasonable balance between catch and escapement. In connection with this river system the Fisheries Research Board of Canada has commenced an investigation of the causes of fluctuation in the abundance of sockeye salmon and the results should be of fundamental importance in relation to maintaining a highly productive fishery.

In connection with the sockeye-salmon run to the Nass River, Dr. Clemens again remarks on the fact that the returns to this river are still quite unpredictable. In connection with the 1944 run, while this was evidently not a particularly large run, it was characterized by an exceptionally large percentage of six-year-old fish. While the small pack of 13,083 cases of sockeye salmon may have been due in part to less extensive fishing, Dr. Clemens suggests that the run was evidently relatively small since the report on the spawning-beds does not refer to a particularly large escapement. Dr. Clemens is not hopeful of a large return to this river in 1945.

For a more detailed account of the analysis of the runs of sockeye salmon to Rivers Inlet, the Skeena and Nass Rivers, the reader is referred to Dr. Clemens' paper published in the Appendix to this report.

HERRING INVESTIGATION.

The investigation of the herring of British Columbia, financed jointly by the Fisheries Research Board of Canada and the Provincial Fisheries Department, was continued in 1944 by Dr. A. L. Tester, Mr. J. C. Stevenson, and their assistants.

The results of a tagging and tag-recovery programme for the 1944–45 season are included in detail in the Appendix to this report. For the most part the results serve to confirm those of previous years regarding the extent of mixture between populations. Some new information has been obtained. For example, it is shown that fish spawning on certain grounds in the vicinity of Gilford Island, in the Queen Charlotte Strait area, contribute to the fishery in the vicinity of Clio Channel but not to that in the upper reaches of Knight Inlet. It is also shown that there is a limited contribution of fish spawning in the southern part of the central coast-line to the fishery in the northern part of the area, in the vicinity of Laredo Sound. Extensive tagging along the Central coast-line during the spring of 1944, coupled with plans for more satisfactory recovery (using induction detectors), should serve to clarify the latter situation next year.

At the instigation of the herring investigation, a new type of tag detector has been designed by Dr. A. C. Young, of the National Research Council, and has been constructed by Mr. F. J. Bartholomew, of the Electric Power Equipment, Limited. Its chief features are stability of operation and ease of control. Preliminary tests have shown promise of satisfactory performance and it is expected that the unit will be in operation during the next fishing season.

Lack of knowledge of the extent of mortality caused by tagging has prevented use of tag-recovery data for calculating fishing mortality; that is, the fraction of the available population taken by the fishery. From December, 1944, to March, 1945, an experiment was conducted to determine the rate of tagging mortality involved in the use of internal metal tags. Tagged fish and controls were confined in a large concrete tank in the intertidal zone for the three-month period, interchange of water being effected by tidal action. The weekly rate of tagging mortality increased rapidly to the fourth week, reached a peak in the sixth week, and declined to a low value in subsequent weeks. For the three-month period the rate of tagging mortality was unexpectedly high—0.6, or 60 per cent. It was higher for males than for females and higher for smaller than for larger fish of both sexes. Post-mortem examination indicated that the controls died from infection through abrasion and from "disease," and that tagged fish died from these causes and also from infection of the tagging incision and the gonads as a result of the tagging operation. The observed rates of tagging mortality may be applied to tagging data as a minimal approximation, but further investigation is necessary to determine the extent of an additional mortality from preliminary handling of the fish and to determine if similar mortality rates pertain to fish caught and tagged during the spawning period. The results to date will be presented for publication in the Journal of the Fisheries Research Board of Canada under joint authorship of the two investigators.

The commercial catches and spawning runs were again sampled for length, weight, sex, and age with 122 samples (11,835 fish) from the former and 15 samples (1,461 fish) from the latter. A new method of recording sampling data in the field was devised, using mimeographed forms. The chief advantage of the new method is that the time necessary for sampling and for making subsequent calculations on the sampling data is considerably reduced. The sampling phase of the work is being undertaken by Mr. Stevenson. A start has been made by both of the herring investigators on a comprehensive study of the age, length, and weight composition of samples collected since and including 1935–36.

The detailed study of variation in scale pattern, begun last year, has been largely discontinued for the present due to a realization that sufficient time was not available.

Results obtained so far are of limited use in contributing to the accuracy of scale reading for age-determination.

Spawning reports, covering herring-spawning conditions in 1944 in all areas, were again collected. Considerable headway has been made in preparing an account of the nature and extent of herring spawning in British Columbia waters over a fifteen-year period.

Daily catch records of the herring-fishery were again collected during the 1944–45 fishing season by means of special pilot-house record-books. During the course of the year an article entitled "Catch statistics of the British Columbia herring fishery to 1943–44" (by Albert L. Tester, *Bulletin No. 67, Fisheries Research Board of Canada*) was published. This includes the presentation of gross and detailed catch statistics for each fishing area and a discussion of observed fluctuations in availability and abundance.

Another publication during the year entitled "Echo sounding for summer herring" (by Albert L. Tester, *Progress Reports (Pacific) No. 61, Fisheries Research Board of Canada*) deals with the location of herring in Alaska and British Columbia waters during the summer of 1944.

SHELL-FISH INVESTIGATION.

The investigation into the shell-fish of British Columbia, with particular emphasis on clams, was continued in 1944. It will be remembered that this investigation was instituted in order to ascertain the conditions prevailing on some of the clam-beaches of British Columbia, particularly those which had been exploited commercially for some considerable time. The investigation was undertaken by the Fisheries Research Board of Canada at the request of the Provincial Fisheries Department and is financed jointly by these two organizations. The work was commenced by Dr. Roy Elsey and is now being conducted by Mr. Ferris Neave, of the Pacific Biological Station at Nanaimo. While all shell-fish are included in the investigation, particular emphasis is being placed on clams, as it is felt that exploitation of this species has been greater than the others, and, consequently, the need for protection is greater on that account.

In the Appendix to this report there will be found a paper by Mr. Ferris Neave, entitled "Biological Investigations of Commercial Shell-fish." In this paper Mr. Neave discusses the commercial butter-clam catch of 1943–44 and also the little-neck clam catch for the same period. In the case of butter-clams the production showed an increase per unit of fishing effort in the year under review and Mr. Neave feels that the condition of the butter-clam beaches in the Province might be regarded as satisfactory, while in the case of little-necks, statistics covering several years show little variation in availability. While the razor-clam production of Graham Island in the Queen Charlottes for the period under review was low, Mr. Neave says that this does not necessarily indicate a depletion of the beaches.

The experiment in managing the production of butter-clams on Seal Island, near Comox, was continued for the fourth season in February, 1945. At this time 100 tons of clams were permitted to be taken. Production per unit of effort showed a decline from previous seasons, although still high in comparison with all of the large coastal areas. Mr. Neave noticed the appearance of fairly large groups of young clams in this area which should attain commercial size within a few years. Mr. Neave discusses generally the condition of the beaches at Seal Island and their future prospects.

The paper also notes that experiments in tank-rearing of oyster larvæ were continued in 1944.

The investigation also covered the reproduction activities of Pacific oysters on the commercial beds at Ladysmith. It is noted that a commercially valuable set took place at the end of July and the beginning of August.

The reader is referred to the Appendix to this report for the complete paper by Mr. Neave.

INTERNATIONAL FISHERIES COMMISSION, 1944.

As provided in the treaty of 1937 under which it operates, the International Fisheries Commission continued the regulation of the Pacific halibut fishery and the investigations upon which the regulations are based. The investigations revealed further improvement in the condition of the stocks of halibut.

The members of the Commission were the same as in the latter part of 1943; namely, Mr. G. W. Nickerson and Mr. A. J. Whitmore for Canada, and Mr. Edward W. Allen and Mr. Charles E. Jackson for the United States. Mr. Nickerson and Mr. Allen were chairman and secretary respectively.

Meetings of the Commission were held at Seattle on November 27th, 28th, and 29th to consider matters connected with the investigation and regulation of the fishery.

On November 28th the Commission met with the Halibut Conference Board, composed of representatives of the halibut vessel owners and fishermen. The results of the Commission's investigations and the effect of regulations upon the condition of the stocks of halibut were discussed and matters pertaining to the future regulation of the fishery were considered.

Regulations governing halibut-fishing in 1944 were issued on March 20th. These were similar to the regulations of the previous year, but contained a few important changes. The Area 3 catch-limit of 27,500,000 lb. was retained, but that for Area 2 was increased from 23,000,000 to 23,500,000 lb. A minimum length-limit of 26 inches for fish with heads on was substituted for the previous minimum weight-limit of 5 lb. 13 oz. for dressed fish with heads on. The pre-season validation of halibut licences for fishing in Areas 1 and 2 and in Areas 3 and 4 was limited to three and five days respectively before the opening of the fishing season. The use of dory gear, previously prohibited only in Areas 1 and 2, was prohibited in all fishing areas. The provision of the regulations prohibiting the retention of halibut caught by set nets was extended to include halibut caught by any type of net.

The changes in the regulations were designed to provide the maximum annual catch justified by the condition of the stocks of halibut, to reduce illegal fishing prior to the beginning of the season, and to give additional protection to the small halibut upon which the future of the fishery depends.

The fishing season opened on April 16th, as in the preceding year, but a dispute over prices delayed the commencement of fishing until approximately May 23rd. Areas 1 and 2 which include all fishing-grounds south of Cape Spencer, Alaska, were closed at midnight July 9th, when the Area 2 catch-limit was attained. Areas 3 and 4, including all grounds north and west of Cape Spencer, were closed at midnight November 30th, the beginning of the statutory closed season. Permits for the retention and landing of halibut caught incidentally during fishing for other species in Areas 1 and 2 after they were closed to halibut-fishing became invalid on November 30th.

The curtailment programme which the fishermen adopted some years earlier as a means of spreading the catch over a longer season was discontinued. This resulted in an increase in the size and frequency of landings, which in conjunction with an increase in the number of Area 2 vessels reduced the Area 2 season to forty-eight days, the shortest in the history of the fishery. In Area 3 the effect of the larger and more frequent trips was more than counterbalanced by the diversion of vessels to the shark-liver and tuna fisheries, with the result that the Area 3 catch-limit was not attained by the beginning of the statutory closed season.

Landings of halibut on the Pacific Coast during 1944 amounted to 52,935,000 lb., approximately 700,000 lb. less than in 1943. The decrease was caused by the failure of the fishing fleet to catch the Area 3 limit before the winter closed season. Landings

from Area 1, which extends south from Willapa Harbour, Washington, amounted to 463,000 lb. Area 2, which lies between Willapa Harbour and Cape Spencer, Alaska, produced 25,616,000 lb., including 845,000 lb. landed under permit after the closure of that area to regular halibut-fishing. Area 3, lying between Cape Spencer and the Aleutian Islands, produced 26,856,000 lb. No halibut were landed from Area 4, in the Aleutian Islands and Bering Sea region.

The halibut-catch of Canadian vessels amounted to 13,308,000 lb., which was 401,000 lb. greater than in 1943. The landings of United States vessels at Canadian ports decreased about 6,874,000 lb. as a result of war-time price and operating conditions which made the landing of such vessels at Alaskan ports more advantageous than in recent previous years.

The programme of biological and statistical investigations, upon which the Commission bases its management policies, was continued by the Commission's staff under the direction of H. A. Dunlop, Director of Investigations, as well as war-time conditions and available personnel permitted. Changes in the fishery were observed and changes in the conditions of the stock of fish resulting from regulation were measured and analysed.

The abundance of halibut as indicated by the average catch per standard unit of fishing effort showed considerable improvement over 1943. Preliminary figures indicate increases of 15 per cent. in Area 2 and 13 per cent. in Area 3. The catch per unit of effort was 143 per cent. and 133 per cent. greater in Areas 2 and 3 respectively than it was in 1930.

Study of the changes taking place in the composition of the stocks of adult halibut as a result of regulations was continued by sampling the commercial catch. Approximately 21,000 fish were measured and material for the determination of changes in age composition was taken from about 3,500 of these. The samples were mainly from Area 2 catches, as abnormalities in the distribution of landings made it almost impossible to secure samples from the Area 3 grounds.

Analysis of the market measurements showed that the improvement in the catch per unit of effort in Area 2 during 1944 was caused, as in 1943, mainly by an increase in the abundance of small commercial sizes. These small fish were present in greater numbers than in 1943 and averaged somewhat larger in size as a result of the additional year's growth. A small increase in the abundance of halibut of larger sizes was also apparent.

Age-determinations, required for determination of the exact year of origin of the changes that have occurred in the stocks of fish, were continued on a limited scale, using materials collected in conjunction with the taking of market measurements from 1933 to 1944. Many age-readings have been made but many more remain to be made before an analysis of the changes in age composition during the period of regulation can be undertaken.

Work upon the success of spawning in Area 2 was confined to the laboratory because of war-time conditions which made field-work impracticable. The results of field-work at sea from 1934 to 1943 inclusive were analysed in greater detail than previously. Organization of these materials for publication was begun.

The investigations of the Commission measured and explained the changes in the stocks of halibut and provided a factual basis for future regulation. They proved that the condition of the stocks was still improving as a result of regulations. They showed that the annual yields, which are now about 10,000,000 lb. greater than in the year before regulation, could be further increased by continued rational control of the fishery.

A PRELIMINARY REPORT ON A FISHERY SURVEY OF TESLIN LAKE, BRITISH COLUMBIA.

The opening of the northern part of the Province of British Columbia by the completion of the British Columbia–Alaska Highway drew the attention of North America to this vast new territory. Even before the road was completed the Provincial Fisheries Department was in receipt of inquiries as to the possibilities of fishing commercially in the northern lakes of the Province which the opening of the highway would make accessible. As the Department had very little or no information as to the possibilities of the waters in the more remote northern regions of the Province, it was deemed advisable to obtain authentic information before permitting commercial fishing in these newly made accessible waters.

In the north-western corner of the Province there are a number of fairly large lakes, including Teslin, Atlin, Tagish, Bennett, and Gladys, as well as a number of smaller lakes. All of these drain into the Yukon drainage-basin. Inasmuch as Teslin Lake lies closest to the highway and was, therefore, the most accessible, it was decided to conduct a survey of Teslin Lake, with special emphasis as to whether or not this lake would support a commercial fishery. Dr. W. A. Clemens, of the University of British Columbia, was in charge of the work and was assisted by Dr. R. V. Boughton and Mr. J. A. Rattenbury. Arrangements were made with the Federal Government to permit the party to establish headquarters in the Yukon Territory at the village of Teslin. Permission was obtained from the Canadian and United States Governments to permit the party to travel over the Highway from Whitehorse to Teslin and arrangements were also made with Mr. R. McCleery, a trader at Teslin, for accommodation. The party left Vancouver the latter part of June, 1944, and were in the field until September. While the party's headquarters were at Teslin, field camps were established at various points on the lake, both on the British Columbia and Yukon sides of the boundary-line.

In the Appendix to this report there will be found a preliminary report on the fishery survey of Teslin Lake. The investigation involved determinations of the surface area, bottom area, and volume of the lake; distributions of water temperatures, oxygen and hydrogen ion concentration; species of fish, their distribution, abundance, age-weight-length relationships, stomach content and parasites; quantitative determinations of plankton and bottom organisms as potential food-supplies for the fish.

Teslin Lake is 78 miles in length and has an average width of approximately 2 miles. The area, as determined from maps, is approximately 137 square miles. The survey indicated a maximum depth of 700 feet and a somewhat irregular average depth of 300 feet. During the two months water temperatures ranged from 12° to 19° C. at the surface to 4° C. at approximately 475 feet and deeper, with little evidence of a thermocline.

During the months of July and August the oxygen content of the water in Teslin Lake was almost at the saturation point at all depths. The hydrogen ion concentration during this period ranged from 7.5 to 8.0.

Fishing was conducted by means of gill-nets and a beach-seine and to some extent by trolling and fly-fishing. The investigators indicated that the fish fauna in Teslin Lake is limited to twelve species, three or more additional species in the Lower Yukon River, but apparently these have not yet extended their range to Teslin Lake. The reader is referred to the interim report in the Appendix for a detailed account of the twelve species occurring in Teslin Lake. It is interesting to note in passing, however, that spring salmon and chum salmon occur in Teslin Lake, which means a migration of approximately 2,000 miles from the sea.

The capacity of any body of water to support a fish population is directly proportional to the food organisms available. The collections of plankton and bottom organisms made in Teslin Lake in 1944 have not yet been examined critically, but it would seem from a general observation that the plankton and bottom fauna are limited, both in species and quantity; consequently, the productivity of the lake in terms of poundage of fish may be expected to be relatively low.

In discussing the potential commercial and sport fisheries of Teslin Lake the authors draw the following tentative conclusions, subject to revision after a complete analysis of the pertinent data has been made. Whitefish are the only species which may be considered for commercial exploitation. It is estimated that the normal annual requirements for local residents are about 20,000 lb., and in view of the present abundance of whitefish in the lake, the results of the studies of age composition and on the basis of data available and the information concerning commercial whitefish fisheries in other lakes, it would appear than an additional 20,000 to 30,000 lb. of whitefish might be removed annually, providing the fishery was not localized. The lake-trout in Teslin are of greater value as a sport fish than as a commercial proposition.

While it would be premature to recommend a policy in regard to exploiting the commercial possibilities of fishing in Teslin Lake until all of the pertinent data have been examined critically, it would appear that the northern lakes, based on the data of Teslin Lake, do not warrant the expectation of developing a commercial fishery in these northern waters, except possibly to supply purely local needs.

The reader is referred to the preliminary report on the fishery survey of Teslin Lake which is published in full in the Appendix to this report.

APPENDICES.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON. (No. 30.)

By W. A. Clemens, Ph.D., Department of Zoology, The University of British Columbia, Vancouver, B.C.

INTRODUCTION.

The run of sockeye salmon to Rivers Inlet and the Skeena and Nass Rivers in 1944 was relatively small as indicated by the pack figures and spawning-bed reports. The pack data are as follows: Rivers Inlet, 36,852 cases; Skeena River, 68,197 cases; Nass River, 13,083 cases; total, 118,132 cases. The reports on the escapements, as supplied by Major J. A. Motherwell, Chief Supervisor of Fisheries, Vancouver, may be briefly listed as follows: Rivers Inlet, light; Skeena River, good; Nass River, quite good or satisfactory.

The small return to Rivers Inlet is a matter of concern. As stated in the report for 1943, it is evident that provision must be made for larger escapements if the run to this area is to be maintained. Unless exceptionally favourable conditions prevail for the period of the life-history of the product of the 1944 spawning, the returns of adult salmon in 1948 and 1949 will be small. Obviously if the same fishing intensity is maintained the stock of this cycle will have little chance of recovery. Two further points may be mentioned: In the first place, since the fish mature at four and five years of age, reduction of the stock in 1944 will affect the returns in 1948 and 1949 and subsequently in 1952, 1953, and 1954. In the second place, if reduction of stock occurs in two successive years, the subsequent results are doubly effective in certain years. For example, the effects of poor returns in 1943 and 1944 will be superimposed in 1948 when both the four- and five-year-old fish will be involved, and again in 1952 and 1953. The importance of maintaining a "margin of safety" is evident.

The Skeena River produced a run of medium size as was expected. As stated in the report for 1943, the Fisheries Research Board of Canada has commenced an investigation of the causes of the fluctuation in abundance of sockeye salmon in this river and the results should be of fundamental importance in relation to maintaining a highly productive fishery.

The returns to the Nass River still remain unpredictable. The return in 1944 was evidently not particularly large and, as will be referred to later, was characterized by an exceptionally large percentage of six-year-old fish.

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 migrated 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 are:—

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

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

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

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

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

1. THE RIVERS INLET SOCKEYE RUN OF 1944.

(1.) General Characteristics.

The pack of sockeye salmon at Rivers Inlet in 1944 was 36,852 cases. The run consisted of 76 per cent. of four-year-old fish, thus fulfilling the prediction made in last year's report, and the unusual predominance of five-year-old fish, as it occurred in 1942 and 1943, has not been continued. However, the return to this spawning area was exceptionally small; in fact, it produced the smallest pack on record with an accompanying "light" escapement. An explanation of this occurrence cannot be made at the present time.

The return in 1945 will be the result of the spawnings in 1940 and 1941. In the former year the pack was 63,469 cases, the run was comprised of 69 per cent. of four-year-old fish and the escapement was reported as large. In 1941, the pack was 93,378 cases, consisting of 59 per cent. of four-year-old fish and the spawning-beds were reported as well "seeded." There should be a fairly good return in 1945 of both four- and five-year-old fish.

(2.) Age-groups.

The data for this year's study are obtained from twenty-eight random samplings of the commercial catch from June 26th to August 3rd, inclusive, representing 1,732 fish. The 4_2 age-group is represented by 1,315 individuals forming 76 per cent. While this percentage is high, it is not unusually so. The thirty-year average (1912 to 1941, inclusive) is 51 per cent. while the ten-year average (1932 to 1941, inclusive) is 58 per cent. The years 1942 and 1943 are excluded in the above calculations because the runs of those years have exceptionally low representations of four-year-old fish, namely 8 per cent. The 5_2 age-group is represented by 402 fish or 23 per cent.; the 5_3 age-group by 13 fish or 1 per cent.; the 6_3 age-group by 2 individuals; and the 6_2 age-group by 2 individuals. The latter two fish are not included in the calculations (Table I.).

(3.) Lengths and Weights.

The average lengths of the males and females of the 4_2 age-group are 21.1 and 21 inches respectively and of the 5_2 age-group 23.5 and 23.3 inches respectively. The average weights of the males and females of the 4_2 age-group are 4.6 and 4.4 lb. and of the 5_2 age-group 6.2 and 6 lb. respectively. The average lengths and weights of the 4_2 fish are close to the averages of the past years of record, but both the average lengths and weights of the 5_2 fish are considerably below the averages of the past years of record (Tables IV. and V.).

The detailed information concerning the distribution of the lengths and weights in 1944 is given in Tables II. and III.

Two individuals of the 6_2 age-group occur, both males, 26 and 28½ inches in length and 9 and 11½ lb. in weight respectively. These fish are not included in the calculations.

(4.) Distribution of the Sexes.

The total number of males in the samplings is 1,019 and of females 715, percentages of 59 and 41 respectively. As may be noted in Table VI., females were considerably in excess in 1942 and 1943. In the 4_2 age-group the males predominate with a percentage of 67, while in the 5_2 age-group the females predominate with a percentage of 67.

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

Year.	Percentage of Individuals.			
	4_2	5_2	5_3	6_3
1907 (87,874 cases)	----	----	----	----
1908 (64,652 cases)	----	----	----	----
1909 (89,027 cases)	----	----	----	----
1910 (126,921 cases)	----	----	----	----
1911 (88,763 cases)	----	----	----	----
1912 (112,884 cases)	21	79	----	----
1913 (61,745 cases)	80	20	----	----
1914 (89,890 cases)	35	65	----	----
1915 (130,350 cases)	13	87	----	----
1916 (44,936 cases)	26	74	----	----
1917 (61,195 cases)	39	61	----	----
1918 (53,401 cases)	57	43	----	----
1919 (56,258 cases)	46	54	----	----
1920 (121,254 cases)	5	95	----	----
1921 (46,300 cases)	49	51	----	----
1922 (60,700 cases)	81	18	1	----
1923 (107,174 cases)	74	24	2	----
1924 (94,891 cases)	43	54	2	1
1925 (159,554 cases)	23	77	----	----
1926 (65,581 cases)	59	38	2	1
1927 (64,461 cases)	81	16	3	----
1928 (60,044 cases)	55	40	4	1
1929 (70,260 cases)	77	18	3	2
1930 (119,170 cases)	49	48	2	1
1931 (76,428 cases)	53	44	2	1
1932 (69,732 cases)	67	27	5	1
1933 (83,507 cases)	44	55	1	----
1934 (76,923 cases)	77	20	2	1
1935 (135,038 cases)	57	41	1	1
1936 (46,351 cases)	53	46	1	----
1937 (84,832 cases)	60	37	2	----
1938 (87,942 cases)	27	70	1	2
1939 (54,143 cases)	67	32	1	----
1940 (63,469 cases)	69	28	3	----
1941 (93,378 cases)	59	40	1	----
1942 (79,199 cases)	8	91	----	1
1943 (47,602 cases)	8	91	----	1
1944 (36,852 cases)	76	23	1	----

Table II.—Rivers Inlet Sockeyes, 1944, 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.	
17	1	-----	-----	-----	-----	-----	-----	-----	1
18	1	-----	-----	-----	-----	-----	-----	-----	1
18½	8	3	-----	-----	-----	-----	-----	-----	11
19	56	4	-----	-----	1	-----	-----	-----	61
19½	100	35	-----	-----	1	-----	-----	-----	136
20	144	63	-----	-----	1	-----	-----	-----	208
20½	118	73	1	1	1	-----	-----	-----	194
21	79	84	3	5	-----	1	-----	-----	172
21½	84	64	8	15	1	1	-----	-----	173
22	94	60	16	33	1	2	-----	-----	206
22½	66	30	20	41	-----	-----	-----	-----	157
23	56	17	24	35	-----	1	-----	-----	133
23½	32	5	12	44	-----	2	-----	-----	95
24	20	-----	14	34	-----	-----	-----	-----	68
24½	10	1	8	28	-----	-----	-----	1	48
25	5	-----	11	19	-----	-----	-----	-----	35
25½	2	-----	2	9	-----	-----	1	-----	14
26	-----	-----	8	2	-----	-----	-----	-----	10
26½	-----	-----	4	2	-----	-----	-----	-----	6
27	-----	-----	2	-----	-----	-----	-----	-----	2
27½	-----	-----	1	-----	-----	-----	-----	-----	1
Totals	876	439	134	268	6	7	1	1	1,732
Average lengths	21.1	21.0	23.5	23.3	20.4	22.4	25.5	24.5	-------

Table III.—Rivers Inlet Sockeyes, 1944, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
2	1	-----	-----	-----	-----	-----	-----	-----	1
3	22	5	-----	-----	1	-----	-----	-----	28
3½	167	73	-----	-----	1	-----	-----	-----	241
4	205	113	4	9	2	-----	-----	-----	333
4½	141	110	5	27	1	1	-----	-----	285
5	123	84	26	36	-----	3	-----	-----	272
5½	86	41	26	56	1	2	-----	-----	212
6	80	10	24	45	-----	1	-----	-----	160
6½	21	-----	12	32	-----	-----	-----	-----	65
7	21	2	5	27	-----	-----	-----	1	56
7½	7	1	11	19	-----	-----	-----	-----	38
8	2	-----	5	11	-----	-----	-----	-----	18
8½	-----	-----	7	3	-----	-----	1	-----	11
9	-----	-----	4	3	-----	-----	-----	-----	7
9½	-----	-----	1	-----	-----	-----	-----	-----	1
10	-----	-----	4	-----	-----	-----	-----	-----	4
Totals	876	439	134	268	6	7	1	1	1,732
Average weights	4.6	4.4	6.2	6.0	4.1	5.2	8.5	7.0	-------

Table IV.—Rivers Inlet Sockeyes, Average Lengths in Inches of the 4_2 and 5_2 Groups, 1912 to 1944.

Year.	4_2		5_2	
	M.	F.	M.	F.
1912–41	22.4	22.4	25.4	24.7
1912–41 (conversion)	21.6	21.6	24.6	23.9
1942	21.9	21.3	25.0	23.8
1943	20.5	21.1	24.3	23.7
1944	21.1	21.0	23.5	23.3

Table V.—Rivers Inlet Sockeyes, Average Weights in Pounds of the 4_2 and 5_2 Groups, 1914 to 1944.

Year.	4_2		5_2	
	M.	F.	M.	F.
1914–41	4.9	4.8	7.0	6.5
1942	5.1	4.6	7.2	6.4
1943	4.1	4.4	6.8	6.3
1944	4.6	4.4	6.2	6.0

Table VI.—Rivers Inlet Sockeyes, Percentages of Males and Females, 1915 to 1944.

Year.	4_2		5_2		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.		
1915–41 (average)	63	37	34	66	50	50
1942	61	39	35	65	38	62
1943	62	38	34	66	36	64
1944	67	33	33	67	59	41

2. THE SKEENA RIVER SOCKEYE RUN OF 1944.

(1.) General Characteristics.

The Skeena River sockeye salmon produced a pack of 68,197 cases. While this may be considered as a pack of medium size, the escapement to the spawning-grounds was reported as good and would seem to indicate a reasonable balance as between catch and escapement.

The return in 1945 will be the product of the 1940 and 1941 spawnings. In the former year the pack was 116,507 cases and the escapement was reported as large. In the latter year the pack was 81,767 cases and the escapement described as satisfactory. There is every reason to expect a fairly large return in 1945.

(2.) Age-groups.

The length, weight, and sex data and scale collections were obtained from 2,154 fish in forty random samplings from June 26th to August 18th, inclusive. The 4_2 age-group is represented by 798 individuals or 37 per cent., the 5_2 by 1,124 or 52 per cent.,

the 5_3 by 140 or 7 per cent., and the 6_3 by 92 or 4 per cent. The distribution of the age-classes is not unusual, as may be seen by reference to Table VII.

(3.) Lengths and Weights.

The average lengths of the males and females in the various age-groups are as follows: 4_2, 22.4 and 21.7 inches; 5_2, 24.8 and 23.9 inches; 5_3, 22.5 and 21.7 inches; 6_3, 25 and 23.7 inches. The above lengths are all slightly less than averages of the past years of record and except in the case of the males of the 4_2 age-class are less than those of 1943 (Table X.).

The average weights of the males and females in the various age-groups are as follows: 4_2, 5.1 and 4.6 lb.; 5_2, 7 and 6.1 lb.; 5_3, 5.3 and 4.6 lb.; 6_3, 7.1 and 5.8 lb. The above weights are essentially equivalent to those of past years of record, except that the average weight of 7 lb. for the males in the 5_2 age-class is above the average (Table XI.).

The distributions of the lengths and weights are given in Tables VIII. and IX.

(4.) Distribution of the Sexes.

The total number of males in the samplings is 923 and of females 1,231, percentages of 43 and 57 respectively, which very closely approximate the proportions of the sexes over the past twenty-nine years of record. The percentage of males in the 4_2 age-group is 54, which is slightly above the average of the past years of record. The females predominate in the 5_2 age-group with a percentage of 66, which is essentially the average of the past years of record (Table XII.).

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

Year.	Percentage of Individuals.			
	4_2	5_2	5_3	6_3
1907 (108,413 cases)	----	----	----	----
1908 (139,846 cases)	----	----	----	----
1909 (87,901 cases)	----	----	----	----
1910 (187,246 cases)	----	----	----	----
1911 (131,066 cases)	----	----	----	----
1912 (92,498 cases)	57	43	----	----
1913 (52,927 cases)	50	50	----	----
1914 (130,166 cases)	25	75	----	----
1915 (116,553 cases)	36	64	----	----
1916 (60,923 cases)	34	38	13	18
1917 (65,760 cases)	57	29	9	5
1918 (123,322 cases)	51	34	9	6
1919 (184,945 cases)	27	60	9	4
1920 (90,869 cases)	15	71	6	8
1921 (41,018 cases)	69	22	6	3
1922 (96,277 cases)	70	16	12	2
1923 (131,731 cases)	56	29	8	7
1924 (144,747 cases)	23	69	7	1
1925 (77,784 cases)	51	45	3	1
1926 (82,360 cases)	62	26	9	3
1927 (83,996 cases)	62	28	9	1
1928 (34,559 cases)	51	39	7	3
1929 (78,017 cases)	62	30	6	2
1930 (132,372 cases)	39	52	8	1
1931 (93,023 cases)	40	30	28	2
1932 (59,916 cases)	44	37	7	12
1933 (30,506 cases)	57	36	5	2
1934 (54,558 cases)	58	34	7	1
1935 (52,879 cases)	49	31	18	2
1936 (81,973 cases)	67	20	11	2
1937 (42,491 cases)	45	40	11	4
1938 (47,257 cases)	64	15	16	5
1939 (68,485 cases)	50	35	11	4
1940 (116,507 cases)	80	15	4	1
1941 (81,767 cases)	39	52	8	1
1942 (34,544 cases)	36	54	7	3
1943 (28,268 cases)	39	39	16	6
1944 (68,197 cases)	37	52	7	4

Table VIII.—Skeena River Sockeyes, 1944, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
18½	1	.....	.....	.....	.....	.....	.....	.....	1
19	2	1	.....	.....	.....	.....	.....	.....	3
19½	3	.....	.....	.....	.....	.....	.....	.....	3
20	13	11	.....	.....	1	.....	.....	.....	25
20½	18	22	.....	.....	2	8	.....	.....	50
21	25	58	.....	1	2	18	.....	.....	104
21½	34	111	2	3	4	23	.....	.....	177
22	84	73	5	11	20	11	.....	.....	204
22½	79	53	6	46	10	6	.....	4	204
23	80	30	18	118	11	4	.....	12	273
23½	64	7	28	156	7	3	3	4	272
24	22	4	36	174	4	2	5	12	259
24½	2	.....	66	133	1	.....	14	2	218
25	1	.....	85	66	2	.....	16	2	172
25½	.....	.....	72	26	.....	1	9	2	110
26	.....	.....	36	10	.....	.....	2	1	49
26½	.....	.....	14	1	.....	.....	.....	.....	15
27	.....	.....	7	1	.....	.....	2	.....	10
27½	.....	.....	2	.....	.....	.....	1	.....	3
28½	.....	.....	1	.....	.....	.....	1	.....	2
Totals	428	370	378	746	64	76	53	39	2,154
Average lengths	22.4	21.7	24.8	23.9	22.5	21.7	25.0	23.7	.....

Table IX.—Skeena River Sockeyes, 1944, 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	2	2	.....	.....	.....	.....	.....	.....	4
3½	16	12	1	.....	.....	3	.....	.....	32
4	47	92	.....	2	5	21	.....	.....	167
4½	65	126	8	24	9	31	.....	.....	263
5	119	91	14	103	19	11	.....	11	368
5½	93	36	23	143	16	5	4	9	329
6	56	9	49	165	8	2	4	12	305
6½	26	2	64	142	4	2	12	1	253
7	4	.....	61	96	1	.....	15	3	180
7½	.....	.....	66	44	2	1	13	2	128
8	.....	.....	44	21	.....	.....	2	1	68
8½	.....	.....	21	5	.....	.....	.....	.....	26
9	.....	.....	18	1	.....	.....	.....	.....	19
9½	.....	.....	4	.....	.....	.....	1	.....	5
10	.....	.....	1	.....	.....	.....	2	.....	3
10½	.....	.....	3	.....	.....	.....	.....	.....	3
11	.....	.....	1	.....	.....	.....	.....	.....	1
Totals	428	370	378	746	64	76	53	39	2,154
Average weights	5.1	4.6	7.0	6.1	5.3	4.6	7.1	5.8	.....

Table X.—Skeena River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1944.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912–41	23.7	23.1	25.8	24.9	24.2	23.4	25.8	24.8
1912–41 (conversion)	23.0	22.4	25.1	24.2	23.5	22.7	25.1	24.1
1942	22.6	22.3	25.2	24.3	24.1	23.7	26.3	24.9
1943	21.9	21.9	25.1	23.9	23.3	22.6	25.8	24.7
1944	22.4	21.7	24.8	23.9	22.5	21.7	25.0	23.7

Table XI.—Skeena River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1944.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1914–41	5.4	5.0	6.8	6.1	5.7	5.1	6.8	6.0
1942	4.9	4.7	6.7	6.0	5.8	5.4	7.2	6.6
1943	4.7	4.6	6.8	5.9	5.5	4.9	7.3	6.1
1944	5.1	4.6	7.0	6.1	5.3	4.6	7.1	5.8

Table XII.—Skeena River Sockeyes, Percentages of Males and Females, 1915 to 1944.

Year.	4_2		5_2		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.		
1915–41 (average)	48	52	43	57	46	54
1942	42	58	25	75	33	67
1943	50	50	31	69	43	57
1944	54	46	34	66	43	57

3. THE NASS RIVER SOCKEYE RUN OF 1944.

(1.) General Characteristics.

The sockeye salmon proceeding to the Nass River produced a pack of 13,083 cases. The small catch may have been due in part to less intensive fishing, but the run was evidently relatively small since the report on the spawning-beds does not refer to a particularly large escapement.

The return in 1945 will be derived largely from the 1940 and 1941 brood-years. In the former year the pack was 13,809 cases and the escapement was medium to light. In the latter year the pack was 24,876 cases and escapement was reported as heavy. Since 1941 will produce the four-year-old fish which form a small percentage of the Nass run, there would appear to be little prospect of a large return to this river in 1945.

(2.) Age-groups.

The material for the 1944 study consists of data for 1,522 fish obtained in thirty-seven random samplings from June 26th to August 18th, inclusive. The representation of the various age-classes is as follows: 4_2, 225 or 15 per cent.; 5_2, 235 or 15 per cent.; 5_3, 490 or 32 per cent.; 6_3, 572 or 38 per cent. The very exceptional feature is the

occurrence of the large percentage of six-year-old fish. The highest percentage previously recorded was 15 in 1943. The observation of the Inspector that the run consisted of 75 per cent. large fish is supported by the analysis of the sampling (Table XIII.).

(3.) Lengths and Weights.

The average lengths of the males and females in the four year-classes are approximately equivalent to the averages of previous years of record as shown in Table XVI.

On the other hand, the average weights of the males and females in the 5_2, 5_3, and 6_3 age-classes are all slightly greater than the averages of the past years of record (Table XVII.).

The distributions of the lengths and weights are given in Tables XIV. and XV.

One fish of 7_3 age-class occurs in the sampling. It is a male, 28 inches in length and 9½ lb. in weight.

(4.) Distribution of the Sexes.

The total number of males in the samplings is 762 and of females 760, a percentage of 50 in each case. The males predominate in the 4_2 and 6_3 age-classes with percentages of 53 and 60 respectively, whereas the females are in excess in the 5_2 and 5_3 age-classes with percentages of 55 and 61 respectively (Table XVIII.).

Table XIII.—Nass River Sockeyes, Percentages of Principal Age-groups from 1912 to 1944 and Packs.

Year.	Percentage of Individuals.			
	4_2	5_2	5_3	6_3
1912 (36,037 cases)	8	27	63	2
1913 (23,574 cases)	15	12	71	2
1914 (31,327 cases)	4	41	45	10
1915 (39,349 cases)	19	14	59	8
1916 (31,411 cases)	9	17	66	8
1917 (22,188 cases)	10	15	71	4
1918 (21,816 cases)	30	16	45	9
1919 (28,259 cases)	7	22	65	6
1920 (16,740 cases)	8	14	72	6
1921 (9,364 cases)	10	7	75	8
1922 (31,277 cases)	6	2	91	1
1923 (17,821 cases)	11	6	77	6
1924 (33,590 cases)	4	3	91	2
1925 (18,945 cases)	23	8	67	2
1926 (15,929 cases)	12	12	63	13
1927 (12,026 cases)	8	7	81	4
1928 (5,540 cases)	30	6	61	3
1929 (16,077 cases)	25	9	60	6
1930 (26,405 cases)	28	15	54	3
1931 (16,929 cases)	10	17	67	6
1932 (14,154 cases)	28	4	61	7
1933 (9,757 cases)	35	7	55	3
1934 (36,242 cases)	13	9	74	4
1935 (12,712 cases)	11	10	73	6
1936 (28,562 cases)	16	7	67	10
1937 (17,567 cases)	22	4	68	6
1938 (21,462 cases)	21	4	70	5
1939 (24,357 cases)	14	13	66	7
1940 (13,809 cases)	23	8	59	10
1941 (24,876 cases)	37	7	52	4
1942 (21,085 cases)	22	7	66	5
1943 (13,412 cases)	5	13	67	15
1944 (13,083 cases)	15	15	32	38

Table XIV.—Nass River Sockeyes, 1944, 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
20	1	.....	.....	.....	.....	.....	.....	.....	1
20½	1	.....	.....	.....	.....	.....	.....	.....	1
21	2	4	.....	.....	.....	.....	.....	.....	6
21½	3	8	.....	.....	.....	2	.....	.....	13
22	2	11	.....	1	2	11	.....	.....	27
22½	14	27	.....	1	6	26	.....	1	75
23	14	30	.....	8	11	36	.....	1	100
23½	32	18	4	13	14	57	1	3	142
24	26	6	3	30	23	71	1	14	174
24½	18	.....	9	27	25	54	4	25	162
25	3	1	17	20	33	29	22	42	167
25½	3	.....	24	17	39	7	33	29	152
26	.....	.....	23	5	28	3	49	27	135
26½	.....	.....	15	3	7	2	43	31	101
27	.....	.....	8	1	1	.....	49	26	85
27½	.....	.....	2	2	2	.....	69	22	97
28	.....	.....	.....	1	1	.....	46	6	54
28½	.....	.....	.....	.....	.....	.....	19	1	20
29	.....	.....	1	.....	.....	.....	6	.....	7
29½	.....	.....	.....	.....	.....	.....	2	.....	2
Totals	120	105	106	129	192	298	344	228	1,522
Average lengths	23.5	22.7	25.7	24.6	24.8	23.8	26.8	25.8	.....

Table XV.—Nass River Sockeyes, 1944, 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	2	.....	.....	.....	.....	.....	.....	.....	2
4	1	5	.....	.....	.....	2	.....	.....	8
4½	8	28	.....	.....	4	20	1	1	62
5	14	32	.....	5	11	57	1	1	121
5½	25	33	3	17	17	77	.....	8	180
6	46	5	4	25	22	72	8	39	221
6½	16	2	11	40	49	47	19	39	223
7	6	.....	19	24	42	19	27	39	176
7½	1	.....	19	12	25	3	62	33	155
8	.....	.....	25	4	17	1	54	39	140
8½	.....	.....	13	1	3	.....	71	25	113
9	.....	.....	8	1	2	.....	42	4	57
9½	.....	.....	2	.....	.....	.....	33	.....	35
10	.....	.....	1	.....	.....	.....	19	.....	20
10½	.....	.....	.....	.....	.....	.....	5	.....	5
11	.....	.....	.....	.....	.....	.....	1	.....	1
11½	.....	.....	.....	.....	.....	.....	1	.....	1
12	.....	.....	1	.....	.....	.....	.....	.....	1
Totals	120	105	106	129	192	298	344	228	1,522
Average weights	5.7	5.0	7.7	6.5	6.7	5.7	8.2	7.1	.....

Table XVI.—Nass River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1944.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912–41	24.5	23.7	26.3	25.2	26.1	25.3	27.7	26.4
1912–41 (conversion)	23.8	23.0	25.6	24.5	25.4	24.6	27.0	25.7
1942	23.9	23.2	26.1	24.9	24.9	24.3	26.9	26.0
1943	22.8	22.2	26.1	24.8	24.1	23.5	27.1	25.8
1944	23.5	22.7	25.7	24.6	24.8	23.8	26.8	25.8

Table XVII.—Nass River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1944.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1914–41	6.0	5.4	7.3	6.4	6.9	6.2	8.0	7.0
1942	5.8	5.1	7.1	6.3	6.2	5.6	7.5	6.7
1943	5.2	4.7	7.6	6.4	5.9	5.3	7.9	6.9
1944	5.7	5.0	7.7	6.5	6.7	5.7	8.2	7.1

Table XVIII.—Nass River Sockeyes, Percentages of Males and Females, 1915 to 1944.

Year.	4_2		5_2		5_3		6_3		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.	M.	F.	M.	F.		
1915–41 (average)	49	52	47	53	45	55	63	37	47	53
1942	42	58	48	52	44	56	70	30	45	55
1943	51	49	67	33	47	53	74	26	54	46
1944	53	47	45	55	39	61	60	40	50	50

REPORT ON PILCHARD-TAG RECOVERY, 1944–45.

By John Lawson Hart, Ph.D., Pacific Biological Station, Nanaimo.

The tagging of pilchards and sardines has been discontinued for some time throughout the North-east Pacific. However, as might be expected, recoveries continue to be made on tags put out in earlier years. For the co-operation required to make these recoveries acknowledgment is made to reduction plant crews and to the accommodation of the operating companies.

This account reports the recovery of twenty-six tags, as follows:—

Canadian tags, put out off the mouth of the Columbia River and Grays Harbour in 1940 and recovered off San Francisco, considered as being out five years	2
Oregon tags recovered in British Columbia	4
California tags recovered in British Columbia	20

Data presented previously (Hart, 1944) show that from the first to fourth years after tagging the number of recoveries of Canadian tags falls off each year to about 30 per cent. of the number taken in the earlier year. As only one recovery was made four years after tagging less than one tag (0.3) would be expected five years after tagging if the rates of decline remained constant. Actually three tags were recovered (two reported herein). The numbers involved are so small that there can be no certainty that the difference between expectation and observation is biologically significant, but the discrepancy arouses special interest as to whether further recoveries will be made in the future.

REFERENCE.

Hart, J. L. Pilchard-tagging and pilchard-tag recovery from 1936 to 1943. Report, British Columbia Fisheries Department, 1943, 43–52, 1944.

TAGGING OF HERRING (*CLUPEA PALLASII*) IN BRITISH COLUMBIA: INSERTIONS AND RECOVERIES DURING 1944–45.

By Albert L. Tester, Ph.D., Pacific Biological Station, Nanaimo, B.C.

CONTENTS.

	Page.
Introduction	45
Tagging	45
Tags	46
Recovery methods	48
Detector recoveries	50
Magnet recoveries	52
Stability of populations and movements	57
Major areas	57
West coast of Vancouver Island	58
South-east coast of Vancouver Island and Discovery Passage	58
Queen Charlotte Strait	58
Central coast-line	58
Mortality rate	59
Summary of results	59
Acknowledgments	61
Detailed list of tags used in 1944–45	62

INTRODUCTION.

This is the ninth in a series of reports giving annual results of a herring-tagging and tag-recovery programme which is designed (1) to add to the general knowledge of the life-history of herring in British Columbia waters, (2) to determine the extent of herring movements, and (3) to determine the strength of the tendency for herring to form local populations. In addition, it is hoped that some information will be obtained on the rates of exploitation of the populations supplying the various fishing-grounds.

Reference may be made to former publications for details of methods of tagging and recovery and for previous results which have been obtained over the period 1936–37 to 1943–44. (Hart and Tester, 1937, 1938, 1939, and 1940; Hart, Tester, and McHugh, 1941; Hart, Tester, and Boughton, 1942; Tester and Boughton, 1943; and Tester, 1944.)

TAGGING.

Methods of tagging in 1944–45 were similar to those of other years. Fish were obtained during the fishing season from a salmon-trap and during the spawning season by means of beach-seines and bait-purse seines, as indicated in Table I. Once caught, they were held (sometimes overnight, or longer) in either a bait-box constructed of wooden slats or in a collapsible bait-pound constructed of web fastened to a rectangular float. The usual practice has been to release the fish one by one into the sea as they are tagged. In one case (9B), however, part of the tagged fish were released into a live-well aboard a gas-boat and were later liberated as a group over deep water to avoid loss from gulls and divers.

Since 1941–42 the policy has been (1) to curtail tagging during the fall and winter fishing season, (2) to concentrate the spring tagging in two major areas, the Strait

of Georgia and Queen Charlotte Strait, but with some tagging in adjacent major areas as time warranted, and (3) to use a relatively large number of tags (about 3,000) in each individual tagging.

Conforming with the above policy, the only tagging during the 1944–45 fishing season was at Sooke (9A), a locality removed from the fishing areas of the south-east coast of Vancouver Island, but on the route of fish migrating to those areas. Compared with previous years, spring tagging effort was somewhat curtailed in the Strait of Georgia where five large taggings were made, three along the south-east coast of Vancouver Island (9B, 9C, and 9D), one along the west coast of the mainland (9E), and one in Discovery Passage (9F). Concentrated effort in the Queen Charlotte Strait area resulted in four large taggings, three (9G, 9I, and 9J) on the outside and one (9H) on the inside of Gilford Island. Departing from the policy of former years, the programme included extensive tagging operations in the Central area and resulted in seven taggings (9K to 9Q) spaced at intervals along the coast-line from Smith Inlet to Principe Channel. Four of these—namely, Takush Harbour (9K), Racey Inlet (9O), Union Passage (9P), and Anger Island (9Q)—were in spawning localities where taggings had not previously been made. Lack of time prohibited trips to either the Northern area or to the west coast of Vancouver Island.

Summarized data on the 1944–45 taggings are given in Table I., along with similar data for other taggings which produced returns in 1944–45. Tagging localities are shown on the accompanying map. Detailed data on the 1944–45 taggings, including code letters or numbers for use in identifying recoveries, are included in Table VII., which is placed at the end of this report for ready reference.

The number of tags used according to season and area for the past five years is shown in the following recapitulation (*see* previous reports for earlier data):—

Locality.	Number of Tags used in each Year.				
	1940–41.	1941–42.	1942–43.	1943–44.	1944–45.
Fall and Winter.					
Strait of Juan de Fuca	.....	496	697	.....	1,409
South-east Coast of Vancouver Island	1,197	.....	.....	.....	.....
Spring.					
Strait of Georgia (including Puget Sound and north to Nodales Channel)	4,947	15,559	21,561	29,590	15,201
Queen Charlotte Strait and south to Nodales Channel	200	5,465	5,077	6,023	11,979
West Coast of Vancouver Island	9,759	.....	.....	4,220	.....
Central British Columbia	5,977	1,497	3,493	6,132	20,399
Northern British Columbia	2,491	.....	.....	.....	.....
Totals	24,571	23,017	30,828	45,965	48,988

TAGS.

Tags recently manufactured have not been identical with those used over the period 1936–37 to 1942–43 owing to a war-time shortage of material. Plating, average dimensions, and average weight of various shipments are shown in the following tabulation:—

Lot.	Type.	Plating.	Length.	Width.	Thickness.	Weight.
			Mm.	Mm.	Mm.	G.
1	A	Nickel	19.35	4.38	1.58	0.94
2	B	Silver	19.41	4.43	1.57	0.92
3	C	Silver	18.65	4.73	1.23	0.76
4	B	Silver	19.19	4.31	1.58	0.93
5	B	Silver	19.15	4.35	1.62	0.94

Table I.—Summary of the Tagging Data for Taggings producing Returns during the 1944–45 Fishing Season and for Tags inserted during the 1944–45 Fishing and the 1945 Spawning Season.

Tagging Code.	Date.	No. of Tags inserted.	Method of Capture of Fish.*	Place of Tagging.
4L	Mar. 17, 18, 1940	1,797	B.S.	Cutter Creek, near Minstrel Island.
4Q	Mar. 18, 1940	1,000	B.S.	Refuge Cove, Sydney Inlet.
5D	Mar. 8, 1941	975	B.S.	Hammond Bay.
5H	Mar. 21, 1941	200	D.N.	Kingcome Inlet, Thomas Point.
5N	Mar. 30, 1941	1,495	S.S.	Kwakshua Passage, Calvert Island.
5Q	Mar. 8, 9, 1941	1,200	B.S.	Kendrick Arm, Nootka Sound.
5U	Mar. 11, 1941	992	B.S.	Queens Cove, Esperanza Inlet.
5V	Mar. 12, 1941	1,192	B.S.	Clanninick Cove, Kyuquot Sound.
5W	Mar. 13, 1941	1,989	B.S.	Browning Inlet, Quatsino Sound.
5X	Mar. 14, 1941	998	B.S.	Bunsby Islands, Ououkinsh Inlet.
6L	Mar. 15, 1942	1,689	B.S.	Retreat Passage.
6M	Mar. 19, 1942	1,497	B.S.	McLaughlin Bay, Campbell Island.
6N	Mar. 28, 1942	2,000	B.S.	Clio Channel.
6O	Mar. 30, 1942	1,776	B.S.	Kingcome Inlet.
7B	Feb. 25, 26, 1943	1,892	B.S.	Ladysmith Harbour.
7C	Mar. 1, 3, 1943	2,997	B.S.	Shingle Point, Valdes Island.
7G	Mar. 29, 1943	2,989	B.S.	Deserted Bay, Jervis Inlet.
7I	Apr. 11, 1943	1,693	B.S.	Union Bay, Baynes Sound.
7J	Mar. 17, 18, 1943	2,989	S.S.	Deepwater Bay, Discovery Passage.
7K	Mar. 22, 1943	1,000	B.P.	Bend Island, Clio Channel.
7L	Mar. 28, 1943	1,099	B.P.	Retreat Passage, Shoal Harbour.
7M	Mar. 31, 1943	3,493	B.S.	Gunboat Passage.
7N	Apr. 5, 1943	2,978	B.S.	Chatham Channel.
8B	Feb. 24, 25, 1944	3,017	B.S.	Departure Bay.
8D	Mar. 2, 3, 1944	3,830	B.S.	Skuttle Bay, near Sliammon.
8E	Mar. 7, 1944	1,178	B.S.	Horswell Point, Departure Bay.
8G	Mar. 12–15, 1944	5,021	B.S.	Kuper Island, near Clam Bay Spit.
8I	Mar. 31, 1944	3,999	B.S.	Deepwater Bay, Discovery Passage.
8J	Mar. 6, 1944	2,997	C.B.S.	Retreat Passage.
8K	Mar. 27, 1944	3,026	B.S.	Retreat Passage, Shoal Harbour.
8L	Mar. 18, 1944	3,121	B.P.	Rivers Inlet, head.
8M	Mar. 20, 1944	3,011	B.S.	Gunboat Passage.
8N	Mar. 26, 27, 1944	4,220	B.S.	Matilda Inlet, Clayoquot Sound.
9A	Oct. 10, 1944	1,409	S.T.	Sooke, Strait of Juan de Fuca.
9B	Feb. 17, 1945	1,934	S.S.	Ladysmith Harbour.
9C	Mar. 10, 11, 12, 1945	3,555	B.S.	Departure Bay.
9D	Mar. 13, 1945	3,227	B.S.	Selby Creek, Prevost Island.
9E	Mar. 15, 1945	3,166	B.S.	Skuttle Bay, north of.
9F	Apr. 3, 4, 1945	3,319	B.S.	Deepwater Bay, Discovery Passage.
9G	Mar. 19, 20, 1945	3,155	B.S.	Viner Sound.
9H	Mar. 22, 1945	3,177	B.S.	Cutter Creek.
9I	Mar. 9, 12, 1945	2,754	S.S.	Retreat Passage.
9J	Mar. 7, 14, 15, 1945	2,893	C.B.S., S.S.	Cramer Passage.
9K	Mar. 26, 1945	3,172	S.S.	Takush Harbour, Angle Inlet.
9L	Apr. 1, 1945	1,895	B.S.	Brown Narrows, Campbell Island.
9M	Mar. 20, 21, 1945	4,310	S.S.	Gunboat Passage.
9N	Mar. 25, 1945	3,450	B.S.	Parsons Anchorage, Laredo Sound.
9O	Mar. 26, 1945	1,523	B.S.	Racey Inlet, head.
9P	Mar. 30, 1945	3,010	B.S.	Union Passage, southerly entrance.
9Q	Mar. 27, 28, 1945	3,039	B.S.	Anger Island, Principe Channel.

* B.S.=bait-seine; S.S.=shore-seine; S.T.=salmon-traps; D.N.=dip-net; B.P.=bait-pound; C.B.S.=commercial bait-seine.

Type A represents the original tag used exclusively until, and to a small extent since, 1942–43. Type B, used for part of the taggings of 1943–44 and 1944–45, differs from Type A in that silver-plating rather than nickel-plating is used. The dimensions of the various lots of Types A and B may be considered identical, slight differences resulting from varying degrees of tumbling (to smooth the edges), except in Lot 5. In this, the tags are slightly shorter and thicker than in Lots 1, 3, and 4, but they are similar in weight. Type C, the entire supply of which was used up in some of the taggings of 1944–45, differs considerably from Types A and B in that it is shorter, wider, thinner, and lighter.

It is conceivable that recent results might not be strictly comparable with earlier results because of the change in type of tag. This change might produce a difference in tagging mortality or in recovery efficiency. The change from nickel- to silver-plated tags is investigated herewith.

Types A and B were both used in the 1943–44 tagging at Matilda Inlet (8N) and in the 1944–45 tagging at Sooke (9A) with the following results:—

Code.	Type of Tag.	Number recovered.	Number used.
8N	A (nickel-plated)	35	2,189
	B (silver-plated)	39	2,031
9A	A (nickel-plated)	22	391
	B (silver-plated)	54	1,018

Application of the Chi-square test to the data gives no significant association ($P = 0.4$ and 0.8 respectively) between relative number of recoveries and type of tag used. From these results it may be assumed that there is no significant difference in either tagging mortality rate or efficiency in recovery between the nickel-plated and silver-plated types.

The results for next year should indicate whether any differences have resulted from the temporary use of Type C (from a consideration of the 9N recoveries in which both Types B and C were used).

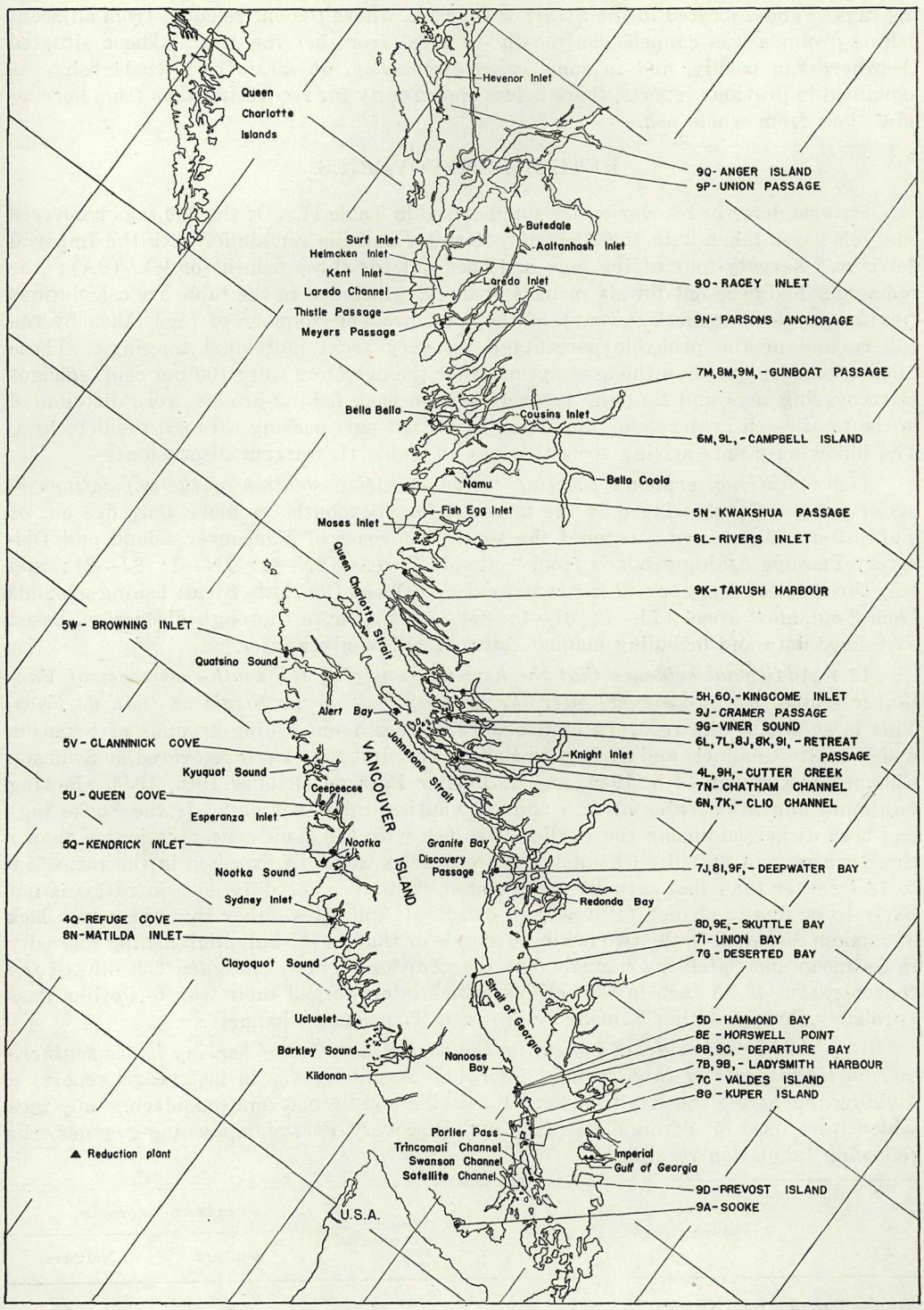
RECOVERY METHODS.

Recovery methods were similar to those of previous years in that induction detectors and magnets were used. The former recovers the tagged fish from a chute in the unloading system of canneries or reduction plants; the latter recovers the tag only, from the meal-line of reduction plants.

The detector used at the Imperial Cannery, Steveston, in 1943–44 was again in operation in 1944–45 with no changes in the installation. Apart from minor breakdowns, it operated successfully and continuously from October 5th, 1944, to December 14th, 1944, and ran efficiently on 87 per cent. of the fish entering the cannery.

The detector used at the Gulf of Georgia cannery in 1943–44 was not used in 1944–45 as there was no possibility of improving its unsatisfactory performance of the previous year.

In January, 1945, the detector earlier used at the Imperial Cannery was moved to the Alert Bay reduction plant, where changes in the unloading system had been made for its accommodation. The installation was similar to that at the Imperial Cannery (Tester, 1944, p. 56), the fish sliding down a chute, through a coil, and over a trap-door before entering the weighing-machine. Tests indicated a high efficiency in recovering tags. The detector operated on 82 per cent. of the fish entering the plant from January 19th, 1945, until it closed down on February 1st, 1945.


Queen Charlotte Islands
Hevenor Inlet
9Q- ANGER ISLAND
9P- UNION PASSAGE
Butedale
Surf Inlet
Aaltanhash Inlet
Helmcken Inlet
Kent Inlet
Laredo Inlet
9O- RACEY INLET
Laredo Channel
Thistle Passage
9N- PARSONS ANCHORAGE
Meyers Passage
7M,8M,9M,- GUNBOAT PASSAGE
Bella Bella
Cousins Inlet
6M,9L,- CAMPBELL ISLAND
Bella Coola
Namu
5N- KWAKSHUA PASSAGE
Fish Egg Inlet
Moses Inlet
8L- RIVERS INLET
Queen Charlotte Strait
9K- TAKUSH HARBOUR
5W - BROWNING INLET
Quatsino Sound
5H,6O,- KINGCOME INLET
9J- CRAMER PASSAGE
Alert Bay
9G- VINER SOUND
6L,7L,8J,8K,9I,- RETREAT PASSAGE
5V - CLANNINICK COVE
Knight Inlet
Kyuquot Sound
4L,9H,- CUTTER CREEK
7N- CHATHAM CHANNEL
5U - QUEEN COVE
Ceepeecee
6N,7K,- CLIO CHANNEL
Esperanza Inlet
Johnstone Strait
VANCOUVER ISLAND
5Q- KENDRICK INLET
Nootka
Granite Bay
Discovery Passage
7J,8I,9F,- DEEPWATER BAY
Nootka Sound
Sydney Inlet
Redonda Bay
4Q- REFUGE COVE
8N- MATILDA INLET
8D,9E,- SKUTTLE BAY
7I- UNION BAY
7G - DESERTED BAY
Clayoquot Sound
Strait of Georgia
Ucluelet
5D - HAMMOND BAY
8E - HORSWELL POINT
Barkley Sound
8B,9C,- DEPARTURE BAY
Nanoose Bay
7B,9B,- LADYSMITH HARBOUR
Kildonan
7C - VALDES ISLAND
8G - KUPER ISLAND
Porlier Pass
Trincomali Channel
Swanson Channel
Satellite Channel
Imperial
Gulf of Georgia
▲ Reduction plant
9D- PREVOST ISLAND
9A- SOOKE
U.S.A.

Magnets in the meal-lines of reduction plants were again instrumental in recovering tags. Those located in the Strait of Georgia, where the entire catch from adjacent fishing-grounds was canned, ran mostly on meal from herring offal. Those situated elsewhere ran mostly, and in some cases exclusively, on meal from whole fish. As explained in previous reports, there is less opportunity for recovering tags from herring offal than from whole fish.

DETECTOR RECOVERIES.

Data on detector recoveries are summarized in Table II. Of the 200 tags recovered one (8M) was taken with the Alert Bay detector and the remainder with the Imperial detector. Seventy-four of the tags had been out for three months or less (9A); the remainder had been out for six months or more. Included in the table are calculations (similar to those made last year) of the total probable number of tags taken by the fishery and of the probable percentage recovery from individual taggings. These calculations are based on the assumptions that the detectors were 100 per cent. efficient at recovering tags and that the recoveries from each fishing-ground were distributed in the total catch in the same proportion as in that part passing through the detectors. The following points arising from the data of Table II. warrant discussion:—

(1.) *Additional evidence pointing to the essential isolation of the populations in major areas.* Considering only the tags out for six months or more, only five out of eighty-four (6 per cent.) entered the south-east coast of Vancouver Island and Discovery Passage fishing-grounds from "outside" areas (8N—2; 7N—1; 8J—2); and only three out of forty-one (7 per cent.) entered Queen Charlotte Strait fishing-grounds from "outside" areas (7J—1; 8I—1; 8M—1). A more thorough discussion, based on refined data and including magnet returns, will be given later.

(2.) *Additional evidence that the herring supplying the south-east coast of Vancouver Island fishing-grounds enter the area by way of the Strait of Juan de Fuca.* This is shown by the recovery of Sooke (9A) tags from fishing-grounds at Swanson and Satellite Channels and at Porlier Pass. The first tags were recovered at Swanson Channel on October 14th, 1944, and at Porlier Pass on October 19th, 1944, showing minimum migration rates of 12.5 and 7.3 nautical miles per day. If the Sooke tags had been dispersed among the Porlier Pass fish with the same concentration as among the Swanson and Satellite Channels fish, recoveries would be expected in the ratio 55.6 to 18.4 rather than that actually encountered, 69 to 5. The difference in ratios is not likely to be due to chance (P less than 0.01). It indicates either that there was lack of random dispersal to the two fishing-grounds or that an initially high fishing intensity in Swanson and Satellite Channels plus the addition of new, untagged fish diluted the concentration of 9A tags in the schools, which later worked their way to Porlier Pass (probably through either Sansum Narrows or Trincomali Channel).

(3.) *Additional evidence indicating the partial isolation of herring in the southern and northern parts of the Strait of Georgia.* Assuming (as in last year's report) a dividing line across the strait between Parksville and Sechelt and considering only tags which were used on Strait of Georgia and Discovery Passage spawning-grounds, the following tabulation results:—

Fishing-grounds.	Number of Recoveries.	Per Cent. Recoveries.	
		Southern.	Northern.
Satellite Channel to Dodd Narrows	46	98	2
Deepwater Bay	33	----	100

Table II.—Actual Number of Tags (N) from Tonnage examined and Probable Total Number of Tags (T) from Tonnage caught at various Fishing-grounds during 1944–45; Detector Returns only.

Code.	Place and Time of Tagging.	Satellite and Swanson Channels.		Porlier Pass Vicinity.		Nanoose Bay.		Granite and Deepwater Bays.		Clio Channel Vicinity.		Head, Knight Inlet.		Laredo Sound Vicinity.		Total.		Number of Tags used.	Percentage Recovery.
		N.	T.	N.	T.	N.	T.	N.	T.	N.	T.	N.	T.	N.	T.	N.	T.		
9A	Sooke, October, 1944	69	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	74	.....	1,409	.....
8G	Kuper Island, March, 1944	32	125.3	5	31.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37	157.1	5,021	3.1
8F	Gabriola Island, March, 1944	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,174	.....
8A	Nanaimo Harbour, February, 1944	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,138	.....
8B	Departure Bay, February, 1944	2	7.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	7.8	3,017	0.3
8E	Horswell Point, March, 1944	1	3.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	3.9	1,178	0.3
8C	Comox Harbour, February, 1944	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,190	.....
8H	Bargain Harbour, April, 1944	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,043	.....
8D	Skuttle Bay, March, 1944	.....	.....	1	6.4	.....	.....	13	46.4	.....	.....	.....	.....	.....	.....	14	52.8	3,830	1.4
8I	Deepwater Bay, March, 1944	.....	.....	.....	.....	.....	.....	18	64.3	1	5.5	.....	.....	.....	.....	19	69.8	3,999	1.7
8J	Retreat Passage, March, 1944	1	3.9	.....	.....	.....	.....	1	3.6	9	49.8	.....	.....	.....	.....	11	57.3	2,997	1.9
8K	Retreat Passage, March, 1944	.....	.....	.....	.....	.....	.....	.....	.....	8	44.3	.....	.....	.....	.....	8	44.3	3,026	1.5
8L	Rivers Inlet, March, 1944	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,121	.....
8M	Gunboat Passage, March, 1944	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	25.2	1	25.2	3,011	0.8
8N	Matilda Inlet, March, 1944	2	7.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	7.8	4,220	0.2
7B	Ladysmith Harbour, February, 1943	4	15.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	15.7	1,892	0.8
7C	Valdes Island, March, 1943	1	3.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	3.9	2,997	0.1
7J	Deepwater Bay, March, 1943	.....	.....	.....	.....	.....	.....	2	7.1	1	5.5	.....	.....	.....	.....	3	12.6	2,989	0.4
7K	Clio Channel, March, 1943	.....	.....	.....	.....	.....	.....	.....	.....	2	11.1	.....	.....	.....	.....	2	11.1	1,000	1.1
7L	Retreat Passage, March, 1943	.....	.....	.....	.....	.....	.....	.....	.....	2	11.1	.....	.....	.....	.....	2	11.1	1,099	1.0
7N	Chatham Channel, April, 1943	.....	.....	.....	.....	.....	.....	1	3.6	14	77.5	.....	.....	.....	.....	15	81.1	2,978	2.7
6O	Kingcome Inlet, March, 1942	.....	.....	.....	.....	.....	.....	.....	.....	1	5.5	.....	.....	.....	.....	1	5.5	1,776	0.3
6L	Retreat Passage, March, 1942	.....	.....	.....	.....	.....	.....	.....	.....	1	5.5	.....	.....	.....	.....	1	5.5	1,689	0.3
6N	Clio Channel, March, 1942	.....	.....	.....	.....	.....	.....	.....	.....	1	5.5	.....	.....	.....	.....	1	5.5	2,000	0.3
6M	Campbell Island, March, 1942	.....	.....	.....	.....	.....	.....	.....	.....	1	5.5	.....	.....	.....	.....	1	5.5	1,497	0.4
	Totals	112	.....	11	.....	.....	.....	35	.....	41	.....	.....	.....	1	.....	200	.....	.....	.....
	Tonnage examined	6,486		2,141		121		1,344		686		214		1,394					
	Tonnage caught	25,400		13,600		500		4,800		3,800		4,100		35,100					

Unfortunately no tags were recovered from a small tonnage caught at Nanoose Bay, so that there was no opportunity of gaining more information on the enigmatical position of that locality in the above division (Tester, 1944, pp. 59–60).

(4.) *Lack of uniform recovery from the various Strait of Georgia taggings of 1944.* The largest recovery (3.1 per cent.) resulted from the Kuper Island tagging (8G). There were no recoveries from Gabriola Island (8F), Nanaimo Harbour (8A), Comox Harbour (8C), and Bargain Harbour (8H), and relatively few from Departure Bay (8B) and Horswell Point (8E). Fish from these taggings apparently failed to contribute to any great extent to south-east coast of Vancouver Island catches for reasons which are obscure. In the first three taggings (8F, 8A, and 8C) the fish were acting abnormally when caught. They were not actually spawning but were massed as a sluggish body along the shore (8F), under a dock (8A), and in shallow water behind a spit (8C). Possibly they were moribund and eventually died for reasons not connected with tagging, although they exhibited no symptoms of disease and there were no reports of unusual mortalities in any of the three localities during the 1944 spawning period. Possibly their numbers were drastically reduced by predation while in the sluggish condition. On the other hand, perhaps along with fish of the other taggings which produced few or no returns (8H, 8B, and 8E) they may have gone to some area not fished or they may have arrived in the fishing area for the most part after the close of the fishing season.

(5.) *Proof similar to that of previous years that fish from several spawning-grounds in the Queen Charlotte Strait area contribute to the Clio Channel fishery, and evidence that these do not necessarily contribute to the fishery at the head of Knight Inlet.* The latter point merits amplification. No Queen Charlotte Strait tags were recovered from 214 tons of fish from the upper reaches of Knight Inlet, whereas thirty-eight Queen Charlotte Strait tags were recovered from 686 tons of fish from the vicinity of Clio Channel. If the fish in the two localities had mixed freely the tags recovered in each would be expected to be divided in the ratio of 29 to 9 rather than 38 to 0. The difference between the expected and actual ratio is statistically significant (P less than 0.01). This indicates that the fish at the head of Knight Inlet may have to be regarded as a local population which is supplied by fish from spawning-grounds possibly well within the inlet itself on which taggings have not yet taken place.

MAGNET RECOVERIES.

The number of tags recovered from reduction plants, chiefly by means of electro-magnets, is shown in the following tabulation:—

Location of Plant.	Name of Plant.	Code.	Number of Recoveries.
West Coast of Vancouver Island	Kildonan	D	3
	Ucluelet	C	16
	Nootka	F	41
	Ceepeecee	E	26
Strait of Georgia	Imperial	A	2
	Gulf of Georgia	L	26
Queen Charlotte Strait	Alert Bay	K	58
Central Coast-line	Namu	B	62
	Butedale	H	21
Northern Coast-line	Port Edward	I	7
Total			262

For each tagging the recoveries are listed in Table III. according to plant making the recovery (in code), reported locality of recovery, certain or probable locality of recovery, and less-likely alternative locality of recovery (with remote alternative locali-

Table III.—List of the Tags recovered by Magnets in Reduction Plants according to Tagging, Plant, and Area of Recovery.

(The "certain or probable" area of recovery is that used in tables dealing with magnet recoveries which follow. For explanation, *see* text.)

Code.		No. of Tags.	Area of Recovery.		
Tagging.	Plant.		Reported.	Certain or Probable.	Alternatives.
4L	K	1	Serpentine Pass	Clio Channel	
4Q	E	1	? (In meal-line)	West Coast V.I.	(South-east Coast V.I.)
5D	K	1	Serpentine Pass	Clio Channel	
5H	K	1	Serpentine Pass	Clio Channel	
5N	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	B	1	Kent Inlet	Northern Central	Southern Central.
5Q	F	1	Sydney Inlet	Sydney Inlet	Barkley and Nootka Sounds; (Quatsino Sound).
5U	F	1	Esperanza Inlet	Esperanza Inlet	Clayoquot and Barkley Sounds; (Quatsino Sound).
	E	1	Esperanza Inlet	West Coast V.I.	(South-east Coast V.I.)
5V	F	1	Nootka Lighthouse	Nootka Sound	Clayoquot Sound and Esperanza Inlet; (Barkley and Quatsino Sounds).
5W	E	1	Esperanza Inlet	West Coast V.I.	(South-east Coast V.I.)
5X	D	1	? (In meal-line)	West Coast V.I. (Barkley or Clayoquot Sounds)	
6M	I	1	Laredo Channel	Northern Central	
	H	1	Surf Inlet	Northern Central	(Including Aaltanhash Inlet.)
	B	1	Meyers Pass	Central	
6N	L	3	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	K	1	Bones Bay	Clio Channel or Knight Inlet	
	K	1	Serpentine Pass	Clio Channel	
	K	1	Knight Inlet	Clio Channel or Knight Inlet	
6O	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	K	1	Knight Inlet	Clio Channel or Knight Inlet	
	K	1	Bones Bay	Clio Channel or Knight Inlet	
7G	L	1	Porlier Pass	?	South-east Coast V.I. or Discovery Passage.
7I	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
7K	K	1	Bones Bay	Clio Channel	(McKenzie Sound.)
	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	K	1	Laredo	?	Northern Central or Queen Charlotte Strait.

Table III.—List of the Tags recovered by Magnets in Reduction Plants according to Tagging, Plant, and Area of Recovery—Continued.

Code.		No. of Tags.	Area of Recovery.		
Tagging.	Plant.		Reported.	Certain or Probable.	Alternatives.
7L	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	K	1	Serpentine Pass	Clio Channel	
	K	2	Knight Inlet	Clio Channel or Knight Inlet	
7M	H	3	"Salmon offal"	1943–44, Kwakshua Passage	
	H	5	Surf Inlet	Northern Central	(Including Aaltanhash Inlet.)
	H	1	Meyers Pass	Northern Central	(Including Aaltanhash Inlet.)
	B	2	Kent Inlet	Central	
	B	2	Kent Inlet	Northern Central	Southern Central.
	B	2	Thistle Pass	Northern Central	Southern Central.
	B	1	Meyers Pass	Central	
	B	4	Bella Bella	Southern Central	Northern Central.
7N	L	1	Satellite Channel	?	Strait of Georgia or Queen Charlotte Strait.
	L	4	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	I	1	Helmcken Inlet	Northern Central	
	K	10	Serpentine Pass	Clio Channel	
	K	1	Bones Bay	Clio Channel	
	K	2	Knight Inlet	Clio Channel or Knight Inlet	
	K	2	Minstrel Island	Clio Channel or Knight Inlet	
	K	5	Bones Bay	Clio Channel	Knight Inlet; (McKenzie Sound).
8D	L	1	Deepwater Bay	Discovery Passage	South-east Coast V.I.
	L	1	Granite Bay	Discovery Passage	South-east Coast V.I.
	E	1	Esperanza Inlet	West Coast V.I.	(South-east Coast V.I.)
	B	1	Bella Bella	Southern Central	Northern Central.
8G	F	1	Sydney Inlet	West Coast V.I.	
	C	1	Sydney Inlet	West Coast V.I.	South-east Coast V.I.
	E	1	?	West Coast V.I.	(South-east Coast V.I.)
8I	L	1	Porlier Pass	Discovery Passage	South-east Coast V.I.
	L	1	Granite Bay	Discovery Passage	South-east Coast V.I.
	L	1	Deepwater Bay	Discovery Passage	South-east Coast V.I.
	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	K	3	Knight Inlet	Clio Channel or Knight Inlet	(McKenzie Sound.)
	K	1	Bones Bay	Clio Channel or Knight Inlet	(McKenzie Sound.)
	B	1	Kent Inlet	Central	
	B	1	Thistle Pass	Central	
	A	1	"Unknown"	?	
8J	L	2	Bones Bay	Clio Channel or Knight Inlet	South-east Coast V.I.; Discovery Passage.
	F	1	Esperanza Inlet	West Coast V.I.	
	K	1	Serpentine Pass	Clio Channel	
	K	1	Bones Bay	Clio Channel	
	K	1	Knight Inlet	Clio Channel or Knight Inlet	(McKenzie Sound.)
	K	3	Laredo	?	Northern Central or Queen Charlotte Strait.
8K	L	2	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	L	1	Bones Bay	Clio Channel or Knight Inlet	South-east Coast V.I.; Discovery Passage.
	F	1	Esperanza Inlet	West Coast V.I.	
	K	1	Bones Bay	Clio Channel	

Table III.—List of the Tags recovered by Magnets in Reduction Plants according to Tagging, Plant, and Area of Recovery—Continued.

Code.		No. of Tags.	Area of Recovery.		
Tagging.	Plant.		Reported.	Certain or Probable.	Alternatives.
8K	K	5	Bones Bay	Clio Channel	(McKenzie Sound.)
	K	5	Bones Bay	Clio Channel	
	K	1	Bones Bay	Clio Channel or Knight Inlet	(McKenzie Sound.)
	K	2	Knight Inlet	Clio Channel or Knight Inlet	(McKenzie Sound.)
	K	1	Laredo	?	Northern Central or Queen Charlotte Strait.
	B	1	Meyers Pass	Central	
8L	B	8	Kent Inlet	Central	
	B	1	Meyers Pass	Central	
	B	2	Bella Bella	Southern Central	Northern Central.
	I	1	Kent Inlet	Northern Central	
	I	1	Helmcken Inlet	Northern Central	
8M	L	1	Bones Bay	Clio Channel	South-east Coast V.I.; Discovery Passage.
	B	2	Kent Inlet	Northern Central	Southern Central.
	B	3	Kent Inlet	Central	
	B	1	Thistle Pass	Northern Central	Southern Central.
	B	1	Helmcken Inlet	Central	
	B	2	Surf Inlet	Central	
	B	1	Meyers Pass	Central	
	B	24	Bella Bella	Southern Central	Northern Central.
	H	2	Laredo Canal	Northern Central	(Including Aaltanhash Inlet.)
	H	1	Laredo Inlet	Northern Central	(Including Aaltanhash Inlet.)
	H	6	Surf Inlet	Northern Central	(Including Aaltanhash Inlet.)
	H	2	Aaltanhash Inlet	Northern Central	(Including Aaltanhash Inlet.)
	I	2	Helmcken Inlet	Northern Central	
	I	1	Surf Inlet	Northern Central	
8N	D	1	? (In meal-line)	West Coast V.I. (Barkley Sound or Sydney Inlet)	
	D	1	Barkley Sound	Barkley Sound	Clayoquot Sound.
	C	2	Barkley Sound	Sydney Inlet	Barkley Sound or Esperanza Inlet; South-east Coast V.I.
	C	4	Barkley Sound	Barkley Sound	Clayoquot Sound or Esperanza Inlet; South-east Coast V.I.
	C	8	Barkley Sound	West Coast V.I.	South-east Coast V.I.
	F	3	Steamboat Cove	Sydney Inlet	Quatsino and Nootka Sounds.
	F	12	Sydney Inlet	Sydney Inlet	Quatsino and Nootka Sounds.
	F	4	Sydney Inlet	West Coast V.I.	
	F	2	Western Channel	West Coast V.I.	
	F	2	Nootka Lighthouse	Nootka Sound	Clayoquot, Barkley, or Quatsino Sounds.
	F	7	Esperanza Inlet	Esperanza Inlet	Clayoquot, Barkley, or Quatsino Sounds.
	F	1	Esperanza Inlet	West Coast V.I.	
	F	4	? (In meal-line)	West Coast V.I.	
	E	2	Sydney Inlet	West Coast V.I.	(South-east Coast V.I.)
	E	10	Esperanza Inlet	West Coast V.I.	(South-east Coast V.I.)
	E	3	Kyuquot	West Coast V.I.	(South-east Coast V.I.)
	E	6	? (In meal-line)	West Coast V.I.	(South-east Coast V.I.)
9A	A	1	"Herring offal"	South-east Coast V.I.	Queen Charlotte Strait.
	C	1	Barkley Sound	West Coast V.I.	South-east Coast V.I.

Table IV.—Summary of the Presumed Sources of Tags from each Tagging producing Returns, which were recovered on Magnets during the 1944–45 Season.

(A condensation of Table III.)

Code.	Place of Tagging.	Area of Recovery.														Total.
		Barkley Sound.	Sydney Inlet.	Nootka Sound.	Esperanza Inlet.	West Coast V.I.	South-east Coast V.I.	Discovery Passage.	Clio Channel.	Clio Channel or Knight Inlet.	Southern Central.	Northern Central.	Central.	Kwakshua Passage, 1943–44.	?	
8N	Matilda Inlet	5	17	2	7	41	----	----	----	----	----	----	----	----	----	72
4Q	Refuge Cove	----	----	----	----	1	----	----	----	----	----	----	----	----	----	1
5Q	Kendrick Arm	----	1	----	----	----	----	----	----	----	----	----	----	----	----	1
5U	Queens Cove	----	----	----	1	1	----	----	----	----	----	----	----	----	----	2
5V	Clanninick Cove	----	----	1	----	----	----	----	----	----	----	----	----	----	----	1
5X	Bunsby Islands	----	----	----	----	1	----	----	----	----	----	----	----	----	----	1
5W	Browning Inlet	----	----	----	----	1	----	----	----	----	----	----	----	----	----	1
9A	Sooke	----	----	----	----	1	1	----	----	----	----	----	----	----	----	2
5D	Hammond Bay	----	----	----	----	----	----	----	1	----	----	----	----	----	----	1
8G	Kuper Island	----	----	----	----	3	----	----	----	----	----	----	----	----	----	3
7G	Deserted Bay	----	----	----	----	----	----	----	----	----	----	----	----	----	1	1
7I	Union Bay	----	----	----	----	----	----	----	1	----	----	----	----	----	----	1
8D	Skuttle Bay	----	----	----	----	1	----	2	----	----	1	----	----	----	----	4
8I	Deepwater Bay	----	----	----	----	----	----	3	1	4	----	----	2	----	1	11
4L	Cutter Creek	----	----	----	----	----	----	----	1	----	----	----	----	----	----	1
5H	Kingcome Inlet	----	----	----	----	----	----	----	1	----	----	----	----	----	----	1
6N	Clio Channel	----	----	----	----	----	----	----	4	2	----	----	----	----	----	6
6O	Kingcome Inlet	----	----	----	----	----	----	----	1	2	----	----	----	----	----	3
7K	Clio Channel	----	----	----	----	----	----	----	2	----	----	----	----	----	1	3
7L	Retreat Passage	----	----	----	----	----	----	----	2	2	----	----	----	----	----	4
7N	Chatham Channel	----	----	----	----	----	----	----	20	4	----	1	----	----	1	26
8J	Retreat Passage	----	----	----	----	1	----	----	2	3	----	----	----	----	3	9
8K	Retreat Passage	----	----	----	----	1	----	----	13	4	----	----	1	----	1	20
5N	Kwakshua Passage	----	----	----	----	----	----	----	1	----	----	1	----	----	----	2
6M	Campbell Island	----	----	----	----	----	----	----	----	----	----	2	1	----	----	3
7M	Gunboat Passage	----	----	----	----	----	----	----	----	----	4	10	3	3	----	20
8L	Rivers Inlet	----	----	----	----	----	----	----	----	----	2	2	9	----	----	13
8M	Gunboat Passage	----	----	----	----	----	----	----	1	----	24	17	7	----	----	49
	Totals	5	18	3	8	52	1	5	51	21	31	33	23	3	8	262

ties in brackets). As in past years, the certain or probable locality of recovery is the author's unbiased interpretation based on plant records of daily tonnages processed from each fishing locality, method of processing, and knowledge of the lag between the time the tagged fish enters the plant and the time the tag is found on the magnet as shown by magnet efficiency tests. In some cases the reported locality of recovery does not agree with the interpreted locality. In most cases the interpreted locality of recovery is a general area rather than a particular fishing-ground. The opportunity for precise information from magnet recoveries during 1944–45 was more limited than in previous years because in most major areas fish from several different fishing-grounds were processed simultaneously or for short intervals of time, thus confusing the interpretation of place of recovery. Mainly for this reason, but also to avoid tiresome reading, the results are compiled in tabular form, omitting the detailed discussion of previous reports.

The results shown in Table III. are summarized according to tagging and presumed area of recovery in Table IV.

Table V.—Summary, according to Major Areas, of the Known and Interpreted Sources of all Tags from Taggings producing Returns on both Magnets and Detector during the 1944–45 Season.

Major Tagging Area.	Major Recovery Area.						Total.
	West Coast V.I.	South-east Coast V.I.	Discovery Passage.	Queen Charlotte Strait.	Central Coast-line.	?	
West Coast V.I.	79	2	----	----	----	----	81
South-east Coast V.I.	3	45	----	1	----	----	49
Northern Strait of Georgia and Discovery Passage	1	1	38	8	3	2	53
Queen Charlotte Strait	2	1	2	101	2	6	114
Central Coast-line	----	----	----	3	83	----	86
Totals	85	49	40	113	88	8	383

STABILITY OF POPULATIONS AND MOVEMENTS.

Major Areas.

Detector returns included in Table II. and magnet returns given in Table IV. are combined and further summarized according to major areas in Table V., omitting the recoveries out for less than six months (9A in Tables II. and IV.) and omitting the 1943–44 returns (7M, in part, in Table IV.). In view of the results of recent years, the Discovery Passage and northern Strait of Georgia area (north of a line between Parksville and Sechelt) is separated from the south-east coast of Vancouver Island area.

It may be seen that fish tagged in the northern Strait of Georgia and Discovery Passage area and in the Queen Charlotte Strait area apparently wandered to a greater extent than those of other major areas. However, in general the results agree with those of previous years in showing that mixture between the populations of major areas is limited, with 346 out of 375 returns, or 92 per cent., coming from the same major area in which they were originally used.

If the data are adjusted to allow for differences in tonnages caught, tonnages mechanically searched for tags, and number of tags originally used (Tester, 1944, pp. 66–68), using magnet returns for the west coast of Vancouver Island, Queen Charlotte Strait, and the Central area, and detector returns for the south-east coast of Vancouver Island and the Discovery Passage area, the results show a return to the same major area of 92.3 per cent. and a mixture with other major areas of 7.7 per cent. If these

results are compared with those of last year (82.7 and 17.3 per cent., again segregating the Strait of Georgia into two areas) they indicate that the extent of mixture between major areas was less in 1944–45 than in 1943–44.

Details of mixing within major areas will be discussed in the following paragraphs.

West Coast of Vancouver Island.

For the most part, magnet recoveries from the west coast of Vancouver Island can not be interpreted as coming from particular fishing-grounds. Such results as are available however (Table IV.) give some information on the dispersal of fish tagged at Matilda Inlet (8N) in the spring of 1943. These results are of interest in view of the recent closure (1944–45 season) of Matilda Inlet to commercial purse-seining.

Of the thirty-three Matilda Inlet recoveries by magnets and induction detector which are referable to particular fishing-grounds, seventeen (52 per cent.) came from the adjacent waters of Sydney Inlet, two (6 per cent.) came from Nootka Sound, five (15 per cent.) from Barkley Sound, seven (21 per cent.) from Esperanza Inlet, and two (6 per cent.) from the south-east coast of Vancouver Island. Closure of Matilda Inlet, while probably increasing the chances of utilization of its excellent spawning-ground facilities, did not prevent widespread exploitation in 1944–45 of the fish which spawned there in the spring of 1944.

South-east Coast of Vancouver Island and Discovery Passage.

The small number of magnet recoveries from these two areas have added little information to that obtained by induction detector recoveries which have already been discussed in another section.

It might be noted that one of the current Sooke (9A) tags, used in October, 1944, was interpreted as being recovered from west coast of Vancouver Island fishing-grounds (possibly Barkley Sound) during the 1944–45 season.

Queen Charlotte Strait.

As already pointed out, detector returns show that several spawning-grounds in the Queen Charlotte Strait area contribute to the fishery in the vicinity of Clio Channel, and that these do not necessarily contribute to the fishery in the upper reaches of Knight Inlet. Magnet returns (Table IV.) give added support to the first observation but give no additional information on the second as it was impossible to determine whether or not tags recovered during the processing of Knight Inlet fish actually came from fish caught in that locality.

Central Coast-line.

In analysing magnet returns from the Central area, in some cases it has been possible to designate the area of recovery as "Southern Central" (Bella Bella vicinity, Bella Coola vicinity, Fish Egg Inlet, etc.), or "Northern Central" (Surf Inlet, Kent Inlet, Helmcken Inlet, Laredo Channel, Meyers Passage, etc., and for some returns including Aaltanhash Inlet). The localities in which tagging took place are all in the Southern Central area, four (5N, 6M, 7M, and 8M) near Bella Bella and one (8L) at Rivers Inlet.

The results (Table IV.) show that for the taggings near Bella Bella twenty-eight tags were recovered from the Southern Central area (probably mostly from fish caught in the Bella Bella vicinity) and thirty tags were recovered from the Northern Central area; and that for the tagging at Rivers Inlet two were recovered from each of the two areas. Thus spawning-grounds in the Southern Central area have contributed to the fishery in the Northern Central area (chiefly in the Laredo Sound vicinity). However, when the tonnages reduced by the three plants submitting returns are considered (Northern Central, 27,874 tons; Southern Central, 4,096 tons) it is apparent that

the concentration of the tags was much greater in Southern Central than in Northern Central fish and that the relative contribution of the Southern Central spawning-grounds to the two areas is not necessarily in proportion to the number of tags recovered in each.

If the reported localities of recovery are considered to be the most likely for tags recovered from particular fishing-grounds in the Northern Central area, the number of tags from each is roughly proportional to the tonnage processed from each, suggesting random distribution of the tagged fish on the various fishing-grounds. An exception to this is the fishing-ground at Hevenor Inlet, in the northern part of the Northern Central area. Apparently no tags were recovered from fish caught in this newly exploited locality.

With widespread tagging in the Central area during the 1945 spawning season, there should be an opportunity of obtaining considerable information of a more detailed nature from the 1945–46 tagging returns.

MORTALITY RATE.

In Table VI. is shown the probable total number of tags recovered for all 7-series taggings producing returns in 1943–44 and 1944–45. For the south-east coast of Vancouver Island and Discovery Passage the results are based on detector returns only (Table II., this report; Table III., report for 1943–44). For other areas they are based on magnet returns for those plants showing least confusion in the interpretation of the origin of the tags. In the 1944–45 results for Queen Charlotte Strait, the tags are considered to have come from Clio Channel catches but not from Knight Inlet catches.

The decrease in the number of tags recovered between 1943–44 and 1944–45, an approximation to total mortality rate for fish of the various taggings, is as follows: South-east coast of Vancouver Island, 88.1 per cent.; northern Strait of Georgia and Discovery Passage, 92.3 per cent.; Queen Charlotte Strait, 83.2 per cent.; and Central Coast-line, 92.7 per cent. The estimate for the south-east coast of Vancouver Island is similar to that obtained for the 6-series (89 per cent.) and the 5-series (88 per cent.) as given in previous reports. It should be pointed out that all estimates may be high, as migration of untagged fish into the area and migration of tagged fish out of the area (to some locality not fished, or fished to but a small extent in proportion to the total population) will increase the apparent mortality rate. In calculations such as these it is also assumed that mortality rates (fishing and "natural") are constant from year to year, an assumption which may not be even approximately valid for some areas. Thus it is likely that estimates for Discovery Passage and northern Strait of Georgia, Queen Charlotte Strait and (particularly) the Central coast-line tagged fish are too high, as tags from all three areas were recovered from the Southern Central area in 1943–44 when the fishery was centred there (Kwakshua Passage) but only to a limited extent in 1944–45 when the fishery was chiefly concentrated in the Northern Central area (Laredo Sound vicinity). Although subject to several sources of error, the rates are presented with the expectation that they may be of some value in relation to future determinations.

SUMMARY OF RESULTS.

The results for 1944–45 agree with those of previous years in showing that the extent of mixture between the herring populations of major areas is small. An interchange of about 8 per cent. is indicated. This is less than that shown by the results for 1943–44.

Fish tagged at Matilda Inlet, a spawning locality on the west coast of Vancouver Island which was recently closed to herring seining, were taken from adjacent fishing-grounds of Sydney Inlet, to a lesser extent from the Nootka and Barkley Sound areas, and to a small extent from the south-east coast of Vancouver Island.

Table VI.—Calculated Total Probable Number of 7-series Tags recovered in 1943–44 and 1944–45 according to Major Area.

Major Tagging Area.	Major Recovery Area.										Totals.	
	West Coast V.I.		South-east Coast V.I.		Discovery Passage.		Queen Charlotte Strait.		Central Coast-line.			
	1943–44.	1944–45.	1943–44.	1944–45.	1943–44.	1944–45.	1943–44.	1944–45.	1943–44.	1944–45.	1943–44.	1944–45.
South-east Coast V.I. (7B, 7C, 7E)	2.1	.....	169.8	20.6	.....	.....	.....	.....	.....	.....	171.9	20.6
Northern Strait of Georgia and Discovery Passage (7D, 7I, 7J)	.....	.....	23.1	.....	58.4	7.1	6.6	2.0	29.5	.....	117.6	9.0
Queen Charlotte Strait (7K, 7L, 7N)	.....	.....	.....	.....	27.5	3.6	106.0	29.3	56.5	1.3	190.0	34.2
Central Coast-line (7M)	.....	.....	.....	.....	.....	.....	2.3	.....	293.9*	21.7	296.2	21.7

* Including 3 tags recovered in 1943–44 and reported in 1944–45.

Partial independence of the population along the south-east coast of Vancouver Island from that in the northern Strait of Georgia and Discovery Passage area was again indicated, although the failure of the fishery at Nanoose Bay prevented clarification of the status of that fishing-ground.

The movement of fish from the Strait of Juan de Fuca to the south-east coast of Vancouver Island fishing-grounds was again demonstrated.

In the Queen Charlotte Strait area, fish from spawning-grounds in the vicinity of Kingcome Inlet, Retreat Passage, Cramer Passage, and Clio Channel contributed to the fishery in the vicinity of Clio Channel but not (to any great extent, at least) to that in the upper reaches of Knight Inlet.

Although fish from Southern Central area spawning-grounds (in the vicinity of Bella Bella and at Rivers Inlet) contributed to the fishery in the Northern Central area (Laredo Sound vicinity) the contribution was relatively small as compared with that to the fishery in the Southern Central area (Bella Bella, etc., in 1944–45; Kwakshua Passage in 1943–44).

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REFERENCES.

HART, J. L., and A. L. TESTER. The tagging of herring (*Clupea pallasii*) in British Columbia: Methods, apparatus, insertions, and recoveries during 1936–37. Report, B.C. Provincial Fisheries Department, 1936, 55–67, 1937.

HART, J. L., and A. L. TESTER. The tagging of herring (*Clupea pallasii*) in British Columbia: Apparatus, insertions, and recoveries during 1937–38. Report, B.C. Provincial Fisheries Department, 1937, 64–90, 1938.

HART, J. L., and A. L. TESTER. The tagging of herring (*Clupea pallasii*) in British Columbia: Apparatus, insertions, and recoveries during 1938–39. Report, B.C. Provincial Fisheries Department, 1938, 51–78, 1939.

HART, J. L., and A. L. TESTER. The tagging of herring (*Clupea pallasii*) in British Columbia: Insertions and recoveries during 1939–40. Report, B.C. Provincial Fisheries Department, 1939, 42–66, 1940.

HART, J. L., A. L. TESTER, and J. L. MCHUGH. The tagging of herring (*Clupea pallasii*) in British Columbia: Insertions and recoveries during 1940–41. Report, B.C. Provincial Fisheries Department, 1940, 47–74, 1941.

HART, J. L., A. L. TESTER, and R. V. BOUGHTON. Tagging of herring (*Clupea pallasii*) in British Columbia: Apparatus, insertions, and recoveries during 1941–42. Report, B.C. Provincial Fisheries Department, 1941, 49–78, 1942.

TESTER, A. L., and R. V. BOUGHTON. Tagging of herring (*Clupea pallasii*) in British Columbia: Apparatus, insertions, and recoveries during 1942–43. Report, B.C. Provincial Fisheries Department, 1942, 44–69, 1943.

TESTER, A. L. Tagging of herring (*Clupea pallasii*) in British Columbia: Insertions and recoveries during 1943–44. Report, B.C. Provincial Fisheries Department, 1943, 53–74, 1944.

Table VII.—Detailed List of Tags inserted during 1944–45.

Identification Marks.	Type of Tag.*	Date released.	Tagging Code.	Where released.	No. of Tags used.
P22701–P23000	A	Mar. 12, 1945	9I	Retreat Passage	296
P24201–P24500	A	Oct. 10, 1944	9A	Sooke	292
P25001–P25400	A	Apr. 1, 1945	9L	Campbell Island, Brown Narrows	393
P27401–P27500	A	Oct. 10, 1944	9A	Sooke	99
LLZZ	A	Mar. 11, 1945	9C	Departure Bay, off Horswell Point	498
MMPP	A	Mar. 10, 1945	9C	Departure Bay, off Horswell Point	499
RRTT	B	Oct. 10, 1944	9A	Sooke	514
RRYY	B	Oct. 10, 1944	9A	Sooke	504
ABBA	C	Mar. 9, 1945	9I	Retreat Passage	689
ACCA	C	Mar. 9, 1945	9I	Retreat Passage	500
ADDA	C	Mar. 12, 1945	9I	Retreat Passage	575
AEEA	C	Mar. 12, 1945	9I	Retreat Passage	694
AHHA	C	Mar. 14, 1945	9J	Cramer Passage	631
AIIA	C	Mar. 15, 1945	9J	Cramer Passage	600
AJJA	C	Mar. 21, 1945	9M	Gunboat Passage	638
AKKA	C	Mar. 20, 1945	9K	Takush Harbour, Angle Inlet	643
AOOA	C	Apr. 3, 4, 1945	9F	Deepwater Bay	651
APPA	C	Apr. 3, 4, 1945	9F	Deepwater Bay	699
ASSA	C	Apr. 4, 1945	9F	Deepwater Bay	660
ATTA	C	Apr. 4, 1945	9F	Deepwater Bay	657
AUUA	C	Apr. 4, 1945	9F	Deepwater Bay	652
AWWA	C	Mar. 15, 1945	9E	Skuttle Bay	669
AXXA	C	Feb. 17, 1945	9B	Ladysmith Harbour	649
AYYA	C	Mar. 19, 1945	9G	Viner Sound	642
AZZA	C	Mar. 19, 1945	9G	Viner Sound	654
BAAB	C	Mar. 20, 1945	9G	Viner Sound	615
BCCB	C	Mar. 22, 1945	9H	Cutter Creek	657
BDDB	C	Mar. 22, 1945	9H	Cutter Creek	609
BEEB	C	Mar. 22, 1945	9H	Cutter Creek	641
BHHB	C	Mar. 22, 1945	9H	Cutter Creek	627
BIIB	C	Mar. 22, 1945	9H	Cutter Creek	643
BJJB	C	Mar. 25, 1945	9N	Laredo Sound, Parsons Anchorage	654
BKKB	C	Mar. 25, 1945	9N	Laredo Sound, Parsons Anchorage	627
BLLB	C	Mar. 25, 1945	9N	Laredo Sound, Parsons Anchorage	644
BMMB	C	Mar. 13, 1945	9D	Prevost Island, Selby Creek	654
BNNB	C	Mar. 7, 1945	9J	Cramer Passage	384
BOOB	C	Mar. 15, 1945	9J	Cramer Passage	1,278
BPPB	C	Mar. 20, 1945	9M	Gunboat Passage	1,266
BSSB	C	Mar. 21, 1945	9M	Gunboat Passage	1,130
BTTB	C	Mar. 21, 1945	9M	Gunboat Passage	1,276
BUUB	C	Mar. 20, 1945	9K	Takush Harbour, Angle Inlet	1,315
BWWB	C	Mar. 20, 1945	9K	Takush Harbour, Angle Inlet	1,214
BXXB	C	Feb. 17, 1945	9B	Ladysmith Harbour	1,285
BYYB	C	Mar. 11, 1945	9C	Departure Bay, off Horswell Point	1,391
BZZB	C	Mar. 12, 1945	9C	Departure Bay, off Horswell Point	1,167
CAAC	C	Mar. 13, 1945	9D	Prevost Island, Selby Creek	1,244
CBBC	C	Mar. 13, 1945	9D	Prevost Island, Selby Creek	1,329
CDDC	C	Mar. 15, 1945	9E	Skuttle Bay	1,178

* A = Original dimensions and weight, nickel-plated.
B = Original dimensions and weight, silver-plated.
C = Shorter, wider, thinner and lighter, silver-plated.

Table VII.—Detailed List of Tags inserted during 1944–45—Continued.

Identification Marks.	Type of Tag.*	Date released.	Tagging Code.	Where released.	No. of Tags used.
CEEC	C	Mar. 15, 1945	9E	Skuttle Bay	1,319
CHHC	C	Mar. 19, 1945	9G	Viner Sound	1,244
CJJC	B	Mar. 25, 1945	9N	Laredo Sound, Parsons Anchorage	520
CLLC	B	Mar. 25, 1945	9N	Laredo Sound, Parsons Anchorage	518
CPPC	B	Mar. 25, 1945	9N	Laredo Sound, Parsons Anchorage	487
CSSC	B	Mar. 26, 1945	9O	Racey Inlet, Head	502
CTTC	B	Mar. 26, 1945	9O	Racey Inlet, Head	515
CUUC	B	Mar. 26, 1945	9O	Racey Inlet, Head	506
CWWC	B	Mar. 27, 1945	9Q	Principe Channel, Anger Island	512
CXXC	B	Mar. 27, 1945	9Q	Principe Channel, Anger Island	514
CYYC	B	Mar. 28, 1945	9Q	Principe Channel, Anger Island	523
CZZC	B	Mar. 28, 1945	9Q	Principe Channel, Anger Island	502
DAAD	B	Mar. 28, 1945	9Q	Principe Channel, Anger Island	489
DBBD	B	Mar. 28, 1945	9Q	Principe Channel, Anger Island	499
DCCD	B	Mar. 30, 1945	9P	Union Passage, southerly entrance	509
DHHD	B	Mar. 30, 1945	9P	Union Passage, southerly entrance	467
DJJD	B	Mar. 30, 1945	9P	Union Passage, southerly entrance	510
DKKD	B	Mar. 30, 1945	9P	Union Passage, southerly entrance	511
DLLD	B	Mar. 30, 1945	9P	Union Passage, southerly entrance	508
DMMD	B	Mar. 30, 1945	9P	Union Passage, southerly entrance	505
DOOD	B	Apr. 1, 1945	9L	Campbell Island, Brown Narrows	533
DSSD	B	Apr. 1, 1945	9L	Campbell Island, Brown Narrows	501
DTTD	B	Apr. 1, 1945	9L	Campbell Island, Brown Narrows	468

* A = Original dimensions and weight, nickel-plated.
B = Original dimensions and weight, silver-plated.
C = Shorter, wider, thinner and lighter, silver-plated.

BIOLOGICAL INVESTIGATIONS OF COMMERCIAL SHELL-FISH.

By Ferris Neave, Pacific Biological Station, Nanaimo, B.C.

Investigations during the past year have continued along the lines indicated in the Report of the British Columbia Fisheries Department, 1943.

As in previous years, the programme, under the direction of the Fisheries Research Board of Canada, has received support, encouragement, and advice from the Provincial Fisheries Department and active co-operation from the Dominion Department of Fisheries.

COMMERCIAL CLAM-CATCH.

Statistics were again collected concerning commercial operations for butter, razor, and little-neck clams, these being the only species of commercial importance at the present time. While an attempt is made to obtain detailed reports on all such operations and thus approximate the total catch, a main objective is to estimate the availability of clams from year to year in terms of the average catch per man per tide.

Reports received for the season of 1943–44 comprise the following total quantities of clams:—

Species.	1943–44. Lb.	1942–43. Lb.
Butter-clams	2,238,627	2,893,222
Razor-clams	298,400	389,825
Little-neck clams	237,753	248,920

In the case of each species, the quantity reported was somewhat less than in the preceding season.

Butter-clams.—The reported catches were distributed as follows:—

Area.	Quantity. 1943–44. Lb.	1942–43. Lb.
Northern British Columbia	828,407	741,421
Central British Columbia	123,300	417,934
Queen Charlotte Strait and Johnstone Strait	362,655	1,066,200
Northern Strait of Georgia	330,745	236,825
South-east coast of Vancouver Island	593,520	430,742

While these figures show a marked decline in production in the Queen Charlotte Strait and Central areas, an increased catch was reported from other centres, notably from the south-east coast of Vancouver Island.

Average catches per man-tide, now available for five consecutive seasons in certain localities, are given in the following table:—

Area.	1939–40.	1940–41.	1941–42.	1942–43.	1943–44.
	Lb.	Lb.	Lb.	Lb.	Lb.
Northern British Columbia	-------	-------	558.1	352.2	300.6
Central British Columbia	-------	182.7	272.3	287.4	282.1
Queen Charlotte Strait, etc.	200.7	198.2	186.7	248.2	274.7
Seal Island	-------	-------	599.9	601.1	792.5
South-east Vancouver Island—					
(*a.*) Chemainus district	120.0	124.7	153.8	175.2	198.0
(*b.*) Sidney district	138.0	149.9	159.1	202.4	218.9

In this table the figures given for Seal Island cannot be compared directly with those for other areas, since digging at this locality takes place only during a short annual period of favourable tides. The continued rise in the production per man-tide in the Chemainus and Sidney districts is not due to reduced competition among diggers, since the digging effort and the total catch have also increased during the past two years.

Little-neck Clams.—The area adjacent to the south-east coast of Vancouver Island has continued to be the main source of little-neck clams. The quantity reported from this area in 1943–44 was 237,753 lb. This is practically the same as the reported catch of the previous season (238,080 lb.). In 1943–44 no catches were reported from other parts of the coast which had previously contributed small quantities to the total British Columbia catch. The reported Vancouver Island catch, except for 1,753 lb., was taken between April 1st and August 6th. The catch per man-tide averaged 127.2 lb. This may be compared with the following figures for previous years: 1941, 129.8 lb.; 1942, 127.8 lb.; 1943, 152.7 lb. It is evident that availability of clams has remained very constant except for the 1943 season. The cause of the high figure in that year is not known.

Razor-clams.—In 1944 the Massett Co-operative Association again provided records of the catches made on the beaches of the north shore of Graham Island, this being the only area in the Province which produces razor-clams commercially at the present time. Comparative figures for the production of 1944 and 1943 (when the present recording system was introduced) are presented in the following table:—

Beach.	Man-tides.	Production.	Average Catch per Man-tide.
		Lb.	Lb.
North, 1943	1,518	118,400	78.0
1944	2,661	147,300	55.4
Middle, 1943	806	82,350	102.2
1944	458	30,450	66.5
South, 1943	1,631	189,075	115.9
1944	1,303	120,650	92.6
All, 1943	3,955	389,825	98.6
1944	4,422	298,400	67.5

The total production in 1944 was low in comparison with the annual yields of previous years. The availability of clams in each of the three sections of beach was also lower than in 1943, which was not regarded as a favourable year. In spite of this lowered availability, it cannot be justifiably concluded that depletion has occurred. In 1944 operations were greatly restricted by bad weather conditions during what should have been the most favourable low-tide periods. Even when large areas of beach are readily accessible for operations, there is much variation in the extent to which the clams reveal their presence by the surface indications which provide the only guide to diggers. In spite of the general poor record of 1944, excellent catches were made on occasional days.

INVESTIGATIONS AT SEAL ISLAND.

Controlled digging of the butter-clam beach at Seal Island, near Comox, was carried out for the fourth consecutive year in February, 1945.

When this programme was started in 1942 certain areas were delimited within the boundaries of the productive portion of the beach. These were subjected to different intensity of digging in order to observe the effect in subsequent years. With the information obtained from these plots it was decided that regulation of the production of the beach as a whole could be attempted. In 1945 no territorial restrictions were placed on the diggers but a general limit of 100 tons for the season was imposed. This quantity was reached during thirteen nights' digging between February 8th and February 22nd.

Operations were conducted in co-operation with the Western Fish Company, which took delivery of the clams produced.

Production and digging effort on this beach during the period of the investigations have been as follows:—

Year.	Man-tides.	Man-hours.	Catch.	Average Catch.	
				Per Man-tide.	Per Man-hour.
			Lb.	Lb.	Lb.
1942	393	1,586	235,757	599.89	148.64
1943	394	1,588	236,825	601.08	149.09
1944	264	1,160	209,211	792.57	180.38
1945	484	2,108	207,160	435.60	98.26

In 1945 the availability of clams, as measured by the average catch per unit of time, showed a marked decrease, although still very high in comparison with other areas in the Province. Although the total quantity of clams present in the beach was certainly less than in the preceding years, the lowered catch per man-tide (and per man-hour) was not entirely a reflection of this condition, since sizeable areas of previously undug territory were still available to diggers. The skill and zeal displayed by the latter, while not readily assessable, appear to vary considerably from year to year and to influence the results to a marked degree.

The total quantity of legal-sized butter-clams in the whole beach at the time of commencement of the programme is considered to have been roughly 550 tons. At the beginning of the 1945 dig, that is after three seasons' digging and three years of growth and replacement, the quantity had been reduced to possibly 350 tons. Since 340 tons had been removed by diggers, these rough calculations would indicate a replacement of 140 tons in that period. This replacement is due of course to the continued growth of individuals of the original population and the attainment of legal size by clams which were previously too small to be available. It is evident that these increments have greatly outweighed the natural mortality during the period but have fallen considerably short of replacing the fishing drain on the stock.

The catches made during the experimental period have depended to a large extent on the heavy seedings of 1934–36. Succeeding year classes were much less numerous and, as has been pointed out in previous reports, comparatively small quantities of clams are attaining legal size each year at the present time. There is now evidence of an improved seeding probably originating mainly in 1943. These clams should enter the commercial stock about 1948. In the meantime the available stock can be expected to decline further if the present annual production is maintained.

It is considered justifiable for production to exceed replacements at the present time, on the grounds that (*a*) replacement, while irregular from year to year, might well exceed the present rate of production over a longer period of time; (*b*) much of the present stock has reached an age when natural mortality can be expected to increase. It should be utilized rather than allowed to die from other causes.

In the immediate future, production per unit of effort can be expected to decline. Up to this year, in spite of a decrease in total available stock, diggers were able to find considerable stretches of beach which were as heavily populated as before. The present remaining population, while far from exhausted, presents fewer opportunities for uninterrupted exploitation of virgin ground.

INVESTIGATIONS ON OYSTERS.

Experiments on the tank-rearing of oyster larvæ, begun in 1943, were continued in the spring and summer of 1944. Both native and Pacific oysters were used in these experiments.

Native oysters placed in the tank on May 4th produced a fairly numerous population of larvæ which were reared to the setting stage in June. Setting in some numbers was observed, but thereafter heavy mortality occurred both among the swimming larvæ and the newly-settled spat.

Heavy concentrations of Pacific oyster larvæ were obtained in the tank on five occasions in July and August. Normal development proceeded for varying periods of time, up to seven days, after which growth was checked and heavy mortality was apparent. The mortality was not related to any particular stage of development but appeared to be associated with physical and chemical conditions of the environment. It is hoped that these difficulties can be overcome in future experiments.

NATURAL REPRODUCTION OF PACIFIC OYSTERS.

In July and August, 1944, observations were made on the plankton and on the condition of oysters in Ladysmith Harbour, as a means of judging the prospects of a commercially valuable set.

A moderate spawning took place about July 11th and the progressive development of the resulting larvæ was noted during the remainder of the month. A good spatfall of larvæ was obtained on floated cultch between July 30th and August 3rd. Light setting continued for several days after the latter date. No further successful spawnings took place. The relatively good set at Ladysmith provided a contrast with the very poor results reported from the extensive oyster-grounds in Washington, where the season of 1944 produced no set of definite commercial value.

SUMMARY.

The commercial butter-clam catch of the 1943–44 season showed a decreased production in the Queen Charlotte Strait and Central areas and an increase in other areas, notably from the beaches on or near the south-east coast of Vancouver Island. The latter district continued to show an increase in the production per unit of fishing effort. The general condition of butter-clam beaches in the Province is regarded as satisfactory.

The little-neck clam-catch was again produced almost entirely in the area adjacent to the south-east coast of Vancouver Island. Statistics covering several years show little variation in availability.

Razor-clam production on Graham Island was low, but this does not necessarily indicate depletion of the beaches.

The experiment in managing the production of butter-clams at Seal Island, near Comox, was continued for the fourth season in February, 1945. Removal of 100 tons of clams was permitted. Production per unit of effort showed a decline from previous seasons, although still very high in comparison with all the large coastal areas. The appearance of a fairly large crop of young clams, which will attain commercial size within a few years, was noted. The general condition and future prospects of the beach are discussed.

Experiments in the tank-rearing of oyster larvæ were continued in 1944.

The reproductive activities of Pacific oysters on the commercial beds at Ladysmith and the development of the free-swimming larval stages were again investigated in the summer of 1944. A commercially valuable set took place at the end of July and beginning of August.

REPORT ON INVESTIGATIONS OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR 1944.

BY B. M. BRENNAN, DIRECTOR.

The International Pacific Salmon Fisheries Commission was established by treaty between the Governments of Canada and the United States in order to restore the Fraser River salmon fishery to something approaching its former magnitude. Investigations towards this end are now in their seventh year and actual rehabilitation measures, sponsored by the two Governments, are progressing rapidly.

THE HELL'S GATE PROJECT.

On July 5th, 1944, copies of the contract and specifications were sent to prospective bidders in the United States and Canada for the construction of the Hell's Gate fishways. The tenders were opened and analysed on August 2nd in the New Westminster offices of the International Pacific Salmon Fisheries Commission. The successful bidder, Coast Construction Co., Limited, began work in the latter part of August. Work progressed as the river fell, until in December it looked as if a very close race was in progress between the contractor and the Fraser River. The hope of the Commission that the right bank fishways on the Canadian Pacific Railway side of the river and the 20-foot wide section of the left bank structure on the Canadian National Railways side of the river would be in operation to pass the 1945 sockeye-salmon migration began to cause some worry as December ended with still so much to be accomplished towards that end.

Much depends upon the time of the break-up of ice conditions and cold weather in the interior and upper regions of the Fraser. Naturally, the later the spring thaw the more time will be available to bring the structures as near to completion as will successfully pass the valuable Chilko sockeye run to the spawning-grounds of the Chilko Lake system at the head of the Chilcotin River.

This year's run of sockeye cannot remain a commercial asset and experience another disastrous season such as occurred in the brood-year of 1941 when a block stage of the river at Hell's Gate of nearly sixty days' duration destroyed an estimated 65 per cent. of the run.

SALT-WATER TAGGING.

Tagging of sockeye salmon was continued at Sooke as in the previous six years. During the season a total of 1,063 sockeye salmon were tagged, of which 450 or 42 per cent. were recovered. Recoveries for past years ranged between 44 and 59 per cent. Numbers tagged and recovered for the seven years of the experiment were as follows:—

Year.	Number tagged.	Number recovered.	Per Cent. recovered.
1938	980	439	44
1939	1,042	558	54
1940	930	437	47
1941	849	503	59
1942	1,803	793	44
1943	1,053	502*	48
1944	1,063	450†	42

* Number recovered as of March 31st, 1944.
† Number recovered as of August 20th, 1945.

For further details *see* the Annual Reports of the International Pacific Salmon Fisheries Commission for 1943 and 1944.

THE COMMERCIAL FISHERY.

Beginning in 1946 the Commission is scheduled to manage the Fraser River sockeye-salmon fishery. In order to be in a position to carry out this important task it is necessary to have accurate data for all recent years and to obtain current data without unnecessary delay. Data that have been collected include total landings, total pack, information concerning fishing boats and fishing areas, etc. Biological information such as age and racial composition of the runs is likewise collected for future use.

THE INDIAN FISHERY.

Interesting methods are being given trials to enumerate the Indian take of sockeye salmon, which promise to give more accurate and comprehensive figures of this annual harvest of the salmon taken by the various Indian tribes for their winter food-supplies on the entire Fraser River system. The co-operation of the Dominion Fisheries guardians in collecting these statistics is much appreciated.

OTHER PROJECTS.

Studies of other projects, both biological and engineering, are being carried out on various parts of the Fraser River and its tributaries. Continued studies of spawning-grounds, scale analysis and research into the life-history of the sockeye are under way. Tagging programmes on sockeye salmon are in progress at Bridge River Rapids on the Fraser River proper above the town of Lillooet and at Farwell Canyon in the Chilcotin River close to the Chilko spawning-grounds, as well as the study of the Skookumchuck Rapids, a difficult piece of water for salmon to surmount on the lower Lillooet River.

A PRELIMINARY REPORT ON A FISHERY SURVEY OF TESLIN LAKE, BRITISH COLUMBIA.

By W. A. Clemens, R. V. Boughton, and J. A. Rattenbury.

During July and August, 1944, a survey of the commercial fishery possibilities of Teslin Lake, British Columbia, was carried out for the Provincial Fisheries Department. This lake, 78 miles in length and averaging 2 miles in width, extends in a north-south direction and forms one of the headwaters of the Yukon River system. The British Columbia-Yukon boundary-line (60th parallel of latitude) crosses the lake at approximately mid-length.

The investigation involved the following: Determinations of surface area, bottom area, and volume; distributions of water temperatures, oxygen and hydrogen ion concentration; species of fish, their distribution, abundance, age-weight-length relationships, stomach contents and parasites; quantitative determinations of plankton and bottom organisms as potential food-supplies for the fishes.

The present account is preliminary and a complete report will be submitted when all the material has been examined and the data analysed.

THE PHYSICO-CHEMICAL FEATURES OF THE LAKE.

As stated previously, Teslin Lake is 78 miles in length and has an average width of nearly 2 miles. Its area as determined from maps is 137 square miles.

In order to obtain data for the plotting of bottom contours and the calculation of volume, extensive series of soundings were made across the lake at selected intervals. The lake occupies a narrow trench whose sides slope rather steeply. The maximum depth obtained was 700 feet. The mid-channel has a somewhat irregular depth with an average of about 300 feet. The calculated volume is 735×10^9 cubic feet.

Temperatures were taken at various depths with a pair of Negretti-Zambra deep-sea reversing thermometers. The surface temperatures ranged from 12° to 19° C. during the two months. The water below approximately 475 feet remained at 4° C. There was a fairly gradual decrease in temperature from the surface to 4° C. with little evidence of a thermocline.

Samples of water were obtained at various depths by means of an insulated deep-sea water-bottle. The oxygen content of each sample was determined by the Winkler method and the hydrogen-ion concentration by use of a Taylor slide form hydrogen-ion comparator. The oxygen content of the lake water was almost at the saturation point at all depths during July and August. The hydrogen-ion concentration ranged from 7.5 to 8.0.

The following meteorological data were kindly supplied by the Department of Transport at the Teslin airport covering the period September 1st, 1943, to August 27th, 1944:—

Total precipitation	13.68 inches.
Maximum temperature	83.4° F.
Minimum temperature	23.6° F.
Mean temperature	35.9° F.
Total snowfall	54.8 inches.

THE FISHES.

Fishes were obtained by means of gill-nets and a beach-seine and, to a limited extent, by trolling and fly-fishing. The gill-nets were operated in a gang consisting of 50 yards each of 1½-inch, 2⅛-inch, 3-inch, 3½-inch, 4-inch, 4½-inch, 5-inch, and 5½-inch stretched mesh, set on the bottom at various depths, usually at right angles

to but occasionally parallel with the shore-line. The beach-seine measured 50 by 12 feet and consisted of ½-inch stretched mesh.

The scientific names of the coregonine fishes as used herein follow Dymond (1943) for the most part.

Common Whitefish, *Coregonus clupeaformis* (Mitchill).

The most abundant species in the lake was the common whitefish. The largest specimen obtained was 23⅜ inches in length, 6⅝ lb. in weight, and was at least 12 years of age. A local resident stated that he had obtained an individual which weighed 9½ lb.

Two forms of the whitefish occur in the lake. In one the dorsal profile of the head is convex while in the other it is flat to concave and there is a prominent hump immediately behind the head. The former is called the sheep-nose and the latter the humpback. These two forms appear to be widely distributed in the Canadian North-west and in Alaska and have been recognized as distinct species under the names *Coregonus kennecotti* Milner and *C. nelsonii* Bean. Dymond in his recent (1943) critical examination of specimens of whitefish from the Great Lakes to the Yukon concludes that only one species is represented—namely, *C. clupeaformis*. In the Teslin Lake specimens, aside from the differences in shape of head and related features, there appear to be significant differences in fin-lengths but none in scale-counts or in gill-raker numbers. Until all the measurements and the age data have been carefully examined it would seem advisable to regard one species as present in the lake.

The common whitefish is caught by the local residents in short lengths of gill-nets of about 4-inch mesh, and used as food for themselves and their dogs.

The species is a bottom feeder and in Teslin Lake consumes snails, small clams, insect larvæ, worms, etc. In turn, it is eaten by lake-trout and pike.

Round Whitefish, *Prosopium cylindraceum* (Pallas).

The round whitefish occurs in considerable numbers, but in much less abundance than does the common whitefish. The largest individual taken was 16½ inches in length and 1½ lb. in weight. An age of 9 years was attained by three fish approximately 16 inches in length. Very few of these fish are caught by the local residents as the mesh of net used is too large to retain them.

The round whitefish is a bottom feeder. Its food materials in Teslin Lake were essentially the same as those of the other whitefishes with a slightly higher percentage of insect larvæ.

Cisco, *Leucichthys sardinella* (Valenciennes).

Apparently only one species of cisco (lake-herring) occurs in the lake. While considerable numbers were taken in the gill-nets, the abundance of the species cannot be judged on the basis of the catches since the fish is pelagic for the most part. Presumably it occurs in moderate abundance. The largest specimen taken was approximately 12 inches in length, weighed ¾ lb. and was 6 years of age. No individuals were taken in the gill-nets of larger than 2⅛-inch mesh and few, if any, are caught in the nets of the local residents.

The cisco is a plankton feeder and in turn forms a considerable part of the food of lake-trout, inconnu, pike, and ling.

Inconnu, *Stenodus leucichthys* (Guldenstadt).

The inconnu occurs in Canada only in the Yukon and Mackenzie River systems and the capture of specimens in the southern portion of Teslin Lake constitutes the first record of the species within the boundary-lines of the Province of British Columbia. The species is distributed in Siberian waters but the American population may be subspecifically distinct. It is closely related to the whitefishes and ciscoes, with which apparently it interbreeds occasionally.

While only twenty-one individuals were obtained, there is reason to believe that the relative abundance of the inconnu in Teslin Lake is greater than the gill-net catch indicates. The sizes ranged from 17¾ inches and 1⅞ lb. to 32½ inches and 12¼ lb. A few fish are caught by local residents in the gill-nets set for whitefish and are dried for dog-feed.

The stomach-contents of ten specimens examined consisted of fish remains of which ciscoes were identified in three individuals.

Lake-trout, *Cristivomer namaycush* (Walbaum).

Lake-trout is the most abundant piscivorous fish in the lake. It is taken to some extent in gill-nets set for whitefish but is caught readily on trolls. Considerable numbers were taken from the north portion of the lake during the period of the building of the Alaska Highway by the men engaged in the construction-work. The largest individual secured during the period of investigation was a female, 31¼ inches in length and 12¾ lb. in weight.

Examination of the stomach-contents of seventy-two individuals showed that the cisco formed the chief food item, although the whitefishes were eaten extensively. Other fishes consumed were lake-trout, pike, ling, and sculpins.

Grayling, *Thymallus arcticus signifer* Richardson.

The grayling appears to be a stream fish during the summer months. The only individual obtained in the lake was a specimen about 3 inches in length discovered in a seine haul. The streams tributary to the lake were well populated. On August 21st thirty-two fish up to 14¼ inches in length were obtained from the Morley River by means of angling in the section of the stream immediately at the highway bridge. While these fish did not put up a good fight the species does provide a fly-fishery.

The food of the specimens in the Morley River consisted of aquatic insects such as mayfly nymphs, caddis larvæ, and midge larvæ; terrestrial insects, including beetles, ants, and wasps; a few snails and traces of fresh-water shrimps and water-mites.

Spring Salmon, *Oncorhynchus tshawytscha* (Walbaum).

A large number of spring salmon make the journey each year from the Bering Sea to Teslin Lake, a distance of approximately 2,000 miles. They enter the lake early in August and are caught in gill-nets by the local residents. Three fish in bright red spawning coloration were observed in the Morley River on August 21st. One small specimen, about 4 inches in length, was obtained in a seine haul.

Chum Salmon, *Oncorhynchus keta* (Walbaum).

The chum salmon is reported to enter Teslin Lake in considerable numbers, but usually somewhat later in the season than the spring salmon. No specimens were observed or reported in 1944 up to end of the period of investigation on August 28th. This species is taken by the local residents in gill-nets and is used chiefly for dog-feed.

Pike, *Esox lucius* Linnæus.

The pike or jackfish was common in the shallow weedy areas of the lake, especially in the upper portions of Nisutlin and Morley Bays. Very few of the fish are taken by the local residents either in gill-nets or by troll. The largest individual obtained was a male 29½ inches in length and 7½ lb. in weight.

The food of the pike covers a wide range of fish species; namely, common whitefish, round whitefish, cisco, pike, northern sucker, sculpin, ling.

Northern Sucker, *Catostomus catostomus* (Forster).

The northern sucker was distributed around the lake in shallow- to medium-depth waters. It was particularly abundant in Nisutlin Bay. The few specimens caught by the local residents are discarded.

The food of the sucker consists of small bottom organisms, especially midge larvæ, small clams and snails, small crustacea, etc.

Ling, *Lota lota maculosa* Le Sueur.

The ling, lawyer, or loche was taken almost everywhere in the gill-nets, but never in numbers. However, considerable numbers of small individuals were obtained in seine hauls, particularly toward the south end of the lake, and the species may occur in greater abundance than the gill-net catches would indicate. The largest specimen was 27¾ inches in length and 4¼ lb. in weight.

The ling is a fish-eater and its stomach-contents revealed the presence of round whitefish, ciscoes, lake-trout, pike, and sculpins.

Sculpin, *Cottus cognatus* Richardson.

This small shore species was taken everywhere around the lake where seine hauls were made. It is a bottom-living fish, reaches a length of about 3 inches, and feeds chiefly upon aquatic insects. On the other hand, it is eaten by small lake-trout, pike, and ling.

The fish fauna of Teslin Lake is limited to twelve species. Three or more additional species occur in the lower Yukon River, but apparently these have not yet extended their ranges to Teslin Lake. No minnow is known to occur in the Yukon River system.

Undoubtedly the species of fish now inhabiting Teslin Lake are those which, during the last glacial period, survived in the lower portion of the Yukon River which was free of ice. With the disappearance of the glacial ice from the upper Yukon area representatives of these species eventually made their way south-eastward into the Teslin area. The limited fauna as compared with that of the Mackenzie River system would seem to indicate the isolation of the Yukon River system from the water areas to the south and west, at least since the last glacial period. All of the species except the lake-trout and the sculpin occur in Siberian waters. A critical comparison of the Yukon and Siberian species is necessary to determine the exact relationships of the fish faunas of these two areas.

OCCURRENCE OF THE TAPEWORM, *TRIÆNOPHORUS CRASSUS* (FOREL).

An examination of the fishes of Teslin Lake for parasites disclosed the presence of the tapeworm, *Triænophorus crassus*. The important phases of the life-history of this parasite (Miller, 1943, 1945) are as follows: The adult worm lives in the intestine of the pike, *Esox lucius*. On maturity in the spring, eggs are liberated from the pike and hatch into free swimming larvæ (coracidia). These are eaten by the copepod, *Cyclops bicuspidatus*, reach the body-cavity and in about ten days reach a stage known as the procercoid. If copepods infected with procercoids are eaten by whitefishes and ciscoes, the larval parasites penetrate the stomach-wall and eventually encyst in the muscles, principally in the region from immediately behind the head to the dorsal fin. This stage of the parasite is known as a pleurocercoid and if eaten by the pike develops in the intestine into an adult tapeworm.

In Teslin Lake the adult form of *Triænophorus crassus* was found in considerable numbers in the intestine of the pike. Pleurocercoids were found as follows: Common whitefish, 53 per cent. of 59 individuals examined; cisco, 85 per cent. of 177 individuals examined. No attempt was made to determine the average number of cysts per specimen, but it was evident that the ciscoes were much more heavily parasitized than the common whitefish. Of twelve specimens of the round whitefish examined no infestation was found, possibly due to the small number involved, since this species has been reported as a host in certain Canadian waters.

While this parasite does not infect human beings, the presence of large numbers of cysts in the muscles of the whitefish and ciscoes renders these fishes unmarketable.

BASIC FOOD-SUPPLIES FOR FISH.

Of the nine species of fish permanently resident in the lake, four—namely, the two whitefishes, the sucker, and the sculpin—feed upon small organisms living on the bottom of the lake; one, the cisco, lives upon the minute animals of the open water known as the zooplankton; the remaining four—the lake-trout, the inconnu, the pike, and the ling—are piscivorous, capturing other fishes, chiefly ciscoes and whitefishes. There are two main food-conversion chains:—

(*a.*) Minute plants of the open water (phytoplankton)—zooplankton—ciscoes—lake-trout, inconnu, pike, and ling.

(*b.*) Plankton organisms dying and settling to the bottom—bottom organisms (worms, crustacea, insect larvæ, small clams, snails)—whitefishes, suckers, and sculpins—lake-trout, inconnu, pike, and ling.

In order to obtain definite data concerning the quantities of the basic food materials—that is, the plankton and bottom organisms—a considerable number of quantitative collections were made.

The plankton collections were obtained by means of a closing plankton-net of No. 20 bolting silk. Vertical series were taken at various places in the lake and the net hauls preserved in weak formalin.

The collections of bottom organisms were made with an Ekman grab-dredge which brought up approximately 81 square inches of bottom. The contents of the dredge were washed through sieves and the retained animals then picked from the sieves and preserved in weak formalin.

The collections of plankton and bottom organisms have not been examined critically as to species taken nor weighed, but it is evident from general observation that both the plankton and bottom fauna are limited in species and quantity. Correspondingly, the productivity of the lake in terms of poundage of fish should be relatively low.

POTENTIAL COMMERCIAL AND SPORT FISHERIES.

While the data relating to the fishes and their food-supplies have not been completely analysed, the following tentative conclusions are presented at the present time:—

The common whitefish is the only species which may be considered for commercial exploitation. From information collected from residents, the writers estimate the normal annual requirements for the local residents, including their dogs, at a maximum of 20,000 lb. In view of the present abundance of the whitefish in the lake and the results of the studies of age-composition there is no evidence that the annual outtake, which in some years may have reached 20,000 lb., has appreciably reduced the stock. On the basis of the data available and the information concerning commercial whitefish fisheries in other lakes, it would appear that an additional 20,000 to 30,000 lb. might be removed annually providing that the fishery were not localized. Whether a profitable commercial market might be developed for a catch of this size cannot be stated.

The lake-trout should be reserved chiefly for sport-fishing. There is need for providing attractions for tourists and for maintaining recreational facilities for Yukon residents. Teslin Lake is an attractive body of water and will undoubtedly be visited by an increasing number of persons. Some lake-trout will be taken in commercial whitefish gill-nets if operated and there would seem to be no reason for not allowing these to be marketed, although a distinct commercial fishery for lake-trout should not be permitted to develop.

The grayling will continue to provide a sport-fishery in the streams.

A reduction in the number of pike in the lake would be desirable, since this fish is the host of the adult of the tapeworm, *Triænophorus*. Encouragement of a sport-fishery for pike would be of some value in this respect.

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REFERENCES.

DYMOND, J. R., 1943. The Coregonine Fishes of Northwestern Canada. Trans. Roy. Canad. Inst., Vol. XXIV., Part II., No. 24, 171–231.

MILLER, R. B., 1943. Studies on Cestodes of the Genus *Triænophorus* from Fish of Lesser Slave Lake, Alberta.

I. Introduction and the Life of *Triænophorus crassus* Forel and *T. nodulosus* (Pallas) in the Definitive Host, *Esox lucius*. Canad. Journ. Res., Vol. 21, 160–170.

II. The Eggs, Coracidia, and Life in the First Intermediate Host of *Triænophorus crassus* Forel and *T. nodulosus* (Pallas). Canad. Journ. Res., Vol. 21, 284–291.

SALMON-SPAWNING REPORT, BRITISH COLUMBIA, 1944.

By Major J. A. Motherwell.

GENERAL.

Sockeye.—Good supplies were found in the Skeena River watershed, Bella Coola district, and the Chilko section of the Fraser River watershed. In the Nass and Lowe Inlet areas the seeding was satisfactory. At Rivers Inlet, whilst some of the most important streams were well supplied, the seeding generally was only fair. Smith Inlet was not up to expectations. In view of the fact that disappointing percentages of four-year fish in 1943 and five-year fish in 1944 were found on the Rivers and Smith Inlets spawning-beds, there would appear reason to believe that some unknown conditions were present during the spawning of the brood-year of 1939 which caused an unusual mortality in the eggs or fry.

Springs.—Taking the Province as a whole the seeding was fair.

Cohoes.—In the northern areas satisfactory supplies were observed. Conditions were better in the southern portion of the Province, particularly in the Vancouver Island streams.

Pinks.—In the Yakoun River and the streams tributary to Juskatla Inlet, all in the Masset district, Queen Charlotte Islands, the seeding was good. Similar conditions obtained in the Lowe Inlet and Bella Bella areas, and along the mainland streams of the Alert Bay area the seeding was the best observed in the past ten years. The seeding in the Skeena area was not up to expectations. In the Vancouver Island streams, south of the Alert Bay area, the supplies were not entirely satisfactory.

Chums.—Generally speaking, there was a very considerable shortage of this variety found on all the spawning-grounds in the Province, notwithstanding the fact that the spawning of previous years justified the expectation of a reasonably good return in 1944.

In the inspection of the Rivers and Smith Inlets spawning-grounds this year the fishery officer was accompanied by representatives of the salmon-canners. An endeavour was made to also have some one representing the fishermen accompany the party, but without success. It is to be hoped that in future inspections the industry will take sufficient interest in spawning conditions in the several areas to have representatives present, particularly during the inspections of the most important areas.

IN DETAIL.

Queen Charlotte Islands Area (North).—Satisfactory supplies of cohoe salmon were found on the spawning-grounds. A good seeding of pinks occurred in the Yakoun River and in the streams tributary to Juskatla Inlet, the two most important spawning-grounds of this species. As a matter of fact, all the streams tributary to Masset Inlet, with the exception of the Ain River, contained good supplies of pinks, and the seeding at Yakoun, Mamon, and Detlamen Rivers is reported as heavy. The seeding in the streams tributary to Naden Harbour, however, was poor. The chum seeding is reported as a failure.

Queen Charlotte Islands Area (South).—The pink-supplies on the spawning-grounds were better than average and quite satisfactory. This applies to all "pink" creeks, particularly those in the Cumshewa area. The pink seeding in the Skidegate area and in the streams along the east coast was an improvement over that of the cycle-year. Supplies in the west coast streams, however, were disappointing. The chum seeding at Skidegate Inlet, Salmon Creek, and in the Jedway area was satisfactory. Elsewhere the seeding was poor.

Lower Nass Area.—The escapement of sockeye through the lower reaches of the Nass district is reported as being quite good, particularly so in view of the less intensive

fishing this year. The seeding by springs was apparently below average. The cohoe-supply is reported as being above average in most of the creeks, with a heavy escapement to the Khutzeymateen, Kwinamass, and Ikinik Rivers. The pink seeding was the best since 1936, the numerous streams in Khutzeymateen Inlet receiving good supplies. The chum-supply was better than average, with a marked improvement at Toon River and Alice Arm.

Upper Nass Area.—A satisfactory seeding of sockeye was observed in the Meziadin Lake district, which is the chief spawning-ground of this variety in the Nass watershed. The supply was somewhat lighter than the heavy seeding reported in 1939, but better than that of 1940 and last year. The spawning-grounds of the lake were well covered with spawning salmon. Fish were still ascending the fishway, and, due to high-water conditions, also the falls, at the time of inspection. Approximately 75 per cent. of the run is reported to be the large or five-year variety. Spawning conditions were normal. The supply of springs was found to be fair, but the cohoes were just commencing to arrive at the time of the inspection. According to the officer reporting for the lower reaches of the watershed, however, there was a good run of this variety proceeding up-river. The fishway is reported to be in good condition, but the outside wall of the cribbing is rotted away and will require to be repaired in the near future. The Indians did not take any salmon from the Meziadin Lake area this season.

Upper Skeena Area.—In the upper reaches of the Skeena River watershed the inspecting officer reports a seeding of sockeye comparable with that of the cycle-year of 1940, which was reported at that time as good, the fish being of a good average size individually. The escapement to the Babine, Morice, and Nakina districts is especially mentioned. Some creeks, of course, were better than others. For instance, at Fifteen Mile stream the seeding was not quite so good as in 1940. Twin Creek showed an increase of 100 per cent. over 1940; Pierre Creek, 15 per cent. better than in 1940; Fulton River showed a seeding comparable with that of 1940, although not quite so good as 1939 when the seeding in the Babine Lake area was reported as being the largest during the preceding decade. The supplies in both upper and lower Babine Rivers were comparable with the years 1939 and 1940. A good seeding of springs occurred in Bear and Morice Rivers, but only fair quantities were found in Babine River. A very satisfactory seeding of cohoes occurred in the Morice and Nakina Rivers. The supply of pinks was disappointing. The chum seeding was very light.

Lower Skeena Area.—Good supplies of sockeye were observed in Williams Creek, tributary to Lakelse Lake. This is the principal sockeye-spawning stream. The seeding in the smaller tributaries was light. The seeding in the Ocstahl River is reported as being good. A heavy supply was observed at Shawatlans. The spring-supplies in the Ocstahl system are reported as being heavy, and the cohoes satisfactory. The pink seeding at Lakelse was heavy and good in the Ocstahl system. The chum seeding was only fair.

Lowe Inlet Area.—Nearly all streams received good supplies of spawning sockeye. Water conditions in the streams were very favourable to the ascent of the salmon. The cohoe-supply was normal. The pink seeding in the northern portion of the area was heavy and nearly all the streams were well seeded, particularly the streams in Kitkatlah Inlet and the upper portion of Grenville Channel. The supplies in the southern portion of the area, while not being as heavy as those in the north, were quite satisfactory. The chum seeding is reported as being light, with the exception of Union Pass where the seeding was heavy.

Butedale Area.—The sockeye seeding in the streams tributary to Gardner Canal and Talamosa Inlet was good. Conditions in the balance of the area were fair. The cohoe-supplies showed an improvement over those of the brood-year, particularly in the Gardner Canal and Devastation Channel portions of the area. Pinks were found in

satisfactory quantities, particularly in the Gardner Canal and Devastation Channel sections. On the whole, the pink seeding was quite satisfactory. The chum seeding, apart from that at Price Creek, was poor.

Bella Bella Area.—The sockeye escapement was fully equal to expectations and a distinct increase compared with the brood-year. There was a satisfactory seeding by cohoes. Pinks compared well with the brood-year with increases in some streams. The seeding at Koeye River was particularly heavy. The chum seeding was considerably in excess of that of the brood-year in all the larger streams, particularly those in the Ellerslie area.

During the season there was an ample supply of water in all streams for the ascent of salmon. The spawning conditions generally were satisfactory.

Bella Coola Area.—The sockeye seeding was fairly heavy, especially at Kimsquit Lake. There were also very good supplies in the Bella Coola-Atnarko River system. Numerous runts were again observed. The seeding by spring salmon was very good, especially in the Atnarko River. The early cohoe-supplies are reported as light, but there was a considerable improvement during October and November. The supply of this variety is reported as quite adequate. A medium supply of pinks was present on the spawning-grounds, and an excellent spawning of chums in all streams is reported, especially so in the streams tributary to Dean Channel.

Rivers Inlet Area.—The usual two inspections were made of this area, the first between September 4th and 8th and the second between October 16th and 25th. The escapement of sockeye to the Owikeno Lake system is reported as light. The spawning in some rivers is up to normal but others are reported as being below. The importance of the several sockeye-spawning streams, tributary to Owikeno Lake, is in the following order: Wannock River, Quap River, Shumahault River, Genesee River, Waukwash River, Asklum River, Indian River, Dallec River, Cheo River, Nookins River, and Hatchery Creek.

The streams in which conditions are normal are the Wannock, Quap, Genesee, and Dallec; three of these, fortunately, being of the most important. Conditions found in the Waukwash and Indian Rivers at the head of the lake were most unsatisfactory. Viewed in comparison with the commercial catch the seeding could be classed as good, but the commercial catch was smaller than expected, for which condition weather was a factor. This year it is the large or five-year-old size sockeye which have failed to return in large numbers. It will be remembered that last year it was the four-year fish which were scarce, the conclusion being that some unusual, unknown condition affected the spawning of 1939. The cohoe-supplies in the area were only fairly satisfactory. Pinks were light, and chums scarce. In the streams below Owikeno Lake the cohoe-supplies were fair, while the pink seeding is reported as good, although the runs of this variety are never large. The chum seeding at the Kildala and Chickwilla Rivers was reported as really good. This also applies to Wannock River. Due to heavy rains and the resultant flood conditions some damage may have been done in the Rivers Inlet area, although these conditions occurred previous to the major escapement of sockeye. Two representatives of the cannery interests accompanied the fishery officer on his inspections of the Rivers Inlet area.

Smith Inlet Area.—There are only two sockeye-salmon streams of any importance in this area, these being the Geluck and Delabah Rivers, the first being much the more important. Two inspections were made, the first between September 10th and 12th and the second between October 10th and 12th. It was expected that the sockeye returns would be very poor in 1944 and, consequently, the commercial fishing boundary was moved out so as to permit a larger percentage of the runs to pass to the spawning-grounds. As a result the escapement is reported by the local, well-experienced fishery officer as a decided improvement over the five-year cycle-year of 1939, for instance,

although not entirely satisfactory. Flood conditions in this area may also have done some damage between the early and late runs. A heavy seeding by spring salmon is reported, cohoes fair, pinks to the Nekite River good, and chums only fair in the Nekite River, poor in the south-east arm, and good in the Takush River. Two representatives of the cannery interests accompanied the fishery officer on the inspections of Smith Inlet area.

Fraser River Watershed.

Prince George Area.—The sockeye-supply on the spawning-beds of the Nechako River system, while not showing the exceptionally large increase of the immediately preceding cycle-year, yet was an improvement on that of the brood-year. The increase to the Francois Lake watershed was approximately 40 per cent. The supply in the Stuart Lake watershed showed a considerable percentage of increase, although the total numbers in recent years have been small. Spawning conditions generally were quite favourable. The supplies of spring salmon were definitely disappointing.

Quesnel Area.—The run of sockeye to the Chilko Lake district was late in arriving, but when it did come, between late August and early September, was very heavy, producing some 350,000 spawning fish, which was equal to the seeding of the brood-year of 1940. Conditions in this area continue to be very encouraging. A few scarred sockeye were observed and a higher percentage of unspent females than in the past several years. In the Quesnel Lake system, including the Horsefly and Mitchell Rivers, the sockeye seeding was practically *nil.* At Bowron River only about 35 per cent. of that of the brood-year. A higher percentage of unspawned females than usual was noticed in this district also. Bears destroyed approximately 10 per cent. of the salmon, both green and partly spent. The seeding by springs throughout the whole inspectorate was only fair.

Kamloops Area.—The sockeye seeding was disappointing, although no large run was expected. This applies to all the main sockeye-spawning areas such as Little River, Adams River, and Raft River systems. The supplies of springs were also disappointing. Indications of the cohoe seeding were more encouraging than those of the brood-year, although the supply was not large. High water prevailed throughout the spawning season and, as a consequence, estimates were difficult.

Pemberton Area.—From 300 to 400 sockeye were observed in the Anderson Lake system. A good seeding occurred in the Birkenhead River. Satisfactory supplies were also found in the main Lillooet River. Fair supplies of springs were observed in the Squamish River, Seton Lake, Bridge River, and Birkenhead River systems. The cohoe seeding was fair in the Squamish River and Birkenhead River systems. Few pink salmon were observed in the Squamish area. A fair seeding of chums occurred in the Squamish River.

Chilliwack Area.—The return of sockeye to Cultus Lake totalled slightly over 14,000 salmon, compared with 74,000 in the brood-year. The usual small numbers were observed in the Chilliwack River. The seeding by springs was light, cohoes not up to expectations, and chums decidedly disappointing.

Harrison Area.—Only a fair seeding of sockeye salmon at Silver Creek, tributary to Harrison Lake, but a very satisfactory return to Morris Creek, the main sockeye tributary. Only a fair seeding of springs and cohoes was observed. The chum-supplies were definitely disappointing.

Pitt Lake Area.—Sockeye salmon were present in quantities equalling those of the brood-year. Only light supplies of springs, cohoes, and chums were observed.

Lower Fraser Area.—Quite a satisfactory seeding of cohoe salmon occurred in the Nicomekl and Serpentine Rivers. This was the "off" year for pinks in the Fraser system.

North Vancouver Area.—The supplies of cohoes and chums were far below expectations.

Alert Bay Area.—The sockeye seeding at the Nimpkish River was disappointing, particularly in view of the satisfactory supplies in the brood-year of 1940. The seeding at Fulmore River, Keough River, McKenzie and Quatsi Rivers was only fair, with light runs to Kahweiken, Kleena Kleene, Nahwitti, and Shushartie Rivers. The spring-supplies were found to be normal. The cohoe seeding in nearly all streams was satisfactory. The supply of pinks to the mainland streams is reported as being the heaviest for the past ten years and nearly all streams were well seeded. Most streams showed an improvement over the brood-year of 1942. In the streams along the Vancouver Island portion of the district the seeding was fair. The inspecting officer describes the seeding of the whole district generally as being 50 per cent. greater than that of the brood-year. Heavy supplies of chum salmon were observed at Seymour, Salmon, and Bond Rivers. Other streams throughout the district contained only medium or light supplies. The Nimpkish River seeding was disappointing in view of the heavy spawning of 1940.

Quathiaski Area.—At Hayden Bay and Phillips Arm, the principal sockeye-spawning grounds in this area, the seeding is reported as only 25 per cent. of that of the brood-year at the former point, but quite satisfactory at the latter. The spring seeding at Campbell, Salmon, and Phillips Rivers was good. The cohoe escapement was quite satisfactory, particularly to the streams tributary to Bute Inlet. The pink seeding is reported as a failure all through the area, apart from Bear River and the streams tributary to Bute Inlet, where good supplies were observed. Chums were very scarce. The spawning by this variety was estimated to be only 15 per cent. of that of the cycle-year.

Comox Area.—Natural spawning conditions through the fall from the standpoint of low-water levels were poor over this whole district. The supply of springs to the Puntledge River was fairly satisfactory. The cohoe seeding in the streams between Shelter Point and Cape Lazo was very satisfactory, particularly at Oyster River. This was no doubt partly the result of the enforcement of longer closed periods. The supplies in the Courtenay River system were satisfactory. The seeding in the streams tributary to Bayne Sound and south to Englishman River, including the Big and Little Qualicums, was decidedly poor. The pink seeding was light. A good percentage of the chum-salmon run passed safely to the spawning-grounds, due to the less intensive fishing and the timely arrival of the fall rains. It is possible, however, that there may be some loss in spawn, due to the seeding taking place on gravel-bars above normal water-levels. In the spawning-streams between Shelter Point and Nile Creek the seeding compared favourably with the light one of four years previous. The quantities found at Big Qualicum River represented approximately 25 per cent. of the heavy seeding of 1940 and at Little Qualicum only 33⅓ per cent.

Pender Harbour Area.—Only a light seeding of sockeye was observed in Saginaw Lake, notwithstanding the fact that the commercial fishing was not intensive. At Tazoonie River some 5,000 sockeye were observed on the spawning-grounds, compared with 400 during the brood-year. An increased seeding by springs was noted. There was an adequate escapement of cohoes. The pink seeding in the Jervis and Toba Inlet systems is considered adequate, although considerably less than that of the brood-year. The chum-supply, while considered reasonably satisfactory, was not up to expectations.

Nanaimo Area.—The cohoe-supplies in the streams between Nanaimo and Arbutus Point, including Nanoose Bay, were quite satisfactory. The chum seeding is reported as being only 60 per cent. of that of the brood-year.

Ladysmith Area.—No sockeye were observed in the Nanaimo River. There was an average seeding of springs and a satisfactory supply of cohoes. The spawning by

chums was very disappointing, being reported as only about 50 per cent. of that of the brood-year.

Cowichan Area.—Springs were found in good average quantities on the spawning-grounds. Cohoes about 70 per cent. of the brood-year and chums 75 per cent. of 1940. The steelhead-supplies are being well maintained.

Victoria Area.—A satisfactory seeding of cohoe salmon was found in this area. The chum-supplies in the Sooke River were unsatisfactory, but a good seeding occurred in the Goldstream Creek.

Alberni Area.—There was a fair seeding of sockeye in the Somass River, Great Central Lake, and Sproat Lake systems. Whilst fewer salmon were observed using the fishway at Stamp Falls, this was on account of natural conditions being more favourable. An unusual percentage of the run passed over the falls without the aid of the fishway. A satisfactory seeding was observed in the Anderson Lake system. The escapement to Hobarton Lake is reported as being very satisfactory, partly as a result, no doubt, of the enforcement of an increased closed period. The supplies of spring salmon to the Somass River, Stamp River, and Nahmint River systems are reported as being very good, but the escapement to the Toquart, Sarita, and Nitinat Rivers was only fair. The cohoe seeding was exceptionally good in all streams frequented by this variety. The chum-supplies on the other hand were extremely disappointing and are reported as a failure. No salmon of any species was observed at the Maggie River fish-ladder.

Clayoquot Area.—A larger proportion than usual of the run of sockeye escaped to the spawning-grounds of Kennedy Lake and provided a fairly satisfactory seeding, comparable with that of the brood-year. The seeding in the Medgin River watershed compared favourably with that of the brood-year. The supplies of spring salmon were excellent and compared favourably with the spawning of last year, which was the heaviest in the previous four years. The cohoe-supplies were also found to be excellent. The chum seeding was the poorest of the last four years.

Nootka Area.—A fair seeding of springs occurred at Gold and Burman Rivers. The cohoe seeding was average. The chum-supplies, however, are reported as being the poorest known, except in the Tahsis River and Sow End River.

Kyuquot Area.—The spawning of springs was below average but the cohoe seeding was fairly satisfactory. The chum-supply was reported as being very poor and even less than the very light brood-year.

Quatsino Area.—There was the usual small supply of sockeye on the spawning-grounds, but these runs are of little value commercially. The seeding of springs was normal in Marble Creek, which is the principal stream used by this species. The cohoe-supply is reported as being above the average in the district, particularly at East Creek, Buck Creek, Marble Creek, Rupert River, Spruce River, and Mahatta River. The seeding of pinks, generally speaking, was light, although heavy at East Creek and Rupert River. The chum seeding was very disappointing.

STATISTICAL TABLES.

PACK OF BRITISH COLUMBIA SALMON, SEASON 1944.

SHOWING THE ORIGIN OF SALMON CAUGHT IN EACH DISTRICT.

District.	Sockeye.	Springs.	Steel-heads.	Cohoe.	Pinks.	Chums.	Total.
Fraser River	88,515	12,577½	293	15,564½	130	13,803½	130,883½
Queen Charlotte Islands	157	20	1	19,615	90,993	81,916	192,702
Nass River	13,083	681½	232½	6,102	31,854	9,143	61,096
Skeena River	68,197	1,500½	2,481	20,191½	48,837	8,741½	149,948½
Rivers Inlet	36,582½	805	88	13,921	5,289½	2,705	59,391
Smith Inlet	3,165	66	.....	343	498½	2,122	6,194½
Central Area	32,715	643	666	25,823	162,986	80,793	303,626
Vancouver Island	5,288½	3,068½	165	79,813½	49,092	56,029½	193,459
Alaska	11	.....	.....	173	12	63	259
Totals	247,714	19,362	3,926½	181,546½	389,692	255,316½	1,097,557½

12,464 cases of bluebacks are combined with cohoes in this table for Vancouver Island.

STATEMENT SHOWING THE TOTAL SALMON-PACK BY SPECIES FROM 1936 TO 1944.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.	1936.
Sockeye	247,714	164,889	666,570	455,298	366,402	269,887	447,450	325,836	414,809
Spring	19,362	10,658	24,744½	51,593	17,740	16,098	15,356	16,174	29,853
Chum	255,316½	363,347½	633,834	926,801	643,441	386,590	541,819	447,760	597,488
Pink	389,692	530,189	270,622½	427,774	213,904	620,595	400,876	585,574	591,535½
Cohoe	181,546½	186,043	211,138	430,513	224,522	245,097	301,081	133,489	229,750
Steelhead	3,926½	3,095	4,649	3,454	1,207	796	1,036	844	1,068
Totals	1,097,557½	1,258,221½	1,811,558	2,295,433	1,467,216	1,539,063	1,707,798	1,509,677	1,864,503½

STATEMENT SHOWING THE TOTAL SALMON-PACK OF BRITISH COLUMBIA BY DISTRICTS.

TOTAL PACKED BY DISTRICTS IN 1936 TO 1944, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.	1936.
Fraser	130,883½	126,541½	549,617	431,299	152,363	199,241	277,084	231,848	260,261
Skeena	149,948½	133,589	152,418½	200,497	195,355	205,604	223,413	133,165	218,634
Rivers Inlet	59,391	79,697½	105,539	138,650	88,665	83,502	122,363	108,782	72,011½
Smith Inlet	6,194½	21,942	23,777	32,109	33,998	28,727	44,921	35,502	14,888
Nass River	61,096	52,333½	100,142½	71,330	60,441	55,946	113,970	49,042	139,575½
Vancouver Island	193,459	347,710½	536,803½	985,835	419,579	590,736	458,554	608,798	559,746½
Other Districts	496,587	496,407	343,260½	398,152	516,815	375,307	467,493	342,350	599,387
Cold storage	.....	.....	.....	46,561	.....	.....	.....	.....	.....
Grand totals	1,097,557½	1,258,221½	1,811,558	2,295,433	1,467,216	1,539,063	1,707,798†	1,509,677*	1,864,503½

* Including 527 cases of Alaska cohoe packed at Skeena River.

† Including 5,779 cases of Alaska sockeye and 26,828 cases of Alaska cohoe packed at Skeena River.

TABLE SHOWING THE TOTAL SOCKEYE-PACK OF THE FRASER RIVER, ARRANGED IN ACCORDANCE WITH THE FOUR-YEAR CYCLE, 1895–1944.

British Columbia	1895— 395,984	1896— 356,984	1897— 860,459	1898— 256,101
Washington	65,143	72,979	312,048	252,000
Total	461,127	429,963	1,172,507	508,101
British Columbia	1899— 480,485	1900— 229,800	1901— 928,669	1902— 293,477
Washington	499,646	228,704	1,105,096	339,556
Total	980,131	458,504	2,033,765	633,033
British Columbia	1903— 204,809	1904— 72,688	1905— 837,489	1906— 183,007
Washington	167,211	123,419	837,122	182,241
Total	372,020	196,107	1,674,611	365,248
British Columbia	1907— 59,815	1908— 74,574	1909— 585,435	1910— 150,432
Washington	96,974	170,951	1,097,904	248,014
Total	156,789	245,525	1,683,339	398,446
British Columbia	1911— 58,487	1912— 123,879	1913— 719,796	1914— 198,183
Washington	127,761	184,680	1,673,099	335,230
Total	186,248	308,559	2,392,895	533,413
British Columbia	1915— 91,130	1916— 32,146	1917— 148,164	1918— 19,697
Washington	64,584	84,637	411,538	50,723
Total	155,714	116,783	559,702	70,420
British Columbia	1919— 38,854	1920— 48,399	1921— 39,631	1922— 51,832
Washington	64,346	62,654	102,967	48,566
Total	103,200	111,053	142,598	100,398
British Columbia	1923— 31,655	1924— 39,743	1925— 35,385	1926— 85,689
Washington	47,402	69,369	112,023	44,673
Total	79,057	109,112	147,408	130,362
British Columbia	1927— 61,393	1928— 29,299	1929— 61,569	1930— 103,692
Washington	97,594	61,044	111,898	352,194
Total	158,987	90,343	173,467	455,886
British Columbia	1931— 40,947	1932— 65,769	1933— 52,465	1934— 139,238
Washington	87,211	81,188	126,604	352,579
Total	128,158	146,957	179,069	491,817
British Columbia	1935— 62,822	1936— 184,854	1937— 100,272	1938— 186,794
Washington	54,677	59,505	60,259	134,641
Total	117,499	244,359	160,531	321,435
British Columbia	1939— 54,296	1940— 99,009	1941— 171,290	1942— 446,371
Washington	43,511	59,354	110,605	263,458
Total	97,807	158,363	281,895	709,829
British Columbia	1943— 31,973½	1944— 88,515		
Washington	19,116½	37,059		
Total	51,090	125,574		

STATEMENT SHOWING THE SALMON-PACK OF BRITISH COLUMBIA, BY DISTRICTS AND SPECIES.

FRASER RIVER, 1929–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Sockeyes	88,515	31,973½	446,371	171,290	99,009	54,296	186,794	100,272
Springs	12,577½	3,505½	9,688	34,038	4,504	5,993	4,308	5,444
Chums	13,803½	52,149	82,573	95,070	35,665	30,150	58,778	20,878
Pinks	130	29,860½	134	102,388	12	95,176	63	94,010
Cohoes	15,564½	8,809	10,542	28,265	13,028	13,557	27,127	11,244
Steelheads	293	244	309	248	145	69	14	.....
Totals	130,883½	126,541½	549,617	431,299	152,363	199,241	277,084	231,848

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Sockeyes	184,854	62,822	139,238	52,465	65,769	40,947	103,692	61,569
Springs	15,126	9,401	16,218	5,579	28,701	9,740	21,127	10,004
Chums	31,565	8,227	104,092	34,391	14,948	251	68,946	144,159
Pinks	.....	111,328	2,199	92,746	385	13,307	30,754	158,208
Cohoes	28,716	24,950	11,392	13,901	16,815	8,165	25,585	40,520
Steelheads	.....	.....	.....	.....	23	657	27,879	12,013
Totals	260,261	216,728	273,139	199,082	126,641	73,067	277,983	426,473

SKEENA RIVER, 1929–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Sockeyes	68,197	28,268½	34,544	81,767	116,507	68,485	47,257	42,491
Springs	1,500½	1,783	6,374	4,985	6,118	4,857	4,318	4,401
Chums	8,741½	6,597	11,421	10,707	4,682	7,773	16,758	10,811
Pinks	48,837	54,509	52,767	50,537	47,301	95,236	69,610	59,400
Cohoes	20,191½	40,479½	44,081½	50,605	20,614	29,198	52,821	15,514
Steelheads	2,481	1,952	3,231	1,896	133	55	42	21
Totals	149,948½	133,589	152,418½	200,497	195,355	205,604	190,806	132,638

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Sockeyes	81,973	52,879	70,655	30,506	59,916	93,023	132,372	78,017
Springs	4,551½	4,039	8,300	3,297	28,269	9,857	7,501	4,324
Chums	15,297½	8,122	24,388	15,714	38,549	3,893	5,187	4,908
Pinks	91,389	81,868	126,163	95,783	58,261	44,807	275,642	95,305
Cohoes	25,390	23,498	54,456	39,896	48,312	10,637	29,617	37,678
Steelheads	33	14	114	267	404	768	58	13
Totals	218,634	170,420	284,096	185,463	233,711	162,986	450,377	220,245

STATEMENT SHOWING THE SALMON-PACK OF BRITISH COLUMBIA, BY DISTRICTS AND SPECIES—*Continued.*

RIVERS INLET, 1929–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Sockeyes	36,582½	47,602½	79,199	93,378	63,469	54,143	87,942	84,832
Springs	805	765	985	1,692	1,226	745	1,209	917
Chums	2,705	11,448	15,874	15,442	9,025	5,462	7,759	9,415
Pinks	5,289½	8,347	954	4,807	3,329	12,095	9,063	7,536
Cohoes	13,921	11,466	8,467	23,202	11,561	10,974	16,285	6,012
Steelheads	88	69	60	129	55	83	105	70
Totals	59,391	79,697½	105,539	138,650	88,665	83,502	122,363	108,782

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Sockeyes	46,351	135,038	76,923	83,507	69,732	76,428	119,170	70,260
Springs	581½	429	436	449	459	325	434	342
Chums	11,505	7,136	895	677	944	429	492	989
Pinks	6,432½	4,554	2,815	5,059	3,483	5,089	18,023	2,386
Cohoes	7,122½	8,375	4,852	3,446	7,062	6,571	756	1,120
Steelheads	19	39	79	82	29	32	105	29
Totals	72,011½	155,571	86,000	93,220	81,709	88,874	138,980	75,126

SMITH INLET, 1929–44, INCLUSIVE.*

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Sockeyes	3,165	15,010	15,939	21,495	25,947	17,833	33,894	25,258
Springs	66	118	8	124	142	215	68	21
Cohoes	343	541	1,813	1,955	1,102	3,880	1,058	241
Pinks	498½	556	527	749	755	3,978	1,761	483
Chums	2,122	5,693	5,490	7,741	6,015	2,771	8,076	9,494
Steelheads	666	24	.....	45	37	50	64	5
Totals	6,194½	21,942	23,777	32,109	33,998	28,727	44,921	35,502

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Sockeyes	12,788	31,648	14,607	37,369	25,488	12,867	32,057	9,683
Springs	30	216	164	354	48	122	290	78
Cohoes	310	1,201	3,941	5,068	273	112	1,460	275
Pinks	65	4,412	6,953	19,995	1,148	824	16,615	853
Chums	1,653	12,427	15,548	8,841	165	133	1,660	113
Steelheads	42	24	43	87	20	36	103	12
Totals	14,888	49,928	41,256	71,714	27,142	14,094	52,185	11,014

* Previously reported in Queen Charlotte and other districts.

STATEMENT SHOWING THE SALMON-PACK OF BRITISH COLUMBIA, BY DISTRICTS AND SPECIES—*Continued.*

NASS RIVER, 1929–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Sockeyes	13,083	13,412½	21,085	24,876	13,809	24,357	21,462	17,567
Springs	681½	1,002½	1,515	519	1,716	708	773	1,251
Chums	9,143	10,146½	12,518	6,246	5,461	2,500	15,911	10,080
Pinks	31,854	17,669	49,003½	22,667	29,278	26,370	61,477	8,031
Cohoes	6,102	9,768	15,487	16,648	10,060	1,996	14,159	12,067
Steelheads	232½	335	534	374	117	15	188	46
Totals	61,096	52,333½	100,142½	71,330	60,441	55,946	113,970	49,042

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Sockeyes	28,562½	12,712	28,701	9,757	14,154	16,929	26,405	16,077
Springs	2,167	560	654	1,296	4,408	1,439	1,891	352
Chums	20,620½	17,481	2,648	1,775	14,515	392	3,978	1,212
Pinks	75,887½	25,508	32,964	44,306	44,629	5,178	79,976	10,342
Cohoes	11,842	21,810	9,935	3,251	7,955	8,943	1,126	1,202
Steelheads	496	143	311	49	10	.....	84	.....
Totals	139,575½	78,214	75,213	60,434	85,671	32,881	113,460	29,185

VANCOUVER ISLAND DISTRICT, 1929–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Sockeyes	5,288½	7,185	51,961	40,273	15,177	16,259	27,965	25,427
Springs	3,068½	2,937	5,407	8,038	2,454	2,889	4,254	2,359
Chums	56,029½	132,843	383,005	593,016	279,064	212,949	266,566	203,900
Pinks	49,092	130,825	14,474	177,292	33,785	235,119	70,108	318,780
Cohoes	79,813½	73,846½	81,837½	166,908	88,885*	123,388	62,054	52,244
Steelheads	165	74	119	308	214	132	27,607	88
Totals	193,459	347,710½	536,803½	985,835	419,579	590,736	458,554	608,798

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Sockeyes	32,696½	22,928	27,282	18,397	27,611	22,199	24,784	10,340
Springs	6,340	6,525	1,630	4,875	10,559	4,055	3,431	1,645
Chums	347,951	143,960	210,239	96,642	70,629	16,329	177,856	162,246
Pinks	82,028½	191,627	54,526	172,945	33,403	81,965	89,941	74,001
Cohoes	90,625	104,366	78,670	60,019	35,132	26,310	30,206	35,504
Steelheads and Bluebacks	105	21	.....	147	28,596	24,638	14,177	11,118
Totals	559,746	469,427	372,347	353,025	205,930	175,541	340,395	294,854

* 23,277 cases of bluebacks are included with the cohoe-pack for Vancouver Island.

STATEMENT SHOWING THE SALMON-PACK OF BRITISH COLUMBIA, BY DISTRICTS AND SPECIES—*Continued.*

QUEEN CHARLOTTE ISLANDS, 1935–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.	1936.	1935.
Sockeyes	157	53	1	149	16	1	179	2	85	.....
Springs	20	.....	38	236	62	36	66	140	227	63
Chums	81,916	35,370	43,801	76,745	164,911	45,519	40,882	72,689	69,304	86,298
Pinks	90,993	313	83,329	524	44,966	2,123	57,952	13	89,355	1,479
Cohoes	19,615	14,488	16,935	27,421	8,897	3,020	16,616	4,631	19,920	5,461
Steelheads	1	.....	41	11	.....	.....	.....	.....	.....	.....
Totals	192,702	50,224	144,145	105,086	218,852	50,699	115,695	77,475	178,891	93,301

CENTRAL AREA, 1935–44, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.	1936.	1935.
Sockeyes	32,715	21,101	17,470	20,854	32,042	26,158	36,178	29,987	27,499	32,417
Springs	643	547	723½	460	1,518	655	540	1,641	830	687
Chums	80,793	109,101	79,152	111,587	135,802	79,384	127,089	110,493	99,592	125,953
Pinks	162,986	288,109½	69,434	66,130	54,478	150,498	130,842	97,321	246,378	94,190
Cohoes	25,823	26,645	31,274	45,218	49,886	44,426	56,716	25,009	45,824	41,831
Steelheads	666	397	355	330	506	392	433	614	373	355
Totals	303,626	445,900½	198,408½	244,579	274,232	301,513	351,798	265,065	420,496	295,433

STATEMENT SHOWING THE SOCKEYE-PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1929 TO 1944, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.	1938.	1937.
Fraser River	88,515	31,973½	446,371	171,290	99,009	54,296	186,794	100,272
Skeena River	68,197	28,268½	34,544	81,767	116,507	68,485	47,257	42,491
Rivers Inlet	36,582½	47,602½	79,199	93,378	63,469	54,143	87,942	84,832
Smith Inlet	3,165	15,010	15,939	21,495	25,947	17,833	33,894	25,258
Nass River	13,083	13,412½	21,085	24,876	13,809	24,357	21,462	17,567
Vancouver Island	5,288½	7,185	51,961	40,273	15,177	16,259	27,965	25,427
Other Districts	32,883	21,437	17,471	22,219	32,484	34,514	36,357	29,989
Totals	247,714	164,889	666,570	455,298	366,402	269,887	441,671*	325,836

	1936.	1935.	1934.	1933.	1932.	1931.	1930.	1929.
Fraser River	183,120	62,822	139,238	52,465	65,769	40,947	103,692	61,569
Skeena River	81,973	52,879	70,655	30,506	59,916	93,023	132,372	78,017
Rivers Inlet	46,351	135,038	76,923	83,507	69,732	76,428	119,170	70,260
Smith Inlet	12,788	31,648	14,607	37,369	25,488	12,867	32,057	9,683
Nass River	28,562½	12,712	28,701	9,757	14,154	16,929	26,405	16,077
Vancouver Island	34,430½	22,928	27,282	18,397	27,611	22,199	24,784	10,340
Other Districts	27,584	32,417	20,438	26,106	21,685	29,071	39,198	35,331
Totals	414,809	350,444	377,844	258,107	284,355	291,464	477,678	281,277

216 cases of Alaska sockeye packed in British Columbia canneries are not shown in the above table for the year 1936.
* 5,779 cases of Alaska sockeye packed at Skeena River are not shown in the above table for the year 1938.

STATEMENT SHOWING THE SPRING-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1933 TO 1944, INCLUSIVE.

	1944.	1943.	1942.	1941.*	1940.	1939.
Fraser River	12,577½	3,505½	9,688	34,038	4,504	5,993
Queen Charlotte Islands	20	.....	38	236	62	36
Nass River	681½	1,002½	1,515	519	1,716	708
Skeena River	1,500½	1,783	6,374	4,985	6,118	4,857
Rivers Inlet	805	765	985	1,692	1,226	745
Smith Inlet	66	118	8	124	142	215
Central Area	643	547	723½	460	1,518	655
Vancouver Island	3,068½	2,937	5,407	8,038	2,454	2,889
Alaska	.....	.....	6	383	.....	.....
Totals	19,362	10,658	24,744½	50,475	17,740	16,098

	1938.	1937.	1936.	1935.	1934.	1933.
Fraser River	4,308	5,444	15,126	9,401	16,218	5,579
Queen Charlotte Islands	66	140	227	63	258	3,575
Nass River	773	1,251	2,167	560	654	1,296
Skeena River	4,318	4,401	4,551½	4,039	8,300	3,297
Rivers Inlet	1,209	917	581½	429	436	449
Smith Inlet	68	21	30	216	164	354
Central Area	540	1,641	830	687	2,116	841
Vancouver Island	4,254	2,359	6,340	6,525	1,630	4,875
Totals	15,536	16,174	29,853	21,920	29,776	20,266

* In addition to the above there were packed 1,118 cases of springs out of cold-storage stocks, catch of 1940.

STATEMENT SHOWING THE COHOE-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1933 TO 1944, INCLUSIVE.

	1944.	1943.	1942.	1941.*	1940.	1939.
Fraser River	15,564½	8,809	10,542	28,265	13,028	13,557
Queen Charlotte Islands	19,615	14,488	16,935	27,421	8,897	3,020
Nass River	6,102	9,768	15,487	16,648	10,060	1,996
Skeena River	20,191½	40,479½	44,081½	50,605	20,614	29,198
Rivers Inlet	13,921	11,466	8,467	23,202	11,561	10,974
Smith Inlet	343	541	1,813	1,955	1,102	3,880
Central Area	25,823	26,645	31,274	45,218	49,886	44,426
Vancouver Island	79,813½	73,846½	81,837½	166,908	88,885	123,388
Alaska	173	.....	701	31,187	20,489	14,658
Totals	181,546½	186,043	211,138	391,409	224,522	245,097

	1938.	1937.	1936.	1935.	1934.	1933.
Fraser River	27,127	11,244	28,716	24,950	11,392	13,901
Queen Charlotte Islands	16,616	4,631	19,920	5,461	8,315	.....
Nass River	14,159	12,067	11,842	21,810	9,935	3,251
Skeena River	52,821	15,514	25,390	23,498	54,476	39,896
Rivers Inlet	16,285	6,012	7,122½	8,375	4,852	3,446
Smith Inlet	1,058	241	310	1,201	3,941	5,068
Central Area	56,716	25,009	45,824	41,831	53,850	33,471
Vancouver Island	89,471	58,244	90,625½	104,366	78,670	60,019
Alaska	26,828	527	.....	.....	.....	.....
Totals	301,081	133,489	229,750	231,492	225,431	159,052

* In addition to the above there were packed 39,104 cases of cohoe out of cold-storage stocks, catch of 1940.

STATEMENT SHOWING THE PINK-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1933 TO 1944, INCLUSIVE.

	1944.	1943.	1942.	1941.	1940.	1939.
Fraser River	130	29,860½	134	102,388	12	95,176
Queen Charlotte Islands	90,993	313	83,329	524	44,966	2,123
Nass River	31,854	17,669	49,003½	22,667	29,278	26,370
Skeena River	48,837	54,509	52,767	50,537	47,301	95,236
Rivers Inlet	5,289½	8,347	954	4,807	3,329	12,095
Smith Inlet	498½	556	527	749	755	3,978
Central Area	162,986	288,109½	69,434	66,130	54,478	150,498
Vancouver Island	49,092	130,825	14,474	177,292	33,785	235,119
Alaska	12	.....	.....	2,680	.....	.....
Totals	389,692	530,189	270,622½	427,774	213,904	620,595

	1938.	1937.	1936.	1935.	1934.	1933.
Fraser River	63	94,010	.....	111,328	2,199	92,746
Queen Charlotte Islands	57,952	13	89,355	1,479	53,398	.....
Nass River	61,477	8,031	75,887½	25,508	32,964	44,306
Skeena River	69,610	59,400	91,389	81,868	126,163	95,783
Rivers Inlet	9,063	7,536	6,432½	4,554	2,815	5,059
Smith Inlet	1,761	483	65	4,412	6,953	19,995
Central Area	130,842	97,321	246,378	94,190	157,336	101,701
Vancouver Island	70,108	318,780	82,028½	191,627	54,526	172,945
Totals	400,876	585,574	591,535½	514,966	436,354	532,535

STATEMENT SHOWING THE CHUM-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1933 TO 1944, INCLUSIVE.

	1944.	1943.	1942.	1941.*	1940.	1939.
Fraser River	13,803½	52,149	82,573	95,070	35,665	30,150
Queen Charlotte Islands	81,916	35,370	43,801	76,745	164,911	45,519
Nass River	9,143	10,146½	12,518	6,246	5,461	2,500
Skeena River	8,741½	6,597	11,421	10,707	4,682	7,773
Rivers Inlet	2,705	11,448	15,874	15,442	9,025	5,462
Smith Inlet	2,122	5,693	5,490	7,741	6,015	2,771
Central Area	80,793	109,101	79,152	111,587	135,802	79,384
Vancouver Island	56,029½	132,843	383,005	593,016	279,064	212,949
Alaska	63	.....	.....	3,908	2,816	82
Totals	255,316½	363,347½	633,834	920,462	643,441	386,590

	1938.	1937.	1936.	1935.	1934.	1933.
Fraser River	58,778	20,878	31,565	8,227	104,092	34,391
Queen Charlotte Islands	40,882	72,689	69,304	86,298	38,062	6,988
Nass River	15,911	10,080	20,620½	17,481	2,648	1,775
Skeena River	16,758	10,811	15,297½	8,122	24,888	15,714
Rivers Inlet	7,759	9,415	11,505	7,136	895	677
Smith Inlet	8,076	9,494	1,653	12,427	15,548	8,841
Central Area	127,089	110,493	99,592	125,953	117,309	128,602
Vancouver Island	266,566	203,900	347,951	143,960	210,239	96,642
Totals	541,819	447,760	597,488	409,604	513,181	293,630

* In addition to the above there were packed 6,339 cases of chums out of cold-storage stocks, catch of 1940.

STATEMENT SHOWING THE QUANTITY OF PILCHARD PRODUCTS PRODUCED IN BRITISH COLUMBIA, 1930 TO 1944.

Season.	Canned.	Meal.	Oil.
	Cases.	Tons.	Gals.
1930–31	55,166	13,934	3,204,058
1931–32	17,336	14,200	2,551,914
1932–33	4,622	8,842	1,315,864
1933–34	2,946	1,108	275,879
1934–35	35,437	7,628	1,635,123
1935–36	27,184	8,666	1,634,592
1936–37	35,007	8,715	1,217,087
1937–38	40,975	8,483	1,707,276
1938–39	69,473	8,891	2,195,850
1939–40	7,300	906	178,305
1940–41	59,166	4,853	890,296
1941–42	72,498	11,437	1,916,191
1942–43	42,008	11,003	1,560,269
1943–44	94,512	15,209	2,238,987
1944–45	78,772	8,435	1,675,090

STATEMENT SHOWING THE QUANTITY OF HERRING PRODUCTS PRODUCED IN BRITISH COLUMBIA, 1935 TO 1944.

Season.	Canned.	Dry-salted.	Pickled.	Meal.	Oil.
	Cases.	Tons.	Tons.	Tons.	Gals.
1935–36	26,143	14,983	.....	5,313	328,639
1936–37	20,914	16,454	.....	10,340	786,742
1937–38	27,365	10,230	.....	14,643	1,333,245
1938–39	23,353	7,600	.....	18,028	1,526,117
1939–40	418,021	7,596	.....	22,870	1,677,736
1940–41	640,252	5,039	892	10,886	923,137
1941–42	1,527,350	.....	779	8,780	594,684
1942–43	1,253,978	.....	502	4,633	323,379
1943–44	1,198,632	.....	591	7,662	512,516
1944–45	1,190,762	.....	26	9,539	717,655

The above figures are for the season, October to March 31st, annually.

STATEMENT SHOWING THE QUANTITY OF MEAL, OIL, AND FERTILIZER, PRODUCED FROM SOURCES OTHER THAN HERRING AND PILCHARD, 1935 TO 1944.

Season.	From Whales.			From other Sources.	
	Whalebone and Meal.	Fertilizer.	Oil.	Meal and Fertilizer.	Oil.
	Tons.	Tons.	Gals.	Tons.	Gals.
1935–36	211	354	426,772	2,226	260,387
1936–37	332	687	763,740	2,857	356,464
1937–38	268	527	662,355	2,445	266,009
1938–39	273	512	543,378	2,059	186,261
1939–40	.....	.....	.....	3,559	331,725
1940–41	181	434	361,820	4,998	415,856
1941–42	270	561	619,025	5,410	405,340
1942–43	130	205	255,555	4,768	1,255,225*
1943–44	62	90	134,553	4,332	882,250†
1944–45	.....	.....	.....	2,721	846,784

* Includes 916,723 gallons fish-liver oil.
† Includes 822,250 gallons fish-liver oil.

CATCH OF FISH TAKEN FROM THE FOLLOWING NON-TIDAL WATERS DURING THE 1944–45 SEASON.

Lakes and Rivers.	Kind of Licence.			Trout.		Kokanee.		Lake-trout.		White-fish.		Carp.		Ling.		Squaw-fish.		Suckers.		Other Fish.		No. of Fish taken.	Approximate Weight (Lb.).
	Fur-farm.	Ordinary.	Sturgeon.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.		
Burns Lake	2					150	75			25	25			15	75	63	253	620	1,188			873	1,616
Christina Lake		7				7,483	2,005							131	642	11	53	1	1			7,626	2,701
Clayburn Creek	1																						
Chain Lake	1	1																					
Cluculz Lake	2			12	20			5	56	3,529	4,240			628	2,670	3,356	2,128	7,836	17,632	5,596	2,151	20,962	28,897
Cobb Lake	2			3	4			3	14	871	1,060			159	770	840	532	1,961	4,312	1,269	539	5,106	7,231
Chief Lake	2			8	16					680	906			68	282	112	176	2,785	4,780			3,653	6,160
Columbia River and Sloughs	3													8	24	224	170	201	276			433	470
Doris Creek	1																						
Decker Lake	2					150	75			25	25			15	75	62	247	620	1,187			872	1,609
Eaglet Lake	2					1,316	330							227	214	512	558	1,032	1,075			3,087	2,177
Finger Lake	2			110	49	488	185			1,125	382							903	261			2,621	877
Francois Lake		8				500	400	744	4,402	271	677	6	35	207	1,035	6	4	42	48	31	53	1,807	6,654
Gwillim Lake		1																					
Little Bull River	1																						
McLeod Lake	1									200	150					60	75	100	100			360	325
McLeese Lake	1															6	10					6	10
Moberley Lake		2								1,500	3,000											1,500	3,000
Murch Lake	1													1	3	147	135	398	286			546	424
Nulki Lake	3			11	24					1,238	861	1,770	900	157	770	1,815	1,799	1,161	1,171	1,609	1,493	7,761	7,018
Nadsilnich Lake	1																						
Nechako Lake			1																				
Naltesby Lake	1																						
Okanagan River and Sloughs	1																						
Okanagan Lake		52				40,395	13,804					23	75					10	10			40,428	13,889
Ootsa Lake	2			16	23					3	3			692	2,110	149	154	571	536			1,431	2,826
Pinkut Lake		1								190	218											190	218
Pinchi Lake	1																						
Squakum Lake	1																						
Stuart Lake	2									694	653			30	126	30	72	559	1,122			1,313	1,973
Swan Lake	1									112	482	5	18					36	101	10	105	163	706
Sinclair Lake	2			16	23					3	3			51	189	78	100	330	372			478	687
Sinkut Lake	1											3,800	1,006					1,243	2,161			5,043	3,167
Tatuk Lake	2			110	54	482	185			1,125	382							903	261			2,620	882
Tchesinkut Lake	1																	650	1,300			650	1,300
Takalaska Lake	1																						

CATCH OF FISH TAKEN FROM THE FOLLOWING NON-TIDAL WATERS DURING THE 1944–45 SEASON—*Continued.*

Lakes and Rivers.	Kind of Licence.			Trout.		Kokanee.		Lake-trout.		Whitefish.		Carp.		Ling.		Squawfish.		Suckers.		Other Fish.		No. of Fish taken.	Approximate Weight (Lb.).
	Fur-farm.	Ordinary.	Sturgeon.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.	No.	Lb.		
Takysie Lake	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2,073	4,968	----	----	2,073	4,968
Watson Lake	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Windermere Lake	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,153	1,350	353	495	----	----	1,506	1,845
Totals	----	----	----	286	213	50,959	17,059	752	4,472	11,591	13,067	5,604	2,034	2,389	8,985	8,624	7,816	24,388	43,643	8,515	4,341	113,108	101,630

Number of non-tidal fishing licences issued—

Fur-farm fishing licences	36
Ordinary fishing licences	71
Sturgeon fishing licences	1
	108

(No sturgeon taken by licence-holder.)

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