PROVINCE OF BRITISH COLUMBIA

REPORT

OF THE

PROVINCIAL FISHERIES DEPARTMENT

FOR THE YEAR ENDED DECEMBER 31ST, 1941

WITH APPENDICES

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
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1942.

To His Honour COL. 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, 1941, with Appendices.

GEORGE SHARRATT PEARSON,
Commissioner of Fisheries.

Provincial Fisheries Department,
Commissioner of Fisheries' Office,
Victoria, British Columbia.

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, 1941, together with Appendices.

I have the honour to be,

Sir,

Your obedient servant,

GEORGE J. ALEXANDER,
Assistant Commissioner.

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REPORT OF THE PROVINCIAL FISHERIES DEPARTMENT FOR 1941.

VALUE OF CANADIAN FISHERIES AND THE STANDING OF THE PROVINCES, 1940.

The value of the fisheries products of Canada for the year 1940 totalled $45,118,757. During that year British Columbia produced fisheries products to the value of $21,710,167, or 48 per cent. of Canada's total.

British Columbia in 1940 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 $11,866,841.

The market value of the fisheries products of British Columbia in 1940 was $4,011,187 more than in the previous year. There was an increase in the value of salmon amounting to $862,279.

The capital invested in the fisheries of British Columbia in 1940 was $24,661,022, or 54.6 per cent. of the total capital employed in fisheries in all of Canada. Of the total invested in the fisheries of British Columbia in 1940, $9,182,425 was employed in catching and handling the catches and $15,478,597 invested in canneries, fish-packing establishments, and fish-reduction plants.

The number of persons engaged in British Columbia fisheries in 1940 was 17,893, or 13.7 per cent. of Canada's total fishery-workers. Of those engaged in British Columbia, 10,444 were employed in catching and handling the catches and 7,449 in packing, curing, and in fish-reduction plants. The total number engaged in the fisheries in British Columbia in 1940 was 2,013 more than in the preceding year.

The following statement gives in the order of their rank the value of the fishery products of the Provinces of Canada for the years 1936 to 1940, inclusive:—

Province.	1936.	1937.	1938.	1939.	1940.
British Columbia	$17,231,534	$16,155,439	$18,672,750	$17,698,980	$21,710,167
Nova Scotia	8,905,268	9,229,834	8,804,231	8,753,548	9,843,326
New Brunswick	4,399,735	4,447,688	3,996,064	5,082,393	4,965,618
Ontario	3,209,422	3,615,666	3,353,775	3,007,315	3,035,100
Quebec	2,108,404	1,892,036	1,957,279	2,010,953	2,002,053
Manitoba	1,667,371	1,796,012	1,811,124	1,655,273	1,988,545
Prince Edward Island	953,029	870,299	930,874	950,412	714,870
Saskatchewan	367,025	527,199	468,646	478,511	450,574
Alberta	309,882	433,354	492,943	430,724	403,510
Yukon	13,385	8,767	5,290	4,867	4,994
Totals	$39,165,055	$38,976,294	$40,492,976	$40,072,976	$45,118,757

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 1936 to 1940, inclusive, is given in the following table:—

Species.	1936.	1937.	1938.	1939.	1940.
Salmon	$13,387,344	$11,907,905	$14,491,285	$12,994,812	$13,757,091
Halibut	943,568	1,094,214	1,041,165	1,305,542	1,397,999
Halibut-livers	96,311	95,842	231,220	193,148	172,999
Herring	1,142,397	1,181,466	855,265	2,198,912	4,426,390
Pilchard	667,313	902,619	867,007	100,693	632,393
Cod, ling	418,142	318,769	351,324	357,990	359,798
Clams	88,422	95,371	162,508	50,937	77,944
Black cod	53,497	95,251	71,297	79,419	132,822
Carried forward	$16,796,994	$15,691,437	$18,071,071	$17,281,453	$20,957,436

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

Species.	1936.	1937.	1938.	1939.	1940.
Brought forward	$16,796,994	$15,691,437	$18,071,071	$17,281,453	$20,957,436
Crabs	38,855	52,188	54,572	61,633	80,628
Soles	37,019	33,201	37,679	39,826	46,866
Shrimps	9,827	15,430	18,985	12,246	16,354
Oysters	59,687	36,199	37,453	59,976	60,596
Abalones	34	477	.....	1,340	2,002
Flounders	3,332	2,339	6,767	5,934	27,851
Red cod	13,875	7,990	22,286	10,693	14,574
Perch	7,633	3,722	3,942	3,752	3,235
Smelt	7,621	3,523	6,884	4,388	7,491
Sturgeon	2,053	1,386	3,013	2,459	2,460
Octopus	982	923	1,016	441	555
Skate	3,233	2,438	2,467	3,026	3,452
Oolachans	803	337	760	1,792	3,887
Whiting	69	50	62	32	88
Trout	.....	.....	.....	.....	.....
Grayfish, etc.—					
Fresh	68	1,274	2,310	.....	.....
Oil	34,745	38,776	68,073	44,072	146,112
Meal	34,906	26,740	42,807	36,322	63,210
Whales	172,201	220,251	184,074	.....	137,624
Fur-seals	5,664	12,431	3,076	1,465	.....
Miscellaneous	1,933	4,327	105,453	77,515	14,050
Anchovies	.....	.....	.....	10,417	119,035
Tuna	.....	.....	.....	40,198	567
Shark-livers	.....	.....	.....	.....	2,094
Totals	$17,231,534	$16,155,439	$18,672,750	$17,698,980	$21,710,167

VALUE OF BRITISH COLUMBIA FISHERIES REACHES NEW HIGH.

A high record value for British Columbia's fishery output was made in 1941, when the total as marketed was $31,732,037, an increase over the preceding year of $10,021,870 or 46 per cent. Of first importance is the salmon-fishery with a product valued at $20,879,104, compared with $13,757,091 in 1940. The salmon pack was the largest ever recorded by the industry (2,295,431 cases*) and its total value rose to $18,406,545 from $11,427,923 in the preceding year. In second place on the list of the chief commercial fishes is herring, with a marketed value in 1941 of $4,665,260. The increasing importance of the herring-fishery is due to the canning operations, which have grown enormously during the past two years. In 1941 the pack of canned herring amounted to 1,014,529 cases, valued at $3,690,097. This value represents 79 per cent. of the total amount credited to the herring-fishery in the year. Third and fourth, respectively, among the principal kinds of fish, in order of value, are halibut ($2,121,689) and pilchards ($1,781,876). Halibut is marketed chiefly as fresh, while oil and meal are the more important products of the pilchard-fishery.

The quantity of fish of all kinds caught and landed by British Columbia fishermen in 1941 totalled 5,418,891 cwt., valued at the point of landing at $15,836,402, compared with a catch of 5,906,896 cwt. and a landed value of $9,067,501 in 1940. Average prices per hundredweight paid to the fishermen for the principal kinds of fish in 1941 were as follows, with figures for 1940 in brackets: Salmon, $6.01 ($3.84); herring, 39 cents (35 cents); halibut, $12.36 ($9.75); and pilchards, 50 cents (45 cents).

CAPITAL, EQUIPMENT, AND EMPLOYEES.

Capital.—The capital equipment of the fisheries of British Columbia in 1941 was valued at $29,314,179, compared with $24,687,397 in the preceding year. The total

* This includes 46,561 cases of salmon packed from fish caught in 1940 and held in cold storage.

NOTE.—The above figures are taken from the advance report on British Columbia Fisheries, Dominion Department of Statistics, Department of Trade and Commerce.

for 1941 comprises: $10,477,873, the value of the vessels, boats, and gear engaged in the primary operations of catching and landing the fish; and $18,836,306, the amount invested in the fish-processing establishments. The greater part of the investment in the fish-processing industry is credited to the salmon-canneries, which numbered thirty-six and had an investment of $14,641,330.

Employees.—The fisheries of the Province gave employment in the year to a total of 18,131 persons, of which 10,217 are classed as employees on vessels, boats, etc., and 7,914 as employees on fish-processing plants. Compared with the preceding year, the total number shows an increase of 244.

THE CANNED-SALMON PACK FOR BRITISH COLUMBIA FOR 1941.

The total pack of canned salmon put up in British Columbia in 1941 amounted to 2,295,433 cases, according to returns made by the canners to the Provincial Fisheries Department. This was the largest pack of canned salmon ever recorded in British Columbia and exceeds the previous record made in 1930 by 73,624 cases. In 1941 the pack was 677,782 cases above the previous five-year average.

A direct comparison of the 1941 pack figures with the figures for previous years is liable to be misleading unless other factors are considered. On account of the war the demand for canned salmon increased sharply. Canned salmon is a high-protein food, almost indestructible, and is packed in containers which make it reasonably easy to handle. Furthermore, canned salmon may be stored almost indefinitely without special facilities. These factors make it an ideal war ration, which the British authorities were quick to realize. This increased demand from Britain, and Canada's desire to meet it, is the principal reason for the exceptionally large pack. Heretofore considerable quantities of salmon have been frozen for the British market, but in 1941 there was no demand for frozen salmon from Britain and no refrigerated space for shipment had a demand existed. In previous years considerable quantities of salmon were salted for export to the Orient, but in 1941 no salteries were licensed by the Provincial Fisheries Department. Also, in previous years considerable quantities of British Columbia salmon were exported fresh to the United States. This trade was heavily curtailed in 1941 by an embargo on exports (except for troll-caught spring salmon), and an embargo was also placed on the freezing of chum salmon. All these controls have had the effect of diverting practically all salmon caught, with the exception of troll-caught spring salmon, to the canneries. Any comparison of the 1941 canned-salmon pack with the pack figures for previous years must, therefore, take these factors into consideration. In other words, the 1941 canned-salmon pack is not a true indication of the catch as compared with previous years.

The 1941 canned-salmon pack consisted of 455,298 cases of sockeye, 51,593 cases of springs, 3,454 cases of steelheads, 430,513 cases of cohoe, 427,774 cases of pinks, and 926,801 cases of chums. Of these, 1,118 cases of springs, 39,104 cases of cohoe, and 6,339 cases of chums were canned from cold-storage stocks which were caught in the year previous. These amount to a total of 46,561 cases which should be deducted from the total pack of 2,295,433 cases to show the true 1941 pack. Except in the case of cohoe this does not materially change the picture, but the fact is mentioned for the purpose of record.

Examination of the pack figures by species shows that the sockeye-pack of 455,298 cases was 88,896 cases above the 1940 figure and exceeded the previous five-year average by 90,421 cases. The spring-salmon pack of 51,593 cases in 1941 was the largest pack of this species since 1932, when 75,958 cases were canned. The 1941 pack of this species exceeds the previous five-year average by 32,513 cases.

Steelhead trout are not salmon, but a few are caught and canned incidental to the fishing and canning operations each year. In 1941 there were 3,454 cases of steelheads canned. This is compared with 1,207 cases in 1940, 796 cases in 1939, and 1,036 cases in 1938.

In 1941 the cohoe-pack amounted to 430,513 cases. This is the largest pack on record for this variety and exceeds the previous record pack of 1938 by 129,432 cases. The 1941 pack of cohoe was 203,725 cases above the average for the previous five years.

The above figures for the 1941 cohoe-pack include 39,104 cases of this species canned from fish caught the previous year which had been frozen for export to Britain and which, on account of the war, were not shipped. These are shown in the tables in the Appendix to this report.

The pink-salmon pack in 1941, consisting of 427,774 cases, was disappointing, especially in the Central and Vancouver Island areas. The 1941 pink-salmon pack was 192,821 cases less than in 1939, the cycle-year, and 54,723 cases less than the average for the previous five-year period. The 1941 pink-salmon run, as indicated by the canned pack, was the second run in succession which was below expectation. The reader is referred to the next section of this report for a more detailed analysis of the pink-salmon pack.

In 1941 the pack of chum salmon amounted to 926,801 cases. This was the largest pack of this species recorded in recent past years and probably establishes a record. The 1941 pack of chums exceeded the pack of the previous year by 283,360 cases and was 403,382 cases greater than the average for the previous five-year period. As pointed out in a previous paragraph, the various controls exercised over the industry by the Government in 1941 no doubt accounts for much of the increase in these pack figures compared with previous years. This is especially true regarding the chum-salmon pack.

BRITISH COLUMBIA'S CANNED-SALMON PACK BY DISTRICTS.

Fraser River System.

The total Canadian pack of all varieties of Fraser River caught salmon amounted to 431,299 cases, composed of 171,290 cases of sockeye, 34,038 cases of springs, 248 cases of steelheads, 28,265 cases of cohoe, 102,388 cases of pinks, and 95,070 cases of chums.

Sockeye Salmon.—In 1941 the Fraser River produced a total pack of sockeye salmon, Canadian and American, amounting to 281,895 cases. This was the largest total pack of sockeye for this cycle since 1917, when the pack was 559,702 cases. It will be noted that the 1941 run belongs to that cycle which formerly produced such large packs, culminating in the exceptionally large pack in 1913, which amounted to 2,392,895 cases, in which year a disaster occurred at Hell's Gate, blocking the river to the passage of salmon. Of the total 1941 catch by Canadian and American fishermen, the Canadian catch was 171,290 cases, while the American fishermen in the State of Washington took 110,605 cases. The catch percentages are 60.7 and 39.3 respectively. The percentage catches of Fraser River sockeye by American and Canadian fishermen are tabulated below for convenience.

	American. Per Cent.	Canadian. Per Cent.
1921	64.0	36.0
1930	78.0	22.0
1931	68.0	32.0
1932	55.0	45.0
1933	71.0	29.0
1934	72.0	28.0
1935	47.0	53.0
1936	25.0	75.0
1937	38.0	62.0
1938	42.0	58.0
1939	44.5	55.5
1940	37.5	62.5
1941	39.3	60.7

The Canadian pack of Fraser River sockeye in 1941 of 171,290 cases was 72,281 cases greater than in the year previous and 71,018 cases above the pack for this variety in 1937, the cycle-year. The 1941 pack was also 46,592 cases above the annual average pack for the previous five-year period, 1936–40, inclusive. In considering the production figures for a river system the canned-salmon pack figures must be considered in conjunction with the escapement to the spawning-beds. In the Appendix to this report

there is published "Spawning Report, British Columbia, 1941," which is again furnished by Major J. A. Motherwell, Chief Supervisor of Fisheries for British Columbia for the Federal Department of Fisheries. The reader is referred to this report for a detailed description of the conditions obtaining on the various spawning-beds. Generally speaking, most of the spawning areas appear to have been adequately stocked.

During the spawning migration of the Fraser River sockeye in 1941, water conditions at Hell's Gate were such as to impede the passage of salmon and considerable apprehension was felt regarding the numbers which might not get through. There probably was some mortality on account of conditions at Hell's Gate but there can be no doubt that a great many did succeed in getting through, as is evidenced by the large numbers reaching many of the spawning-grounds on the upper reaches of this river system. On the other hand, the run of sockeye to the Adams River, in the Shuswap district, while not expected to be large in 1941, actually was a failure. This may have been due to the temporary obstructions at Hell's Gate caused by exceptionally low water.

Spring Salmon.—There were 34,038 cases of spring salmon caught on the Fraser River in 1941. This was an exceptionally large pack of this species and is compared with packs of recent past years, namely: 1940, 4,504 cases; 1939, 5,993 cases; 1938, 4,308 cases; and 1937, 5,444 cases. The comparatively large pack of spring salmon in 1941 no doubt reflects the Federal Government's policy of diverting all salmon possible into the canning trade.

Cohoe Salmon.—In 1941 there were 28,265 cases of cohoe canned from Fraser River caught fish. This figure is compared with 27,127 cases in 1938, the cycle-year. The 1941 pack was 15,237 cases above the 1940 pack and was 9,531 cases greater than the average for the previous five-year period.

Pink Salmon.—The runs of pink salmon to the Fraser River coincide with the odd-numbered years. In 1941 the pink run produced a pack amounting to 102,388 cases, which seems about normal for the cycle. The 1941 pack exceeded the pack of 1939 by 7,212 cases and was also 21,075 cases above the average annual pack for the five cycle-years immediately preceding. This average, however, includes the year 1931, when curtailment of production by the canners on account of economic conditions reduced the pack of that year to 13,307 cases.

Chum Salmon.—The 1941 pack of Fraser River chum salmon, amounting to 95,070 cases, was the largest in recent past years. The 1941 pack is compared with 35,665 cases in 1940, 30,150 cases in 1939, 58,778 cases in 1938, and 20,878 cases in 1937. The comparatively large pack in 1941 does not necessarily indicate that the run was so much greater than the runs of other years, but rather reflects Government policy as outlined in a previous paragraph.

In all cases where not specifically mentioned, the reader is referred to the spawning report published in the Appendix to this report for spawning conditions.

Skeena River.

The total pack of all varieties of salmon caught on the Skeena River in 1941 was 200,497 cases. This was 5,142 cases greater than were packed in the year previous. The 1941 pack consisted of 81,767 cases of sockeye, 4,985 cases of springs, 1,896 cases of steelheads, 50,605 cases of cohoe, 50,537 cases of pinks, and 10,707 cases of chums.

Sockeye Salmon.—The canned-sockeye pack from Skeena River caught fish in 1941, consisting of 81,767 cases, though 34,740 cases less than in the year previous, must be considered as reasonably satisfactory when compared with the pack figures for the cycle to which this year's run belongs. The average pack for the previous five cycle-years, 1921–37, inclusive, was 54,635 cases. The 1941 pack was the largest pack in this cycle since 1925, when 81,146 cases were canned, and was 10,460 cases above the average for the previous five years.

The escapement to the spawning-beds was considered satisfactory. This river system has been experiencing a period of low sockeye production, but it would appear that the somewhat drastic conservation efforts instituted a few years ago by the Federal officers were having the desired effect.

Spring Salmon.—This species is canned on the Skeena River only incidental to the canning of other varieties. In 1941 there were 4,985 cases of spring salmon canned. This figure is compared with 6,118 cases in 1940, 4,857 cases in 1939, and 4,318 cases in 1938.

Cohoe Salmon.—There were 50,605 cases of cohoe salmon canned from Skeena River caught cohoe in 1941. This was 29,991 cases greater than the previous year's pack for this variety and is compared with 52,821 cases packed in 1938, the cycle-year. The 1941 pack of cohoe was 21,898 cases above the five-year average. In addition to the 50,605 cases of cohoe canned from Skeena River caught fish, there were also canned in Skeena River canneries 31,187 cases of cohoe which were imported from Alaska.

According to reports from the spawning-grounds, a heavy seeding of cohoe took place in this area.

Pink Salmon.—Sufficient pink salmon were caught on the Skeena River in 1941 to fill 50,537 standard cases. The 1941 pack was only 3,236 cases above that of the previous year, which year was considered very disappointing. The pack of this variety in 1941 was 22,050 cases below the previous five-year average and was 44,699 cases less than the cycle-year 1939. The 1941 pack of Skeena River pinks was the smallest in this cycle since 1931. An examination of the pack figures for Skeena River caught pinks for the previous few years would seem to indicate that greater protection for this species during the spawning migration is in order.

Reports from the pink-salmon spawning areas of the Skeena River watershed indicate that seeding by this variety was from "good to fairly heavy."

Chum Salmon.—The chum-salmon pack on the Skeena River is never large and the year 1941 was no exception, 10,707 cases having been packed. This figure is compared with 10,811 cases in 1937, four years previous. The 1941 pack was 357 cases above the five-year average, 1936–40, inclusive.

Seeding of the spawning-beds by this variety was reported as having been light.

Nass River.

The total pack of all species of salmon caught on the Nass River in 1941 was 71,330 cases, compared with 60,441 cases caught in 1940. The 1941 pack consisted of 24,876 cases of sockeye, 519 cases of springs, 374 cases of steelheads, 16,648 cases of cohoe, 22,667 cases of pinks, and 6,246 cases of chums.

Sockeye Salmon.—The 1941 sockeye-pack on the Nass River of 24,876 cases must be considered satisfactory. On account of the many year-cycles which make up the runs of sockeye to the Nass River, it is difficult to compare the catch of any given year with the cycle-year. A direct comparison with previous years' packs, however, may indicate the trend. The 1941 pack of sockeye was the largest of any year since 1936, in which year 28,562 cases were canned. The packs for the intervening years were as follows: 1940, 13,809 cases; 1939, 24,357 cases; 1938, 21,462 cases, and 1937, 17,567 cases. The run in 1941 produced a pack which was 3,725 cases above the average for the previous five-year period, 1936–40, inclusive. The catch in 1941 indicates that this year's run of sockeye was much better than the year previous, and reports from the spawning-grounds bear out this assumption, as the seeding of sockeye for the whole area is reported as "very satisfactory."

Spring Salmon.—The spring-salmon pack on the Nass River is never a large factor as springs are caught and canned incidental to fishing for other varieties. The pack in 1941 amounted to 519 cases and the packs of recent past years were as follows: 1940, 1,716 cases; 1939, 708 cases; 1938, 773 cases, and 1937, 1,251 cases.

Cohoe Salmon.—Cohoe were caught on the Nass River in 1941 sufficient to fill 16,648 cases. This was the largest pack of this variety since 1935, when the pack amounted to 21,810 cases. The 1941 pack exceeded the previous five-year average by 6,623 cases. The spawning areas frequented by this variety are reported as having been heavily seeded, "the best since 1938."

Pink Salmon.—The pink-salmon run to the Nass River produced a pack of 22,667 cases in 1941, which was 6,611 cases less than were caught in the year previous. The 1941 pack may be considered as satisfactory when compared with the catches of

previous years belonging to this cycle. The catch in 1939 produced a pack of 26,370 cases and, while the pack of 1937 was only 8,031 cases, the packs of 1935 and 1933 were both greater than that of 1941, being 25,508 cases and 44,306 cases respectively. The 1941 pack was only 788 cases less than the average for the previous five cycle-years, 1931 to 1939, inclusive.

Reports from the spawning-grounds indicate that the seeding by this variety was better than was expected from the size of the commercial catch.

Chum Salmon.—The Nass River never produced a large pack of chum salmon, although the 1941 pack of 6,246 cases was considerably lower than what might have been reasonable to expect. This was slightly greater than the year previous when 5,461 cases were canned, but the 1941 pack was 3,834 cases less than in the cycle-year 1937 and 4,668 cases less than the previous five-year average.

Reports from the spawning-beds indicate that the chum seeding was "good to medium."

Rivers Inlet.

In 1941 there were caught in Rivers Inlet salmon of all varieties sufficient to produce a total of 138,650 cases. This pack was 49,985 cases greater than the pack for this inlet in 1940. The 1941 pack was made up of 93,378 cases of sockeye, 1,692 cases of springs, 129 cases of steelheads, 23,202 cases of cohoe, 4,807 cases of pinks, and 15,442 cases of chums.

Sockeye Salmon.—The 93,378 cases of sockeye salmon packed on Rivers Inlet in 1941 was the largest pack of this variety since 1935 and exceeds the pack of the cycle-year 1937 of the four-year cycle by 8,546 cases and was 47,027 cases greater than in 1936, the previous cycle-year belonging to the five-year cycle. The 1941 pack for Rivers Inlet was 26,031 cases above the previous five-year average and 15,542 cases above the average for the previous ten years, 1931–40, inclusive.

Reports from the spawning-grounds indicate an excellent seeding in all places frequented by this variety.

Spring Salmon.—Spring salmon are caught and canned in Rivers Inlet only incidental to fishing and canning of other varieties. There were canned on Rivers Inlet in 1941, 1,692 cases of springs compared with 1,226 cases in 1940, 745 cases in 1939, 1,209 cases in 1938, and 917 cases in 1937.

Cohoe Salmon.—The catch of Rivers Inlet cohoe in 1941 amounted to 23,202 cases. This was the largest pack of this variety in recent years and exceeds the pack of the cycle-year 1938 by 6,917 cases. It was also 12,811 cases above the average for the previous five-year period 1936–40, inclusive.

The escapement to the spawning-beds is reported as better than usual for this variety.

Pink Salmon.—Pink salmon do not frequent Rivers Inlet in great numbers but are canned each year in varying amounts. In 1941 there were caught and canned 4,807 cases. This figure is compared with 12,095 cases canned in 1939, the cycle-year. The 1941 pack was the smallest of any year in that cycle since 1935, when 4,554 cases were canned. The pack of pinks in 1941 was 2,884 cases below the average annual pack for the previous five-year period 1936–40, inclusive.

Chum Salmon.—The comparatively large pack of chum salmon, amounting to 15,442 cases, caught in Rivers Inlet in 1941 no doubt reflects in some measure the heavy demand for all varieties of salmon for canning in 1941. The pack for this year was 6,417 cases above that of 1940 and was 6,809 cases above the average annual pack for the five-year period 1936–40, inclusive. The escapement was reported as "good."

Smith Inlet.

Smith Inlet is primarily a sockeye gill-net fishing area, although some seining is carried on in this inlet in the fall of the year for chum salmon. The total pack of Smith Inlet caught salmon in 1941 amounted to 32,109 cases and consisted of 21,495 cases of sockeye, 124 cases of springs, 45 cases of steelheads, 1,955 cases of cohoe, 749 cases of pinks, and 7,741 cases of chums.

Sockeye Salmon.—The 21,495 cases of sockeye salmon caught in this inlet in 1941 was slightly less than the catch in 1937, the cycle-year, and, notwithstanding reports that the spawning-beds were adequately seeded, the catch was somewhat disappointing. The 1941 pack was 1,649 cases below the five-year average and was 2,274 cases less than the average for the previous ten-year period.

Spring Salmon.—In Smith Inlet, like Rivers Inlet, spring salmon are caught incidental to fishing for other varieties and on this account the pack does not indicate the size of the run. In 1941, 124 cases were canned compared with 142 cases caught and canned in 1940.

Cohoe Salmon.—Cohoe, like springs, are never a large factor in the Smith Inlet catch and the catch of this variety in 1941 was no exception, amounting to 1,955 cases compared with the previous year's catch of 1,102 cases and with 3,880 cases in 1939. The average for the previous five-year period was 1,318 cases.

Seeding of the spawning-beds was reported as "reasonably good."

Pink Salmon.—In 1941, 749 cases of pink salmon were caught in Smith Inlet incidental to fishing for sockeye. The pack the year previous was 755 cases. Smith Inlet is not a pink-salmon area, although in some past years as many as 20,000 cases of pinks have been canned in this district.

Chum Salmon.—Some seining for chum salmon is done in Smith Inlet in the fall of the year. In 1941 the catch amounted to 7,741 cases, compared with 9,494 cases caught in 1937, the cycle-year. In 1940 the catch amounted to 6,015 cases and in 1939 to 2,771 cases. There were packed in 1938, 8,076 cases of this variety.

Queen Charlotte Islands.

Salmon-fishing in the Queen Charlotte Islands, with the exception of trolling, is confined almost exclusively to seining for pinks and chums and some cohoe. Other varieties listed as caught and canned from this district are caught incidental to fishing for the above-named varieties. Chum salmon are fished for each year, but pink salmon put in an appearance in the Queen Charlotte Islands only in every alternate year, the runs coinciding with the even-numbered years. The total pack of all varieties of salmon caught and canned in the Queen Charlotte Islands in 1941 amounted to 105,086 cases, of which 76,745 cases were chums and 27,421 cases were cohoe. The balance was made up of 149 cases of sockeye, 236 cases of springs, 11 cases of steelheads, and 524 cases of pinks.

Chum Salmon.—The pack of this variety caught and canned in the Queen Charlotte Islands in 1941, amounting to 76,745 cases, was 88,166 cases less than were caught in the previous year and is compared with 72,689 cases caught in 1937, the cycle-year. The 1941 catch was 1,916 cases less than the yearly average for the five-year period 1936–40, inclusive.

Reports from the spawning-grounds indicate a satisfactory seeding, except in the Cumshewa and Sewell Inlet areas. These two areas were formerly large producers of chum salmon.

Pink Salmon.—This being an "off" year, there was no run of this variety to the streams in the Queen Charlotte Islands in 1941. As mentioned above, pink salmon frequent the streams in these islands only in the even-numbered years.

Cohoe Salmon.—The 27,421 cases of cohoe caught and canned in the Queen Charlotte Islands in 1940 are compared with 16,616 cases canned in 1938, the cycle-year, and 8,897 cases caught in 1940. The pack in 1941 was 16,804 cases greater than the average annual pack of this variety for the five-year period 1936–40.

Reports from the spawning-beds indicate the seeding as having been heavy.

Central Area.

The Central area, for statistical purposes, comprises all of the salmon-fishing areas between Cape Calvert and the Skeena River, except Rivers Inlet. The total pack of all species of salmon caught in this area in 1941 amounted to 244,579 cases. The pack for this area in 1940 was 274,232 cases. The 1941 pack consisted of 20,854 cases of

sockeye, 460 cases of springs, 330 cases of steelheads, 45,218 cases of cohoe, 66,130 cases of pinks, and 111,587 cases of chums.

Sockeye Salmon.—Burke and Dean Channels and Fitzhugh Sound are the principal sockeye-fishing grounds in this area. Some sockeye are also caught in the vicinity of Banks Island and Principe Channel and a few are also taken in Gardner Canal. In 1941 the catch of sockeye in the whole area amounted to 20,854 cases. This was the smallest pack for a number of years and was 11,188 cases less than for the previous year. The 1941 pack was 9,519 cases below the average for the five-year period 1936–40, inclusive. The reader is referred to the spawning report published in the Appendix to this report, contributed by the Chief Supervisor of Fisheries for the Federal Government, for details of conditions found on the various spawning-beds.

Spring Salmon.—Spring salmon are caught and canned in this area but, as in other districts, the catch of springs is incidental to fishing for other varieties. In 1941 only 460 cases of spring salmon were canned.

Cohoe Salmon.—Sufficient numbers of this species were caught in 1941 to fill 45,218 cases. The pack was 11,498 cases less than in the cycle-year 1938, but was 846 cases above the average for the five-year period 1936–40, inclusive.

Pink Salmon.—Probably the most disappointing of all salmon-catches in British Columbia was the catch of pinks in the Central area. The 1941 pack amounted to 66,130 cases, which must be considered a failure when compared with the pack of 1939, the cycle-year, which amounted to 150,498 cases. The year 1941 was the second year in succession in which the pink-catch was a failure, the year 1940 having produced a pack of only 54,478 cases. It is true that the year 1941 belongs to what may be termed the small cycle for pink salmon in this area, but even in the small years it is reasonable to expect a pack of 100,000 cases. The average annual pack for this area for the five-year period 1936–40, inclusive, is 135,903 cases. There can be little doubt that the pink-salmon runs in the Central area will, in future, require greater protection with a view to building up these runs commensurate with the area's proven production capabilities. Reports from the spawning-grounds indicate that the escapement on the whole was considered as "not good."

Chum Salmon.—There were packed from Central area caught fish 111,587 cases of chum salmon. In 1937, the cycle-year, the pack amounted to 110,493 cases. The 1941 pack was 1,315 cases above the average annual pack for the previous five years and must be considered as satisfactory.

Vancouver Island.

The total salmon-pack credited to Vancouver Island in 1941 was 985,835 cases. This was the largest catch ever recorded for this area. The pack was composed of 40,273 cases of sockeye, 8,038 cases of springs, 308 cases of steelheads, 166,908 cases of cohoe (which figure includes 30,027 cases of bluebacks), 177,292 cases of pinks, and 593,016 cases of chums.

Sockeye Salmon.—The 40,273 cases of sockeye caught in the Vancouver Island area in 1941 was the largest pack of this species credited to this area in recent past years. The 1941 pack is compared with 15,177 cases in 1940 and was 16,768 cases above the average for the five-year period 1936–40, inclusive. Assuming a four-year cycle for most of the sockeye in this area, the 1941 catch was 12,308 cases above the cycle-year 1938. For details of the escapement to the spawning-grounds the reader is referred to the spawning report published in the Appendix to this report. Generally speaking, the sockeye seeding was reported as having been very good.

Spring Salmon.—In 1941 the pack of springs credited to Vancouver Island was 8,038 cases, compared with 2,454 cases in the year previous and 2,889 cases in 1939. The catch of spring salmon in the waters adjacent to Vancouver Island is taken principally by trolling-gear and this production finds a market in the fresh- and frozen-fish trade. The canned pack of this species reported in this column represents those spring salmon caught incidental to fishing for other varieties.

Cohoe Salmon.—There were 166,908 cases of cohoe canned from fish caught in the Vancouver Island area in 1941. This figure includes 30,027 cases of bluebacks. Figures

for the 1941 pack are compared with the 1940 pack figures, in which year there were canned 88,885 cases of cohoe, which figure includes 23,277 cases of bluebacks; and the 1939 pack of cohoes, amounting to 123,388 cases, with which is included 48,209 cases of bluebacks. In 1938 the Vancouver Island cohoe-pack was 89,471 cases, 27,417 cases of these being bluebacks.

Pink Salmon.—Pink salmon were caught and canned in the Vancouver Island area in 1941 to the extent of 177,292 cases, which pack was rather disappointing when compared with the previous packs belonging to this cycle. In 1939 the pink-pack was 235,119 cases or 57,827 cases above 1941, while in 1937 the pack was 141,488 cases more than were canned in 1941. The pack in 1937 amounted to 318,780 cases. The 1941 pack was 22,795 cases less than the yearly average for the previous five cycle-years 1931–39, inclusive. Spawning, as reported, was not satisfactory.

Chum Salmon.—The pack of chum salmon in the Vancouver Island district in 1941, amounting to 593,016 cases, was probably a record canned pack of this variety for this district. Heretofore large quantities of Vancouver Island caught chums have found an outlet in the salt-fish and frozen-fish trades and, in addition, there has existed a considerable demand for this fish from south of the International Border. Since the outbreak of hostilities in 1939 the Provincial Government has declined to issue salmon-saltery licences and, as a result, salteries have not operated. In 1941 no chum salmon were frozen. In addition, the Federal Government prohibited the export of chum salmon, except under permit. No permits were issued during the chum-salmon fishing season in the Vancouver Island district, thus all chum salmon caught were canned which, no doubt, accounts in some measure for the exceptionally large pack of canned chums from this district in 1941. In the year under review the pack was 330,930 cases above the average for the previous five-year period 1936–40, inclusive, and was 313,952 cases above the pack of the previous year. Notwithstanding the measures mentioned above which, no doubt, diverted large quantities of Vancouver Island caught chums to the canneries, other indications, such as the conditions on the spawning-grounds and reports from the fishing-grounds during the season, would all point to a very heavy run of this species in 1941. All spawning-beds were exceptionally well seeded.

REVIEW OF BRITISH COLUMBIA'S SALMON-CANNING INDUSTRY, 1941.

There were thirty-six salmon-canneries licensed to operate in British Columbia in 1941. This was two less than the number licensed to operate in 1940. The operating canneries were situated in the various districts, as follows:—

Queen Charlotte Islands	2
Nass River	2
Skeena River	7
Central area	4
Rivers Inlet	2
Johnstone Strait	4
Fraser River and Lower Mainland	11
West coast of Vancouver Island	4

Compared with the year previous, there were operated in 1941 one cannery less in the Queen Charlotte Islands district and the same number as the year previous on the Nass River, Skeena River, and in the Central area. In Rivers Inlet in 1941 there were two canneries less in operation than in the year previous, while in Johnstone Strait and on the west coast of Vancouver Island the number operating in 1941 was the same as in the previous year. In the Fraser River and lower mainland district there was one more cannery operated in the year under review than in the previous year. This extra cannery was a new establishment built in North Vancouver. There was no pink-salmon run to the Queen Charlotte Islands in 1941, which probably accounts for the one less cannery operating in that district. There were only two canneries operated in Rivers Inlet in 1941. Those other plants which formerly operated as canneries were all used as net-camps, the catches being transported for canning to other canneries in the district. As in the year previous, there were no canneries operated in Smith Inlet

in 1941. The three cannery properties located in this latter area, however, all operated as net-camps. One salmon-cannery in the Johnstone Strait area was destroyed by fire in mid-season, the cannery in question being the Quathiaski Cannery belonging to the British Columbia Packers, Limited.

Probably the most outstanding feature of the 1941 salmon-canning operations in British Columbia was the exceptionally large pack of salmon put up by the comparatively small number of canneries operated, which indicates that the salmon-canneries of British Columbia, generally speaking, are very seldom worked to maximum capacity. Early in the 1941 operating season the Federal Government indicated that the British Ministry of Food was anxious to obtain a large portion of the British Columbia salmon-pack; i.e., 1,200,000 cases of an anticipated 1,700,000 cases. Realizing that there would be no difficulty in disposing of their pack, the salmon-canners went all out to put in cans as much as possible of the salmon-catch. The Federal and Provincial Governments both adopted policies which would have the effect of diverting as much as possible of the salmon-catch to the canneries. The Provincial Government declined to permit the operation of salmon dry-salteries and the Federal Government placed an embargo on the export of fresh salmon in certain categories and also discouraged the freezing of salmon for a portion of the season. These measures had the desired effect, with the result that most of the fall fish were canned, whereas heretofore large quantities of fall fish have found an outlet in the frozen-fish and salt-fish trades. These facts should be taken into consideration when making comparisons between the canned-salmon pack figures for British Columbia for 1941 and the pack figures of other years. The result of these various efforts was a total salmon-pack amounting to 2,295,433 cases, which is the largest pack on record, and of this amount approximately 1,500,000 cases were exported to England for the account of the British Ministry of Food.

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

Pilchard.—The pilchard-canneries in British Columbia are located principally on the west coast of Vancouver Island, as it is in the waters off the shores of Vancouver Island where the principal pilchard-fishery is conducted. While the bulk of the pilchard-catch is reduced to meal and oil, nevertheless there is a growing trade in canned pilchards. There were five pilchard-canneries operated in 1941 compared with four plants in operation in 1940. These five plants produced 72,498 cases of canned pilchards in 1941, compared with 73,000 cases in the previous year.

Herring.—Previous to 1939 herring were canned in British Columbia to some extent but the pack was never large, owing to the limited market. In 1939, due principally to orders arising on account of hostilities in Europe, the canning of herring assumed the proportions of a major industry and in that year there were canned 418,021 cases. In 1940 Britain's requirement of a low-cost high-protein food was directed to British Columbia canned herring and, as a result, sixteen herring-canneries were licensed to operate in that year, producing a pack of 640,252 cases. That this product was favourably received by the British authorities is evidenced by the fact that early in 1941 the British Government negotiated with the Canadian Government for a pack of canned herring equivalent to 1,600,000 cases. British Columbia canners undertook to produce this large pack, and in order that as much as possible of the herring-catch would find an outlet through the canners the Provincial Government declined to issue herring dry-saltery licences. In addition to this, the Federal Government placed an embargo on the reduction of herring caught on the east coast of Vancouver Island, except that amount not suitable for canning. The result of these restrictions, together with increased effort on the part of the fishermen, the twenty-three herring-canneries which were licensed to operate in 1941 produced a pack of 1,527,350 cases, all of which was shipped to Great Britain.

The requirement of Great Britain for a low-cost high-protein food during war-time is an ideal opportunity for the herring-packers of British Columbia to demonstrate to the British consumer the possibility of supplying canned herring and, if the operators insist on maintaining a high standard of quality, there seems to be no good reason why a very large portion of this trade could not be retained after the cessation of hostilities.

Shell-fish.—Shell-fish, principally clams and oysters, are canned to some extent in British Columbia. The operation is never large, although in some years the production is considerably higher than in others. In 1941 there were four shell-fish canneries licensed to operate. These four canneries produced a pack of 11,560 cases of clams and 6,773 cases of crabs. There was also a small quantity of oysters canned in 1941.

Tuna-fish.—In 1939 there was a small experimental pack of tuna-fish put up in British Columbia and in 1940 no cannery made returns to the Provincial Fisheries Department, indicating that no tuna-fish had been canned. In 1941, however, returns again indicate that tuna-fish were canned in small quantities, one cannery only making returns.

MILD-CURED SALMON.

In 1941 four plants were licensed to operate as tierced-salmon plants, the same number as were licensed in the year previous. The four plants in 1941 produced a pack of 1,481 tierces, as against 767 tierces produced in the year previous.

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 largely to the increased demand occasioned by the war for inexpensive protein foods, such as canned chum 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 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 dry-salted in British Columbia in 1941.

For the above-noted reasons the British Columbia Salt-fish Board was inoperative during the 1941 season and on that account no report of the British Columbia Salt-fish Board is included in this report as heretofore.

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 past years have reduced the quantity of dry-salt herring considerably. In 1941, however, the British Columbia Government 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 were no herring dry-salteries operated in British Columbia in 1941.

PICKLED HERRING.

Owing to the outbreak of hostilities in Europe, certain markets in the United States which formerly obtained their supplies of pickled herring from European countries suddenly found themselves without a source of supply and, as a result, some pickled herring was produced in British Columbia during the 1939–40 season. The quantity produced, however, was small in that year and the pack was more or less of an experimental nature. In 1940 the Provincial Government licensed five pickled-herring plants

to operate in British Columbia, which five plants produced a pack of 5,500 barrels of herring. In 1941 three pickled-herring plants were licensed to operate, these three plants producing a pack of 3,095 barrels. There is no doubt that this pack would have been considerably larger except that the British Columbia Government, in order to divert as much as possible of the east coast herring-catch to the herring-canneries, again declined to permit pickled-herring plants to operate on fish caught on the east coast of Vancouver Island. This action forced the operation of pickled-herring plants largely to the west coast of Vancouver Island or, at least, to operations conducted on west coast caught fish, which no doubt materially reduced the size of the pack that otherwise would have been produced.

HALIBUT PRODUCTION.

The total halibut-landings on the Pacific Coast of North America are regulated by the International Fisheries Commission. On this account there is very little fluctuation in the amount 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, are Areas Nos. 2 and 3, the waters off the coast of Washington and British Columbia corresponding with Area No. 2 and the waters off the coast of Alaska corresponding with Area No. 3.

In 1941 the catch-limits set by the International Fisheries Commission were: For Area No. 2, 22,700,000 lb. and for Area No. 3, 26,300,000 lb.—a total of 49,000,000 lb. These catch-limits differed from the year previous in that in 1940 the catch-limit for Area No. 3 was 25,300,000 lb. There was no change in the amount of halibut which was permitted to be taken in 1941 in any of the other areas. In addition to the 49,000,000 lb. permitted to be taken from Areas Nos. 2 and 3, the International Fisheries Commission issues permits which allow vessels to land halibut caught incidental to fishing for other species in an area closed to halibut-fishing while halibut-fishing is permitted in another area. The regulations of the International Fisheries Commission also permit the landings of halibut caught in Area No. 1 so long as Area No. 2 is open to fishing and halibut caught in Area No. 4 may be landed so long as halibut are permitted to be fished in Area No. 3. Catch-limits, however, are set only in Areas Nos. 2 and 3. The production from Areas Nos. 1 and 4 is comparatively small.

The total landings of all vessels in 1941 amounted to 52,118,000 lb., which was 1,122,495 lb. less than the total landings in 1940. The 52,118,000 lb. include 332,000 lb. landed from Area No. 1. Of the balance, 23,845,000 lb. were caught in Area No. 2 and 27,941,000 lb. were caught in Area No. 3. The total halibut-landings at Canadian ports by all vessels, Canadian and American, amounted to 22,837,000 lb., and of this total 12,206,000 lb. were caught in Area No. 2 while 10,631,000 lb. were caught in Area No. 3. These figures are compared with 12,885,211 lb. for Area No. 2 and 10,999,908 lb. for Area No. 3 in the year previous. The Canadian fleet caught and landed in Canadian ports 10,469,000 lb. from Area No. 2 and 2,334,000 lb. from Area No. 3, making a total of 12,803,000 lb. landed by Canadian vessels in Canadian ports in 1941. This was 128,621 lb. greater than the Canadian catch landed in Canadian ports in 1940. In addition to the above, Canadian vessels landed in American ports 61,000 lb. from Area No. 2 and 16,000 lb. from Area No. 3. The total Canadian catch of halibut in 1941, therefore, was 12,880,000 lb.

Heretofore the unweighted average price for Canadian halibut in Prince Rupert was used as a basis for comparison. The International Fisheries Commission, through whose courtesy these figures are supplied, is now using the weighted average price rather than the unweighted figures. The International Fisheries Commission advised, however, that the unweighted prices did not differ appreciably from the weighted values and are sufficiently close for comparison. In 1941 the weighted average price paid for Canadian halibut in Prince Rupert was 9.86 cents per lb.

Halibut-livers in 1941 were again in demand by pharmaceutical houses as a valuable source of concentrated vitamins. Since the outbreak of hostilities there has been an increased demand for halibut-livers. These were formerly thrown away but now are producing a considerable sum to the halibut-fishermen of the Pacific. This

amounted to $456,598 in 1941. In addition to the livers, halibut-fishermen are now landing halibut viscera, which is also a rich source of vitamin-bearing oils. In 1941 the Pacific halibut fleet received $126,180 for halibut viscera.

The above figures are compiled from information supplied by the International Fisheries Commission, which information is gratefully acknowledged.

FISH OIL AND MEAL.

The production of fish-oil and edible fish-meal from various species of British Columbia fish has become an important factor in the fishing industry of the Province. Pilchard and herring have been, and probably still are, the principal species used for the production of oil and meal, but considerable quantities of these products are also produced from dogfish and cannery waste. Due to the exigencies of the war in Europe and the necessity for natural sources of vitamins and the discovery that certain British Columbia fish-oils are potent in Vitamins A and D, there has developed in British Columbia in the past eighteen months a very important branch of the fishing industry engaged in producing unquestionably high vitamin oils from various fish-livers, some of which have not been used heretofore. The livers used principally in this branch of the fish-oil industry are dogfish-livers, various species of cod-livers, halibut livers, shark-livers (notably soup-fin shark), and others.

The Provincial Government did not license the operation of plants producing liver-oils exclusively in 1941; therefore, no returns have been made to the Provincial Fisheries Department, but it is known that the production of high vitamin liver-oils was quite considerable in 1941.

In addition to the vitamin oils mentioned above, British Columbia reduction plants produced fish-oil and edible fish-meal in large quantities. The oil is used in numerous manufacturing processes, principally in the making of soaps, paints, linoleums, etc., and in recent years considerable quantities of this oil have found an outlet as a feeding oil for the feeding of poultry and other live stock. The meal is also used to fortify stock foods.

Pilchard Reduction.—The pilchard-fishery of British Columbia is conducted principally on the west coast of Vancouver Island and while the bulk of the pilchard-catch is taken well off-shore, there appear in certain seasons schools of pilchards in the inner passages in the proximity of Queen Charlotte Sound. In 1941, nine pilchard-reduction plants were licensed to operate in British Columbia. These nine plants produced 11,437 tons of pilchard-meal and 1,916,191 imperial gallons of oil. In 1940 there were six plants licensed to operate and these six plants produced 4,853 tons of meal and 890,926 imperial gallons of oil.

Herring Reduction.—The reduction of herring in British Columbia has grown and is now an important branch of our winter fishery. Herring are caught from October through to March, and while heretofore the fishery was conducted largely on the west coast and south-east coast of Vancouver Island and in the vicinity of Prince Rupert, in recent years the fishery has been extended to practically the whole of the British Columbia coast. In 1941, however, the demand from Great Britain for a high-protein food at low cost, which demand could be met by a large-scale production of the canning of herring, made necessary such Government action as would divert as much herring as possible from the reduction plants to the herring-canneries. The Provincial Government 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. Plants located on the east coast were licensed on the 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. These Provincial Government regulations were supplemented by further regulations by 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 of the herring-catch as possible, the fifteen herring-reduction plants which were licensed to operate in British Columbia in 1941 produced somewhat less meal and

oil than the fifteen licensed plants did in 1940. In 1940 there were produced 10,886 tons of herring-meal and 923,137 imperial gallons of herring-oil, whereas in 1941 the production of meal was 8,780 tons and the production of oil amounted to 594,684 imperial gallons.

Whale Reduction.—In 1941 two whale-reduction plants were licensed to operate in British Columbia. This was one more than operated in 1940. The two plants, located at Naden Harbour and Rose Harbour, in the Queen Charlotte Islands, killed 328 whales which produced 270 tons of meal and 561 tons of fertilizer. In addition, there were produced 110,313 imperial gallons of whale-oil and 508,712 imperial gallons of sperm-oil.

Miscellaneous Reduction.—Dogfish and fish-offal reduction plants are licensed to operate each year in British Columbia. These plants produce meal and oil from the carcasses of dogfish and cannery waste, etc. In 1941 there were twelve such plants licensed compared with eleven plants in 1940. The production amounted to 16,488 tons of meal and 381,755 imperial gallons of oil in 1941 compared with 4,061 tons of meal and 378,957 imperial gallons of oil in 1940. In addition to this meal and oil produced from cannery waste and dogfish, etc., two reduction plants reduced anchovies to the extent of 351 tons of meal and 23,585 imperial gallons of oil.

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. 27.)

In the Appendix to this report will be found paper No. 27 in the series "Contributions to the Life-history of the Sockeye Salmon." This paper is again the work of Dr. W. A. Clemens, formerly director of the Pacific Biological Station at Nanaimo, and now head of the Department of Zoology, University of British Columbia.

In paper No. 27 attention is directed to the fact that the Rivers Inlet sockeye-pack in 1941 was above the average for the past thirty-four years and that the pack of sockeye for the Nass River in 1941 was slightly above the average for the past twenty-nine years but that the pack of Skeena River sockeye was below the average for the past thirty-four years.

In the case of seeding of the spawning-beds, it is pointed out by the author that in all three cases the seeding was apparently satisfactory.

Commenting specifically on the particular river systems, Dr. Clemens remarks as follows:—

Rivers Inlet Sockeye Run, 1941.

The Rivers Inlet sockeye run of 1941, amounting to 93,378 cases, falls in what might be considered the medium-sized range between 60,000 and 100,000 cases. A considerable number of four-year-old fish from the 1937 brood-year appeared in the 1941 run, as well as a rather large number of five-year-old fish from the 1936 spawning. It will be recalled that there was an exceptionally large escapement in 1936 because of the strike among the fishermen, and also that late in the autumn of that year there occurred a very severe freshet which it was thought at the time may have caused considerable damage to the spawning-beds. Dr. Clemens points out that since there have been no extraordinary returns of fish in 1940 or 1941, it would seem reasonable to conclude that the freshet did have some adverse effect upon the production, but just how much it is impossible to say.

With regard to the run which may be expected in this inlet in 1942, Dr. Clemens points out that the 1942 Rivers Inlet sockeye run will be the result of the spawnings of 1937 and 1938. If the packs are considered as an indication of the size of the run,

there would seem to be reason to believe that the pack in 1942 should be approximately equivalent to those of 1937 and 1938. In the former year the pack was 84,832 cases and the escapement was stated to have been satisfactory. In the latter year the pack was 87,942 cases and the escapement was reported as better than usual.

Skeena River Sockeye Run, 1941.

Commenting on the general characteristics of the Skeena River sockeye run, Dr. Clemens points out that this run produced a pack of 81,767 cases of sockeye and the escapement is described as satisfactory. Attention is directed to the 1940 report, where it was pointed out that the run of 1941 would depend largely upon the production of four-year-old fish from the spawning of 1937, because the 1936 spawning had already produced a very large run of four-year-old fish in 1940 and in view of the fact that the percentage of fish in the 4_2 age-group in 1941 is relatively low, the pack is obviously large in relation to the brood-years.

Commenting on the possibilities for the 1942 run, the author points out that this year will be the production of the brood-years of 1937 and 1938. In the former year the pack was 42,491 cases and in the latter year the pack was 47,257 cases. The escapement in both years was reported as being good. Unless the production from this escapement is exceptionally good, the author feels that the prospects for a large run in 1942 would not appear to be very bright.

Nass River Sockeye Run, 1941.

With regard to the Nass River run of sockeye in 1941, the author contents himself by observing that the pack in 1941 was 24,876 cases, which was close to the average pack of the past twenty-nine years, and that the run in 1942 will be derived from the spawnings of 1937 and 1938. In the former year the pack was 17,567 cases, with the escapement reported as being quite good on the whole, and in the latter year the pack was 21,462 cases with the escapement reported as being heavy. As previously stated, the returns to the Nass River are entirely unpredictable.

PILCHARD AND HERRING INVESTIGATIONS.

The pilchard and herring investigations have been carried on during the year under a continuation of the agreement between the Fisheries Research Board of Canada and the Provincial Fisheries Department, and they have continued to provide information on the stocks of fish which supply these two important British Columbia fisheries. The work has been conducted by Dr. J. L. Hart, Dr. A. L. Tester, Dr. R. V. Boughton, and their assistants. The personnel engaged in this work has been reduced owing to two experienced men having joined the armed forces.

Pilchards.

The pilchard-fishery proved unexpectedly successful during the 1941 season and the catch made for unit fishing effort was as high as it has ever been since the inception of the fishery. This unexpectedly successful year was a result of the occurrence on the fishing-grounds of a large proportion of pilchards which were smaller and younger than those customarily encountered by the British Columbia fleet. The reason for the occurrence is not plain, but is believed to be connected with hydrographic conditions which brought younger-than-usual fish within range of the British Columbia fishing operations. Evidently this physical phenomenon has followed the successful production of one or several abundant year-classes of young fish, but the degree to which these year-classes are abundant can not be stated at the present time. A noteworthy feature of the pilchard-fishery has been the taking of fish during the winter, since several thousand tons of pilchards were captured along the west coast of Vancouver Island during the winter months.

A curtailed tagging and tag-recovery programme has been maintained and, as reported in the Appendix, has been instrumental in demonstrating some of the relationships between the pilchard populations along the west coast of the North American continent.

Herring.

The British Columbia herring-fishery has assumed greatly increased importance because of the need for canned herring to augment the food-supply of the United Kingdom during the war. In the 1940–41 herring season the total catch amounted to over 94,000 tons, of which 76.7 per cent. was taken from fishing-grounds in the vicinity of Vancouver Island and the balance, 23.3 per cent., from fishing-grounds to the north of Vancouver Island. The total catch was less than that in the previous season, when it amounted to over 150,000 tons, and the decrease is largely due to the failure of herring to appear in quantity in the central and northern fishing-grounds prior to the closure of the season. In the southern areas, on the contrary, the availability of the fish was higher than in the previous year. The canned-herring production in 1940–41 (640,252 cases) was greater than in 1939–40 (418,021 cases).

Several features of the 1940–41 fishing season are revealed in daily catch statistics collected through the medium of Pilot House Record Books: the failure of fishing in Prince Rupert Harbour, but the exploiting of new grounds to the north at Union Bay and Wark Channel; successful fishing during December and January at Aaltanhash Inlet, near Butedale; a very late run to Laredo Inlet; extensive scouting of the Bella Bella, Rivers Inlet, Smith Inlet, and Queen Charlotte Sound areas, but with relatively poor returns; a lower availability at Deepwater Bay and Okisollo Channel than in the previous year; high availability and early attainment of the 30,000-ton quota on the south-east coast of Vancouver Island; and slightly more successful fishing on the west coast of Vancouver Island than in the previous year, with " outside " fishing in Nicolaye Channel, Kyuquot Sound.

The sampling of the commercial catch to determine size, age composition, and growth rate was continued in 1940–41 with the collection of 129 samples, comprising about 13,700 fish. It was found that on the south-east and west coasts of Vancouver Island the herring were larger than in the two previous years, and that the precociously mature group of age II. was no longer present. Fish of the 1938 year-class (age III.) were particularly abundant and formed about 80 per cent. of the catch on the south-east coast, and in Clayoquot, Nootka, and Kyuquot Sounds. There was great variation in age composition between samples from different fishing-grounds in the Queen Charlotte Sound area, and, in general, the fish were older but smaller than those from areas to the south. To the north of Vancouver Island, there was a general decrease in average length and age from that of 1939–40. The 1938 year-class was particularly abundant at Laredo Inlet and Bella Bella.

Spawning-ground studies were again made with the co-operation and assistance of Department of Fisheries officers. For the Strait of Georgia, the spawning appeared to be slightly heavier than in 1940, whereas on the west coast of Vancouver Island it was slightly lighter. In the Queen Charlotte Sound area it also appeared to be slightly lighter, but in most northern areas it showed a fair increase.

A memorandum was prepared covering the five-year test of a quota system of regulation of the herring-fishery of both the east and west coast of Vancouver Island. The general reaction of the herring populations to the quotas was assessed. During the five-year period the east coast fishery has been fairly stable and limited by the quota. On the west coast the catch declined to 1938–39 and then increased slightly, but only in one year, 1936–37, has the quota been approximated. On the average, the spawn-deposition has been much less on the west than on the east coast. As a result of this experiment, the Department of Fisheries requested that the tests be continued for a second five-year period, and revised the quotas by raising that for the east coast and lowering that for the west coast.

Racial studies, which have had as their objective, firstly, the defining of individual geographical populations if possible, and secondly, the extent of their intermingling, have been largely curtailed and a report of the findings is being prepared. The amount of useful information which can be obtained from studies of this type is definitely limited, and the method has been supplanted by the more direct approach of tagging and tag-recovery.

A complete account of tagging and tag-recovery during the 1941–42 season is included in the Appendix to this report. The tag returns in 1941–42 were less than in previous years, chiefly because of the larger quantities of fish canned and the smaller quantities reduced. In the canned fish, tags may be recovered from the offal which passes through reduction plants, but it is known that this is not nearly as productive of tags as whole fish. Although the information obtained in 1940–41 is somewhat less than in previous years, the results confirm past findings with regard to the practical independence of the populations in major areas—i.e., the Strait of Georgia, the west coast of Vancouver Island, Queen Charlotte Sound, the central coast-line, and the northern coast-line. They again show that within major areas there is some mixing of the runs to particular localities, but that this mixing is incomplete. The 1941–42 results gave indications of this tendency toward segregation in the runs to various fishing-grounds in the Strait of Georgia.

THE CLAM INVESTIGATION.

The investigation into the clams of British Columbia was continued in 1941. This investigation was instituted in order to ascertain the conditions prevailing on some of the clam-beaches of British Columbia, particularly those which have been exploited commercially for some considerable length of time. The investigation was undertaken by the Fisheries Research Board at the request of the Provincial Fisheries Department and is financed jointly by the Fisheries Research Board of Canada and the Provincial Fisheries Department. The work was commenced by Dr. Roy Elsey and latterly has been carried on by Mr. D. B. Quayle. Mr. Quayle obtained leave of absence for the purpose of joining the Royal Canadian Air Force, and the scientific work is now being conducted by Mr. Ferris Neave, of the Pacific Biological Station, Nanaimo.

In the Appendix to this Department's report for 1939 there appeared a preliminary report on the investigation by Mr. Quayle. While the investigation is primarily for the purpose of obtaining information on the clams of the Province, it is broad enough to include shell-fish generally and in future reports it is possible that reports will be given on other species than clams.

In the Appendix to this report will be found a report, "The Butter-clam (*Saxidomus giganteus* Deshayes): Studies in Productivity," by Ferris Neave. In this paper Mr. Neave makes a comparison between the productivity of different areas in respect of butter-clams in the terms of average catch per "man-tide." Mr. Neave also comments on an experiment which has been started on Seal Island, near Comox, to investigate the relation between clam population and production and to determine the effect of limiting the annual catch under a quota system. In this paper figures are presented showing the catch made during the first season from beach areas of known extent, together with estimates of the clam population of these areas. From this preliminary work and the evidence adduced so far, Mr. Neave concludes that there appeared to be a direct relation between abundance of clams and the yield obtained. It is generally conceded that the clam-beaches in the lower part of British Columbia which have been exploited for the longest period of time have been depleted to some extent, and it is hoped that this investigation will be the means of indicating to what extent this has occurred and pointing to a means of correction.

These papers outlining the progress of the work will be published in this report from time to time.

INTERNATIONAL FISHERIES COMMISSION, 1941.

The International Fisheries Commission completed its tenth year of successful regulation of the Pacific halibut-fishery. It continued the scientific investigations of the fishery and of the stocks of halibut that provide the basis for rational control of the fishery.

Meetings of the Commission were held on June 12th and on November 27th, 28th, and 29th. During these the condition of the fishery and the programme of investigation and regulation were considered. On November 28th the Commission met with the Conference Board, composed of representatives of the fishermen's and owners' organ-

izations from British Columbia, Washington, and Alaska. At this conference the success of the conservation measures adopted by the Commission was discussed and recommendations for the regulation of the fishery in 1942 were received from the fleets.

The members of the Commission were the same as in 1940: Mr. L. W. Patmore (chairman) and Mr. A. J. Whitmore for Canada; Mr. Edward W. Allen (secretary) and Mr. Charles E. Jackson for the United States. At the meeting of November 29th Mr. Edward W. Allen was elected chairman and Mr. L. W. Patmore secretary for the calendar years 1942 and 1943.

Halibut-fishing regulations in 1941 were essentially the same as in 1940. The Area 2 catch-limit of 22,700,000 lb. was retained. However, the Area 3 catch-limit was increased 1,000,000 lb. from 25,300,000 to 26,300,000 lb. The validity of permits for the retention of halibut caught incidentally during fishing for other species in areas closed to halibut-fishing was extended to twenty days after closure of the last area open to halibut-fishing. The opening date of the 1942 season was set as midnight of April 15th.

The catch-limits of Areas 2 and 3 were attained earlier in 1941 and the fishing season was shorter than in any previous year. Fishing began on April 1st, as in 1940. The grounds south of Cape Spencer, Area 2, were closed to fishing at midnight of June 30th, thirteen days earlier than in 1940. Area 3, west of Cape Spencer, was closed at midnight of September 14th, twelve days earlier than in 1940. As provided in the regulations, Areas 1 and 4 closed at the same time as Areas 2 and 3 respectively. Permits for the retention of halibut caught incidentally during other fishing in Area 2 became invalid at midnight of October 4th.

The total catch of halibut on the Pacific Coast in 1941 was 52,118,000 lb. Of this, 342,000 lb. were recorded from Area 1 south of Willapa Harbor, Washington; 23,845,000 lb. from Area 2, and 27,941,000 lb. from Area 3. No catches were made in Area 4. The Area 2 catch included 510,000 lb. taken under permit while fishing for other species after closure of Area 2.

The earlier attainment of the catch-limits and the earlier closure of the areas resulted from a combination of factors. There was an increase in the number of regular halibut vessels and of small boats fishing in Area 2. Several large vessels, chiefly from the sardine or pilchard fishery, joined the Area 3 fleet. A larger proportion of the catches from both areas was landed at ports closer to the fishing-grounds. As a result of the earlier closure of Area 2, a greater number of Area 2 vessels fished in Area 3 after closure of the former. The Area 2 class of vessel that in 1932, the first year of regulation, caught only 224,000 lb. in Area 3, accounted for 6,827,000 lb. of the Area 3 catch in 1941.

The fleets continued their programme of voluntary curtailment, involving lay-up periods between trips and limits upon the size of trips, to spread the permitted catch-limits over a longer period of the year. Lay-up periods were increased in 1941, but were insufficient to compensate for the factors that tended to further shorten the season. However, the season would have been materially shorter had the curtailment programme not been in effect.

The total number of regular halibut-boats in the Canadian Area 2 fleet decreased but the fishing power of the fleet increased. The addition of several larger vessels more than offset a decline in number of smaller boats. The Canadian catch of halibut was 12,880,000 lb., about 250,000 lb. greater than in 1940 and the second highest annual catch since 1915. Of this catch, 10,530,000 lb. were reported as from Area 2 and 2,350,000 lb. as from Area 3, constituting 44 per cent. and 8 per cent. respectively of the totals for those areas.

The scientific investigations of the Commission which have been found to be indispensable to the rational control of the fishery were continued. Changes in the fishery and changes in the condition of the stocks resulting from past regulation were measured and analysed to determine the proper course of future regulation.

The condition of the spawning stock in Area 2 was studied by means of quantitative determinations of the abundance of eggs and larvæ on the important spawning area in the vicinity of Cape St. James, British Columbia. The operations of the halibut-vessel "Eagle," which were begun in late December, 1940, were continued

until the middle of March, 1941. A total of 399 net-hauls were made at 158 stations, which have been sampled annually in a comparable manner for the past eight years. Hydrographic samples were taken at twelve stations to determine the currents and water conditions in the spawning area. Similar operations were again undertaken in early December, 1941.

A preliminary analysis of the materials collected during investigation of the success of spawning in the winter of 1940–41 indicates that for the fourth consecutive season no increase in the production of spawn occurred. This finding is in accord with results from other studies of the Commission in respect to the present condition of the Area 2 stock.

Study of the changes taking place in the composition of the stocks of adult halibut as a result of regulation was continued. More than 75,000 fish in the market catches from representative fishing-grounds were measured, 43,000 from banks off the coast of British Columbia in Area 2 and 32,000 from grounds off Alaska in Area 3. These measurements showed that the Area 3 stock is in sound condition but that Area 2 still has relatively few spawners. As in the case of other investigations of the condition of the Area 2 stock, these data failed to indicate any improvement.

Determination of the changes in the age-composition of the adult stocks, a more exact method of measuring the changes in the stocks, was begun using age materials collected incidentally during the taking of market measurements. When completed, this will accurately relate the changes that have occurred to the years in which they originated and thus to the events producing them.

The investigations of the Commission prove that the condition of the stock of halibut in Area 3 has improved markedly under regulation. The abundance and average size of the fish are both greater, indicating the presence of a greater supply of fish of spawning size. The stock has been rebuilt to the condition that prevailed about 1924. With the expenditure of only 50 per cent. as much fishing effort and without injury to the future yield, it is now producing as great a catch as was obtained in 1930 with unrestricted fishing. The stock is in sound condition but must be kept under close observation as the rate of improvement, which was at first very rapid, is diminishing.

The condition of the Area 2 stock has also improved greatly since 1930, but is still far from sound. As in Area 3, the initial rate of improvement was very rapid. However, the rate of improvement slowed down after 1935 and since 1938 has ceased. This cessation of improvement must be viewed with concern, as replenishment of the stock by reproduction is still very limited in amount.

The cessation of improvement in Area 2 coincided with and must be ascribed to the catching of large amounts of halibut in excess of the permitted catch-limits, chiefly through illegal fishing after closure of the area. Due to these excess catches, the actual catch in Area 2 has become as great as those which were taken about 1924 and which caused a deterioration of the stock when it was in a condition comparable to that now existing. The past history of the fishery indicates that unless such excess catches are eliminated the gains resulting from the past ten years of regulation in Area 2 will be lost.

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION, 1941.

Under the treaty between Canada and the United States, known generally as the "Sockeye Treaty," there was set up in 1937 the International Pacific Salmon Fisheries Commission, which Commission is charged with investigating the various problems connected with the sockeye-salmon runs to the Fraser River. The scientific work of this Commission is under the direction of Dr. W. F. Thompson, who formerly directed the scientific work of the International Fisheries Commission dealing with the halibut-fishery of the Pacific. We have prevailed upon Dr. Thompson to briefly review the scientific work in connection with the International Pacific Salmon Fisheries Commission covering the year 1941. Dr. Thompson's report deals chiefly with the conditions prevailing at Hell's Gate, although mention is also made of other activities in connection with the Commission's investigation into the sockeye runs to the Fraser River. Dr. Thompson's report will be found in the Appendix to this report.

APPENDICES.

CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON. (No. 27.)

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

INTRODUCTION.

Of the 455,297 cases of sockeye salmon packed in 1941 in British Columbia, 200,021 consisted of fish proceeding to Rivers Inlet and the Skeena and Nass Rivers.

The Rivers Inlet pack amounted to 93,378 cases, which is above the average of the past thirty-four years—namely, 82,813 cases. The Dominion Fisheries Inspector reports the spawning-grounds to have been "well seeded."

The pack of Skeena River fish was 81,767 cases, which is below the average of the past thirty-four years—namely, 91,850. However, the deposition of eggs throughout the river system is stated to have been very satisfactory.

The Nass River pack consisted of 24,876 cases, which is slightly above the average of the past twenty-nine years—namely, 21,835 cases. The escapement is reported as heavy and the conditions for spawning as very satisfactory.

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 1941.

(1.) General Characteristics.

As stated previously the pack of sockeye salmon at Rivers Inlet in 1941 amounted to 93,378 cases. This falls in what may be considered as the medium-size range; that is, between 60,000 and 100,000 cases. A goodly number of four-year-old fish from the 1937 brood-year appeared in the run, as well as a rather large number of five-year-old fish from the 1936 spawning.

It may be recalled that there was an exceptionally large escapement in 1936 because of a strike among the fishermen. Also, that late in the autumn there occurred a very severe freshet which was feared to have caused considerable damage to the spawning-beds. Since there have been no extraordinary returns of fish in either 1940 or 1941, it would seem reasonable to conclude that the freshet did have some adverse effect upon the production, but just how much cannot be determined.

The return in 1942 will be the result of the spawnings in 1937 and 1938. In the former year the pack was 84,832 cases and the escapement was stated to have been satisfactory. In the latter year the pack was 87,942 cases and the escapement was reported as "better than usual." In view of the fact that these packs were somewhat above the average and that the escapements were apparently good, it would seem that a run at least approximately equivalent to those of 1937 and 1938 should appear.

(2.) Age-groups.

The data for this year's study were obtained from 2,286 fish taken in twenty-nine random samplings of the commercial catch from June 30th to August 1st. The 4_2 age-group is represented by 1,338 individuals forming 59 per cent., the 5_2 age-group by 922 individuals or 40 per cent., the 5_3 by 20 or 1 per cent., and the 6_3 by 6 fish. In addition there is one individual of the 4_1 age-group and one of the 3_1 age-group (Table I.).

(3.) Lengths and Weights.

The average lengths of the males and females of the 4_2 age-group are 21.3 and 21.7 inches respectively. These are considerably below the averages of the past twenty-nine years and the lowest on record, with the exception of the year 1936. As was the case in 1940, the females slightly exceed the males in average length. In the 5_2 age-group, the average lengths are 25.0 and 24.7 inches for males and females respectively. These are approximately equivalent to the averages of the past years of record (Table IV.).

The average weights of the males and females are 4.1 and 4.2 lb. respectively. These are much below the averages of the past twenty-nine years and in the case of the males constitute a new low record. In the 5_2 age-group the average weights are 6.4 and 6.1 lb. for the males and females respectively and are somewhat below the average of the past years of record (Table V.).

It is evident that the fish comprising the run of 1941 are comparatively small in size. The difference in lengths and weights of the fish of the 5_2 age-group in 1940 and 1941 is particularly striking. The difference in size of fish in the two years is reflected in the number of fish required to fill a 48-lb. case. In 1940 the figure was 12.61 while in 1941 it is 13.40. These data are supplied through the kindness of Major J. A. Motherwell.

The information concerning the distribution of lengths and weights in 1941 is given in Tables II. and III.

(4.) Distribution of the Sexes.

The total number of males in the samplings is 1,208 and of females 1,080, percentages of 53 and 47 respectively. The averages for the past twenty-seven years are 50 and 50 respectively. In the 4_2 age-group the males predominate with a percentage of 69, while in the 5_2 age-group the females predominate with a percentage of 71. While these percentages are rather high, they are not exceptional (Table VI.).

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	----

Table II.—Rivers Inlet Sockeyes, 1941, 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.	
17½	1	.....	.....	.....	.....	.....	.....	.....	1
18	.....	.....	.....	.....	.....	.....	.....	.....	.....
18½	2	.....	.....	.....	.....	.....	.....	.....	2
19	9	.....	.....	.....	.....	.....	.....	.....	9
19½	31	1	.....	.....	.....	.....	.....	.....	32
20	96	10	.....	.....	1	.....	.....	.....	107
20½	157	30	.....	.....	1	1	.....	.....	189
21	168	89	.....	1	2	1	.....	.....	261
21½	171	99	.....	2	5	.....	.....	.....	277
22	128	86	2	1	2	1	.....	.....	220
22½	60	54	4	27	.....	4	.....	.....	149
23	39	24	24	41	1	.....	.....	.....	129
23½	34	15	26	62	.....	.....	.....	.....	137
24	17	5	28	95	.....	.....	.....	.....	145
24½	3	2	43	123	.....	1	.....	1	173
25	5	1	29	119	.....	.....	1	.....	155
25½	.....	.....	33	75	.....	.....	.....	3	111
26	.....	1	27	64	.....	.....	.....	.....	92
26½	.....	.....	24	28	.....	.....	.....	.....	52
27	.....	.....	24	12	.....	.....	.....	.....	36
27½	.....	.....	4	1	.....	.....	1	.....	6
28	.....	.....	3	.....	.....	.....	.....	.....	3
Totals	921	417	271	651	12	8	2	4	2,286
Ave. lengths	21.33	21.73	24.98	24.66	21.42	22.25	26.25	25.25	.....

Table III.—Rivers Inlet Sockeyes, 1941, 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
2½	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	51	3	.....	.....	1	.....	.....	.....	55
3½	264	78	.....	2	3	1	.....	.....	348
4	312	175	2	6	5	1	.....	.....	501
4½	162	101	9	27	2	3	.....	.....	304
5	74	46	25	77	1	2	.....	.....	225
5½	36	12	47	145	.....	1	.....	.....	241
6	19	1	55	144	.....	.....	.....	.....	219
6½	2	1	39	108	.....	.....	.....	3	153
7	.....	.....	40	76	.....	.....	1	1	118
7½	.....	.....	26	41	.....	.....	.....	.....	67
8	.....	.....	17	22	.....	.....	1	.....	40
8½	.....	.....	8	3	.....	.....	.....	.....	11
9	.....	.....	3	.....	.....	.....	.....	.....	3
Totals	921	417	271	651	12	8	2	4	2,286
Ave. weights	4.07	4.18	6.35	6.06	3.96	4.56	7.50	6.62	.....

Table IV.—Rivers Inlet Sockeyes, Average Lengths in Inches of the 4_2 and 5_2 Groups, 1912 to 1941.

Year.	4_2		5_2	
	M.	F.	M.	F.
1912	23.2	22.8	25.8	24.6
1913	22.9	23.0	25.9	25.2
1914	23.0	22.8	25.9	25.2
1915	22.9	22.8	26.0	25.1
1916	22.9	22.8	25.8	25.0
1917	22.5	22.3	25.0	24.4
1918	22.3	22.5	24.9	24.5
1919	22.4	22.3	24.8	24.4
1920	.....	.....	26.0	25.0
1921	22.9	22.6	25.2	24.2
1922	22.5	22.4	24.6	24.2
1923	22.4	22.3	24.6	24.1
1924	22.3	22.3	24.9	24.3
1925	22.2	22.2	25.5	24.8
1926	22.8	22.9	25.1	24.6
1927	22.1	22.4	24.6	24.2
1928	22.3	22.8	26.1	25.2
1929	22.6	22.2	25.2	25.3
1930	22.7	22.6	26.0	25.2
1931	21.9	22.0	25.2	24.8
1932	22.4	22.4	25.2	24.6
1933	22.1	22.0	25.5	24.7
1934	22.4	22.2	25.6	25.0
1935	22.4	22.4	25.8	25.1
1936	21.0	20.9	24.6	23.4
1937	22.0	21.9	24.5	24.0
1938	23.1	22.8	26.6	25.5
1939	22.0	21.9	25.3	24.5
1940	22.0	22.5	26.7	25.6
Average lengths	22.4	22.4	25.4	24.7
1941	21.3	21.7	25.0	24.7

Table V.—Rivers Inlet Sockeyes, Average Weights in Pounds of the 4_2 and 5_2 Groups, 1914 to 1941.

Year.	4_2		5_2	
	M.	F.	M.	F.
1914	5.4	5.2	7.3	6.8
1915	5.3	5.1	7.3	6.6
1916	5.5	5.0	7.6	6.7
1917	5.0	4.9	6.6	6.2
1918	4.9	5.1	6.7	6.7
1919	4.9	4.8	6.3	5.9
1921	5.2	4.9	6.9	6.0
1922	6.0	5.9	7.4	7.0
1923	5.0	4.8	6.5	5.9
1924	4.9	4.8	6.6	6.1
1925	4.6	4.4	6.9	6.2
1926	5.2	5.2	6.9	6.3
1927	5.3	5.8	7.3	7.6
1928	4.8	5.0	7.5	6.7
1929	5.0	4.8	6.6	6.7
1930	4.9	4.8	7.5	6.9
1931	4.5	4.6	6.7	6.4
1932	4.7	4.7	6.5	6.5
1933	4.8	4.6	7.3	6.6
1934	4.9	4.6	7.3	6.7
1935	4.5	4.3	6.9	6.1
1936	4.9	4.1	7.9	6.7
1937	4.6	4.4	6.1	5.8
1938	4.7	4.5	7.1	6.4
1939	4.4	4.2	6.5	5.9
1940	4.7	4.8	8.2	7.3
Average weights	4.9	4.8	7.0	6.5
1941	4.1	4.2	6.4	6.1

Table VI.—Rivers Inlet Sockeyes, Percentages of Males and Females, 1915 to 1941.

Year.	4_2		5_2		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.		
1915	---	---	---	---	45	55
1916	65	35	43	57	49	51
1917	63	37	39	61	48	52
1918	79	21	49	51	66	34
1919	77	23	41	59	58	42
1920	74	26	48	52	49	51
1921	63	37	40	60	51	49
1922	66	34	38	62	61	39
1923	71	29	31	69	62	38
1924	74	26	31	69	50	50
1925	66	34	34	66	41	59
1926	63	37	32	68	51	49
1927	68	32	36	64	62	38
1928	63	37	30	70	50	50
1929	57	43	36	64	53	47
1930	56	44	37	63	47	53
1931	59	41	33	67	47	53
1932	54	46	28	72	47	53
1933	56	44	32	68	42	58
1934	55	45	27	73	49	51
1935	63	37	39	61	53	47
1936	43	57	20	80	32	68
1937	61	39	28	72	48	52
1938	49	51	32	68	37	63
1939	56	44	37	63	50	50
1940	64	36	23	77	52	48
1941	69	31	29	71	53	47
Average	63	37	34	66	50	50

2. THE SKEENA RIVER SOCKEYE RUN OF 1941.

(1.) General Characteristics.

The run of sockeye salmon to the Skeena River produced a pack of 81,767 cases, with an escapement described as very satisfactory. It was stated in the 1940 report that the size of the run in 1941 would depend largely upon the production of four-year-old fish from the spawning of 1937 since the 1936 spawning had already produced a very large run of four-year-old fish in 1940. In view of the fact that the percentage of fish in the 4_2 age-group in 1941 is relatively low, the pack is obviously large in relation to the brood-years.

The return in 1942 will be the production of the brood-years 1937 and 1938. In the former year the pack was 42,491 cases and in the latter year 47,257 cases. In both years the escapements were reported as very good. Unless the production from these escapements is exceptionally good, the prospects for a large run in 1942 would not appear to be very bright.

(2.) Age-groups.

The length, weight, and sex data and scale collections were obtained from 1,830 fish in forty-four random samplings from July 3rd to August 22nd. The 4_2 age-group is represented by 707 individuals or 39 per cent., the 5_2 by 959 or 52 per cent., the 5_3 by 142 or 8 per cent., and the 6_3 by 22 or 1 per cent. (Table VII.). The five-year-old fish thus constitute 60 per cent. of the sampling, and in view of the size of the pack would seem to indicate a real preponderance of this age-class as well as a relative scarcity of four-year-old fish. The brood-year of 1936 was thus extraordinarily successful in that it produced an exceptionally large number of four-year-old fish in 1940 and, in addition, a large number of five-year-olds in 1941.

(3.) Lengths and Weights.

The average length of the males of the 4_2 age-group is 23.2 inches, which is somewhat below the average of 23.7 for the past twenty-nine years of record. That of the females is 23.2 inches, practically identical with the average of the past years (Table X.). It may be noted that the average lengths of the males and females are identical. This is an unusual occurrence for the Skeena River fish. On the other hand, in the case of Rivers Inlet fish the females not infrequently exceed the males in average length.

The average lengths of the males and females of the 5_2 age-group are 26.2 and 25.2 inches respectively. These are slightly above the past years of record. The average lengths of the 5_3 and 6_3 age-groups present no unusual features (Table X.).

The average weights of the males and females of the 4_2 age-group are 5.0 and 4.9 lb. respectively and are very slightly below the averages of the past years of record. The average weights of the 5_2 age-group are 6.7 and 6.2 lb. for males and females respectively and practically identical with the averages of the past years (Table XI.).

(4.) Distribution of the Sexes.

The total number of males in the samplings is 657 and of females 1,173, percentages of 36 and 64 respectively. These figures represent a new record in the proportions of males to females but are somewhat similar to those of 1939 and 1940, when the percentages of males were 37 and 38 respectively. The females predominate in both the 4_2 and 5_2 age-groups, with percentages of 62 and 67 respectively.

There has usually been an excess of females in the samplings from the Skeena River, but in recent years the excess has become more pronounced.

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

Table VIII.—Skeena River Sockeyes, 1941, grouped by Age, Sex, and Length, and by their Early History.

Length in Inches.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
20	1	-----	-----	-----	-----	-----	-----	-----	1
20½	1	1	-----	-----	-----	-----	-----	-----	2
21	13	1	-----	-----	-----	-----	-----	-----	14
21½	20	17	-----	-----	1	4	-----	-----	42
22	24	43	-----	2	3	7	-----	-----	79
22½	38	75	-----	1	5	21	-----	-----	140
23	32	97	-----	10	4	11	-----	-----	154
23½	37	102	7	24	8	18	1	-----	197
24	51	58	10	48	17	11	-----	3	198
24½	31	29	12	107	13	7	-----	3	202
25	15	10	32	129	9	1	2	-----	198
25½	5	3	38	131	1	-----	3	3	184
26	3	-----	61	106	-----	-----	1	1	172
26½	-----	-----	60	71	1	-----	-----	-----	132
27	-----	-----	45	16	-----	-----	2	-----	63
27½	-----	-----	36	2	-----	-----	2	-----	40
28	-----	-----	5	-----	-----	-----	-----	-----	5
28½	-----	-----	4	-----	-----	-----	-----	-----	4
29	-----	-----	2	-----	-----	-----	1	-----	3
Totals	271	436	312	647	62	80	12	10	1,830
Ave. lengths	23.23	23.16	26.16	25.23	24.17	23.11	26.17	24.8	-----

Table IX.—Skeena River Sockeyes, 1941, 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	7	6	-----	-----	-----	1	-----	-----	14
4	39	42	-----	2	1	6	-----	-----	90
4½	56	121	3	13	11	25	-----	1	230
5	68	148	7	52	10	26	1	1	313
5½	51	84	26	110	20	15	-----	4	310
6	35	29	40	180	16	5	2	1	308
6½	9	5	77	158	4	2	4	1	260
7	5	1	80	98	-----	-----	3	2	189
7½	-----	-----	53	31	-----	-----	-----	-----	84
8	-----	-----	22	3	-----	-----	-----	-----	25
8½	-----	-----	4	-----	-----	-----	2	-----	6
Totals	271	436	312	647	62	80	12	10	1,830
Ave. weights	5.02	4.93	6.73	6.15	5.41	4.94	6.75	5.8	-----

Table X.—Skeena River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1941.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912	24.6	23.5	26.4	25.2	-----	-----	-----	-----
1913	23.5	22.9	25.5	24.7	-----	-----	-----	-----
1914	24.2	23.4	26.2	25.1	-----	-----	-----	-----
1915	24.2	23.5	25.9	25.0	24.5	23.4	25.6	24.4
1916	23.9	23.6	26.2	25.0	24.1	23.8	26.2	24.8
1917	23.6	23.2	25.5	24.7	23.9	23.8	25.4	25.0
1918	24.1	23.3	25.9	25.0	23.9	23.4	25.2	24.7
1919	24.3	23.4	25.7	24.8	24.3	23.4	25.8	24.7
1920	23.8	23.2	26.2	25.3	24.1	23.4	26.2	25.1
1921	23.8	23.1	25.2	24.2	24.2	23.4	24.9	24.2
1922	23.6	23.2	25.3	24.4	23.8	23.3	24.6	24.1
1923	23.7	23.1	25.5	24.5	23.9	23.2	25.6	24.4
1924	24.1	23.3	26.2	25.2	24.7	23.6	25.8	24.8
1925	23.6	22.8	25.6	24.7	24.1	23.3	25.8	24.8
1926	23.8	23.4	25.6	24.8	24.6	23.8	26.0	25.0
1927	23.9	23.3	25.7	24.8	24.1	23.5	25.2	24.9
1928	23.3	22.8	25.3	24.7	23.5	22.8	25.6	24.7
1929	22.9	22.7	25.5	24.7	23.8	22.8	25.5	24.3
1930	23.1	22.7	24.7	23.9	23.5	22.4	24.6	23.2
1931	23.5	23.1	25.7	24.8	23.8	23.1	25.8	24.7
1932	23.4	22.7	25.2	24.4	24.1	22.8	25.4	24.4
1933	23.2	22.8	26.1	25.2	24.3	23.4	26.4	25.3
1934	23.8	23.2	26.3	25.2	25.2	24.1	26.0	24.9
1935	23.1	22.9	26.3	25.2	23.6	22.8	26.2	25.1
1936	23.8	23.2	26.0	25.2	24.4	23.5	26.3	25.0
1937	23.5	22.9	26.2	25.1	24.9	24.1	26.9	25.5
1938	23.3	22.5	25.3	24.4	23.6	23.1	25.6	24.3
1939	24.1	23.9	26.1	25.4	24.8	24.1	26.3	25.1
1940	24.0	23.3	27.0	25.7	24.3	23.8	27.0	26.1
Average lengths	23.7	23.1	25.8	24.9	24.1	23.4	25.8	24.8
1941	23.2	23.2	26.2	25.2	24.2	23.1	26.2	24.8

Table XI.—Skeena River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1941.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1914	5.9	5.3	7.2	6.3	.....	.....	.....	.....
1915	5.7	5.2	6.8	6.2	5.9	5.2	6.6	6.0
1916	5.4	5.1	7.1	6.3	5.8	5.4	7.1	5.9
1917	5.3	5.0	6.4	6.0	5.5	5.2	6.3	5.8
1918	5.8	5.3	6.9	6.4	5.7	5.3	6.6	6.1
1919	6.1	5.5	7.0	6.2	6.1	5.4	6.9	6.3
1920	5.6	5.1	7.2	6.4	6.3	5.1	7.3	6.3
1921	5.7	5.1	6.4	5.7	5.8	5.1	6.0	5.6
1922	5.4	5.1	6.5	5.7	5.5	5.1	6.2	5.7
1923	5.3	4.9	6.3	5.7	5.3	4.8	6.3	5.4
1924	5.6	5.0	7.0	6.3	5.9	5.1	6.6	5.8
1925	5.1	4.7	6.5	5.8	5.5	4.9	6.9	5.4
1926	5.3	5.1	6.5	5.8	5.9	5.2	6.9	6.2
1927	5.4	5.1	6.5	5.9	5.4	5.0	6.0	5.8
1928	5.0	4.6	6.4	5.8	5.0	4.6	6.5	5.8
1929	4.9	4.7	6.8	6.2	5.6	4.9	6.8	5.7
1930	5.4	5.1	6.7	6.0	5.6	5.0	6.8	5.8
1931	5.4	5.1	6.8	6.3	5.5	5.0	6.9	6.0
1932	5.4	4.9	6.9	6.1	6.0	5.0	6.8	5.9
1933	4.9	4.7	7.1	6.3	5.7	5.0	7.1	6.3
1934	5.7	5.2	7.7	6.6	6.7	5.8	7.7	6.2
1935	5.1	4.9	7.4	6.5	5.5	4.7	7.2	6.4
1936	5.6	5.2	7.3	6.6	6.1	5.5	7.4	6.2
1937	4.9	4.6	6.4	5.8	5.7	5.1	7.0	6.1
1938	5.2	4.6	6.6	6.1	5.3	5.0	6.9	5.9
1939	4.9	4.7	6.3	5.7	5.4	4.9	6.6	5.5
1940	5.6	5.1	8.2	6.9	5.7	5.2	8.2	6.8
Average weights	5.4	5.0	6.8	6.1	5.7	5.1	6.8	6.0
1941	5.0	4.9	6.7	6.2	5.4	4.9	6.8	5.8

Table XII.—Skeena River Sockeyes, Percentages of Males and Females, 1915 to 1941.

Year.	4_2		5_2		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.		
1915	56	44	45	55	49	51
1916	70	30	43	57	55	45
1917	66	34	48	52	60	40
1918	63	37	46	54	57	43
1919	53	47	46	54	49	51
1920	41	59	37	63	38	62
1921	44	56	44	56	45	55
1922	52	48	41	59	50	50
1923	60	40	37	63	52	48
1924	50	50	43	57	45	55
1925	57	43	42	58	50	50
1926	40	60	43	57	42	58
1927	45	55	41	59	44	56
1928	48	52	45	55	46	54
1929	50	50	46	54	50	50
1930	47	53	56	44	53	47
1931	43	57	39	61	44	56
1932	47	53	63	37	54	46
1933	48	52	40	60	45	55
1934	42	58	33	67	39	61
1935	41	59	32	68	40	60
1936	38	62	36	64	39	61
1937	45	55	39	61	42	58
1938	40	60	51	49	42	58
1939	34	66	42	58	37	63
1940	38	62	39	61	38	62
1941	38	62	33	67	36	64
Average	48	52	43	57	46	54

3. THE NASS RIVER SOCKEYE RUN OF 1941.

(1.) General Characteristics.

The pack of sockeye salmon from the Nass River run in 1941 was 24,876 cases. This, as stated previously, is close to the average pack of the past twenty-nine years, in which the range has been from 5,540 cases in 1928 to 39,349 in 1915.

The run in 1942 will be derived from the spawnings of 1937 and 1938. In the former year the pack was 17,567 cases and the escapement was reported as " quite good on the whole." In the latter year the pack was 21,462 cases and the escapement was recorded as large and the seeding heavy. As stated in previous reports, the returns to the Nass River are entirely unpredictable.

(2.) Age-groups.

The analysis of the run of 1941 is based upon data for 1,581 fish obtained in forty-six randon samplings from July 1st to August 22nd. The representation of the various age-groups is as follows: 4_2, 579 fish or 37 per cent.; 5_2, 118 fish or 7 per cent.; 5_3, 828 fish or 52 per cent.; and 6_3, 56 fish or 4 per cent. (Table XIII.).

The outstanding feature is the exceptionally high percentage of the 4_2 group of fish and the correspondingly low percentage of the 5_3 group. Over the past twenty-nine years the average representation of the former age-class has been 16 per cent. and of the latter 67 per cent. Since the 5_3 fish constitute the dominant age-class in Nass River system, apparently the condition in 1941 should be attributed to a limited number of five-year-old fish rather than to an exceptional number of four-year-olds. It may be noted that the Fishery Inspector reported for the Meziadin Lake spawning-ground areas that " the run was composed of large and medium sized fish about evenly divided."

(3.) Lengths and Weights.

The average lengths of the males and females of the 4_2 age-group are 25 and 24 inches respectively and somewhat above the averages of the past years of record. The averages for the 5_3 age-group are 26.1 and 25.1 respectively and almost identical with the average of the past years. The averages for the smaller age-groups—namely, the 5_2 and 6_3—are somewhat above the twenty-nine-year averages.

The average weights of the males and females in the 4_2 age-group are 6.2 and 5.5 lb. respectively and in the 5_3 age-group, 6.6 and 6.0 lb. respectively. The former are slightly above the averages of the past years and the latter slightly below (Tables XVI. and XVII.).

(4.) Proportions of the Sexes.

The total number of males in the samplings is 755 and of females 826, percentages of 48 and 52 respectively. The above percentages are almost identical with those of the averages of the twenty-seven years of record—namely, 47 and 53. In the 4_2, 5_2, and 5_3 age-classes the females slightly outnumbered the males in the 1941 run (Table XVIII.).

Table XIII.—Nass River Sockeyes, Percentages of Principal Age-groups from 1912 to 1941 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

Table XIV.—Nass River Sockeyes, 1941, 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.	
21	.....	1	.....	.....	.....	.....	.....	.....	1
21½	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	4	.....	.....	.....	.....	.....	.....	4
22½	2	8	.....	.....	.....	.....	.....	.....	10
23	6	45	.....	.....	.....	7	.....	.....	58
23½	10	59	.....	1	.....	18	.....	.....	88
24	24	77	.....	3	9	41	.....	.....	154
24½	53	49	.....	5	8	68	.....	.....	183
25	76	43	1	16	43	119	1	.....	299
25½	56	13	3	12	41	101	3	1	230
26	35	3	11	15	110	76	1	2	253
26½	13	.....	5	5	88	15	2	2	130
27	2	.....	14	7	60	3	3	2	91
27½	.....	.....	8	.....	16	1	3	1	29
28	.....	.....	6	.....	4	.....	9	2	21
28½	.....	.....	5	.....	.....	.....	7	1	13
29	.....	.....	1	.....	.....	.....	11	.....	12
29½	.....	.....	.....	.....	.....	.....	3	.....	3
30	.....	.....	.....	.....	.....	.....	2	.....	2
Totals	277	302	54	64	379	449	45	11	1,581
Average lengths	25.01	23.98	26.99	25.55	26.11	25.09	28.07	26.95	.....

Table XV.—Nass River Sockeyes, 1941, grouped by Age, Sex, and Weight, and by their Early History.

Weight in Pounds.	Number of Individuals.								Total.
	4_2		5_2		5_3		6_3		
	M.	F.	M.	F.	M.	F.	M.	F.	
3½	.....	1	.....	.....	.....	.....	.....	.....	1
4	.....	.....	.....	.....	.....	.....	.....	.....	.....
4½	.....	9	.....	.....	.....	4	.....	.....	13
5	19	93	.....	1	7	29	.....	.....	149
5½	43	112	1	5	22	105	.....	.....	288
6	84	58	1	16	56	165	.....	.....	380
6½	91	29	9	19	133	121	5	5	412
7	33	.....	9	14	121	23	7	2	209
7½	7	.....	16	8	31	2	9	2	75
8	.....	.....	13	1	7	.....	14	2	37
8½	.....	.....	5	.....	2	.....	5	.....	12
9	.....	.....	.....	.....	.....	.....	5	.....	5
Totals	277	302	54	64	379	449	45	11	1,581
Average weights	6.18	5.50	7.40	6.53	6.62	6.00	7.74	7.14	.....

Table XVI.—Nass River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1941.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1912	24.6	23.3	26.5	25.1	26.2	25.4	27.0	25.6
1913	24.1	23.5	25.6	24.8	26.0	25.2	26.0	26.6
1914	24.6	22.7	26.1	25.1	26.3	25.5	26.9	25.6
1915	24.0	23.5	25.9	25.2	26.5	25.9	26.6	25.3
1916	24.5	23.3	26.4	25.0	26.5	25.6	27.9	25.7
1917	23.4	23.2	25.5	24.7	25.3	24.7	26.5	25.5
1918	25.0	24.3	25.7	24.7	25.9	25.0	27.2	25.2
1919	24.9	24.1	26.2	25.2	26.5	25.8	27.9	26.7
1920	24.0	23.4	26.3	25.0	26.7	25.9	27.4	25.9
1921	24.3	23.5	25.5	24.3	26.2	25.6	27.9	26.2
1922	24.2	23.4	25.6	24.6	25.7	25.0	28.0	25.9
1923	24.3	23.7	25.9	25.3	26.2	25.5	27.2	26.5
1924	24.7	23.8	26.2	24.9	26.3	25.4	28.0	25.4
1925	24.4	23.8	25.9	24.7	25.9	25.0	26.9	25.4
1926	24.9	24.1	26.1	25.3	26.1	25.3	27.9	27.0
1927	24.9	24.2	25.3	25.2	26.3	25.9	27.6	26.5
1928	24.3	23.5	26.0	25.1	25.5	24.6	28.1	26.2
1929	24.1	23.5	26.1	25.2	25.9	24.9	27.2	26.2
1930	24.5	23.7	26.5	25.4	26.4	25.3	27.9	26.8
1931	24.5	23.8	26.5	25.7	26.1	25.3	28.2	27.1
1932	24.9	23.9	26.4	25.2	26.6	25.6	28.3	27.1
1933	24.6	23.7	27.1	25.8	25.9	25.2	28.4	27.9
1934	24.9	24.1	26.9	25.9	26.3	25.4	28.6	27.1
1935	24.9	24.0	27.3	25.9	26.5	25.2	28.9	27.6
1936	24.9	24.1	26.8	25.8	26.6	25.6	28.3	27.1
1937	23.8	23.3	26.0	24.5	25.0	24.2	27.2	26.3
1938	24.1	23.5	26.0	24.8	25.2	24.4	26.6	26.1
1939	24.9	24.2	26.9	25.8	26.1	25.3	27.9	26.6
1940	25.6	24.6	28.2	26.8	27.2	26.1	29.3	28.1
Average lengths	24.5	23.7	26.3	25.2	26.1	25.3	27.6	26.4
1941	25.0	24.0	27.0	25.6	26.1	25.1	28.1	27.0

Table XVII.—Nass River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1941.

Year.	4_2		5_2		5_3		6_3	
	M.	F.	M.	F.	M.	F.	M.	F.
1914	6.2	5.0	7.4	6.5	7.2	6.5	7.9	6.8
1915	5.6	5.2	6.9	6.4	7.0	6.6	7.2	6.5
1916	6.0	5.3	7.2	6.3	7.2	6.2	8.1	6.4
1917	5.3	5.3	6.8	6.2	6.3	5.8	7.3	6.4
1918	6.3	5.8	7.2	6.3	7.2	6.4	8.3	6.7
1919	6.0	5.5	6.6	5.9	6.7	6.1	7.8	6.7
1920	5.6	5.2	7.4	6.3	7.4	6.7	7.9	7.0
1921	6.0	5.4	6.9	6.1	6.9	6.3	7.7	6.6
1922	5.9	5.4	6.8	6.2	6.8	6.3	8.1	6.6
1923	5.8	5.2	6.7	6.1	6.6	6.0	7.2	6.8
1924	5.9	5.4	7.2	6.1	6.8	6.1	8.0	6.5
1925	5.9	5.4	6.8	6.1	6.7	6.0	7.4	6.3
1926	6.0	5.4	6.9	6.2	6.7	6.0	7.8	7.1
1927	6.2	5.8	7.1	6.3	6.9	6.2	7.8	7.0
1928	5.6	5.0	7.0	6.2	6.2	5.5	8.1	6.6
1929	5.7	5.2	7.1	6.6	6.7	5.9	7.6	6.8
1930	5.9	5.2	7.3	6.5	7.1	6.1	8.2	7.2
1931	6.0	5.5	7.4	6.8	6.8	6.2	8.3	7.4
1932	6.3	5.6	7.5	6.6	7.3	6.3	8.7	7.5
1933	6.2	5.4	8.1	7.0	7.0	6.2	8.4	7.9
1934	6.7	5.9	8.4	7.3	7.6	6.7	9.4	8.1
1935	6.1	5.2	7.8	6.5	7.0	6.1	8.4	7.4
1936	6.5	5.7	7.8	7.1	7.6	6.7	8.7	7.5
1937	5.5	5.2	6.8	6.1	6.2	5.5	7.8	7.0
1938	5.9	5.8	7.4	6.3	6.5	5.8	7.6	6.8
1939	5.3	5.0	6.8	6.1	6.0	5.3	7.1	6.1
1940	6.9	6.0	8.9	7.8	8.0	7.0	9.5	8.5
Average weights	6.0	5.4	7.3	6.4	6.9	6.2	8.0	7.0
1941	6.2	5.5	7.4	6.5	6.6	6.0	7.7	7.1

Table XVIII.—Nass River Sockeyes, Percentages of Males and Females, 1915 to 1941.

Year.	4_2		5_2		5_3		6_3		Per Cent. Total Males.	Per Cent. Total Females.
	M.	F.	M.	F.	M.	F.	M.	F.		
1915	55	45	49	51	52	48	53	47	52	48
1916	61	39	61	39	50	50	68	32	55	45
1917	55	45	47	53	46	54	58	42	47	53
1918	52	48	40	60	50	50	70	30	51	49
1919	53	47	48	52	46	54	54	46	48	52
1920	46	54	39	61	40	60	66	34	42	58
1921	40	60	45	55	47	53	54	46	46	54
1922	36	64	32	68	46	54	64	36	44	56
1923	43	57	43	57	47	53	60	40	46	54
1924	55	45	44	56	47	53	67	33	48	52
1925	58	42	52	48	45	55	68	32	49	51
1926	43	57	44	56	44	56	57	43	46	54
1927	39	61	54	46	45	55	61	39	46	54
1928	50	50	48	52	42	58	62	38	46	54
1929	48	52	51	49	44	56	58	42	46	54
1930	49	51	43	57	40	60	63	37	43	57
1931	49	51	53	47	43	57	70	30	47	53
1932	49	51	46	54	45	55	72	28	48	52
1933	49	51	56	44	47	53	76	24	49	51
1934	48	52	51	49	50	50	58	42	50	50
1935	39	61	40	60	39	61	71	29	42	58
1936	42	58	35	65	43	57	50	50	43	57
1937	56	44	43	57	50	50	56	44	51	49
1938	51	49	52	48	40	60	58	42	44	56
1939	51	49	51	49	46	54	61	39	48	52
1940	48	52	60	40	49	51	68	32	51	49
1941	48	52	46	54	46	54	80	20	48	52
Average	49	52	47	53	45	55	63	37	47	53

COMPARISON LENGTHS AND WEIGHTS OF SOCKEYES, 1940–41.

In 1940 the average lengths and weights of the fish composing the run to the Nass River were exceptionally large. The records for the Skeena River fish were somewhat above the averages of the past years and for Rivers Inlet the fish of the 5_2 age-group were exceptionally large.

In 1941 the average lengths and weights of the Nass and Skeena River fish were near the averages of the past years of record, while those of the Rivers Inlet fish were considerably below the past years' averages.

The differences in average lengths and weights for 1940 and 1941 are presented in Table XIX. In order to simplify comparisons the averages of the male and female lengths and weights are given.

It will be seen that in all cases, except for the lengths of the 6_3 fish of Rivers Inlet, where the representation of this age-group is very small, the fish were shorter and lighter in 1941.

It seemed of interest to determine the relation of weight to length among the fish of the various age-groups for the two years. For this purpose there has been used what is usually called the "condition factor." The procedure followed was that commonly used wherein the weight is multiplied by 100,000 and the product divided by the cube of the length. The figure 42 is usually considered as the average "condition factor." Values above this represent increasing plumpness and values below decreasing plumpness. The data in Table XIX. indicate that the Rivers Inlet fish, in spite of their small size, are plumper in relation to their length than are the fish of the other two areas and, on the other hand, the large fish of the Nass River are less plump in relation to their lengths.

Furthermore, for each river system the larger fish of 1940 tended to be plumper than the smaller fish of 1941.

Finally, there are presented herewith, through the kindness of Major J. A. Motherwell, the number of salmon required to fill a 48-lb. case in each of the three sockeye areas under consideration:—

	1940.	1941.
Nass River	10.17	11.94
Skeena River	12.48	12.50
Rivers Inlet	12.61	13.40

These figures further illustrate the considerable differences in sizes of the fish in the two years in the Nass River and Rivers Inlet areas. In the former region one and three-quarters more fish were required per case in 1941 and in the latter region nearly four-fifths of a fish. On the Skeena River the numbers were practically identical in the two years.

Table XIX.—Comparison Lengths and Weights of Sockeyes, Rivers Inlet, Skeena River, and Nass River, 1940–41.

	4_2		5_2		5_3		6_3	
	1940.	1941.	1940.	1941.	1940.	1941.	1940.	1941.
Nass River—								
Length	25.1	24.5	27.5	26.3	26.7	25.6	28.7	27.6
Weight	6.5	5.9	8.4	7.0	7.5	6.3	9.0	7.4
Condition factor	41	40	39	38	39	38	38	35
Skeena River—								
Length	23.7	23.2	26.4	25.7	24.1	23.7	26.6	25.5
Weight	5.4	5.0	7.6	6.5	5.5	5.2	7.5	6.3
Condition factor	41	41	41	39	39	39	40	38
Rivers Inlet—								
Length	22.3	21.5	26.2	24.9	22.8	21.8	25.7	25.8
Weight	4.8	4.2	7.8	6.3	5.2	4.3	7.3	7.1
Condition factor	43	42	43	41	44	41	43	41

TAGGING BRITISH COLUMBIA PILCHARDS (*SARDINOPS CÆRULEA* (GIRARD)): INSERTIONS AND RECOVERIES FOR 1941–42.

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

INTRODUCTION.

Since 1936 an annual tagging programme has been carried on in connection with the fishing operations of the British Columbia fishing fleet. This programme, supplemented by corresponding investigations conducted by California, Oregon, and Washington State fisheries organizations, has brought to light the essential facts concerning pilchard migrations. The fact that pilchards move from the fishing-ground of one political subdivision to another and do so in considerable abundance is now established beyond doubt. Certain quantitative aspects of the migrations involved remain to be investigated, but, as far as Canadian researches are concerned, these can only be studied by a considerable intensification of the work with more equipment and personnel. Under present conditions it has appeared inadvisable to attempt such an expansion of the programme and for this reason the work during the past year was limited to attending to returns of tagging carried out in former years or by other agencies, and to somewhat specialized problems.

METHODS.

Tagging.

The essentials of tagging have remained unchanged from previous years. A small, oblong strip of nickel-plated magnetic metal, with smoothly rounded ends and edges and bearing an identifying number, is inserted through a slit into the body-cavity of the pilchard. In tagging operations carried out during the 1941–42 season the slit in the side of the fish was made with a small knife having the cutting-edge at the end and the tag was manipulated by hand (Hart, 1937). The fish for tagging were caught with a small-meshed bait-seine, and were impounded in it until tagging was complete.

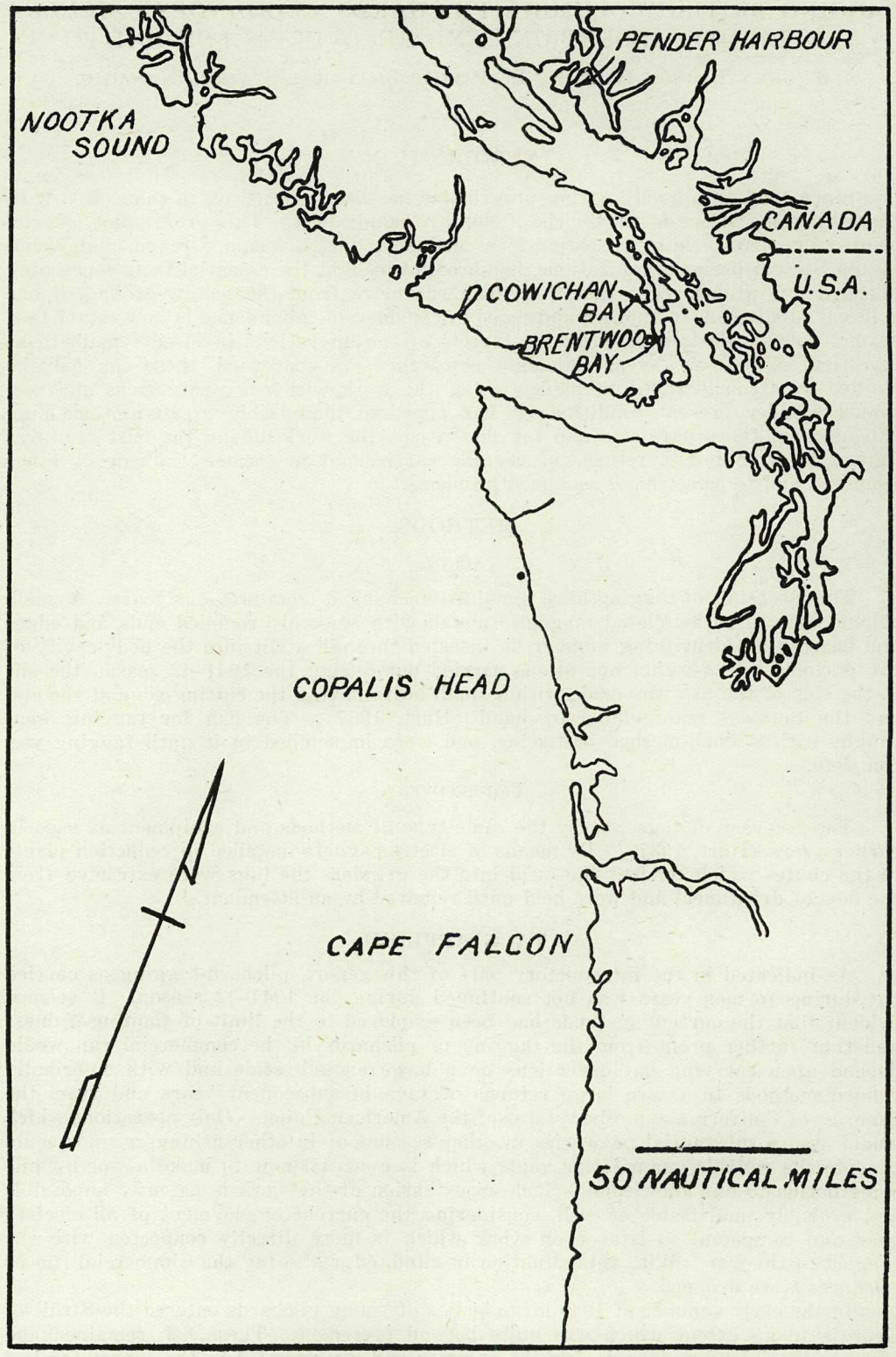
Tag-recovery.

The recovery of tags was by the same type of methods and equipment as used in earlier years (Hart, 1937). By means of electromagnets installed in reduction plants in the chutes which conduct the meal into the grinders the tags were extracted from the flow of dried meal and were held until removed by an attendant.

TAGS APPLIED.

As indicated in the introductory part of this report, pilchard-tagging as carried out during former years was not continued during the 1941–42 season. It seemed evident that the current methods had been employed to the limit of their usefulness and that further profit from the tagging of pilchards in the commercial run would depend upon carrying out operations on a large enough scale and with sufficiently refined methods to assure large returns of tags in subsequent years and from the fisheries of California and other states of the American Union. Only operations which would assure substantial recoveries in other seasons or in other fishing-grounds could provide the reliable quantitative value which is essential now to make a worth-while contribution to our knowledge. Such an extension of the work is patently impossible and probably inadvisable as well, considering the current employment of all efficient gear and competent assistance on work which is more directly connected with the conduct of the war. With this situation in mind, efforts to tag the commercial run of pilchards were dropped.

In the early summer of 1940 large bodies of young pilchards entered the Strait of Georgia to an extent which was quite beyond precedent. These fish remained and grew in the inland waters during the summer and, as recorded in the report for last


PENDER HARBOUR
NOOTKA SOUND
CANADA
U.S.A.
COWICHAN BAY
BRENTWOOD BAY
COPALIS HEAD
CAPE FALCON
50 NAUTICAL MILES

year, 1,000 of them were tagged in the autumn of 1940. During the winter which followed, these pilchards experienced a very heavy mortality in several parts of the strait. It seems desirable to know whether these fish which have strayed beyond the limits of their usual habitat will ever rejoin the main body of pilchards and contribute to the regular commercial fishery. To test this, further attempts at tagging were made during the winter of 1941–42.

In carrying out the tagging experiments it is understood that negative evidence will carry but little weight; i.e., if no returns are made of the tags used on the Strait of Georgia fish, the evidence that they failed to join the general population will be rather weak. If, on the other hand, tags are recovered from the west coast of Vancouver Island or United States fisheries, there will be positive proof of a migration to the open water and of the union of schools of fish which have had widely different histories. In the following tabulation all of the tags used in connection with pilchard-tagging in the Strait of Georgia are recorded:—

Date.	No. of Fish tagged.	Place Tagged Fish released.	Serial Numbers of Tags used, C, F, and G.
September 10, 1940	1,000	Cowichan Bay	K3000–K3999 (small tags).
November 20, 1941	1,000	Pender Harbour	C3000–C3999
February 20, 1941	1,000	Brentwood Bay	C4000–C4999

TAGS RECOVERED.

In all, twenty-five tags were recovered from pilchards during the regular season of 1941 and the winter of 1941–42.

Three of the tags recovered had been put out by Canadian investigators. Two were used during the pilchard season of 1940, off Copalis Head and Cape Falcon, when the British Columbia fishing fleet was operating off the United States coast. One tag was put out in Kendrick Arm of Nootka Sound on a herring-tagging trip and was apparently placed in a pilchard by mistake during night-tagging operations. It is possible, of course, that the tag entered the reduction plant in a herring, but this seems unlikely in view of the rarity with which herring are encountered in summer schools of pilchards. On the other hand, the alternative explanation is favoured by the known fact that Kendrick Arm is a usual wintering area for " homesteading " pilchards.

Twenty-one of the tags were used in California by the California State Fisheries Laboratory between the years 1937 and 1940 and one tag was put out by the Oregon State Fish Commission.

The total number of tags recovered was rather small in view of the relatively large catch of pilchards made. This may be accounted for, in part at least, by the notably small size and presumably low age of the fish caught. Small fish, especially those of the 1939 year-class, which comprised a considerable part of the catch, would have been exposed to the possibility of being tagged for a relatively short time.

One fish certainly, and two more probably, of the 1939 year-class tagged in California during 1940 were recovered during the summer of 1941 off British Columbia fishing-grounds. The recoveries are interesting in that they demonstrate beyond dispute that the young fish of that year-class which were prevalent on the fishing-grounds during the summer of 1941 did not consist entirely of the fish of the same year-class which had been common in northern waters during the previous summer.

Two California tags were recovered during pilchard-fishing operations carried out during the winter of 1941–42.

ACKNOWLEDGMENTS.

The investigation has received the co-operation of the companies operating reduction plants in permitting the installation of magnets for recovering tags, and of the plant employees who have recovered tags from the magnets and sent them in for examination. It is indebted, also, to the California State Fisheries Laboratory for supplying the tags used during the past season.

The pilchard-tagging programme has been financed under a joint agreement between the Fisheries Research Board of Canada and the Department of Fisheries of the Province of British Columbia. The support of the executive officers concerned, Dr. R. E. Foerster and Mr. G. J. Alexander, is gratefully acknowledged.

REFERENCE.

HART, J. L. Tagging British Columbia pilchards (*Sardinops cærulea* (Girard)): Methods and preliminary results. Report, B.C. Provincial Fisheries Department, 1936, 49–54, 1937.

TAGGING OF HERRING (*CLUPEA PALLASII*) IN BRITISH COLUMBIA: APPARATUS, INSERTIONS, AND RECOVERIES DURING 1941–42.

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INTRODUCTION.

This report deals with the herring-tagging and tag-recovery work which was carried out during the 1941–42 fishing season and which was completed soon after the close of the 1942 spawning season. As originally planned, the herring-tagging programme was designed (1) to determine the strength of the tendency of herring to form local populations, (2) to determine the extent of herring movements, and (3) to add to the general knowledge of the life-history of herring in British Columbia waters. The work during the past year is a continuation of the general programme as laid out and constitutes the sixth year of investigation.

TAGGING.

The tagging methods present no new feature over previous years. The essential part of the operation is introducing into the body-cavity of the fish a small piece of magnetic metal which is stamped with identifying marks (Hart and Tester, 1937). During the past year this was done either "by hand" (Hart and Tester, 1937) or "with a gun" (Hart and Tester, 1938). Fish for tagging were obtained by the use of small bait purse-seines, with beach-seines, with dip-nets, from salmon-traps, and from bait pounds, as indicated in Table I. In all cases every reasonable precaution was taken to avoid injuring the fish by handling.

Continuing the policy decided upon in 1939 of curtailing tagging on the fishing-grounds, no attempt was made to tag in connection with ordinary herring-fishing operations, although 496 tags were used at the Sooke salmon-traps during the fishing season.

Table I.—Summary of the Tagging Data for Taggings producing Returns during the 1941–42 Fishing Season and for Tags inserted during the 1941–42 Fishing Season and the 1942 Spawning Season.

Tagging Code.	Date.	No. of Tags inserted.	Method of Capture of Fish.*	Tagging Method.†	Place of Tagging.
3B	Oct. 11, 1938	1,078	C.S.	G	Swanson Channel.
3G	Jan. 12, 1939	798	C.S.	G	S.E. Arm, Quatsino Sound.
3J	Mar. 6, 7, 1939	1,299	C.S.	G, K′	Laredo Inlet.
3K	Mar. 2, 5, 1939	945	S.S.	G, K°	Departure Bay, near Nanaimo.
3M	Mar. 9, 1939	997	S.S.	G, K°	Kulleet Bay, near Ladysmith.
3R	Mar. 19, 1939	2,192	B.S.	G, K°	Campbell Island, near Brown Narrows.
3U	Mar. 7, 1939	1,494	B.S.	G, K′	Toquart Bay, Barkley Sound.
3V	Mar. 19, 1939	1,599	B.S.	G, K′	Off Markale, Kyuquot Sound.
3W	Mar. 21, 22, 1939	1,491	B.S.	G, K′	Kendrick Arm, Nootka Sound.
3Y	Mar. 29, 1939	682	C.S.	G, K′	Sydney Inlet.
4G	Mar. 3, 1940	1,499	B.S.	G, K′°	Ganges Harbour, Saltspring Island.
4I	Mar. 9, 1940	1,199	B.S.	G, K′°	Nanoose Bay, at black buoy.
4J	Mar. 4, 5, 1940	1,799	C.S.	G, K′	Laredo Inlet.
4K	Mar. 13, 1940	1,197	D.N.	G, K′°	Deep Bay, Baynes Sound.
4L	Mar. 17, 18, 1940	1,797	B.S.	G, K′°	Cutter Creek, near Minstrel Island.
4M	Mar. 19, 1940	1,000	B.S.	G, K′°	Shoal Harbour, Gilford Island.
4N	Mar. 21, 1940	999	B.S.	G, K′°	Bend Island, Clio Channel.
4O	Mar. 23, 24, 1940	500	B.S.	K′	Von Donop Creek, Cortes Island
4P	Mar. 16, 17, 18, 1940	1,150	B.S.	G, K′	Whitepine Cove, Clayoquot Sound.
4Q	Mar. 18, 1940	1,000	B.S.	K′	Refuge Cove, Sydney Inlet.
4R	Mar. 19, 1940	1,199	B.S.	K′	Kendrick Arm, Nootka Sound.
4S	Mar. 20, 1940	996	B.S.	K′	Queens Cove, Esperanza Inlet.
4T	Mar. 21, 1940	1,000	B.S.	K′	Clanninick Cove, at entrance to Kyuquot Sound.
4U	Mar. 24, 1940	1,595	B.S.	K′	Winter Harbour, Quatsino Sound.
4W	Mar. 18, 1940	1,399	B.S.	G, K′	Campbell Island, near Brown Narrows.
4X	Mar. 20, 1940	1,499	B.S.	G, K′	Big Bay, near Prince Rupert.
4Y	Mar. 21, 1940	800	C.S.	G, K′	Butler Cove, near Prince Rupert.
4Z	Mar. 23, 1940	798	B.S.	G, K′	Lake Island, Milbanke Sound.
4AA	Mar. 28, 29, 1940	1,397	B.S.	K′	Head of Toquart Bay, Barkley Sound.
5C	Mar. 6, 1941	1,000	B.S.	G, K′	Gabriola Bluff, near Dodd Narrows.
5D	Mar. 8, 1941	975	B.S.	G, K′	Hammond Bay.
5E	Mar. 10, 1941	1,000	B.S.	G, K′	Entrance to Nanoose Bay.
5F	Mar. 11, 1941	974	B.S.	G	Breakwater Island, Gabriola Pass.
5G	Mar. 17, 1941	998	B.P.	G	Bargain Harbour.
5H	Mar. 21, 1941	200	D.N.	K′	Thomas Point, Kingcome Inlet.
5I	Mar. 17, 1941	1,488	S.S.	G, K′	Campbell Island, near Brown Narrows.
5J	Mar. 20, 1941	1,704	S.S.	G, K′	Duncan Bay, near Prince Rupert.
5K	Mar. 23, 1941	787	S.S.	G	Jap Inlet, Porcher Island.
5L	Mar. 28, 1941	1,697	S.S.	G, K′	Laidlaw Island, Laredo Sound.
5M	Mar. 29, 1941	1,197	S.S.	G, K′	Deer Passage, near Bella Bella.
5N	Mar. 30, 1941	1,495	S.S.	G, K′	Kwakshua Passage, Calvert Island.
5O	Mar. 4, 1941	1,200	B.S.	K′	Lyall Point, Barkley Sound.
5P	Mar. 5, 1941	995	B.S.	K′	Toquart Bay, Barkley Sound.
5Q	Mar. 8, 9, 1941	1,200	B.S.	K′	Kendrick Arm, Nootka Sound.
5U	Mar. 11, 1941	992	B.S.	K′	Queens Cove, Esperanza Inlet.
5V	Mar. 12, 1941	1,192	B.S.	K′	Clanninick Cove, entrance to Kyuquot Sound.
5W	Mar. 13, 1941	1,989	B.S.	K′	Browning Inlet, Quatsino Sound.
5X	Mar. 14, 1941	998	B.S.	K′	Bunsby Islands, entrance to Ououkinsh Inlet.
5Y	Mar. 16, 1941	1,193	B.S.	K′	Refuge Cove, Sydney Inlet.
6A	Oct. 17, 1941	496	S.T.	K′	Sooke.
6B	Feb. 19, 1942	997	B.S.	K′	Selby Creek, Prevost Island.
6C	Feb. 26, 1942	497	B.S.	K′	Ganges Harbour, Saltspring Island.
6D	Mar. 2, 1942	500	D.N.	K′	Departure Bay, near Nanaimo.
6E	Mar. 6, 1942	993	B.S.	K′	East side Kuper Island.

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

† G=gun; K′=fish held with one hand while knife and tag are manipulated with other hand; K°=fish held by one man while another manipulates knife and tag; K′°=both types of knife-tagging used.

Table I.—Summary of the Tagging Data—Continued.

Tagging Code.	Date.	No. of Tags inserted.	Method of Capture of Fish.*	Tagging Method.†	Place of Tagging.
6F	Mar. 7, 1942	1,004	B.S.	K′	Head of Departure Bay, near Nanaimo.
6G	Mar. 9, 1942	1,000	B.S.	G	Kulleet Bay, near Ladysmith.
6H	Mar. 9, 1942	2,000	B.S.	K′	Union Bay, Baynes Sound.
6I	Mar. 10, 1942	1,489	B.S.	K′	Skuttle Bay, near Sliammon.
6J	Mar. 12, 1942	1,579	B.S.	K′	Porpoise Bay, Seechelt Inlet.
6K	Mar. 27, 1942	1,499	B.S.	K′	Squirrel Cove, Cortes Island.
6L	Mar. 15, 1942	1,689	B.S.	G, K′	Retreat Passage.
6M	Mar. 19, 1942	1,497	B.S.	G	McLaughlin Bay, Campbell Island.
6N	Mar. 28, 1942	2,000	B.S.	G, K′	Clio Channel.
6O	Mar. 30, 1942	1,776	B.S.	G, K′	Kingcome Inlet.
6P	Apr. 21, 22, 1942	1,498	B.P.	K′	Cahnish Bay.
6Q	Apr. 24, 1942	1,005	S.S.	K′	Departure Bay, near Nanaimo.
6R	May 2, 1942	698	S.S.	K′	Departure Bay, near Nanaimo.
6S	June 3, 4, 1942	800	S.S.	K′	Nanaimo Harbour.

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

† G=gun; K′=fish held with one hand while knife and tag are manipulated with other hand; K°=fish held by one man while another manipulates knife and tag; K′°=both types of knife-tagging used.

Whereas the tagging technique and the curtailment of fishing-ground tagging represent no change from previous reports, other policies adopted in the tagging of the 1941–42 season formulated on the results of past years' experience are new. A review of results obtained to date indicates that the information obtained from the west coast of Vancouver Island is as complete as is likely to be obtained by a continuation of the available method on the scale which has been accepted as practical. Although knowledge is less thorough, a similar situation holds in the Central and Northern parts of the Province, in that the essential features concerning the major populations are fairly well understood and more detailed information of value is obtainable only by intensive study. Under existing war-time conditions, it has seemed best to reduce to a minimum the expenditure of resources in those more distant areas, and to concentrate all available effort on the more readily accessible Strait of Georgia and Queen Charlotte Sound areas, where much remains to be learned concerning details of the movements and mixtures of the various spawning populations, some of which have contributed to the most dependable fishery in British Columbia.

Two seine-boats were used during March for tagging operations and the work carried out by them was supplemented by two taggings carried out in the Strait of Georgia from the "Whiff" (Hart and Tester, 1939), and another small boat, having no live well. One seine-boat was used for most of the work on the Strait of Georgia and experienced very fair success in the southern part, with the result that, in all, eleven lots of herring were tagged. Owing apparently to lack of fish, operations in the area between Cape Mudge and Nodales Channel were less successful and it was possible to tag only two lots of fish. During March a hurried trip was taken up the west coast of Vancouver Island in the hope that a few lots of spawning herring would be encountered and tagged. This hope was not realized, in spite of the fact that the trip was made at what might, in the light of previous experience, be considered a most opportune time. The second seine-boat was successful in tagging three lots of herring in the Queen Charlotte Sound area. It made one rapid trip up to the Central area, where one lot of herring was successfully tagged near Campbell Island.

The results of tagging operations during the 1941–42 season are indicated in Table I. In this table are given also the pertinent details of all taggings which are directly involved in this report. Places referred to in the table are shown in the accompanying maps. In Table VII., at the end of the report, the tags put out during the past year are listed in order according to their identifying marks, along with the data on tagging code and the date and place the fish were released. Similar tables in earlier reports have given corresponding data for previous years. The following

recapitulation shows the number of tags used in each area in each year of the investigation.

Locality.	1936–37.	1937–38.	1938–39.	1939–40.	1940–41.	1941–42.
Fall and Winter.						
Strait of Juan de Fuca	1,500	1,199	1,454	897	.....	496
South-east coast of Vancouver Island	7,090	4,086	2,525	495	1,197	.....
West coast of Vancouver Island	.....	2,798	1,094	.....	.....	.....
Central British Columbia	.....	.....	2,494	1,799	.....	.....
Northern British Columbia	.....	.....	755	.....	.....	.....
Queen Charlotte Islands	.....	.....	.....	400	.....	.....
Spring.						
Strait of Georgia (including Puget Sound and north to Nodales Channel)	1,898	5,279	6,587	9,077	4,947	15,559
Queen Charlotte Sound and south to Nodales Channel	.....	.....	.....	3,796	200	5,465
West coast of Vancouver Island	5,692	6,684	5,947	8,437	9,759	.....
Central British Columbia	.....	1,395	3,489	2,497	5,877	1,497
Northern British Columbia	.....	.....	2,696	2,299	2,491	.....
Totals	16,180	21,441	27,041	29,697	24,471	23,017

After the close of the spawning season there occurred along the central part of the south-westerly shore of the Strait of Georgia an unprecedented mortality among the herring. It seems quite possible that such mortality may affect the returns from tags put out in that region during the spring of 1942. It will be noticed from Table I. that four separate taggings were carried out in Departure Bay and, in addition, three others in the region where the mortality occurred. It is hoped that some estimate of the influence of the unusual mortality on the supply of fish may be deduced by comparing the returns for these taggings among themselves and with other taggings.

There is some confusion concerning the 6D tagging carried out at Departure Bay. This tagging was carried out on impounded fish believed to have been caught locally. Later it was found that some of these fish had been brought in from Selby Creek.

No tests of tagging technique were included in the work originated in 1942, and it may be noted here that no noteworthy additions were made by the recoveries to the data bearing on the relative efficiencies of different tagging techniques.

RECOVERY METHODS.

As in previous years, two methods of recovering tags were employed. Induction detectors were installed at Ucluelet and Steveston to take advantage of the more satisfactory information accompanying returns made by them. Magnets were used in other plants in order to have some coverage of the whole coast which did not require the constant supervision of specially trained assistants. One tag was recovered in dressing herring for the table and this recovery has been included among the detector recoveries since the information accompanying it most resembles that which accompanies detector recoveries.

INDUCTION DETECTORS.

As mentioned above, an induction detector was installed again at Ucluelet. This installation for reasons not yet clear did not prove effective, and was not successful in making recoveries.

The detector formerly used at Galiano Island and at Nootka was installed at the Imperial cannery, Steveston, and gave satisfactory performance apart from short periods when it was not in operation because of electrical, mechanical, or operational difficulties. When first installed, the mechanical arrangement for recovering tagged fish was essentially similar to that used at Galiano Island and at Nootka (Hart and Tester, 1937 and 1939). The fish passed up the marine leg, along an overhead conveyer, down a sloping wooden chute, through a coil (located at A), over a trap-door (located at B), and thence into the plant by means of a slat-conveyer (C), (Fig. 1).

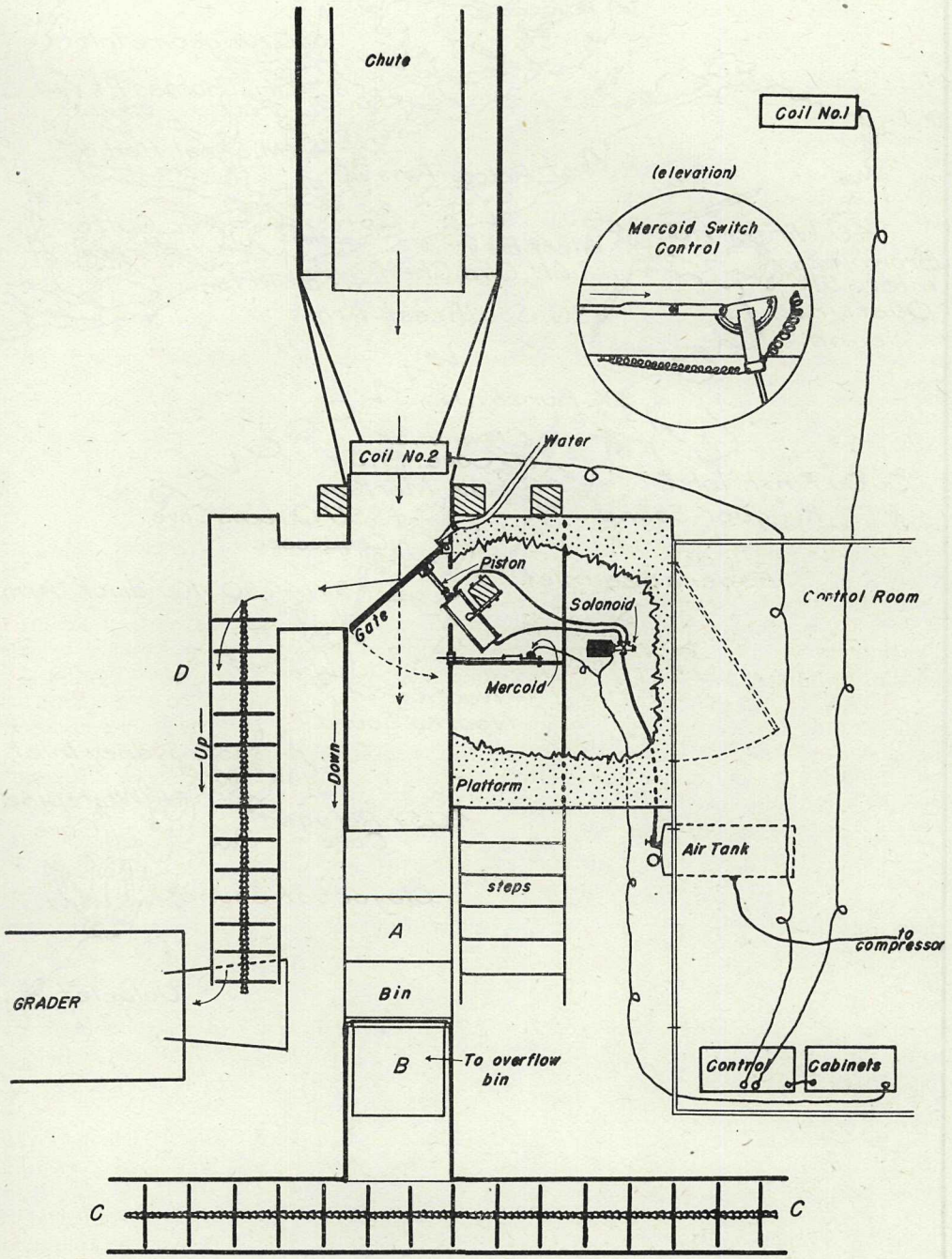
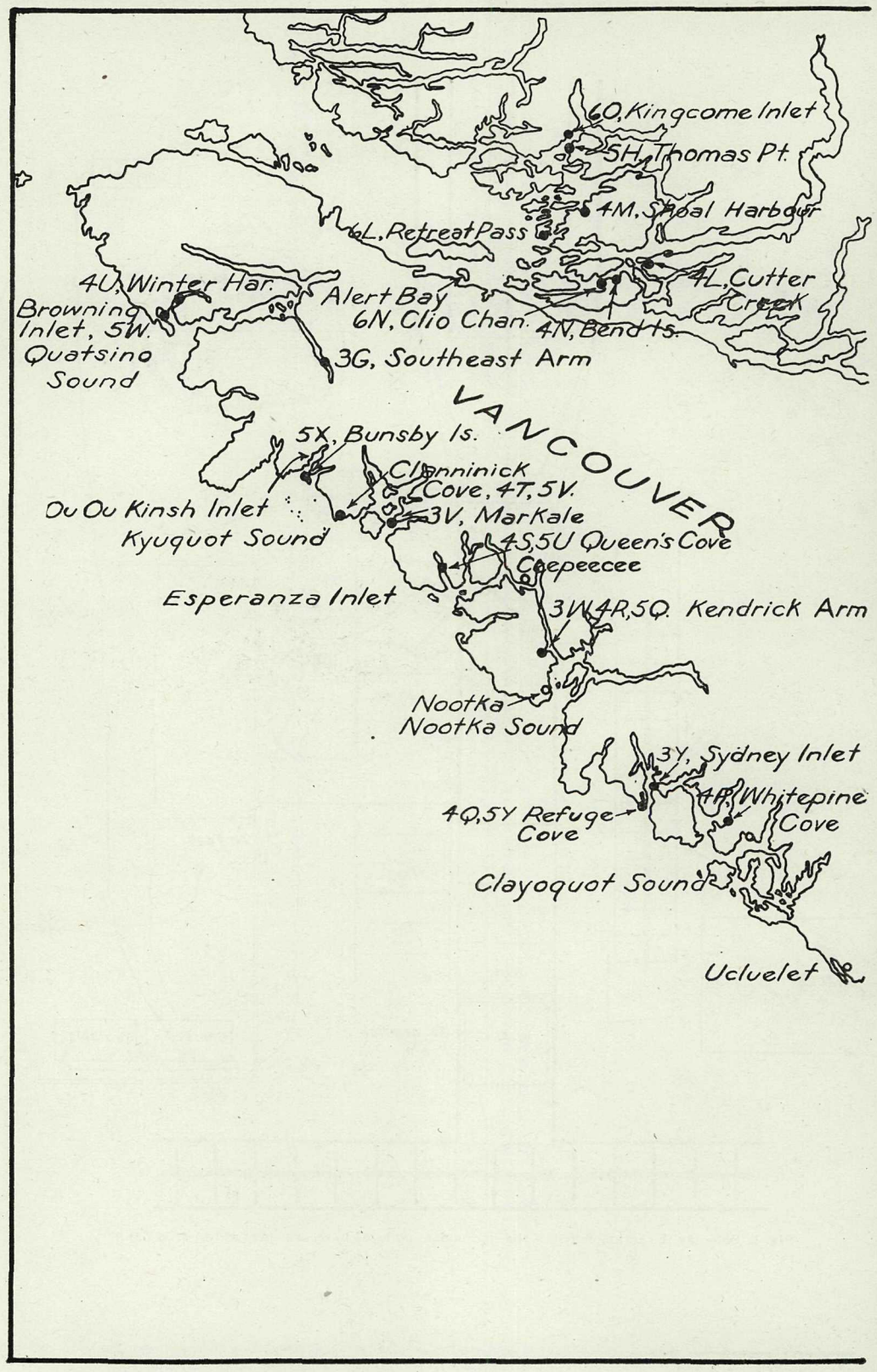
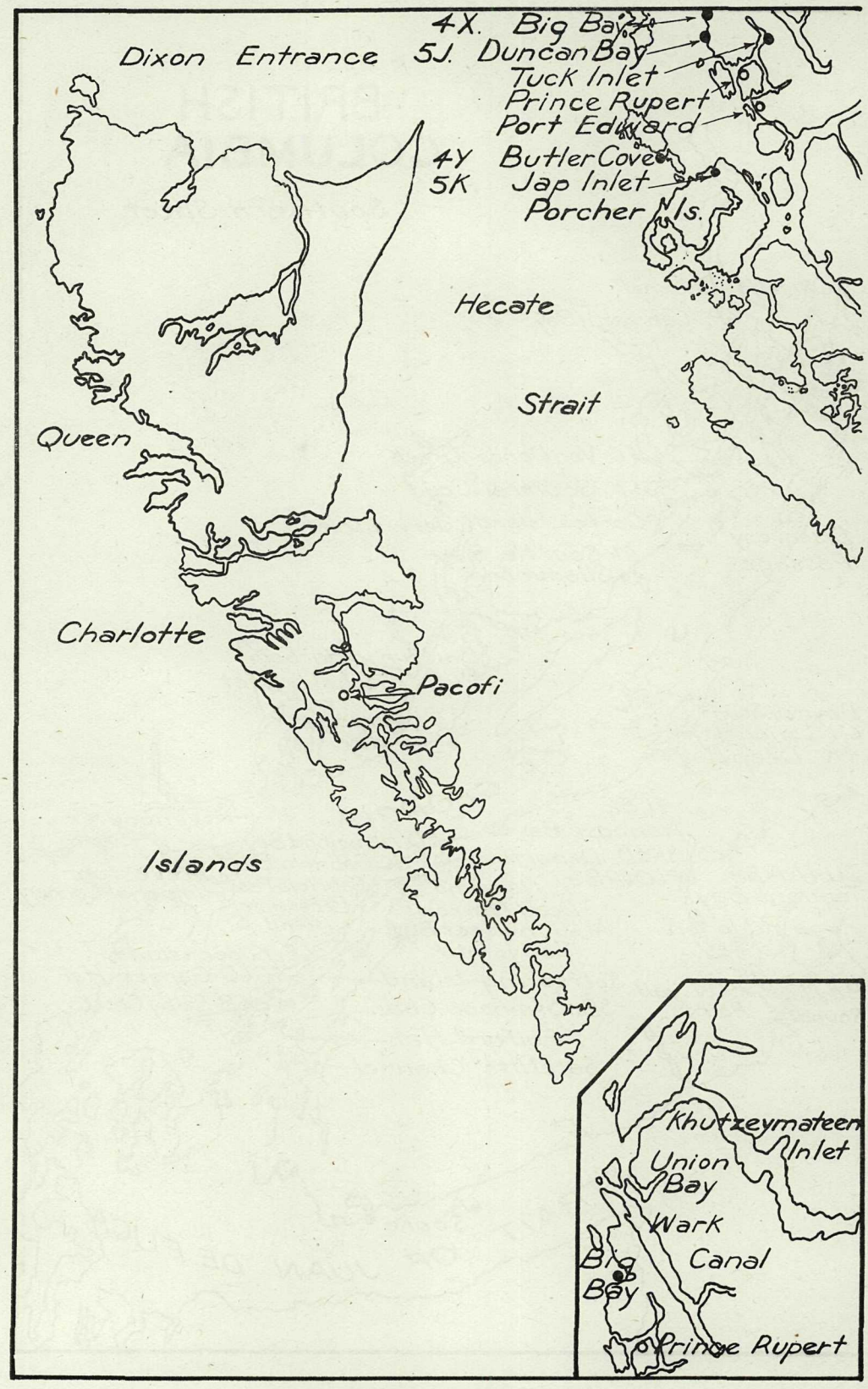
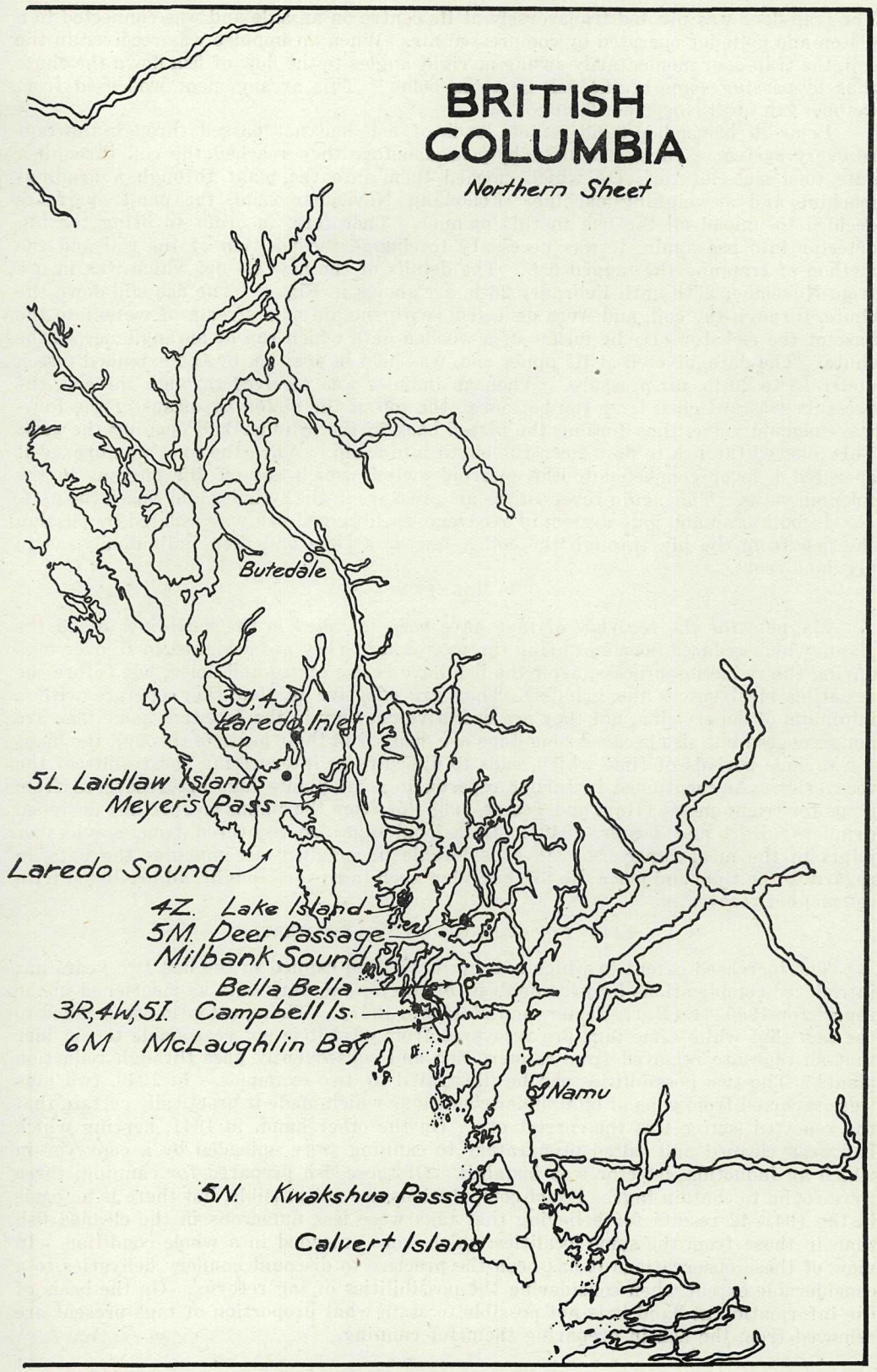


Fig. 1. Showing the arrangement of the equipment employed to recover tags at Imperial Cannery.


6O, Kingcome Inlet
5H, Thomas Pt.
4M, Shoal Harbour
6L, Retreat Pass
4L, Cutter Creek
4U, Winter Har.
Alert Bay
Browning Inlet, 5W.
6N, Clio Chan.
4N, Bendts.
Quatsino Sound
3G, Southeast Arm
VANCOUVER
5X, Bunsby Is.
Clannick Cove, 4T, 5V.
Ou Ou Kinsh Inlet
Kyuquot Sound
3V, Markale
4S, 5U Queen's Cove
Coopeecee
Esperanza Inlet
3W, 4R, 5Q. Kendrick Arm
Nootka
Nootka Sound
3Y, Sydney Inlet
4P, Whitepine Cove
4Q, 5Y Refuge Cove
Clayoquot Sound
Uclulet

BRITISH COLUMBIA
Southern Sheet
Okisollo Channel
6P, Cahnish Bay
40, Von Donop Creek
6K, Squirrel Cove
Cortes Island
Jervis Inlet
Discovery Passage
61, Scuttle Bay
Sliammon
5G, Bargain Harbor
Sechelt Inlet
Baynes Sound
6H, Union Bay
4K, Deep Bay
6J, Porpoise Bay
STRAIT OF GEORGIA
ISLAND
41, 5E, Nanoose Bay
5D, Hammond Bay
Vancouver
3K, 6D, Departure Bay
5C Gabriola Bluff
Steveston
3U, 4AA, 5P, 6F, 6O, 6R
Toquart Bay
Nanaimo
Gabriola Pass
Imperial Cannery
Dodd Narrows
Breakwater Island, 5F
Kildonan
3M, 6G Kulleet Bay
Ladysmith
6E, Kuper Island
Saltspring Island
4G, 6C Ganges Har.
Barkley Sound
50, Lyall Point
3B, Swanson Chan.
6B Selby Creek
Fulford Har.
Satellite Channel
6A, Sooke
STRAIT OF JUAN DE FUCA


4X. Big Bay
Dixon Entrance
5J. Duncan Bay
Tuck Inlet
Prince Rupert
Port Edward
4Y Butler Cove
5K Jap Inlet
Porcher Is.
Hecate
Strait
Queen
Charlotte
Pacofi
Islands
Khutzeymateen Inlet
Union Bay
Wark Canal
Big Bay
Prince Rupert


BRITISH
COLUMBIA
Northern Sheet
Butedale
3J, 4J
Laredo Inlet
5L. Laidlaw Islands
Meyer's Pass
Laredo Sound
4Z. Lake Island
5M. Deer Passage
Milbank Sound
Bella Bella
3R, 4W, 5I. Campbell Is.
6M McLaughlin Bay
Namu
5N. Kwakshua Passage
Calvert Island

The trap-door was pivoted transversely at its centre on an axle and was connected to a piston and cylinder operated by compressed air. When an impulse was received in the coil, the trap-door momentarily swung at right angles to the flow of fish down the chute thus by-passing some of the fish to a bin below. This arrangement was used from October 7th until November 22nd.

Prior to November 22nd, a few loads of fish had not passed through the tag-recovery system. These had been by-passed before they reached the coil through a gate to a slat-elevator (D) which carried them into the plant through a grading-machine and a weighing-machine. Following November 22nd, the plant operators decided to unload all the fish in this manner. Therefore, in order to bring the tag detector into use again, it was necessary to change the position of the coil and the method of trapping the tagged fish. The details of the new set-up, which was in use from November 25th until February 26th, are shown in Fig. 1. The fish slid down the chute, through the coil, and were deflected (with the aid of a stream of water) to the base of the elevator (D) by means of a wooden gate which ran at an angle across the chute. The gate, pivoted at its upper end, was held in position by the extended piston under 15 to 20 lb. air-pressure. When an impulse was received through the coil, the pressure was switched from the bottom to the top of the piston by means of the four-way solonoid valve, thus forcing the piston back in the cylinder and opening the gate. This allowed the fish to flow down the chute into a bin. When the gate was opened it operated a lever connected to the mercoid switch which cut off the current to the solonoid valve. This again reversed the air-pressure in the cylinder and closed the gate.

In both trap and gate system of recovery, each tagged fish was isolated by passing the fish from the bin through the coil a few at a time and then individually, as in previous years.

Magnets.

Magnets for the recovery of tags have been installed in the meal-lines of all the plants which reduced herring during the past year. They are designed to recover tags during the reduction process, after the fish have been pressed and dried, but before the resulting meal enters the grinder. They are effective in that they operate with a minimum of supervision, but they are defective not only in the fact that some tags are not recovered but also because some tags are delayed in their passage through the plant for various periods of time which leads to difficulty in interpreting the results of the recoveries. As mentioned in earlier reports, in some plants tags are recovered from traps for tramp metal (Hart and Tester, 1939) or from the sumps on specially designed grinders (Hart and Tester, 1940). Occasional tags are recovered from crevices or joints in the meal-conveyers. As considerable uncertainty accompanies the data in regard to the time and place the fish carrying such tags were caught, all are listed with the magnet recoveries.

Effect of Canning on Tag-recovery.

The increased extent to which herring have been canned in the last two years has introduced complications into the analysis of the tag-recovery data as mentioned in the report for 1940–41 (Hart, Tester, and McHugh, 1941). There, attention was called to the fact that while some tags are recovered from offal it is not reasonable to consider that all tags are removed from cannery fish and subsequently pass through reduction plants. The two possibilities can be illustrated by two examples. In 1940, two tags were reported from runs of offal under conditions which made it practically certain that the reported source was the correct one. On the other hand, in 1941, herring which had been cleaned and salted preparatory to canning were unloaded by a conveyer in which an induction detector was installed. Of these fish prepared for canning, three were found to contain tags. Exact computations are not possible, but there is no basis in the 1941–42 results for believing that tags were less numerous in the cleaned fish than in those from the same localities which were unloaded in a whole condition. In view of these observations it has been the practice to discount cannery deliveries to a considerable extent when considering the possibilities of tag returns. On the basis of the information at hand it is not possible to state what proportion of tags present are removed from the fish in preparing them for canning.

Other Possible Methods of recovering Tags.

In view of the increasing difficulty of recovering tags from cannery deliveries by magnets in reduction plants and the impossibility of operating more induction detectors, it is intended to extend the activities of the recovery programme by canvassing in the canneries and kippering establishments, asking employees to be on the lookout for tags which may drop from the body-cavities of the fish to the working-tables. The possibility of such accidental recoveries is indicated by the return to us of a tag found by a lighthouse-keeper while preparing herring for the table.

RECOVERIES.

In last year's report (Hart, Tester, and McHugh, 1941), a general discussion was introduced of the qualifications which must be considered in interpreting the returns of herring-tags. For purposes of convenience they are reported in summarized form in the following paragraphs:—

The tagged portion of a school of spawning fish may not truly represent the whole population in the vicinity of the spawning-grounds at the time of tagging and will represent all fish which spawn in the general area even less accurately.

Under practical conditions it is not possible to tag equal proportions of the populations in all areas.

Lack of uniformity in the efficiency of recovery may lead to distortion of the results and difficulty in interpretation.

Difficulties arise owing to cannery operations and these have been dealt with in an earlier section of this report.

Inequalities in the intensity of exploitation of different fishing-grounds must also be taken into consideration in interpreting the results.

Owing to a variety of causes, independent of the movements of the fish, some recoveries are relatively certain as to point of origin, etc., and others must be regarded as questionable. As the incidence of positive returns depends upon such things as the location of induction detectors and the operating policies of interested companies, due allowance must be made in basing conclusions on the number of returns which are regarded as certain.

All of these qualifications have been given due consideration in interpreting the results.

Induction Detectors.

Excluding the recovery made when dressing fish, forty-two recoveries were made by induction detector. The results are summarized in Table II. Thirty-five of the forty-two tags included in the tables had been out for more than six months and seven tags (6A) had been out for a comparatively short time.

The 6A tags, used at Sooke on October 17th, were recovered at the following locations and dates in 1941: October 23rd, Otter Bay (Swanson Channel); October 24th, Otter Bay (Swanson Channel); November 4th, Nanoose Bay; November 17th, Nanoose Bay; November 26th, Swanson Channel; November 26th, Trincomali Channel (off Montague Harbour); February 12th, Nanoose Bay. The first Swanson Channel record represents a minimum migration of some 50 nautical miles in six days and the first Nanoose Bay recovery indicate a minimum migration of some 85 nautical miles in eighteen days. It would seem that the fish tagged at Sooke did not remain in a body, but became more or less generally distributed over the fishing-grounds.

Examination of Table II. shows that of the thirty-six returns which had been out for more than six months, thirty-two were recovered from fish caught on the east coast of Vancouver Island, which had been tagged in the Strait of Georgia. One recovery was of a tag put out in Quatsino Sound and recovered there. One recovery was of a tag used at Bend Island in 1940 and recovered in Okisollo Channel. (This recovery offers definite confirmation of what was suspected last season; namely, that there is some movement of fish from the Queen Charlotte Sound area into the Discovery Passage area.) One tag used on the west coast was recovered on the east coast and one tag used at Shoal Harbour in the Queen Charlotte Sound area was recovered at Laredo

Inlet. In summary it may be said that of the thirty-six returns, thirty-three came back from the general area of tagging, one confirmed a mixing, still of unknown degree, suspected on the grounds of previous work of existing between adjacent major areas, and two demonstrated movements between contiguous major areas which are regarded as being in general distinct.

Table II.—Tags recovered by Induction Detectors during 1941–42.

Code.	Place and Month of Tagging.	Place of Capture.						
		Quatsino Sound.	Swanson Channel.	Trincomali Channel.	Nanoose Bay.	Okisollo Channel.	Laredo Inlet.	Total.
3U	Barkley Sound, March, 1939	....	1	....	....	....	....	1
4U	Quatsino Sound, March, 1940	1	....	....	....	....	....	1
3B	Swanson Channel, October, 1938	....	....	1	....	....	....	1
3K	Departure Bay, March, 1939	....	1	....	....	....	....	1
4G	Ganges Harbour, March, 1940	....	....	1	....	....	....	1
4I	Nanoose Bay, March, 1940	....	....	2	....	....	....	2
4K	Deep Bay, March, 1940	....	....	....	1	....	....	1
4O	Von Donop Creek, March, 1940	....	....	....	2	....	....	2
5C	Gabriola Bluff, March, 1941	....	....	1	1	....	....	2
5D	Hammond Bay, March, 1941	....	1	3	4	....	....	8
5E	Nanoose Bay, March, 1941	....	1	2	2	....	....	5
5F	Breakwater Island, March, 1941	....	1	1	3	....	....	5
5G	Bargain Harbour, March, 1941	....	....	....	4	....	....	4
6A	Sooke, October, 1941	....	3	1	3	....	....	7
4M	Shoal Harbour, March, 1940	....	....	....	....	....	1	1
4N	Bend Island, March, 1940	....	....	....	....	1	....	1
								43

The data in Table II. have been examined for evidence of relationship between tagging locality and fishing-ground and the following tabulation has resulted:—

Tagging Areas from South to North.	Locality of Recovery.	No. of Recoveries.
Ganges Harbour and Swanson Channel	Trincomali Channel	2
Breakwater Island to Nanoose Bay	Swanson Channel	4
	Trincomali Channel	9
	Nanoose Bay	10
Deep Bay, Bargain Harbour, and Von Donop Creek	Nanoose Bay	7

These figures suggest that fish which spawn north of Nanoose Bay are more likely to be caught on Nanoose Bay fishing-grounds in subsequent seasons than those which spawned farther to the south.

Magnets.

Three hundred and ninety-nine tags were recovered by magnets in ten plants. These recoveries are classified in Table III. according to plant making the return and the individual tagging. The data in this table are so arranged that they are quite free from the possibility of subjective interpretation. Attention may be called to the general tendency of the tagging localities to be close to the sites of the plants making the recoveries. In a foot-note are given the localities from which herring were delivered to the plants concerned, and it is evident that in almost all cases the recovered tags can be accounted for by fish delivered from fishing-grounds close to the area of tagging. A summarization such as Table III. cannot take into consideration the times at which fish deliveries were made. It is, accordingly, desirable to present, as far as possible, information concerning the fish which actually produce the tag. Data on this point which accompanies returns are sometimes not satisfactory. For this reason Table IV.

has been drawn up from the following discussion of individual tag-recoveries on the basis of fish deliveries and the known behaviour of the various plants in returning tags. Table IV. includes only magnet recoveries. The following discussion, however, includes also induction detector returns.

Discussion of Sources of Individual Recoveries.

Swanson Channel (3B): One recovery made by induction detector among fish caught in Trincomali Channel.

Quatsino Sound (3G): One recovery reported from Barkley Sound. Quatsino Sound is a likely alternative source and other west coast of Vancouver Island localities and the east coast of Vancouver Island possible ones in descending order of probability.

Laredo Inlet (3J): One recovery reported from Thistle Passage at the entrance to Laredo Inlet. The reported area is probably correct although fishing-grounds in the northern part of British Columbia (Khutzeymateen Inlet and Union Bay) are possible.

Departure Bay (3K): One recovery made by induction detector from fish caught in Swanson Channel.

Kulleet Bay (3M): Two recoveries. One was correctly reported from east coast of Vancouver Island fishing-grounds; the other was rather vaguely reported from "Kyuquot and Queens Cove," although any other fishing-grounds on the west coast of Vancouver Island north of Sydney Inlet appears equally probable as sources and east coast localities are possible.

Campbell Island (3R): One recovery was recorded from Laredo Inlet. This report is probably correct, although alternative possibilities in order of likelihood are: Other areas in Central British Columbia, fishing-grounds in Northern British Columbia, the Queen Charlotte Sound area, the east coast of Vancouver Island.

Barkley Sound (3U): Two tags recovered. One was reported from Barkley Sound, probably correctly but with the east coast of Vancouver Island as a possible alternative. The other was also reported from Barkley Sound, but fishing-grounds in the Sydney Inlet area northward to Kyuquot Sound on the west coast of Vancouver Island appear equally likely and the east coast of Vancouver Island is a possible source.

One 3U tag was recovered by induction detector from fish caught in Swanson Channel.

Kyuquot Sound (3V): Six recoveries. Five were reported from Kyuquot Sound. Four of these are no doubt correct, with Sydney Inlet, Barkley Sound, and the east coast of Vancouver Island as possible alternatives for one; two others had Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay as possible alternatives; and one had Nootka Sound and the east coast of Vancouver Island as possibilities. The fifth tag reported from Kyuquot Sound might equally well have entered the plant with Nootka Sound fish with the following other possibilities: Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay. The remaining 3U tag was recovered during operations on pilchards caught in Barkley Sound. The tag may have entered the plant in a herring mixed with the pilchards or, more probably, with herring from Sydney Inlet, Barkley Sound, or Ououkinsh Inlet in the preceding catches. East coast localities are also possible sources.

Nootka Sound (3W): Two recoveries. One reported from Ououkinsh Inlet probably correctly had Nanoose Bay as a possible alternative. The other was reported from Kyuquot Sound probably correctly and had the east coast of Vancouver Island and Nootka Sound as possible alternatives.

Sydney Inlet (3Y): One recovery reported from Kyuquot Sound. Other west coast localities such as Nootka Sound, Quatsino Sound, Sydney Inlet, Ououkinsh Inlet, and Barkley Sound appear almost equally likely and the east coast of Vancouver Island is a possible alternative.

Ganges Harbour (4G): One recovery by induction detector from fish caught in Trincomali Channel.

Nanoose Bay (4I): Two recoveries made by induction detector from fish caught in Trincomali Channel.

Laredo Inlet (4J): One recovery reported probably correctly from Laredo Inlet. Localities in Northern British Columbia such as Khutzeymateen Inlet and Union Bay are possible alternatives.

Deep Bay (4K): One recovery reported from fish taken at Active Pass. Barkley Sound and other east coast of Vancouver Island localities are possible alternative sources.

One recovery was made by induction detector from fish caught at Nanoose Bay.

Cutter Creek (4L): Four returns, two reported from Bones Bay and two reported from Bones Bay or Retreat Passage. These fishing-grounds probably indicate the sources of the tags as accurately as possible. However, Knight Inlet and Deepwater Bay are alternatives for one tag and those areas plus the east coast of Vancouver Island for the others.

Shoal Harbour (4M): Five recoveries, three recorded from Bones Bay, one recorded from Bones Bay or Retreat Passage, and one recorded from Khutzeymateen Inlet. The recoveries reported from Queen Charlotte Sound fishing areas are probably correct in that the fish carrying the tags originated in that general area, although they could have come into the plant with fish caught on the east coast of Vancouver Island. The reported recovery of a tag from Khutzeymateen Inlet would also appear to be correct, although Union Bay (near Prince Rupert), Queen Charlotte Sound, and Nanoose Bay are other possibilities.

One 4M tag was recovered by induction detector from fish caught at Laredo Inlet.

Bend Island (4N): One recovery reported probably correctly from fish taken at Bones Bay. Other fishing-grounds in the Queen Charlotte Sound area and the east coast of Vancouver Island are possible alternative sources.

One Bend Island tag was recovered by the induction detector from fish taken in Okisollo Channel.

Von Donop Creek (4O): Two recoveries were made by the induction detector from fish caught at Nanoose Bay.

Whitepine Cove (4P): Six recoveries reported from the following fishing-grounds: Barkley Sound, one; Sydney Inlet, two; Esperanza Inlet, one; Klaskish Inlet, one; Quatsino Sound, one. Examination of plant records indicate that the tag recorded from Barkley Sound more probably originated from Sydney Inlet, with alternatives in descending order of probability: Kyuquot Sound, Barkley Sound, east coast of Vancouver Island. Of the tags reported from Sydney Inlet one is probably correctly reported, Barkley Sound and the east coast of Vancouver Island being possible alternatives. The other tag recorded from Sydney Inlet could have originated more readily from fish caught in Nootka Sound, Quatsino Sound, Kyuquot Sound, Ououkinsh Inlet, and possibly from the east coast of Vancouver Island. The Esperanza Inlet recovery was probably correct, although other west coast of Vancouver Island fishing-grounds south of Quatsino Sound are possible sources. The reported recovery from Klaskish may be correct, but Sydney Inlet, Kyuquot Sound, Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island are possible alternatives. The Quatsino Sound report may be correct, but Nootka Sound appears to be equally likely as a source. Other possible sources of the tag are Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and the east coast of Vancouver Island.

Refuge Cove (4Q): Seven recoveries reported from the following localities: Barkley Sound, one; Sydney Inlet, one; Nootka Sound, two; Kyuquot Sound, three. The recovery reported from Barkley Sound was made during a run on pilchards. It is probable that the tag entered the plant with deliveries of herring caught in the Sydney Inlet area, with Kyuquot Sound, Barkley Sound, and east coast of Vancouver Island localities as other possibilities. The Sydney Inlet recovery is probably correct, with Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island as possible alternative sources. The two Nootka Sound recoveries are probably correct, with Quatsino Sound, Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay as possible alternatives. The returns reported from Kyuquot Sound are probably correct, although one of them might have come from Sydney Inlet, Ououkinsh Inlet, or Nanoose Bay and the other from Nootka Sound or some fishing-ground on the east coast of Vancouver Island.

Kendrick Arm (4R): Twelve recoveries reported from the following fishing-grounds: Sydney Inlet, two; Esperanza Inlet, one; Kyuquot Sound, six; Ououkinsh

Inlet, one; Quatsino Sound, two. One of the Sydney Inlet records is probably correct, with alternative sources possible in Kyuquot Sound, Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island. The other Sydney Inlet tag was recovered during a run on pilchards and more probably entered the plant with herring caught at Nootka or Quatsino Sounds; Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay are other possible sources. The Esperanza Inlet recovery is probably reported correctly, although Quatsino Sound, Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay are possible sources. All of the six returns reported from Kyuquot Sound are probably correct, but two have alternative sources in Nootka Sound and the east coast of Vancouver Island, and the remaining four in Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay. The reported recovery from Ououkinsh Inlet probably correctly describes the origin of the tag, although the recovery took place during a run on pilchards. The only alternative source was rather improbable—Nanoose Bay. Examination of plant operation records make it appear improbable that one of the recoveries reported from Quatsino Sound is correctly reported. The possible sources in order of probability are: Nootka Sound, Kyuquot Sound, Quatsino Sound, and the east coast of Vancouver Island. The other Quatsino Sound return is possibly correct, but Nootka Sound is almost equally possible as a source and other alternatives are to be found in Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay.

Esperanza Inlet (4S): Fourteen recoveries reported as follows: Sydney Inlet, one; Nootka Sound, one; Esperanza Inlet, two; Kyuquot Sound and Esperanza Inlet, two; Kyuquot Sound, three; Ououkinsh Inlet, three; Klaskish Inlet, one; Quatsino Sound, one. The Sydney Inlet report is possibly correct but Kyuquot Sound is almost equally probable as a source. Other possible sources are Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island. The recovery reported from Nootka Sound probably originated there, although Quatsino Sound is a fairly likely source and the following points of origin are possible: Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay. The recoveries reported from Esperanza Inlet are probably correctly indicated, although Nootka and Kyuquot Sounds are also possible sources as well as Quatsino Sound and the east coast of Vancouver Island. The same alternatives exist for the two recoveries reported from Kyuquot Sound and Esperanza Inlet. The three reports of 4S tags recovered from Kyuquot Sound are probably correct, but alternatives exist in Nootka Sound and the east coast of Vancouver Island. The recoveries reported from Ououkinsh Inlet are probably correctly reported and the only possible alternative—Nanoose Bay—is quite improbable. The recovery indicated from Klaskish Inlet is possibly correct, although alternatives are to be found in Sydney Inlet, Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island. The Quatsino Sound record may have come from Nootka Sound fish, or less probably from Kyuquot Sound fish or fish taken in Sydney or Ououkinsh Inlets or Nanoose Bay.

Kyuquot Sound (4T): Fourteen returns recorded as follows: Barkley Sound, one; Sydney Inlet, one; Esperanza Inlet, two; Esperanza Inlet and Kyuquot Sound, two; Kyuquot Sound, six; Ououkinsh Inlet, one; Quatsino Sound, one. The Barkley Sound record is probably correct, although many other alternatives exist, including Quatsino Sound, Nootka Sound, Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and the east coast of Vancouver Island. The Sydney Inlet recovery is probably incorrectly reported, although that area is a possible alternative to Nootka Sound or Quatsino Sound, which appear probable. Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and east coast of Vancouver Island are other additional sources. The Esperanza Inlet reports are probably correct, although other Nootka Sound fishing-grounds, Kyuquot Sound, and the east coast of Vancouver Island are possible alternatives. The same alternatives exist for the two recoveries reported from Kyuquot Sound and Esperanza Inlet. The six recoveries reported from Kyuquot Sound are probably correct; three of them have alternatives in Sydney and Ououkinsh Inlets and Nanoose Bay and the remaining three had as alternatives Nootka Sound and the east coast of Vancouver Island. The Ououkinsh recovery is probably correct and the only possible alternative to it is Nanoose Bay. The Quatsino Sound recovery is possibly correct but Nootka Sound is also a probable source. Other alternatives are Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay.

* Quatsino Sound (4U): Fifty-five recoveries from the following localities: Barkley Sound, nine; Sydney Inlet, six; Nootka Sound, seven; Esperanza Inlet, ten; Esperanza Inlet or Kyuquot Sound, one; Kyuquot Sound, seven; Ououkinsh Inlet, one; Quatsino Sound, fourteen. All of the Barkley Sound recoveries were made under circumstances which made recovery from runs of Quatsino Sound fish more probable and there is little reasonable doubt that all of them did so, although other west coast localities and the east coast of Vancouver Island are possible sources. Similarly, it would appear that the tags recorded from Sydney Inlet were recorded incorrectly, as plant records indicate that as being a most improbable source. One of the tags so recorded almost certainly came from Kyuquot Sound and the remaining five most probably came from Quatsino Sound or Nootka Sound. Besides the localities named, Ououkinsh Inlet and the east coast of Vancouver Island are possible alternative sources for any of these tags. All of the tags recorded from Nootka Sound may be correctly reported, but Quatsino Sound appears as an equally probable source for the tags. For these tags Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay are possible alternative sources. Of the ten recoveries reported from Esperanza Inlet, two are probably correct and the rest are possibly so, although the chances appear good that some of the returns came from Quatsino Sound fish. Possible alternatives for the two recoveries which are considered as probably being from Esperanza Inlet are Nootka Sound, Kyuquot Sound, Quatsino Sound, and the east coast of Vancouver Island. Additional possible alternatives for the remaining eight recoveries are Nootka Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay. Additional possible alternatives for the tag reported from Kyuquot Sound and Esperanza Inlet are Quatsino Sound, Nootka Sound, and the east coast of Vancouver Island. Of the seven recoveries reported from Kyuquot Sound, three are presumably correct, but two of these have alternative sources in Nootka Sound and the east coast of Vancouver Island and one in Sydney and Ououkinsh Inlets, and Nanoose Bay. The other four recoveries might equally well have come from Quatsino Sound fish and, in addition, they have Nootka Sound, Sydney Inlet, Ououkinsh Inlet, and the east coast of Vancouver Island as possible alternatives. Ououkinsh Inlet as the reported place of recovery of one 4U tag is almost certainly correct, although Nanoose Bay is an improbable alternative. Of the fourteen recoveries reported from Quatsino Sound, eleven are probably correct but have a variety of alternative possibilities—namely, Nootka Sound, Esperanza Inlet, Sydney and Ououkinsh Inlets, and Nanoose Bay. The remaining three have as possible sources Nootka and Kyuquot Sounds and the east coast of Vancouver Island.

It is not believed that all the 4U tags were returned from fish caught in Quatsino Sound, but the fact that none of the tags were returned by plants which failed to operate upon Quatsino Sound fish does indicate that the bulk of the fish bearing 4U tags were confined to the westerly part of the west coast of Vancouver Island. Moreover, attention is called to the fact that the plant which processed the largest proportion of the Quatsino Sound fish was instrumental in recovering thirty-eight of the fifty-five 4U tags.

One 4U tag was found in dressing herring caught in Quatsino Sound.

Campbell Island (4W): Five recoveries reported as follows: Laredo Inlet, four; "Rupert District," one. The Laredo recoveries are probably all correct, although three have the following alternatives: Khutzeymateen Inlet, Union Bay, Queen Charlotte Sound, and Nanoose Bay, and the other one could have entered the reduction plant concerned with fish from either Khutzeymateen Inlet or Union Bay. The remaining tag may be correctly reported, but alternative sources such as Queen Charlotte Sound and Central British Columbia appear possible.

Big Bay (4X): Three recoveries, one reported from Union Bay and two from the vicinity of Khutzeymateen Inlet. All recoveries are probably reported correctly, although one had Union Bay and Laredo Inlet as possible alternatives, and the others had Union Bay, Queen Charlotte Sound, and Nanoose Bay.

Butler Cove (4Y): Two recoveries reported from Khutzeymateen Inlet and Meyers Passage. The first is probably correct, with Union Bay, Queen Charlotte Sound, and

* For additional recoveries from this tagging *see* postscript at the end of the report, page 76.

Nanoose Bay as alternatives. The recovery reported from Meyers Passage is less dependable and it seems equally likely that it originated with fish caught in Khutzeymateen Inlet, with Union Bay as a second possibility.

* Lake Island (4Z): Nine recoveries. Seven recorded from Laredo Inlet, or its approaches, and two reported from Meyers Passage. All of these recoveries are probably correctly reported. To some extent they have each other as possible alternatives and, in addition, the tags may have alternatives in some or all of Khutzeymateen Inlet, Union Bay, other fishing-grounds in Central British Columbia, Queen Charlotte Sound, and the east coast of Vancouver Island.

* Barkley Sound (4AA): Seven recoveries were recorded from the following localities: Deepwater Bay, one; Esperanza Inlet and Kyuquot Sound, one; Kyuquot Sound, four; Quatsino Sound, one. The recovery reported from Deepwater Bay, off Discovery Passage, is probably correct, but the tag may have entered the plant with fish caught on other fishing-grounds on the east coast of Vancouver Island. The recovery reported from Kyuquot Sound and Esperanza Inlet probably originated in one of these localities, but Nootka Sound and the east coast of Vancouver Island are other possibilities. All of the Kyuquot Sound recoveries may be correctly indicated, but it would appear from plant records that one of them could equally well have come from Nootka or Quatsino Sounds, with east coast fishing-grounds as a further possible alternative. These alternatives also apply to one other 4AA tag reported from Kyuquot Sound. The two remaining tags may be correctly reported, but have Sydney and Ououkinsh Inlets and Nanoose Bay as possible alternatives. The Quatsino recovery is possibly correct but has a variety of possible alternatives, including Nootka Sound, Sydney and Ououkinsh Inlets, and Nanoose Bay.

* Gabriola Bluff (5C): Two recoveries were made by induction detector from fish caught at Trincomali Channel and Nanoose Bay respectively.

Hammond Bay (5D): Two recoveries reported from fish caught at Deepwater Bay in Discovery Passage. The report is probably accurate, although Okisollo Channel and areas on the east coast of Vancouver Island are also possible sources.

Eight 5D tags were recovered by induction detector from fish caught in the following localities: Swanson Channel, one; Trincomali Channel, three; Nanoose Bay, four.

Nanoose Bay (5E): One recovery reported from Central British Columbia (Fish Egg Inlet), but plant records showed that all of the fish landed at about that time were delivered from Swanson Channel fish, and it is accordingly concluded that Swanson Channel is the correct source of the tag.

Five 5E tags were recovered by induction detector from the following fishing-grounds: Swanson Channel, one; Trincomali Channel, two; Nanoose Bay, two.

Breakwater Island (5F): One recovery reported from Nanoose Bay probably correctly and the fish carrying the tag was certainly caught on the east coast of Vancouver Island.

Five 5F tags were recovered by induction detector, one each from Swanson and Trincomali Channels and three from Nanoose Bay.

Bargain Harbour (5G): One recovery reported, probably correctly, from the Strait of Georgia.

Four 5G tags were recovered by induction detector from fish caught at Nanoose Bay.

Thomas Point (5H): One recovery recorded from Union Bay (near Prince Rupert) or Okisollo Channel. These fishing-grounds indicate the most probable points of origin for the tag, but a variety of fishing-grounds in the Queen Charlotte Sound area are possible sources.

* Campbell Island (5I): One recovery reported from the Strait of Georgia. This record is probably correct.

Duncan Bay (5J): Fifteen recoveries, four reported from Union Bay, ten from Khutzeymateen Inlet, and one from Passage Island in the Central area. All of these recoveries are probably correctly reported. The Union Bay and nine of the Khutzeymateen recoveries had Laredo Inlet as a possible alternative source. The remaining

* For additional recoveries from this tagging *see* postscript at the end of the report, page 76.

Khutzeymateen recovery had no possible alternatives. The only possible alternative source for the Passage Island tag is Klemtu.

Jap Inlet (5K): Two recoveries reported from Khutzeymateen Inlet—no doubt correctly. No reasonable alternatives are evident for one of the returns. Discovery Passage and Queen Charlotte Islands are improbable alternatives for the other.

*Laidlaw Islands (5L): Four returns all reported, probably correctly, from Laredo Inlet. The alternative possible sources are included among the following: Khutzeymateen Inlet, Union Bay (near Prince Rupert), other fishing-grounds in Central British Columbia, Queen Charlotte Sound, and the east coast of Vancouver Island.

Deer Passage (5M): Two recoveries reported from Meyers Passage in Central British Columbia and Laredo Inlet. It seems probable that the indicated areas are correct or that Laredo Inlet is correct for both returns, although Khutzeymateen Inlet and Union Bay are possible alternatives.

Kwakshua Passage (5N): Five recoveries recorded from Nootka Sound, Esperanza Inlet and Kyuquot Sound, Kyuquot Sound, Quatsino Sound, and Union Bay or Bella Coola. Other alternatives on the west coast of Vancouver Island, such as Sydney and Ououkinsh Inlets, are possible for the first four and there is some possibility of the tags having come to the plant with fish caught on the east coast of Vancouver Island, but it is not reasonable to suppose that any of them were caught in Central British Columbia. The last-mentioned tag probably came from some fishing-ground in Central or Northern British Columbia and there is a possibility that it originated from the Discovery Passage area.

*Barkley Sound (5O): Seven recoveries, five of them reported from Barkley Sound and one each from Esperanza Inlet and Kyuquot Sound. Four of the Barkley Sound recoveries are probably correct, with all having the east coast of Vancouver Island as a possible, if improbable, alternative. In addition, one of the returns had Kyuquot Sound and Sydney Inlet as alternatives and the remaining one had these localities and Quatsino Sound and Ououkinsh Inlet as well. The fifth Barkley Sound record may be correct, but Quatsino and Nootka Sound seem from the plant record to be equally probable sources, while other possible ones are Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and the east coast of Vancouver Island. The Esperanza Inlet record is probably correct, with possible alternatives as follows: Nootka Sound, Kyuquot Sound, Quatsino Sound, and east coast of Vancouver Island. The Kyuquot Sound report, also, is probably correct, with possible alternatives in Nootka Sound and the east coast of Vancouver Island.

*Barkley Sound (5P): Fourteen recoveries recorded as follows: Barkley Sound, seven; Sydney Inlet, two; Queens Cove, two; Kyuquot Sound, two; Union Bay or Okisollo Channel, one. Five of the Barkley Sound records are probably correctly reported, although the various tags had alternative sources as follows: East coast of Vancouver Island, four; and east coast of Vancouver Island and Ououkinsh Inlet, one. One of the tags reported from Barkley Sound would appear to have an equal possibility of being returned from Sydney Inlet, Kyuquot Sound, or, possibly, the east coast of Vancouver Island; and the remaining one could equally well have originated from fish caught in Quatsino or Nootka Sounds, Sydney or Ououkinsh Inlets, or Nanoose Bay. Both of the Sydney Inlet recoveries are probably correct, but they had Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island as possible alternatives. Either of the Queens Cove records may be correct, but one had a nearly equal chance of being returned from Kyuquot Sound and could have been returned from the east coast of Vancouver Island; and the other had an almost equal chance of having entered the plant with Quatsino Sound fish and could have done so with fish caught in Kyuquot Sound, Ououkinsh Inlet, or the east coast of Vancouver Island. One of the Kyuquot Sound records is probably correct, with Ououkinsh and Sydney Inlets and Nanoose Bay as possible alternatives. The other one could equally well have been returned from Nootka Sound or Quatsino Sound, and also had Ououkinsh and Sydney Inlets and Nanoose Bay as alternatives. The recovery reported from Union Bay or Okisollo Channel had the various fishing-grounds of the Queen Charlotte Sound area as alter-

* For additional recoveries from this tagging *see* postscript at the end of the report, page 76.

native points of origin, but it is clear that the tag was not returned from fish caught on the west coast of Vancouver Island.

Kendrick Arm (5Q): Thirty-six recoveries reported as follows: Barkley Sound, seven; Sydney Inlet, five; Nootka Sound, three; Esperanza Inlet, eight; Kyuquot Sound, six; Quatsino Sound, seven. Five of the Barkley Sound reports are probably correct, although two have Sydney Inlet, Kyuquot Sound, and the east coast of Vancouver Island as alternative possibilities, and the remaining three have those alternatives in addition to Nootka and Quatsino Sounds and Ououkinsh Inlet. In the cases of the remaining two Barkley Sound reports it appears that the tags would have had an equal opportunity of entering the plant with fish caught in Sydney Inlet or Kyuquot Sound, with possible sources in Ououkinsh Inlet and the east coast of Vancouver Island. Three of the Sydney Inlet records are probably correct, but two have alternative sources in Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island, and one of them in Kyuquot Sound, Ououkinsh Inlet, and the east coast of Vancouver Island. The other reports are possibly correct, but other fishing-grounds such as Nootka and Quatsino Sounds appear equally likely to have produced the tags, and still further possible alternatives exist in Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay. The three tags reported from Nootka Sound are probably correct, although Quatsino Sound, Kyuquot Sound, Sydney and Ououkinsh Inlets, and the east coast of Vancouver Island are possible alternatives. All of the Esperanza Inlet recoveries are probably correct, although a variety of alternatives exist, comprising for three of the recoveries, Quatsino, Kyuquot and Nootka Sounds, Sydney and Ououkinsh Inlets, and Nanoose Bay, and for the remaining five, Kyuquot, Quatsino, and Nootka Sounds, and the east coast of Vancouver Island. All of the five records listed from Kyuquot Sound are probably correct, although four of them could have come from Nootka Sound or the east coast of Vancouver Island, and the remaining one had Sydney and Ououkinsh Inlets and Nanoose Bay as alternatives. All of the seven recoveries reported from Quatsino Sound may be correct, but Nootka Sound is rather a probable alternative for all of them, and there is a possibility that any of the tags may have originated in any of the following localities: Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay.

Esperanza Inlet (5U): Thirteen recoveries reported as follows: Sydney Inlet, one; Esperanza Inlet, four; Esperanza Inlet and Kyuquot Sound, one; Kyuquot Sound, four; and Quatsino Sound, three. The Sydney Inlet report is probably correct, although Barkley Sound, Ououkinsh Inlet, and the east coast of Vancouver Island are possible alternatives. Two of the Esperanza Inlet recoveries are probably correct, with alternative possibilities in Nootka, Kyuquot, and Quatsino Sounds, and the east coast of Vancouver Island. The other two are possibly correct, but from the plant records it appears that Quatsino Sound is equally possible as a source. Other possible sources of the tags are Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay. The tag reported from Esperanza Inlet and Kyuquot Sound is probably correctly indicated, but might have come from the east coast of Vancouver Island. The recoveries reported from Kyuquot Sound all appear to be probably correct, although they might have entered the plant with fish caught in the Nootka Sound area or on the east coast of Vancouver Island. Any of the three tags reported from Quatsino Sound might equally well have been returned from Nootka Sound or Esperanza Inlet. Other alternatives for two of them were Sydney Inlet, Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay, and for the other one the east coast of Vancouver Island.

Kyuquot Sound (5V): Thirteen recoveries, one reported from Esperanza Inlet and the remaining twelve from Kyuquot Sound. The Esperanza Inlet record is probably correct, but there are alternative possibilities in Kyuquot, Quatsino, and Nootka Sounds, and the east coast of Vancouver Island. The Kyuquot Sound recoveries are probably correct, but nine of them have Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay as alternative possibilities, and three of them have Nootka Sound area and the east coast of Vancouver Island as possible alternatives.

* Quatsino Sound (5W): Forty-eight recoveries reported from the following fishing-grounds: Barkley Sound, nine; Sydney Inlet, four; Nootka Sound, two; Esperanza

* For additional recoveries from this tagging *see* postscript at the end of the report, page 76.

Inlet, nine; Kyuquot Sound, nine; Quatsino Sound, fifteen. Any of the Barkley Sound reports may be correct, but from plant records it would appear that the chances of recovery from Quatsino Sound fish is equal to that of recovery from Barkley Sound fish. In this connection it is worthy of remark that one plant which operated extensively on Barkley Sound herring but no Quatsino Sound herring at the time recoveries were being made turned in no 5W tags. Other alternative localities of capture for the tags under discussion were, for eight, Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and the east coast of Vancouver Island, and, for the remaining one, Nootka Sound, Sydney Inlet, Ououkinsh Inlet, Kyuquot Sound, and the east coast of Vancouver Island. The four recoveries indicated from Sydney Inlet are probably incorrectly reported. Plant records indicate that the chances are about equal for recovery from Quatsino and Nootka Sound areas, with Sydney and Ououkinsh Inlets and Nanoose Bay as further possibilities. The recoveries reported from Nootka Sound would appear to have an equal chance of being recovered from Quatsino Sound. Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay are also possible places of origin for these tags. Two of the recoveries reported from Esperanza Inlet are probably correct, but have Nootka and Kyuquot Sounds and the east coast of Vancouver Island as alternatives. The remaining seven are possibly reported correctly, but there is considerable likelihood that they originated in Quatsino Sound and less likelihood that the fish carrying the tags were caught in Nootka or Kyuquot Sounds, or Sydney or Ououkinsh Inlets, or at Nanoose Bay. Five of the recoveries reported from Kyuquot Sound are probably correct, although two of them have Nootka Sound and the east coast of Vancouver Island as possible alternatives, and three of them have Sydney Inlet, Ououkinsh Inlet, and Nanoose Bay as possible sources. The remaining four recoveries are possibly correct, but all have Quatsino Sound as a reasonably likely alternative source. In addition, one has Nootka and Kyuquot Sounds and the east coast of Vancouver Island as possible alternative sources and the other three have Nootka Sound, Sydney and Ououkinsh Inlets, and Nanoose Bay. Any of the reports of recoveries of 5W tags from Quatsino Sound may be correct, but alternatives from other areas on the west coast of Vancouver Island and on the east coast of Vancouver Island occur for all of them. In view of the fact that the greater majority of the 5W tags were recovered while landings of Quatsino Sound fish were being made, whether the individual tags were recorded from Quatsino Sound or other fishing-grounds, all of these tags are considered as having originated in Quatsino Sound.

* Bunsby Islands (5X): Forty-nine recoveries reported from the following fishing-grounds: Barkley Sound, Sydney Inlet, and Esperanza Inlet, one; Sydney Inlet, four; Esperanza Inlet, nine; Esperanza Inlet and Kyuquot Sound, three; Kyuquot Sound, thirty; Quatsino Sound, two. The recovery indicated as coming from Barkley Sound or Esperanza Inlet or Sydney Inlet no doubt originated in one of these places or on the east coast of Vancouver Island. Two of the Sydney Inlet recoveries are probably correct, with Ououkinsh Inlet and Nanoose Bay as possible alternatives. The remaining two are possibly correct and have as alternative sources Nootka, Quatsino and Kyuquot Sounds, Sydney and Ououkinsh Inlets, and Nanoose Bay. All of the Esperanza Inlet recoveries are probably correct, although one of them has an almost equal chance of originating from Quatsino Sound, with Sydney Inlet, Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay as other alternatives. One other of these tags could have had as possible alternatives: Sydney Inlet, Barkley and Kyuquot Sounds, and the east coast of Vancouver Island. The remaining seven of the recoveries reported from Esperanza Inlet had Kyuquot and Nootka Sounds and the east coast of Vancouver Island as possible sources. The three recoveries reported from Esperanza Inlet and Kyuquot Sound probably came from one of those areas, but might have originated from Nootka Sound or the east coast of Vancouver Island. Twenty-seven of the Kyuquot Sound recoveries are probably correct, although fourteen have Sydney and Ououkinsh Inlets and Nanoose Bay as possible alternatives, and thirteen the Nootka Sound area and the east coast of Vancouver Island. The remaining three are possibly correctly reported, but have various alternative possibilities, such as Nootka and

* For additional recoveries from this tagging *see* postscript at the end of the report, page 76.

Quatsino Sounds, Sydney and Ououkinsh Inlets, and the east coast of Vancouver Island. The two reports from Quatsino Sound may be correct, but one has Nootka and Kyuquot Sounds as probable alternatives, as well as the east coast of Vancouver Island, and the other has Nootka Sound as a likely alternative, in addition to possible alternatives in Sydney Inlet, Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay.

Refuge Cove (5Y): Twenty recoveries reported as follows: Barkley Sound, five; Sydney Inlet, six; Nootka Sound, one; Esperanza Inlet and Kyuquot Sound, one; Kyuquot Sound, seven. One of the recoveries reported from Barkley Sound is probably correct, but had Ououkinsh and the east coast of Vancouver Island as possible alternatives. Although the remaining four appear more doubtful, with Sydney Inlet as a probable alternative, they may be correct; two of them have Esperanza Inlet and the east coast of Vancouver Island as additional alternative sources, and two of them have Kyuquot Sound, Ououkinsh Inlet, and the east coast of Vancouver Island. Four of the reported recoveries from Sydney Inlet appear to be correct, although Kyuquot Sound, Ououkinsh Inlet, and the east coast of Vancouver Island are also possible sources of the fish carrying the tags. The remaining two Sydney Inlet recoveries, while they may be correct, are more doubtful. They have as alternative sources Quatsino Sound, Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay. The report from Nootka Sound is probably correct, with Sydney Inlet, Kyuquot Sound, Ououkinsh Inlet, and Nanoose Bay as possible alternatives. The recovery reported from Esperanza Inlet and Kyuquot Sound is probably correct, but Quatsino Sound, Nootka Sound, and the east coast of Vancouver Island are also possible sources. Five of the Kyuquot Sound reports are probably correct, although Sydney Inlet is a reasonably likely alternative and Ououkinsh Inlet and the east coast of Vancouver Island are fairly probable ones. Two other Kyuquot reports appear improbable, though possible. Alternative sources were Nootka Sound and the east coast of Vancouver Island for one and those areas plus Quatsino Sound for the other.

Sooke (6A): Two recoveries, one reported from the Strait of Georgia and the other from the "Alert Bay District." The first is certainly correct. The other one may have originated from some fishing-ground within the Queen Charlotte Sound area, but the east coast of Vancouver Island is also possible as a source.

Seven 6A tags were recovered by induction detector, three each from fish caught in Swanson Channel and Nanoose Bay and one from fish caught in Trincomali Channel.

It is noteworthy that no returns were reported from tagging 5B, in which 997 tags were used at Satellite Channel and Fulford Harbour at the end of the 1940 fishing season.

STABILITY OF POPULATIONS AND MOVEMENTS.

An examination of Table IV. indicates a definite tendency for tags to be recovered close to areas in which they were originally used. At the same time there is evidence that some fish are caught far from the original tagging area. This is brought out more clearly in Table V., in which both tagging areas and fishing-grounds are grouped according to major area. It is evident that when such major areas are considered the great preponderance of the fish are caught in the same region as that in which they were tagged six months or more previously. The table shows that out of the 435 returns for which interpretations are offered, 419 were recovered from the major tagging areas. On this basis, it is possible to say that 96 per cent. of the tagged fish returned to the same general area.

The discussion of the interchange of fish between and within fishing areas follows.

West Coast of Vancouver Island.

More tags were recovered from the west coast of Vancouver Island than from any other major area. This fact may be related to (1) a more intensive fishery on the west coast; (2) more intensive tagging in that area; (3) more efficient recovery in that area; (4) factors connected with the movements of the fish; and (5) difference in the efficiency of tagging. It is believed that most of the difference between the west coast of Vancouver Island and other fishing areas can be attributed to causes under the first three headings.

Table III.—Tags from each Tagging recovered by each Plant making Recoveries during the 1941–42 Season.

Code.	Locality and Month of Tagging.	Plant making Recovery. (*See* foot-note for fish processed.)										Total.
		Kildonan.	Ucluelet.	Nootka.	Ceepeecee.	Imperial.	Alert Bay.	Namu.	Butedale.	Port Edward.	Tuck Inlet.	
3U	Barkley Sound, March, 1939	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	2
4AA	Barkley Sound, March, 1940	.....	.....	3	3	1	.....	.....	.....	.....	.....	7
5O	Barkley Sound, March, 1941	2	2	1	2	.....	.....	.....	.....	.....	.....	7
5P	Barkley Sound, March, 1941	4	5	3	1	.....	1	.....	.....	.....	.....	14
3Y	Sydney Inlet, March, 1939	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	1
4P	Whitepine Cove, March, 1940	2	2	2	.....	.....	.....	.....	.....	.....	.....	6
4Q	Refuge Cove, March, 1940	1	1	3	2	.....	.....	.....	.....	.....	.....	7
5Y	Refuge Cove, March, 1941	2	7	8	3	.....	.....	.....	.....	.....	.....	20
3W	Nootka Sound, March, 1939	.....	.....	1	1	.....	.....	.....	.....	.....	.....	2
4R	Nootka Sound, March, 1940	.....	1	8	3	.....	.....	.....	.....	.....	.....	12
5Q	Nootka Sound, March, 1941	2	7	16	11	.....	.....	.....	.....	.....	.....	36
4S	Esperanza Inlet, March, 1940	.....	2	6	6	.....	.....	.....	.....	.....	.....	14
5U	Esperanza Inlet, March, 1941	.....	1	4	8	.....	.....	.....	.....	.....	.....	13
3V	Kyuquot Sound, March, 1939	1	1	3	1	.....	.....	.....	.....	.....	.....	6
4T	Kyuquot Sound, March, 1940	.....	1	6	7	.....	.....	.....	.....	.....	.....	14
5V	Kyuquot Sound, March, 1941	.....	.....	9	4	.....	.....	.....	.....	.....	.....	13
5X	Bunsby Islands, March, 1941	2	.....	22	25	.....	.....	.....	.....	.....	.....	49
3G	Quatsino Sound, January, 1939	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
4U	Quatsino Sound, March, 1940	.....	9	38	8	.....	.....	.....	.....	.....	.....	55
5W	Quatsino Sound, March, 1941	.....	8	32	8	.....	.....	.....	.....	.....	.....	48
3M	Kulleet Bay, March, 1939	.....	.....	.....	1	.....	.....	1	.....	.....	.....	2
4K	Deep Bay, March, 1940	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
5D	Hammond Bay, March, 1941	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	2
5E	Nanoose Bay, March, 1941	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1
5F	Breakwater Island, March, 1941	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1
5G	Bargain Harbour, March, 1941	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
6A	Sooke, October, 1941	.....	.....	.....	.....	.....	1	1	.....	.....	.....	2
4L	Cutter Creek, March, 1940	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	4
4M	Shoal Harbour, March, 1940	.....	.....	.....	.....	.....	4	.....	1	.....	.....	5
4N	Bend Island, March, 1940	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
5H	Kingcome Inlet, March, 1941	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
3J	Laredo Inlet, March, 1939	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
3R	Campbell Island, March, 1939	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1
4J	Laredo Inlet, March, 1940	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
4W	Campbell Island, March, 1940	.....	.....	.....	.....	.....	.....	1	3	1	.....	5
4Z	Lake Island, March, 1940	.....	.....	.....	.....	.....	.....	3	2	4	.....	9
5I	Campbell Island, March, 1941	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
5L	Laidlaw Islands, March, 1941	.....	.....	.....	.....	.....	.....	1	3	.....	.....	4
5M	Deer Passage, March, 1941	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	2
5N	Kwakshua Passage, March, 1941	.....	.....	3	1	.....	.....	1	.....	.....	.....	5
4X	Big Bay, March, 1940	.....	.....	.....	.....	.....	.....	.....	2	1	.....	3
4Y	Butler Cove, March, 1940	.....	.....	.....	.....	.....	.....	.....	1	1	.....	2
5J	Duncan Bay, March, 1941	.....	.....	.....	.....	.....	.....	.....	2	12	1	15
5K	Jap Inlet, March, 1941	.....	.....	.....	.....	.....	.....	.....	1	.....	1	2
	Totals	18	49	169	95	4	14	10	15	23	2	399

Kildonan: Barkley Sound, east coast of Vancouver Island, Sydney Inlet, Esperanza Inlet, Quatsino Sound.

Ucluelet: Quatsino Sound, Sydney Inlet, east coast of Vancouver Island, Barkley Sound, Ououkinsh Inlet, Kyuquot Sound.

Nootka: Quatsino Sound, Nootka Sound and Esperanza Inlet, Kyuquot Sound, Sydney Inlet, Ououkinsh Inlet, Barkley Sound, Nanoose Bay.

Ceepeecee: Kyuquot Sound, Nootka Sound and Esperanza Inlet, east coast of Vancouver Island, Quatsino Sound.

Imperial: East coast of Vancouver Island, Okisollo Channel and Deepwater Bay, Laredo Inlet, Union Bay, Barkley Sound.

Alert Bay: Queen Charlotte Sound area, Okisollo Channel and Deepwater Bay, Laredo Inlet, east coast of Vancouver Island, Khutzeymateen Inlet.

Namu: Laredo Inlet, Northern British Columbia, other areas in Central British Columbia, Queen Charlotte Sound, east coast of Vancouver Island.

Butedale: Khutzeymateen Inlet and Union Bay, Laredo Inlet, etc., east coast of Vancouver Island, Passage Island and Klemtu, Queen Charlotte Sound.

Port Edward: Khutzeymateen Inlet and Union Bay, Laredo Inlet.

Tuck Inlet: Union Bay, Laredo Sound.

Table IV.—Summarizing the Supposed Sources of Tags from each Tagging producing Returns on Magnets during the 1941–42 Season.

(The entries in this table represent the authors' interpretation of the recoveries based on data concerning the amounts and dates of fish delivered to each plant, the plants which failed to make recoveries from certain taggings, and the peculiarities of each plant in returning tags as determined by tests. Details of the qualifications concerning the interpretations are given in the text.)

Code.	Locality and Month of Tagging.	Place of Capture.												Total.
		Barkley Sound.	Sydney Inlet.	Nootka Sound and Esperanza Inlet.	Kyuquot Sound.	Ououkinsh Inlet.	Quatsino Sound.	East Coast of Vancouver Island.	Discovery Passage.	Queen Charlotte Sound.	Laredo Inlet and Thistle and [illegible] Passages.	Union Bay and Khutzeymateen Inlet.	No Interpretation offered.	
3U	Barkley Sound, March, 1939	1	----	----	----	----	----	----	----	----	----	----	1	2
4AA	Barkley Sound, March, 1940	----	----	----	----	----	----	----	1	----	----	----	6	7
5O	Barkley Sound, March, 1941	4	----	1	1	----	----	----	----	----	----	----	1	7
5P	Barkley Sound, March, 1941	5	2	----	1	----	----	----	----	----	----	----	6	14
3Y	Sydney Inlet, March, 1939	----	----	----	----	----	----	----	----	----	----	----	1	1
4P	Whitepine Cove, March, 1940	----	1	1	----	----	----	----	----	----	----	----	4	6
4Q	Refuge Cove, March, 1940	----	1	2	3	----	----	----	----	----	----	----	1	7
5Y	Refuge Cove, March, 1941	1	4	1	5	----	----	----	----	----	----	----	9	20
3W	Nootka Sound, March, 1939	----	----	1	----	1	----	----	----	----	----	----	----	2
4R	Nootka Sound, March, 1940	----	1	1	6	1	----	----	----	----	----	----	3	12
5Q	Nootka Sound, March, 1941	5	3	11	5	----	----	----	----	----	----	----	12	36
4S	Esperanza Inlet, March, 1940	----	----	3	3	3	----	----	----	----	----	----	5	14
5U	Esperanza Inlet, March, 1941	1	----	2	4	----	----	----	----	----	----	----	6	13
3V	Kyuquot Sound, March, 1939	----	----	----	4	----	----	----	----	----	----	----	2	6
4T	Kyuquot Sound, March, 1940	1	----	2	6	1	1	----	----	----	----	----	3	14
5V	Kyuquot Sound, March, 1941	----	----	1	12	----	----	----	----	----	----	----	----	13
5X	Bunsby Islands, March, 1941	----	2	9	27	----	----	----	----	----	----	----	11	49
3G	Quatsino Sound, January, 1939	----	----	----	----	----	----	----	----	----	----	----	1	1
4U	Quatsino Sound, March, 1940	----	----	2	4	1	20	----	----	----	----	----	28	55
5W	Quatsino Sound, March, 1941	----	----	2	5	----	15	----	----	----	----	----	26	48
3M	Kulleet Bay, March, 1939	----	----	----	----	----	----	1	----	----	----	----	1	2
4K	Deep Bay, March, 1940	----	----	----	----	----	----	1	----	----	----	----	----	1
5D	Hammond Bay, March, 1941	----	----	----	----	----	----	----	2	----	----	----	----	2
5E	Nanoose Bay, March, 1941	----	----	----	----	----	----	1	----	----	----	----	----	1
5F	Breakwater Island, March, 1941	----	----	----	----	----	----	1	----	----	----	----	----	1
5G	Bargain Harbour, March, 1941	----	----	----	----	----	----	1	----	----	----	----	----	1
6A	Sooke, October, 1941	----	----	----	----	----	----	1	----	----	----	----	1	2
4L	Cutter Creek, March, 1940	----	----	----	----	----	----	----	----	4	----	----	----	4
4M	Shoal Harbour, March, 1940	----	----	----	----	----	----	----	----	4	----	1	----	5
4N	Bend Island, March, 1940	----	----	----	----	----	----	----	----	1	----	----	----	1
5H	Kingcome Inlet, March, 1941	----	----	----	----	----	----	----	----	----	----	----	1	1
3J	Laredo Inlet, March, 1939	----	----	----	----	----	----	----	----	----	1	----	----	1
3R	Campbell Island, March, 1939	----	----	----	----	----	----	----	----	----	1	----	----	1
4J	Laredo Inlet, March, 1940	----	----	----	----	----	----	----	----	----	1	----	----	1
4W	Campbell Island, March, 1940	----	----	----	----	----	----	----	----	----	4	----	1	5
4Z	Lake Island, March, 1940	----	----	----	----	----	----	----	----	----	9	----	----	9
5I	Campbell Island, March, 1941	----	----	----	----	----	----	1	----	----	----	----	----	1
5L	Laidlaw Islands, March, 1941	----	----	----	----	----	----	----	----	----	4	----	----	4
5M	Deer Passage, March, 1941	----	----	----	----	----	----	----	----	----	2	----	----	2
5N	Kwakshua Passage, March, 1941	----	----	1	1	1	1	----	----	----	----	----	1	5
4X	Big Bay, March, 1940	----	----	----	----	----	----	----	----	----	----	3	----	3
4Y	Butler Cove, March, 1940	----	----	----	----	----	----	----	----	----	----	1	1	2
5J	Duncan Bay, March, 1941	----	----	----	----	----	----	----	----	----	1	14	----	15
5K	Jap Inlet, March, 1941	----	----	----	----	----	----	----	----	----	----	1	1	2
	Totals	----	----	----	----	----	----	----	----	----	----	----	----	399

Table V.—Summary, according to Major Areas, of the Supposed Sources of all Tags from Taggings producing Returns during the 1941–42 Season.

(This table is based upon the same interpretations as Table IV. and is accordingly subject to the same qualifications.)

General Locality of Tagging.	General Locality of Recovery.							
	West Coast of Vancouver Island.	East Coast of Vancouver Island.	Discovery Passage Area.	Queen Charlotte Sound Area.	Central British Columbia.	Northern British Columbia.	No Specific Source assigned, but evidently not from Major Area of Tagging.	No interpretation offered.
West Coast of Vancouver Island	325	1	1	....	....	....	1	1
East Coast of Vancouver Island	....	43	2	....	....	....	....	2
Discovery Passage	....	2	....	....	....	....	....	....
Queen Charlotte Sound	....	....	1	9	1	1	....	1
Central British Columbia	4	1	....	....	22	....	....	2
Northern British Columbia	....	....	....	....	1	20	....	1

Table VI.—Summary of the Supposed Sources of all Tags recovered during the 1941–42 Fishing Season which were used on the West Coast of Vancouver Island or which are interpreted as having been returned from that Major Area.

(This table is based upon the same interpretations as Table IV. and is accordingly subject to the same qualifications.)

Tagging Area.	Area of Interpreted Recovery.						
	Barkley Sound.	Sydney Inlet and Clayoquot Sound.	Nootka Sound and Esperanza Inlet.	Kyuquot Sound and Ououkinsh Inlet.	Quatsino Sound.	Areas not included in the West Coast of Vancouver Island.	No Interpretation offered.
Barkley Sound	10	2	1	2	....	3	13
Sydney Inlet and Clayoquot Sound	1	6	4	8	....	....	15
Nootka Sound and Esperanza Inlet	6	4	18	23	....	....	26
Kyuquot Sound	1	2	12	50	1	....	16
Quatsino Sound	....	....	4	10	36	....	55
Areas not included in the West Coast of Vancouver Island	....	....	1	2	1	102	7

Of the 328 tags used on the west coast (for which interpretations are offered) 325 were recovered in that major area, one was recovered on the east coast of Vancouver Island, one was recovered in Discovery Passage area, and the other one was recovered either in the Discovery Passage area or in Northern British Columbia. Four tags used in Central British Columbia were recovered on the west coast of Vancouver Island.

The movements within the west coast area are illustrated in the summary shown in Table VI. From the table it may be calculated that out of the 201 recoveries of tags used on the west coast (for which interpretations are offered in regard to particular area of recovery) and recovered in the same major area, 120 or 60 per cent. were reported from the particular tagging area. If the Nootka-Esperanza and Kyuquot-Ououkinsh areas are combined, 155 tags may be considered as recovered from the tagging area, or 77 per cent. These estimates of the extent of segregation within the west coast of Vancouver Island fishing areas agree reasonably well with those based

on returns made in previous years and indicate that unlimited movement does not take place within the west coast area.

The limitation of movement applies even between the closely situated Nootka Sound-Esperanza Inlet area and the Kyuquot Sound-Ououkinsh Inlet area, as may be illustrated in the following tabulation:—

Place of Tagging.	Interpreted Place of Recovery.		
	In Nootka Sound and Esperanza Inlet.	In Kyuquot Sound.	Outside of the Nootka-Kyuquot Area.
Nootka Sound and Esperanza Inlet	(*a*) 18	(*b*) 23	(*c*) 10
Kyuquot Sound	(*d*) 12	(*e*) 50	(*f*) 4
Outside of Nootka-Kyuquot area	(*g*) 9	(*h*) 20	(*i*) 55

In considering the tabulation it should be kept in mind that two of the principal factors influencing number of recoveries are the number of tags present and the amount of fish caught. In view of the fact that about twice as many fish were taken in the Kyuquot Sound-Ououkinsh Inlet area as in the Nootka Sound-Esperanza Inlet area the relatively high value in cells *a* and *e*, combined, as compared with that in *b* and *d*, combined, indicate that mixing between those two areas is not entirely random. The independence of the combined areas from the rest of the west coast can be estimated quantitatively as 79 per cent. by comparing the sum of the values in the cells *a*, *b*, *d*, *e*, and *i* with the total value in all the cells.

There is, in the results, evidence of considerable independence of the fish from Quatsino Sound. Reference to Table III. shows that the amount of fish from Quatsino Sound and the number of Quatsino tags recovered rather closely parallel one another, and accordingly suggests that the degree of isolation indicated by the interpretations is too low.

In the report for 1940–41, attention was called to the fact that of the Barkley Sound taggings 4AA tags behaved generally differently than those of the 3U tagging and that in general they showed a less well marked tendency to be interpreted as being recovered from Barkley Sound. Reference to the text analysis of the sources of 4AA tags indicates that the tendency to wander away from Barkley Sound was continuous into the succeeding year. Of the seven tags recovered, one was recovered in another major area and all of the others were recovered under circumstances which make the possibility of recovery from Barkley Sound appear impossible or highly improbable.* This condition is in contrast to those for the other Barkley Sound taggings, 3U, 5O, and 5P, a majority of whose interpreted returns are from Barkley Sound.

The 4U tagging at Quatsino Sound is unique in that, of all taggings producing substantial numbers of returns, it is the only one to produce more tags in the second season after tagging than the first. (The 2M tagging is an exception to this statement, but in its case the comparatively low recovery in the first year was evidently due to technical difficulties with recovery of tags in plants situated near the fishing-grounds most concerned.) In the 1940–41 season, when twenty-eight recoveries of 4U tags were made, a very small amount of fish was taken in Quatsino Sound and most of the tags recovered were taken off Kyuquot Sound. In the report for 1940–41, attention was called to the greater concentration of 4U tags among the few fish caught in Quatsino Sound than those taken off Kyuquot Sound. It is evident that the concentration of 4U tags in the Kyuquot Sound area in 1940–41 (0.63 per hundred tons of herring) was less than that observed in Quatsino Sound in 1941–42 (0.93 per hundred tons of herring considering returns interpreted as being from Quatsino Sound, 1.90 considering all 4U returns, with the correct value no doubt being between these two).

East Coast of Vancouver Island.

The number of tags recovered from the east coast of Vancouver Island was small considering the amount of fish caught in the east coast fishery. This is largely to be

* For additional recoveries from this tagging *see* postscript at the end of the report, page –.

attributed to the extensive canning operations carried on in the east coast which offer little opportunity for tag-recovery. In general, recovery has been small for the east coast of Vancouver Island in recent years.

Interpretations were offered for forty-five tags put out on the east coast. Of these, forty-three were returned from the east coast and two were recovered from Discovery Passage. Tags interpreted as coming from fish caught on the east coast numbered forty-seven. Of these, forty-three came from east coast taggings, one from a west coast tagging, two from a tagging carried out in the Discovery Passage area, and one from a Central British Columbia tagging. The situation under which no movement out of the east coast area was indicated (aside from the movement into the Discovery Passage area, which has a doubtful status) while there was definite evidence of movement into the area is in contrast with that for the previous year when no tags from outside the area were recovered on east coast fishing-grounds and 27 per cent. of the tags recovered from east coast taggings were recovered outside the east coast area. (If Discovery Passage is included in this calculation and regarded as not being a part of the east coast of Vancouver Island, 45 per cent. of the east coast tags are shown to be recovered from outside the major tagging area.)

The relationship between tagging area within the east coast of Vancouver Island region and the fishing-ground producing recoveries has been pointed out in an earlier section. There is evidence of a tendency for fish tagged in the northern part of the Strait of Georgia to be recovered from Nanoose Bay. This is a further indication of a heterogeneity among the herring populations spawning in the Strait of Georgia which has been suggested in earlier reports.

Discovery Passage.

The recoveries made during the past season give no indications of the independence of the herring populations of the Discovery Passage area. This may be largely because neither the tagging during 1940–41 nor the recovery during 1941–42 was completed in such a way as to provide a suitable test of the independence of the area. Owing to a comparative failure of spawning in the area during the spring of 1941, no tags were put out. During the fishing season, the fishery was conducted in such a way that there was little opportunity of any returns from the Discovery Passage area being reported with certainty.

Queen Charlotte Sound.

Recoveries from and within the Queen Charlotte Sound area were greatly reduced from the previous year. This is partly a result of the very sparse tagging in Queen Charlotte Sound in the spring of 1941 and may be in part caused by curtailed fishing in the area on stock which consisted largely of immature fish. No tags used in areas outside Queen Charlotte Sound were interpreted as being recovered from fish caught in that area, but three tags from Queen Charlotte Sound taggings were interpreted as coming from three other major fishing areas. Ten of the thirteen tags recovered from Queen Charlotte Sound taggings were returned by the plant operating upon most of the Queen Charlotte Sound fish.

Central British Columbia.

The number of returns for Central British Columbia is comparatively low for the second successive year. This small return is not attributable to the number of tags out as shown by the following figures for the number of tags put out and recovered:—

Year.	Tags put out.	Tags recovered in Year following Tagging.	
		Number.	Percentage.
1938	1,395	58	4.2
1939	3,489	311	8.9
1940	2,497	45	1.8
1941	5,877	30	0.5

It is evident that all of the difference in the percentage recovery is not due to decline in the catch and it is regarded as unreasonable to believe that it is due to deterioration in technique. By elimination it would appear then that the decline in tag-recovery is related to some change in the life-history of the fish or some change in the relationship between the fish population and the fishery. It is suggested tentatively that the facts of the case, including the continuation of satisfactory spawnings in the region, are covered by the supposition that two groups of fish formerly spawned together in the region, but that one group which was accustomed to approach the shore and enter the inlets early in the season has become less numerous, while the other group which characteristically remains off-shore until immediately before spawning has maintained its abundance.

During the 1941–42 season the independence of the Central British Columbia fishing area was maintained only imperfectly. Twenty-two tags put out in the Central area were interpreted as being recovered in the same area. This may be compared with two tags put out in other areas which are interpreted as being recovered in the Central British Columbia region and five Central British Columbia tags which are interpreted as being recovered in other major areas. In the last connection, the four Kwakshua Passage (5N) tags recovered on the west coast of Vancouver Island are noteworthy.

Northern British Columbia.

The number of tags recovered from Northern British Columbia was small but larger than in the previous year. The decline in number of recoveries is less than that shown for the Central area, but is, nevertheless, marked. The figures for recoveries and tags used in this major area follow:—

Year.	Tags put out.	Tags recovered in Year following Tagging.	
		Number.	Percentage.
1939	2,696	53	2.0
1940	2,299	10	0.4
1941	2,491	22	0.9

The independence of the Northern British Columbia area is reasonably well maintained. Twenty tags used in the area were recovered from Northern British Columbia fishing-grounds and one was interpreted as coming from beyond the limits of the area. One tag from Central British Columbia was recovered from within the area. It is evident again that fish spawning in Big Bay occur in substantial numbers during the subsequent fishing season on fishing-grounds to the north such as those in Union Bay and Khutzeymateen Inlet.

SUMMARY OF RESULTS.

The results of the herring-tagging and recovery programme agree in general with those obtained in previous years. They establish the relative isolation of the major fishing areas. On the whole these may be regarded as 96 per cent. independent. The results also show that within major areas a certain amount of segregation of populations takes place, and this may occur even between closely associated contiguous areas. There is evidence of heterogeneity in regard to the fishing-grounds supplied by the different spawning populations of the Strait of Georgia. No evidence has been obtained to indicate the separation of the Discovery Passage area from the rest of the east coast of Vancouver Island.

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As in former years, the herring-tagging investigation has enjoyed the co-operation of many individuals and agencies. British Columbia Packers, Limited, and the Nootka-Banfield Company, Limited, have been most accommodating in permitting the installation of induction detectors in their plants at Steveston and Port Albion (Ucluelet)

respectively. Plant crews have again assisted the investigators by attending to the recoveries of tags from magnets.

The Nootka-Banfield Company, Limited, and Nelson Brothers Fisheries, Limited, have again placed the seine-boats "Snowfall" and "Jessie Island No. 11" at our disposal for the spring tagging operations. The crews of these boats, Captains Ole Bruno and Sigurd Berg, and Messrs. E. Lund, A. Carefoot, J. Yauk, and M. Campbell, have given competent and willing assistance, as has Mr. S. Vollmers in his operation of the "Whiff." Mr. N. Tibbo, as a volunteer assistant, has given valuable help.

The courtesies of all of the foregoing are gratefully acknowledged, especially since such co-operation as that extended is absolutely essential to the execution of a widespread programme such as that involved in herring-tagging.

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POSTSCRIPT.

Since the completion of the foregoing report additional tags have been received from two plants. Five of these were recovered at Butedale and were caught under circumstances which make it evident that they came from fish caught in Laredo Inlet or Meyers Passage. The tags were: 4Z, Lake Island—one; 5I, Campbell Island—one; 5L, Laidlaw Island—two; 2M, Bella Bella—one. The site for the Bella Bella tagging is not shown in the map accompanying this report but is illustrated in reports for previous years. The 2M tag, used on March 25th, 1938, was out for a longer period than any other recovered in the present investigation.

Twenty-two additional tags have been received from Kildonan as follows: 4U, Quatsino Sound—two; 4AA, Barkley Sound—three; 5C, Gabriola Bluff—one; 5O, Barkley Sound—seven; 5P, Barkley Sound—six; 5W, Quatsino Sound—two; 5X, Bunsby Islands—one. The following remarks deal with the sources of the tags as interpreted on the basis of plant operations.

Quatsino Sound (4U): One reported from Quatsino Sound, probably correctly. The other one reported from Barkley Sound fish is interpreted as coming from Quatsino Sound fish also. Other possibilities are Barkley Sound, east coast of Vancouver Island, Sydney Inlet, Esperanza Inlet, and Kyuquot Sound.

Barkley Sound (4AA): Two reported from Barkley Sound, evidently correctly, and one from Winter Harbour. It is considered probable that the last-mentioned tag also entered the plant with Barkley Sound fish. Other possible sources are Esperanza and Sydney Inlets, east coast of Vancouver Island, and Kyuquot Sound.

Gabriola Bluff (5C): Reported from Barkley Sound. Other possible sources are: Esperanza and Sydney Inlets, east coast of Vancouver Island, and Kyuquot Sound. A tag used on the west coast of Vancouver Island recovered under the circumstances of this one would have been regarded as probably originating with Barkley Sound fish. However, it is possible that the tag entered the plant with fish caught on the east coast of Vancouver Island, and this appears more probable in view of the blackened condition of the tag. No interpretation is offered.

Barkley Sound (5O): All seven recoveries reported from Barkley Sound, probably correctly. Other alternative sources are Esperanza and Sydney Inlets, east coast of Vancouver Island, and Kyuquot Sound.

Barkley Sound (5P): All six recoveries reported from Barkley Sound, probably correctly. Alternative possible sources for one of the tags were Sydney Inlet, east coast of Vancouver Island, and Kyuquot Sound, and for the remaining five, those localities plus Esperanza Inlet.

Quatsino Sound (5W): Two recoveries, both reported, probably correctly, from Quatsino Sound. Possible alternative sources are Barkley Sound, east coast of Vancouver Island, Sydney Inlet, Esperanza Inlet, and Kyuquot Sound.

Bunsby Islands (5X): Reported from Barkley Sound. This may be correct, but Quatsino Sound is also quite possible as an alternative source, with the east coast of Vancouver Island, Sydney and Esperanza Inlets, and Kyuquot Sound as other alternatives. No interpretation is offered as to the point of origin on the west coast of Vancouver Island.

The additional recoveries will necessitate changes in some entries in the tables in the body of the paper and in some cases will affect calculations based on them. The alterations which will be caused will not affect the important general conclusions in any way.

Table VII.—Detailed List of Tags inserted during 1941–42 (with a Correction to a Previous List).

Identification Marks.	Date released.	Tagging Code.	Where released.	No. of Tags used.
P20001–P21100	Mar. 15, 1942	6L	Retreat Passage	1,093
P21101–P22700	Mar. 12, 1942	6J	Porpoise Bay	1,579
P26101–P26700	Mar. 15, 1942	6L	Retreat Passage	596
P26701–P27200	Mar. 19, 1942	6M	Campbell Island	498
AASS	Feb. 19, 1942	6B	Selby Creek	997
BBAA	Mar. 2, 1942	6D	Departure Bay	500
BBLL	Oct. 17, 1941	6A	Sooke	496
BBTT	Feb. 26, 1942	6C	Ganges Harbour	497
HHII	June 4, 1942	6S	Nanaimo Harbour	200
HHPP	May 2, 1942	6R	Departure Bay	199
HHTT	Mar. 10, 1942	6I	Skuttle Bay	194
IIAA	Mar. 10, 1942	6I	Skuttle Bay	100
IIOO	Mar. 10, 1942	6I	Skuttle Bay	98
IIPP	Mar. 10, 1942	6I	Skuttle Bay	97
II44	June 4, 1942	6S	Nanaimo Harbour	100
JJII*	Mar. 17, 1941	5I	Brown Narrows	99
JJKK	Mar. 6, 1942	6E	Kuper Island	993
JJLL	Mar. 9, 1942	6H	Baynes Sound	998
JJMM	Mar. 9, 1942	6H	Baynes Sound	1,002
JJNN	Mar. 10, 1942	6I	Skuttle Bay	1,000
JJOO	Mar. 7, 1942	6F	Departure Bay	1,004
JJ66	Mar. 28, 1942	6N	Clio Channel	1,000
KKHH	Mar. 19, 1942	6M	Campbell Island	999
KKII	Mar. 30, 1942	6O	Kingcome Inlet	1,000
KKKK	Apr. 21, 1942	6P	Cahnish Bay	998
KKMM	Mar. 30, 1942	6O	Kingcome Inlet	776
KKOO	Mar. 28, 1942	6N	Clio Channel	1,000
KKXX	Apr. 24, 1942	6Q	Departure Bay	502
KKZZ	Apr. 22, 1942	6P	Cahnish Bay	500
NNJJ	Mar. 9, 1942	6G	Kulleet Bay	499
NNKK	Mar. 9, 1942	6G	Kulleet Bay	501
NNOO	Mar. 27, 1942	6K	Squirrel Cove	500
NNPP	Mar. 27, 1942	6K	Squirrel Cove	500
NNTT	Mar. 27, 1942	6K	Squirrel Cove	499
NNUU	May 2, 1942	6R	Departure Bay	499
NNXX	Apr. 24, 1942	6Q	Departure Bay	503
PPII	June 3, 1942	6S	Nanaimo Harbour	500

* Erroneously recorded as VVII in the 1940–41 report.

THE BUTTER-CLAM (*SAXIDOMUS GIGANTEUS* DESHAYES): STUDIES IN PRODUCTIVITY.

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

INTRODUCTION.

In a previous report (B.C. Fisheries Dept., 1939) Mr. D. B. Quayle pointed out the desirability of estimating the stocks of marketable clams existing from year to year in the main areas of production. In order to provide a basis for comparison over a period of years and thus gain an idea of the trend of the fishery, a system of recording catches was instituted, whereby the average quantity of clams obtained by a digger during one tide can be estimated. This unit of effort, the "man-tide," is used as an index to compare the productivity of different areas and of different years. The necessary statistics are obtained through the assistance and co-operation of the Dominion Department of Fisheries, the clam-buyers, and the individual diggers.

In addition to this general survey, a more intensive investigation of the factors governing production has been started at Seal Island.

COMPARISON OF AREAS.

The following figures were obtained by Mr. Quayle for various areas during the 1940–41 season. Averages for 1939–40, when these are available, are given for comparison. The figures under "Catch" are the quantities from which the averages were calculated and do not necessarily represent the total catch from these localities.

Area.	Catch.	Total Number of Man-tides.	Average Catch per Man-tide.	1939–40.
	Lb.		Lb.	Lb.
Alert Bay	161,965	694	233.4	172.6
Old Village	656,395	3,535	185.7	210.1
Chatham Channel	522,555	2,537	206.0	206.2
Bella Bella	504,179	2,760	182.7	.....
Quathiaski	61,376	354	173.1	.....
Comox	60,880	349	174.4	.....
Chemainus	246,193	1,973	124.7	120.0
Sidney	181,952	1,214	149.9	138.0
West Coast of Vancouver Island	39,320	218	180.4	.....

SEAL ISLAND.

A special investigation of the butter-clam beach at Seal Island, near Comox, was begun in January, 1942. This beach, which has been closed to diggers since 1939, at which time it was in a depleted condition, was believed to have developed a heavy population of marketable clams. Experimental digging of these grounds was authorized by an Order in Council of January, 1942, and an opportunity was thereby provided for obtaining information on the population and productivity of a well-stocked beach under controlled conditions. Specific information was sought regarding (1) the population of clams existing in a beach which had not been dug for several years; (2) the quantities of clams obtained by diggers from such a beach under known conditions; (3) the effect of imposing annual quotas on certain areas of known extent; and (4) the annual yield which can be sustained over a period of years. In view of the limited results obtainable in a single season, the present discussion is devoted to a partial consideration of (1) and (2).

The initiation of the experiment and the completion of the necessary arrangements were in large measure due to Mr. George J. Alexander, Assistant Commissioner of

Fisheries. Operations were conducted through the co-operation of British Columbia Packers.

Methods.

Before digging commenced, three areas (A, B, and C) were staked out within the portion of the beach considered to possess the heaviest population. These areas were contiguous and were approximately 10,700 square yards, 11,000 square yards, and 7,500 square yards in extent.

Digging operations took place during two sets of low tides—namely, from January 29th to February 2nd and from February 10th to 13th. Digging was permitted on one specified area only during a given night. Digging in Area A was stopped when it was considered that two-thirds of the territory had been fully exploited, about one-quarter of Area B was dug, while in Area C digging was continued until no digger considered it worth further attention. Diggers were paid according to the weight of clams delivered.

Digging Effort.

Estimation of the effort involved in taking the clams was based on the number of forks in use during each of the eight nights on which operations were conducted. Diggers were assisted on most nights by a relatively small number of "pickers," who are not included in the figures presented below.

In conformity with the procedure outlined in the first paragraph of this report, figures are given for average catches per man-tide. Since all the Seal Island digging was done under supervision, however, an estimate was also possible in terms of "man-hours"—i.e., the average catch made by one fork in one hour. In view of the varying length of time available for digging on different tides, it was felt that the "man-hour" might provide a somewhat more accurate unit for estimating the digging effort.

Catch.

Catches were weighed by the buyer on delivery. The number of clams was estimated from counts made on a series of weighed samples.

The following statistics were obtained for the three areas:—

Area.	No. of Tides.	No. of Diggers (Man-tides).	Man-hours.	Catch.	No. of Clams.	Average Catch.	
						Per Man-tide.	Per Man-hour.
				Lb.		Lb.	Lb.
A	2	160	655.35	111,292	386,100	695.57	169.82
B	4	65	250.75	25,920	90,288	398.77	103.37
C	2	168	680	98,545	342,600	586.58	144.92
Totals	8	393	1,586.10	235,757	818,988	599.89	148.64

Estimate of Population.

The catches were extremely heavy. In order to ascertain the effect of digging operations on the stock of clams, a knowledge of the population of the areas is essential. On the basis of the known size of the areas and the estimated extent to which each was "dug out," the following figures were obtained regarding the total population of marketable clams before digging commenced:—

Area.	Pounds.	No. of Clams.	Average Pounds per Square Yard.
A	166,938	579,150	15.60
B	103,680	361,152	9.42
C	100,000	347,648	13.33

The general accuracy of these estimates is borne out by the close relation which exists between the estimated population per square yard and the average catch per man-hour.

Thus: Area A, $\frac{15.60}{169.82} = 0.0918$. Area B, $\frac{9.42}{103.37} = 0.0911$. Area C, $\frac{13.33}{144.92} = 0.0920$.

The average amount of work performed per hour appears to have been nearly constant during the digging periods. The average length of the digging tides allotted to each area was almost the same (3.89 hours for Area A, 4.04 hours for Area B, and 4.00 hours for Area C). On the basis of the foregoing estimates the average amount of work done by one fork in one night was the equivalent of 43.63 square yards completely dug. Under these circumstances closely similar estimates of the population can be reached by the use of either of the following equations:—

(1) Population (pounds per square yard) = (average catch per man-hour) $\times$ 0.0916

(2) Population (pounds per square yard) = $\frac{\text{Total catch}}{(\text{No. of man-tides}) \times 43.63}$

Estimates would be:

	A.	B.	C.
(1)	15.56	9.47	13.27
(2)	15.94	9.14	13.44

It is intended to follow the trend of population and production through annual diggings over a period of several years.

REPORT ON INVESTIGATIONS OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1941.

During 1941 the outstanding feature of the season was the final demonstration that a blockade still exists at Hell's Gate Canyon, 135 miles up the Fraser River, where it passes through the Coast and Cascade mountains. This has been under observation by tagging experiments since 1938, and evidence has been accumulating each year. Special attention was called in the reports of the Commission for 1938 and 1939 to the evidence secured by the tagging experiment of those years showing a blockade and the need for further studies. In 1940 extensive evidence of the delay was presented to the Advisory Board by the Commission. In 1941 special efforts were made to complete this evidence.

It will be recalled that the first mention of an obstruction at Hell's Gate was made in 1913 when serious mortality was caused by rock dumped into the river at various points along the canyon. Energetic efforts removed much of these obstructions, but in January of 1914 a further and very great slide of rock recurred at Hell's Gate. The removal of this was not completed until February of 1915.

The obstruction in 1913 was followed by a decline of over 75 per cent. in the return of 1917. The return in 1918 from the spawning of 1914 was reduced over 85 per cent. The return in 1921 from the spawning of 1917 was reduced 75 per cent. By 1918 damage to those particular races most affected by the obstruction seemed to have reached its maximum because the catch thereafter was more or less stable at a low level. Since then sporadic increases in later years indicate what may constitute partial recovery of certain of these races—namely, those of Chilko and Adams River. But the former great run of the 1913 cycle has definitely vanished, a loss which at present prices might be between 30 and 35 millions of dollars every fourth year.

To this should be added the loss caused by damage to four other species of salmon with which the Commission is not directly concerned.

Species of fish have great recuperative powers, this being possibly due to an increase in the survival rate during early stages when the species becomes scarce. From experience with other fisheries, it would be expected that those races which were depleted would rebuild themselves. But only two have done this to any great degree—namely, the Chilko and the Adams River races. If these two could do this, and if those races spawning below Hell's Gate could maintain themselves, there would seem to have been some continuing influence which affected those races which remained in a depleted condition.

Tagging at Hell's Gate has shown that the several races of sockeye pass at different times. It has also shown that delay at Hell's Gate occurs as a rule in the latter part of August, with variation according to the year. From this it has seemed that if this delay resulted in mortality an explanation was at hand for the difference in condition of the various races of sockeye.

The existence of a delay at Hell's Gate has been surmised by various observers since 1913, notably in 1926 and 1927, and many have thought, without proof, that it damaged the run. The delay has been abundantly indicated in 1938, 1939, and 1940 by the tagging experiments, which showed that the proportion of recaptures below Hell's Gate increased steadily with the accumulation of fish in the eddies below the obstruction. They also showed that the average time between tagging and recapture in the same eddies increased until a water-level was reached at which fish were able to pass.

But no evidence of actual unusual mortality had been adduced save the stranding of salmon among the rocks at points where there was difficulty of passage. It was assumed, without disproof, that the delayed salmon ultimately passed. Nor was the evidence from the tagging as to the exact levels at which the blockade occurred as precise as it should be.

To secure this evidence there were tagged in 1941 a total of 13,537 sockeye below and 921 above Hell's Gate. Many of these were recovered on the spawning-grounds while *en route* or along the main river below the obstruction. To carry out these opera-

tions a large part of the staff of the Commission was employed from the time the blockade developed in July until December.

The recovered tags and supplemental investigations showed:—

(1.) Between water-levels of 25 and 40 feet few fish passed through at the beginning of the period and none in the latter half.

(2.) A delay of more than twelve days left sockeye unable to pass when the blockade became passable after the period August 15th to September 1st. Later any delay whatever seemed fatal.

(3.) The first period of blockade lasted thirty-six days. The second lasted thirty-one days, after a one- or two-day opening. In this short time there passed the major share of all spawners reaching the upper Fraser in 1941. After this opening no fish passed through. Since a delay of twelve days resulted in failure to pass, the seriousness of the blockades in 1941 is obvious.

(4.) Fish tagged immediately below the blockade twelve days or less prior to its opening gave about 20 per cent. as many recoveries from up-river as did fish tagged 3,000 feet above the blockade. This was undoubtedly due to the presence of a large body of fish below the blockade which had been delayed too long to resume their normal migration and which were mixed with those which were able to stand the delay or were recently arrived.

(5.) Fish tagged below, but which later passed, were in large part delayed and abnormal in their migration in contrast to the direct speedy migration of those tagged above.

(6.) As the result of the blockades, a great mass of sockeye, estimated at a half to two-thirds of all reaching the blockade, failed to pass Hell's Gate, and were followed by investigators through subsequent disappearance below the turbid waters of the Fraser until their death two to three months later, even as late as December. These fish passed through the normal physiological changes usually accompanying migration. They successively became less active, fell back into quieter water, assumed a bottom-swimming habit, thus disappearing from view, tried to spawn in unfavourable places, died and sank to the bottom. It was estimated by some observers that over a million sockeye died thus. The disappearance explains the failure to observe the effects of blockades in the years since 1913.

(7.) Whereas a delay of twelve days was found to be too great in 1941, for the race concerned and the time of season in question, records of water-levels at Hell's Gate show that since 1913 the average duration of a blockade is 34.6 days, with a minimum of nine to a maximum of sixty. The average date of beginning of the blockade is August 10th, at the height of the season of migration.

(8.) Examination of the spawning runs to those grounds in the Fraser River which were populated by races which passed Hell's Gate at the time the blockade was effective showed that these were seriously damaged, by elimination of sections of the run corresponding to the time of blockade as corrected for the time required for migration.

(9.) Records for 1938, 1939, and 1940 confirm these findings of 1941, allowing for variations in conditions and the scope of the experiments.

From these results it would seem that an explanation is at hand for the failure of up-river races of sockeye to be rehabilitated. It may well be surmised that those races which made up the major part of the so-called "big" year of the 1931 cycle were those whose time of passage at Hell's Gate coincided most closely with the period of blockade. A corollary of this is that the variation in periods of blockade and of migration cause a variable degree of interference and that this renders the maintenance of certain other races precarious, even though they show increases at present. A further corollary is that damage to a race is not necessarily abrupt or complete, but may be partial and variable.

The discovery of definite and demonstrable damage of this kind tends for the moment to overshadow everything else in the programme of the Commission. But it should not be forgotten that further results of perhaps equal importance can be expected as the experiments are completed and their results analysed.

Several years' research were necessary to produce these first results, each year's programme being built upon the results of the preceding years. For instance, the proper observation of the Hell's Gate obstruction involved knowledge of migration times, accurate observation of spawning-grounds and points of capture *en route*, adequate recovery of tagged fish, and a knowledge of the physiological changes which occur in migratory salmon, as well as development in scope and efficiency of the actual tagging experiments. To complete the present work and to analyse the great mass of data already on hand is a major task, undoubtedly the most important and urgent that the Commission faces.

Nor should it be forgotten that the future regulation of the fishery, the sharing of the catch, the effect of the Indian fishery (which evidence indicates may be as important to some races as Hell's Gate), and the actual rebuilding of runs freed of mortality at obstructions will claim a great deal of effort in future research. And there still remain many fundamental problems in the life-history of the fish which must be solved.

The tagging at the Sooke traps at the southern end of Vancouver Island was carried on under the same arrangements as in former years, with the cordial co-operation of the owners and the Dominion Department of Fisheries. In the last four years the numbers tagged and recovered were as follows:—

Year.	Number tagged.	Number recovered.	Per Cent. recovered.
1938	980	431	44
1939	1,051	547	51
1940	930	417	45
1941	849	485	58

In 1941 the Commission chartered three vessels of Canadian registry for various lengths of time. The "Laila," a small seine-boat, was operated for three months at the mouth of the Fraser. The "Clara M." was operated for one and a half months to purchase fish for tagging from seiners near the San Juan Islands. The "Phylima" was used for one month in Johnstone Straits for the same purpose.

During the last four years the results of such experiments have been as follows:—

Year.	Number tagged.	Number recovered.	Per Cent. recovered.
1938	2,587	1,231	47.6
1939	6,152	3,990	65.0
1940	3,279	1,614	49.3
1941	4,737	2,871	60.5

At Hell's Gate 13,537 sockeye were tagged below and 921 above the narrows. The results are described above.

Four observers were stationed at the canneries at Steveston, Bellingham, and Anacortes. They recovered tagged fish, took representative series of sockeye, and collected statistics. A system of log-book records was begun, with a high degree of success. The purpose of the statistics is to lay a basis of knowledge of gear, vessels, men, and behaviour of the schools, which will allow regulation and division of the catch according to treaty provisions.

The usual survey of the spawning-grounds was carried on. Tags were recovered; time and place of run were determined; scientific observations were made on size, sex, and spawning; methods of enumeration were developed; and material was gathered for racial studies.

It was estimated that about 73 per cent. of the spawning escapement of 1941 went to Chilko River and Lake where the work of the Commission was extensive.

The interesting observation was made that certain runs which apparently were seriously affected by the blockade at Hell's Gate nevertheless were as large as the runs

in their cycle-years. This would indicate that a large increase can be expected with the removal of the obstruction.

On the other hand, the run to the North and South Thompson rivers was exceedingly poor, totalling about 300 fish, and for the most part it must be conceded that the failure was the result of the blockade at Hell's Gate. About thirty-four fish were counted in Adams River, far below the run in 1937.

The experiment in development of methods of counting escapement, which has been carried on in the Harrison system, was brought to completion and will be continued only in partial form next year.

The Cultus Lake experiment in predator control and counting of migrants was continued. Some 6,676 coarse fish were recovered. The adult migrants numbered 18,164; the first and second age-group seaward migrants totalled 3,959,490.

Collection of historical material was continued and has resulted in extensive information bearing on the history of the fishery and the runs.

Members of the staff contributing material to the above were Dr. J. L. Kask, Assistant Director; Messrs. M. B. Schaefer, C. E. Atkinson, L. E. Whitesel, D. R. Johnson, and H. S. Tremper.

SPAWNING REPORT, BRITISH COLUMBIA, 1941.

By J. A. Motherwell.

GENERAL.

It is most satisfactory to be able to report that, notwithstanding a record salmon-pack in British Columbia, the seeding of the spawning-grounds has been found to be well above average, with the exception of the pink variety. In this case the runs, particularly in the northern waters, were disappointing, but extra restrictions were placed on the fishing, which permitted a larger percentage of the runs than usual to reach the spawning-grounds. Water conditions, apart from several small areas, were very favourable, and freshets have done little, if any, damage.

SOCKEYE.

This variety was found in abundance in the usual areas. The Nass, Skeena, Bella Coola, and Rivers Inlet watersheds were amply supplied and other less important areas received satisfactory seedings. In the case of the Fraser River watershed, notwithstanding the difficulty experienced at Hell's Gate, the seeding by sockeye in the Chilko River and Lake watershed was over 200 per cent. better than that of the brood-year of 1937. This year's estimate is 350,000 spawners compared with 110,000 in 1937. This watershed has been building up very satisfactorily in recent years. In the Stuart Lake, Francois Lake, and Quesnel Lake systems the spawning was heavier than in the brood-year. In the Shuswap area the run was practically a failure, although no heavy return was expected in that district during the year under review. The sockeye spawning was above average, also, in the Hayden Bay, Sproat, Stamp, Anderson, and Nimpkish River systems.

SPRINGS.

The seeding by this variety can be considered a good average, generally speaking.

COHOES.

The supplies of cohoes found on the spawning-grounds were, as a rule, excellent, many of the fish being very large individually.

PINKS.

In the areas north of Vancouver Island the pink-supply was entirely inadequate, though, through extra closed seasons, a larger percentage of these runs was saved for the spawning-grounds. One outstanding exception was the case of Bella Coola, where the pink-spawning grounds are reported as being filled to capacity. The seeding of the Skeena River district was an improvement over the brood-year of 1939. A heavy seeding of pinks was also reported in the Harrison Lake district, including the streams tributary to the Fraser, from Harrison Lake down to the mouth of the river.

CHUMS.

A splendid seeding by this variety was observed, particularly in the areas around Vancouver Island and the Mainland opposite, notwithstanding a record catch of this variety.

A more detailed description of conditions found follows:—

QUEEN CHARLOTTE ISLANDS.

There was the usual showing of sockeye in several of the streams in the Masset Inlet area and Copper River. These, however, are of little commercial value and the only serious toll taken of the runs is by the Indians for their own food purposes. The cohoe seeding was found to be heavy. This being an "off" year for the pink variety,

the seeding, as expected, was very light. Generally speaking, the chum seeding was satisfactory, with the exception of the streams tributary to Cumshewa and Sewell Inlets.

NASS AREA.

The Meziadin Lake district is the chief sockeye-spawning grounds of this watershed. The inspecting officer refers to an early and late run. By the former he means the quantities of salmon actually seen on the spawning-grounds around Meziadin Lake; by the latter he refers to the last part of the run which is proceeding up the Meziadin River through the fishway to the lake. The seeding by the early run is reported as heavy, an improvement over those of the years 1936 and 1940, and similar to the heavy run of 1937. The seeding by the late run was also fairly heavy; not quite up to that of 1936, but exceeding those of the years 1937 and 1940. The general seeding by sockeye over the whole Nass area, including the tributary streams between Meziadin and salt water, has evidently been very satisfactory.

The fishway in the dam at the outlet of Meziadin Lake is in good condition and constitutes no obstruction to the ascent of salmon. Spawning conditions over the whole area were good.

Whilst the supply of spring salmon on the spawning-grounds in the upper reaches of the watershed is reported as being quite good, the lower tributary streams contained an unusually heavy run. The supply of spawning cohoe observed in the several streams frequented by this variety is reported as being the best since 1938. The seeding at all points is reported as being heavy. The seeding by the pink variety is estimated as a good average and better than was expected from indications in the commercial fishing areas. In the three principal pink-salmon streams, the Quinnimas, Ikginik, and Khutzeymateen, the escapement was better than the cycle-year of 1939. The supply of chums on the spawning-grounds is reported as a good medium.

SKEENA AREA.

The Babine Lake and River section, which is the principal sockeye-spawning area of the watershed, was supplied with a satisfactory quantity of sockeye-eggs. There was some waste of eggs at Pierre Creek and Fifteen-mile Creek, which points will require some attention in the future. The conditions for spawning were good as there has been very little frost and plenty of water to cover the eggs. The number of salmon taken by the Indians for food purposes was smaller than expected, owing to their absence for haying operations, employment in mines and local sawmills.

The supply of springs is reported as fairly heavy, cohoes as a heavy run, and the pinks as fairly heavy. In the Kispiox watershed the Inspector's report refers to the supplies of sockeye, springs, and cohoes as heavy, and a medium run of pinks. In the Lakelse Lake area, heavy supplies of sockeye were observed at Williams Creek, which contains the principal spawning-beds. A satisfactory supply was also found at Schulbuckhand Creek and satisfactory quantities in the smaller Granite Creek. There was a heavy seeding by cohoes in this area. The pink seeding was reported as good, and an improvement over the cycle-year of 1939. On the spawning-grounds of the streams tributary to the Skeena River, below Lakelse River, satisfactory quantities of springs, cohoes, and pinks were found. The chum seeding was light, but the Skeena watershed is not a prolific chum area.

LOWE INLET.

Due to heavy prevailing rains during the latter part of September and most of October, together with unusually strong winds, it was impossible to inspect all sockeye-spawning grounds. The supply found, however, is reported as fairly heavy, generally speaking, comparing favourably with the heavy spawning of 1936. The escapement to the streams on the west coast of Banks Island is reported as very heavy and a decided improvement over that of the brood-year. The weather during the sockeye run was hot, with no rain, and it was found necessary to enforce special closures until the rains arrived. The supply of cohoes in most streams was found to be heavy, and compared favourably with the heavy spawning of the brood-year of 1938.

The pink run was disappointing, although the seeding, due to extra conservation measures, was better than expected. On the whole, however, the pink situation was found to be not good. The spawning was the heaviest in the streams in the northern portion of the area. On the other hand, the chum seeding was found to be quite satisfactory.

BUTEDALE AREA.

Due to the seining season being the driest in the past nine years, it was necessary to close a considerable portion of this area to ensure a proper escapement to the spawning-grounds. The sockeye spawning, although never extensive, was found to be the lightest for some years past. The average escapement in the southern part of the area was below that of 1937; but to the major spawning-grounds, such as the Kwakwa and Talamoso Inlets, was very satisfactory. The cohoe seeding is reported as excellent, although not quite as good as the cycle-year of 1938. The pink-supply was normal for this "off" year cycle, but owing to less fishing intensity a larger percentage of the run reached the spawning-grounds. The chum seeding was better than normal, an increase over the cycle-year of 1937, which was considered a fair year.

BELLA BELLA AREA.

On the whole, salmon escapement was satisfactory; the sockeye seeding being a medium one, cohoes reported as heavy, pinks medium, and chums heavy, compared with the brood-years. Water-levels were favourable.

BELLA COOLA AREA.

Owing to there being no seaplane service available, the inspection of this difficult area was made on foot. Much time was lost in the clearing of a passable trail over a distance of approximately 50 miles from salt water. Conditions were unusually difficult, due to a continuous downpour of rain which flooded the areas through which the trail passes.

In the Bella Coola and Atnarko River system the supply of sockeye on the spawning-grounds was found to be entirely satisfactory; a distinct improvement compared with the brood-year. A noticeable feature was the almost total absence of runts, which are usually much in evidence in this area. The run of springs is reported as heavy, equal to that of last year, which was the best in the experience of the inspecting officer, covering eighteen years. This is reported as being the third successive heavy spawning of springs in the area. The cohoe-supply was up to usual. All the pink-salmon spawning-grounds are reported as being filled to capacity. The chum-supply was found to be good and a decided increase over that of the brood-year, the spawners being found in nearly all tributary streams as well as in the usual creeks.

RIVERS INLET AREA.

The inspecting officer states that he is more than satisfied with the escapement of sockeye to the Owikeno Lake system, which is the spawning-ground of the sockeye, particularly in connection with the supply of five-year-old fish. The escapement to the Waukwash River was better than average and that area was well seeded. At Indian River every bar is reported as being covered with spawning sockeye, and more springs were observed than in past years.

At Shumahault River more sockeye were observed than for some years. At Genesee Creek the inspecting officer reports the best showing and the greatest number of fish he had ever seen in the creek, and spawning conditions perfect. Conditions at Nookins River were good. At Asklum River the beds are reported as being well seeded with sockeye. At Quap River the inspecting officer found the bed of the stream literally covered with spawning sockeye, and refers to the escapement as huge.

The Whonnock River is reported as being heavily seeded by sockeye, and springs, cohoes, and chums were also observed in good quantities.

The inspecting officer states that the sockeye run was earlier than usual; that the greater part of the escapement is comprised of five-year-old sockeye; that the area in

general has been well seeded, and although a heavy freshet occurred in the middle of October little, if any, damage was done to the spawning-grounds.

In connection with the escapement of fall salmon the report reads that the cohoe spawning was better than usual, the pinks very good, and chums good.

SMITH INLET AREA.

There are only two important sockeye-spawning grounds in this area. The principal one is the Geluck River where the seeding was found to be good. In the second river, the Delabah, and in the lake at the mouth of the river, very considerable quantities of sockeye were observed and the seeding is rated quite adequate.

The seeding of springs was reasonably good and this also applies to the cohoes and pinks, but the chum-supply was only fair.

FRASER RIVER WATERSHED.

Prince George Area.—This spawning area is divided into two definite districts—the Stuart Lake watershed and the Fraser Lake-Francois Lake watershed. The quantities of sockeye appearing on the spawning-grounds in both watersheds show a decided increase over those of the brood-year of 1937; although the supplies of salmon, of course, are still infinitesimal compared with the large runs of this cycle previous to its destruction at Hell's Gate in the fall of 1913. The run of springs which is found in the Upper Nechako River, Stuart River, and in the upper portion of the Fraser River was normal. Spawning conditions of both varieties were good throughout both areas, and the salmon arrived in good physical condition.

Quesnel Area.—In the Bowron River watershed the run of sockeye salmon showed a considerable increase over that of the brood-year. This also applies to the Horsefly system. The spring-salmon run was normal. Spawning conditions were favourable. A surprisingly large return of sockeye was found in the Chilko Lake and Chilcotin River system, the inspecting officer estimating a total of 350,000 spawners compared with 110,000 in the brood-year of 1937, notwithstanding the fact that evidently considerable difficulty had been experienced by the salmon in reaching the spawning-grounds, which was evidenced by the wounds and bruises appearing on a large percentage of the fish. An average supply of spring salmon was observed to this system. Spawning conditions were good.

Kamloops Area.—The principal sockeye-spawning grounds are found in the Shuswap, Adams River and Lake systems. Only a small return was expected this year but, even so, the return was very disappointing, only a few sockeye being found in Adams River and in Raft River, a tributary of the North Thompson. An average supply of spawning springs was observed. Spawning conditions were favourable.

Pemberton Area.—In the Seton-Anderson Lake system approximately 1,200 sockeye were passed over the counting-fence. Approximately another 800 spawned in Seton Creek, below the fence, and in the Fraser River. This compared with approximately 50,000 observed in the system in the brood-year of 1937. In this connection it is interesting to recall that at certain stages of the water at the rapids in the Fraser River, at the outlet of Bridge River, sockeye have had difficulty in passing up-stream and it has been observed that in some years when most difficulty was experienced, much larger quantities of sockeye were found in the Anderson-Seton Lake system, the inference being, as previously pointed out, that they may have dropped back from Bridge River rapids.

A good supply of spawning sockeye was observed in the Birkenhead River system, an increase over that of the brood-year. These fish are reported as having been in good physical condition. A substantial run of spring salmon was also observed. The cohoe seeding is reported as favourable and was continuing at the time of inspection.

In the Squamish River watershed a satisfactory seeding by springs was found on the spawning-grounds. The cohoe seeding was satisfactory and was continuing at the time of inspection. The supply of pinks was estimated as medium heavy, an increase over that of the brood-year. An exceptionally heavy seeding of chum salmon occurred.

In the Howe Sound portion of the district the several tributary creeks showed a light seeding of cohoe, and a good seeding of pinks and chums.

Hope Area.—Unusual numbers of sockeye salmon were found in most of the small streams tributary to the Fraser in this area. This was undoubtedly due to the difficult water conditions at Hell's Gate, which evidently prevented a portion of the run passing above this point. They, no doubt, dropped back to the smaller streams below the Gate. At Kawkawa Lake and Sucker Creek, for instance, the limited spawning-grounds were crowded with sockeye, the fish showing numerous bruises. A similar condition was observed in 1930 when the run of sockeye to the Fraser River exceeded, as it did in the year under review, all expectations. In that year the Fraser tributaries for 65 miles below Hell's Gate were crowded with sockeye. There was an average spawning of springs and a light supply of chum salmon.

Chilliwack Area.—The principal sockeye-spawning ground in this area is at Cultus Lake, where at the time of inspection over 18,000 of this variety had been counted over the fence. This compared with approximately 2,900 sockeye in the brood-year of 1937. Cohoe were found in all streams tributary to the Chilliwack River, equal to the medium run in the brood-year. The pink seeding is reported as heavy and a very definite increase over the brood-year of 1939. A heavy spawning of chums also occurred, large individual specimens predominating. Spawning conditions were favourable.

Harrison Lake Area.—The principal sockeye-spawning grounds are the Morris Creek system and Silver and Douglas Creeks, tributary to Harrison Lake. Some 10,000 of this variety were observed spawning at Morris Creek, which is a very considerable increase over the spawning of the brood-year. A normal spawning occurred at Silver and Douglas Creeks. A satisfactory spawning of springs occurred in the Harrison River. The cohoe-supply is reported as light. A very heavy seeding of pinks is reported, which extended to the streams tributary to the Fraser River between the outlet of Harrison River and New Westminster. This also applies to chums.

Pitt Lake Area.—The spawning of sockeye in this area compared favourably with recent years. The quantity appeared to be adequate. A light run of springs was observed. A fair seeding of cohoes, pinks, and chums is also reported.

Lower Fraser Area.—The Nicomekl and Serpentine Rivers were both well seeded by cohoe.

North Vancouver Area.—The cohoe seeding was found reasonably good, the pinks substantial, and chums abundant.

ALERT BAY AREA.

The sockeye seeding was entirely satisfactory. At the Nimpkish River, the most important stream, the seeding is reported as heavy and much greater than that of the brood-year. A satisfactory seeding occurred at Fulmore River, with fair supplies at Keough River, Glendale Cove, McKenzie River, and Kahweiken River, Thompson Sound. Light supplies, comparable to the brood-year, were observed in Shushartie and Nahwitti Rivers. The spring seeding was normal with heavy runs at Wakeman and Kleena Kleene Rivers. The Adams River seeding was light. Practically all streams were well supplied with cohoe-eggs. The inspecting officer comments on the unusually large size of the individual fish, some weighing up to 20 and 22 lb. The heaviest seeding of pinks occurred at Wakeman River, Keough River, and at all streams in Knight Inlet. The seeding at Bond and Kahweiken Rivers was an improvement over the brood-year, but the showing at Adams and Klucksivi Rivers was only about 50 per cent. of that of 1939. An exceptionally heavy seeding by chums was observed throughout the whole area.

QUATHIASKI AREA.

The sockeye seeding in the Hayden Bay area is reported as heavy. The sockeye run at this point is undoubtedly increasing. The escapement at Phillips River is also reported as very heavy, compared with the brood-year. The spring seeding was normal. The cohoe seeding was excellent throughout the district. The pink-supply was poor and considerably lighter than the brood-year of 1939. This, of course, was the "off"

year for this species in the area. The chums were very plentiful on the spawning-grounds and the seeding is reported as very heavy, compared with the years of 1937 and 1938.

COMOX AREA.

This is not a sockeye area. The spring seeding at Puntledge River was disappointing. The supply of cohoes on the spawning-beds was found to be very satisfactory, particularly at Puntledge and Courtenay Rivers. The inspecting officer comments, for the second year in succession, on the large number of two-year-old cohoes. Even for an " off " year, the pink seeding was poor, although in the Tsolum River a better supply was expected as a result of the good seeding in 1939. There was a fair showing in Morrison Creek, tributary to the Puntledge River. The chum-supply is reported as extremely heavy and much in excess of the brood-year of 1937. The inspecting officer remarks on the definite rehabilitation of this run to numerous small streams in Baynes Sound, and the continued improvement at Oyster River where the chum run is reported as being of very recent origin. The seeding of both Qualicum Rivers was also heavy.

PENDER HARBOUR AREA.

The only sockeye-stream of any value in this area is Saginaw River, where the escapement was considerably greater than that of the brood-year. The seeding of springs was average. The cohoe-supplies were found to be very good and, in most of the streams, an increase over those of the brood-year. The seeding was particularly good in the Toba Inlet area. The spawning of pinks is considered inadequate, although an exception was observed in the streams tributary to Jervis and Seechelt Inlets. An unusually heavy seeding of chums was found and was reported as the heaviest spawning for many years. All streams throughout the district are reported as being filled with this variety.

NANAIMO AREA.

In the small streams lying between Englishman River and Nanaimo the return of cohoes to the spawning-grounds was about the same as in 1938, the brood-year. The spawning-ground of the local streams carried chum salmon in greater quantity and over a longer spawning period than is usually the case. Spawning was much heavier than in the years 1937 and 1938.

LADYSMITH AREA.

There was a good average seeding of springs and a noticeable improvement in the supply of cohoes. The usual few pinks were observed, although this is not a pink area. The chum seeding is reported as much better than the years 1937 and 1938.

COWICHAN AREA.

The seeding of springs is reported as very good and the cohoe-supply is stated to be the largest in the experience of the local Inspector. He also speaks of the chum seeding as the biggest he has ever seen. The steelhead-supplies are apparently being well maintained.

VICTORIA AREA.

The cohoe seeding was a fair average, smaller than that of the brood-year, when the run was exceptionally large. The chum seeding is reported as very satisfactory.

ALBERNI AREA.

The sockeye areas are the Somass, Anderson, and Hobarton River system. The escapement to the Somass is reported as the best in the last thirteen years. This also includes Sproat Lake and its tributaries. There was an excellent seeding in the Anderson system. The escapement to the Hobarton area was very good. The seeding of springs in the Somass, Nahmint, Sarita, Toquart, and Nitinat areas, which are those frequented by this variety, was good. The cohoe escapement was exceptionally good in

all streams frequented by this variety. The chum seeding is reported as the heaviest since 1936, both in the Barkley Sound and Nitinat areas. The Inspector for the district reports that the runs, both from a commercial catch and spawning-ground standpoint, have been the best for many years.

CLAYOQUOT AREA.

The sockeye seeding in the principal spawning-areas of Kennedy Lake system is reported as extremely satisfactory. The spring seeding in the area generally is reported as good. The cohoe-supplies were found to be very heavy, the runs of this species showing a considerable increase during the last three or four years. The chum seeding was good and heavier than that of the brood-year and also last year.

NOOTKA AREA.

The usual small supply of sockeye, not commercially important, was found on the spawning-grounds. The spring seeding was normal. The cohoe-supplies, which are never large in this area, provided an average showing. The chum seeding was the best in years.

KYUQUOT AREA.

The spring seeding was very good compared with previous years, and the supply of cohoes showed an increase over that of the brood-year. There was a heavy escapement of chums, notwithstanding the largest catch of this variety in many years.

QUATSINO AREA.

The sockeye runs to this area are never of much importance commercially, but the seeding in the year under review was normal. The spring seeding is reported as medium. The cohoe-supplies, on the other hand, were above average. This was an "off" year for pinks and only a light seeding was observed. The chum seeding was reported as normal, although the run of this variety was considered light. Fishing operations, however, were not as intensive as usual.

PACK OF BRITISH COLUMBIA SALMON, SEASON 1941.

SHOWING THE ORIGIN OF SALMON CAUGHT IN EACH DISTRICT.

District.	Sockeye.	Springs.	Steel-heads.	Cohoe.	Pinks.	Chums.	Total.
Fraser River	171,290	34,038	248	28,265	102,388	95,070	431,299
Queen Charlotte Islands	149	236	11	27,421	524	76,745	105,086
Nass River	24,876	519	374	16,648	22,667	6,246	71,330
Skeena River	81,767	4,985	1,896	50,605	50,537	10,707	200,497
Rivers Inlet	93,378	1,692	129	23,202	4,807	15,442	138,650
Smith Inlet	21,495	124	45	1,955	749	7,741	32,109
Central Area	20,854	460	330	45,218	66,130	111,587	244,579
*Vancouver Island	40,273	8,038	308	166,908	177,292	593,016	985,835
Alaska	1,216	383	113	31,187	2,680	3,908	39,487
Packed out of cold-storage stocks, 1940 catch	----------	1,118	-------	39,104	----------	6,339	46,561
Totals	455,298	51,593	3,454	430,513	427,774	926,801	2,295,433

* 30,027 cases of bluebacks are included with the cohoe-pack for Vancouver Island.

TABLE SHOWING THE TOTAL SOCKEYE-PACK OF THE FRASER RIVER, ARRANGED IN ACCORDANCE WITH THE FOUR-YEAR CYCLE, 1895–1941.

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	
Washington	43,511	59,354	110,605	
Total	97,807	158,363	281,895	

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1926 TO 1941, INCLUSIVE.

Fraser River.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Sockeyes	171,290	99,009	54,296	186,794	100,272	184,854	62,822	139,238
Springs	34,038	4,504	5,993	4,308	5,444	15,126	9,401	16,218
Chums	95,070	35,665	30,150	58,778	20,878	31,565	8,227	104,092
Pinks	102,388	12	95,176	63	94,010	.....	111,328	2,199
Cohoes	28,265	13,028	13,557	27,127	11,244	28,716	24,950	11,392
Steelheads	248	145	69	14	.....	.....	.....	.....
Totals	431,299	152,363	199,241	277,084	231,848	260,261	216,728	273,139

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Sockeyes	52,465	65,769	40,947	103,692	61,569	29,299	61,393	85,689
Springs	5,579	28,701	9,740	21,127	10,004	5,082	18,453	32,952
Chums	34,391	14,948	251	68,946	144,159	193,106	67,259	88,495
Pinks	92,746	385	13,307	30,754	158,208	2,881	102,536	32,256
Cohoes	13,901	16,815	8,165	25,585	40,520	27,061	24,079	21,783
Steelheads	.....	23	657	27,879	12,013	795	10,658	13,776
Totals	199,082	126,641	73,067	277,983	426,473	258,224	284,378	274,951

Skeena River.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Sockeyes	81,767	116,507	68,485	47,257	42,491	81,973	52,879	70,655
Springs	4,985	6,118	4,857	4,318	4,401	4,551½	4,039	8,300
Chums	10,707	4,682	7,773	16,758	10,811	15,297½	8,122	24,388
Pinks	50,537	47,301	95,236	69,610	59,400	91,389	81,868	126,163
Cohoes	50,605	20,614	29,198	52,821	15,514	25,390	23,498	54,456
Steelheads	1,896	133	55	42	21	33	14	114
Totals	200,497	195,355	205,604	190,806	132,638	218,634	170,420	284,096

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Sockeyes	30,506	59,916	93,023	132,372	78,017	34,559	83,996	82,360
Springs	3,297	28,269	9,857	7,501	4,324	6,420	19,038	30,594
Chums	15,714	38,549	3,893	5,187	4,908	17,716	19,006	63,527
Pinks	95,783	58,261	44,807	275,642	95,305	209,579	38,768	210,081
Cohoes	39,896	48,312	10,637	29,617	37,678	30,194	26,326	30,208
Steelheads	267	404	768	58	13	241	582	754
Totals	185,463	233,711	162,986	450,377	220,245	298,709	187,716	407,524

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1926 TO 1941, INCLUSIVE—*Contd.*

Rivers Inlet.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Sockeyes	93,378	63,469	54,143	87,942	84,832	46,351	135,038	76,923
Springs	1,692	1,226	745	1,209	917	581½	429	436
Chums	15,442	9,025	5,462	7,759	9,415	11,505	7,136	895
Pinks	4,807	3,329	12,095	9,063	7,536	6,432½	4,554	2,815
Cohoes	23,202	11,561	10,974	16,285	6,012	7,122½	8,375	4,852
Steelheads	129	55	83	105	70	19	39	79
Totals	138,650	88,665	83,502	122,363	108,782	72,011½	155,571	86,000

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Sockeyes	83,507	69,732	76,428	119,170	70,260	60,044	65,269	65,581
Springs	449	459	325	434	342	468	608	685
Chums	677	944	429	492	989	3,594	1,122	11,727
Pinks	5,059	3,483	5,089	18,023	2,386	16,546	671	12,815
Cohoes	3,446	7,062	6,571	756	1,120	868	2,094	7,286
Steelheads	82	29	32	105	29	7	9	11
Totals	93,220	81,709	88,874	138,980	75,126	81,527	69,773	98,105

Smith Inlet, 1926–41.*

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Sockeyes	21,495	25,947	17,833	33,894	25,258	12,788	31,648	14,607
Springs	124	142	215	68	21	30	216	164
Cohoes	1,955	1,102	3,880	1,058	241	310	1,201	3,941
Pinks	749	755	3,978	1,761	483	65	4,412	6,953
Chums	7,741	6,015	2,771	8,076	9,494	1,653	12,427	15,548
Steelheads	45	37	50	64	5	42	24	43
Totals	32,109	33,998	28,727	44,921	35,502	14,888	49,928	41,256

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Sockeyes	37,369	25,488	12,867	32,057	9,683	33,442	22,682	17,921
Springs	354	48	122	290	78	286	349	112
Cohoes	5,068	273	112	1,460	275	230	2,990	164
Pinks	19,995	1,148	824	16,615	853	167	732	689
Chums	8,841	165	133	1,660	113	19	2,605	31
Steelheads	87	20	36	103	12	6	8	----
Totals	71,714	27,142	14,094	52,185	11,014	34,150	29,366	18,917

* Previously reported in Queen Charlotte and other districts.

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1926 TO 1941, INCLUSIVE—*Contd.*

NASS RIVER, 1926–41.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Sockeyes	24,876	13,809	24,357	21,462	17,567	28,562½	12,712	28,701
Springs	519	1,716	708	773	1,251	2,167	560	654
Chums	6,246	5,461	2,500	15,911	10,080	20,620½	17,481	2,648
Pinks	22,667	29,278	26,370	61,477	8,031	75,887½	25,508	32,964
Cohoes	16,648	10,060	1,996	14,159	12,067	11,842	21,810	9,935
Steelheads	374	117	15	188	46	496	143	311
Totals	71,330	60,441	55,946	113,970	49,042	139,575½	78,214	75,213

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Sockeyes	9,757	14,154	16,929	26,405	16,077	5,540	12,026	15,929
Springs	1,296	4,408	1,439	1,891	352	1,846	3,824	5,964
Chums	1,775	14,515	392	3,978	1,212	3,538	3,307	15,392
Pinks	44,306	44,629	5,178	79,976	10,342	83,183	16,609	50,815
Cohoes	3,251	7,955	8,943	1,126	1,202	10,734	3,966	4,274
Steelheads	49	10	.....	84	.....	36	96	375
Totals	60,434	85,671	32,881	113,460	29,185	104,877	39,828	92,749

VANCOUVER ISLAND DISTRICT, 1927–41.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Sockeyes	40,273	15,177	16,259	27,965	25,427	32,696½	22,928	27,282
Springs	8,038	2,454	2,889	4,254	2,359	6,340	6,525	1,630
Chums	593,016	279,064	212,949	266,566	203,900	347,951	143,960	210,239
Pinks	177,292	33,785	235,119	70,108	318,780	82,028½	191,627	54,526
Cohoes	166,908	88,885*	123,388	62,054	52,244	90,625	104,366	78,670
Steelheads	308	214	132	27,607	88	105	21	.....
Totals	985,835	419,579	590,736	458,554	608,798	559,746	469,427	372,347

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

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

STATEMENT SHOWING THE SALMON-PACK OF THE PROVINCE, BY DISTRICTS AND SPECIES, FROM 1926 TO 1941, INCLUSIVE—*Contd.*

QUEEN CHARLOTTE ISLANDS, 1932–41.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.	1933.	1932.
Sockeyes	149	16	1	179	2	85	.....	.....	.....	.....
Springs	236	62	36	66	140	227	63	258	3,575	278
Chums	76,745	164,911	45,519	40,882	72,689	69,304	86,298	38,062	6,988	358
Pinks	524	44,966	2,123	57,952	13	89,355	1,479	53,398	.....	2,415
Cohoes	27,421	8,897	3,020	16,616	4,631	19,920	5,461	8,315	.....	3,805
Steelheads	11	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	105,086	218,852	50,699	115,695	77,475	178,891	93,301	100,033	10,563	6,856

CENTRAL AREA, 1932–41.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.	1933.	1932.
Sockeyes	20,854	32,042	26,158	36,178	29,987	27,499	32,417	20,438	26,106	21,685
Springs	460	1,518	655	540	1,641	830	687	2,116	841	3,236
Chums	111,587	135,802	79,384	127,089	110,493	99,592	125,953	117,309	128,602	166,653
Pinks	66,130	54,478	150,498	130,842	97,321	246,378	94,190	157,336	101,701	80,034
Cohoes	45,218	49,886	44,426	56,716	25,009	45,824	41,831	53,850	33,471	41,172
Steelheads	330	506	392	433	614	373	355	733	827	591
Totals	244,579	274,232	301,513	351,798	265,065	420,496	295,433	351,782	291,548	313,371

STATEMENT SHOWING THE TOTAL SALMON-PACK OF THE PROVINCE BY DISTRICTS, 1926 TO 1941, INCLUSIVE.

TOTAL PACKED BY DISTRICTS IN 1926 TO 1941, INCLUSIVE.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Fraser	431,299	152,363	199,241	277,084	231,848	260,261	216,728	273,139
Skeena	200,497	195,355	205,604	223,413	133,165	218,634	170,420	284,096
Rivers Inlet	138,650	88,665	83,502	122,363	108,782	72,011½	155,571	86,000
Smith Inlet	32,109	33,998	28,727	44,921	35,502	14,888	49,928	41,256
Nass River	71,330	60,441	55,946	113,970	49,042	139,575½	78,214	75,213
Vancouver Island	985,835	419,579	590,736	458,554	608,798	559,746½	469,427	372,347
Other Districts	398,152	516,815	375,307	467,493	342,350	599,387	388,734	451,815
Cold storage	46,561	.....	.....	.....	.....	.....	.....	.....
Grand totals	2,295,433	1,467,216	1,539,063	1,707,798‡	1,509,677†	1,864,503½	1,529,022	1,583,866

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Fraser	199,082	126,641	73,067	277,983	426,473	258,224	284,378	274,951
Skeena	185,463	233,711	162,986	450,377	220,245	298,709	187,716	407,524
Rivers Inlet	93,220	81,709	88,874	138,980	75,126	81,527	69,773	98,105
Smith Inlet	71,714	27,142	14,094	52,185	11,014	34,150	29,366	18,917
Nass River	60,434	85,671	32,881	113,460	29,185	104,877	39,828	92,749
Vancouver Island	353,025	205,930	175,541	340,395	294,854	390,470	373,463	347,722
Other Districts	302,111	320,227	137,661	848,439	341,873	901,822	405,476	844,139*
Grand totals	1,265,049	1,081,031	685,104	2,221,819	1,398,770	2,035,629	1,360,634	2,065,190

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

† 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.

STATEMENT SHOWING THE SOCKEYE-PACK OF THE PROVINCE, BY DISTRICTS, 1926 TO 1941, INCLUSIVE.

	1941.	1940.	1939.	1938.	1937.	1936.	1935.	1934.
Fraser River	171,290	99,009	54,296	186,794	100,272	183,120	62,822	139,238
Skeena River	81,767	116,507	68,485	47,257	42,491	81,973	52,879	70,655
Rivers Inlet	93,378	63,469	54,143	87,942	84,832	46,351	135,038	76,923
Smith Inlet	21,495	25,947	17,833	33,894	25,258	12,788	31,648	14,607
Nass River	24,876	13,809	24,357	21,462	17,567	28,562½	12,712	28,701
Vancouver Island	40,273	15,177	16,259	27,965	25,427	34,430½	22,928	27,282
Other Districts	22,219	32,484	34,514	36,357	29,989	27,584	32,417	20,438
Totals	455,298	366,402	269,887	441,671*	325,836	414,809	350,444	377,844

	1933.	1932.	1931.	1930.	1929.	1928.	1927.	1926.
Fraser River	52,465	65,769	40,947	103,692	61,569	29,299	61,393	85,689
Skeena River	30,506	59,916	93,023	132,372	78,017	34,559	83,996	82,360
Rivers Inlet	83,507	69,732	76,428	119,170	70,260	60,044	65,269	65,581
Smith Inlet	37,369	25,488	12,867	32,057	9,683	33,442	22,682	17,921
Nass River	9,757	14,154	16,929	26,405	16,077	5,540	12,026	15,929
Vancouver Island	18,397	27,611	22,199	24,784	10,340	14,248	24,835	25,070
Other Districts	26,106	21,685	29,071	39,198	35,331	26,410	37,851	44,462
Totals	258,107	284,355	291,464	477,678	281,277	203,542	308,052	337,012

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 THE PROVINCE, BY DISTRICTS, 1930 TO 1941, INCLUSIVE.

	1941.*	1940.	1939.	1938.	1937.	1936.
Fraser River	34,038	4,504	5,993	4,308	5,444	15,126
Queen Charlotte Islands	236	62	36	66	140	227
Nass River	519	1,716	708	773	1,251	2,167
Skeena River	4,985	6,118	4,857	4,318	4,401	4,551½
Rivers Inlet	1,692	1,226	745	1,209	917	581½
Smith Inlet	124	142	215	68	21	30
Central Area	460	1,518	655	540	1,641	830
Vancouver Island	8,038	2,454	2,889	4,254	2,359	6,340
Alaska	383	----------	----------	----------	----------	----------
Totals	50,475	17,740	16,098	15,536	16,174	29,853

	1935.	1934.	1933.	1932.	1931.	1930.
Fraser River	9,401	16,218	5,579	28,701	9,740	21,127
Queen Charlotte Islands	63	258	3,575	278	854	131
Nass River	560	654	1,296	4,408	1,439	1,891
Skeena River	4,039	8,300	3,297	28,269	9,858	7,501
Rivers Inlet	429	436	449	459	325	434
Smith Inlet	216	164	354	48	122	290
Central Area	687	2,116	841	3,236	754	1,721
Vancouver Island	6,525	1,630	4,875	10,559	4,055	3,431
Totals	21,920	29,776	20,266	75,958	27,147	36,526

* 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 THE PROVINCE, BY DISTRICTS, 1930 TO 1941, INCLUSIVE.

	1941.*	1940.	1939.	1938.	1937.	1936.
Fraser River	28,265	13,028	13,557	27,127	11,244	28,716
Queen Charlotte Islands	27,421	8,897	3,020	16,616	4,631	19,920
Nass River	16,648	10,060	1,996	14,159	12,067	11,842
Skeena River	50,605	20,614	29,198	52,821	15,514	25,390
Rivers Inlet	23,202	11,561	10,974	16,285	6,012	7,122½
Smith Inlet	1,955	1,102	3,880	1,058	241	310
Central Area	45,218	49,886	44,426	56,716	25,009	45,824
Vancouver Island	166,908	88,885	123,388	89,471	58,244	90,625½
Alaska	31,187	20,489	14,658	26,828	527	.....
Totals	391,409	224,522	245,097	301,081	133,489	229,750

	1935.	1934.	1933.	1932.	1931.	1930.
Fraser River	24,950	11,392	13,901	16,815	8,818	25,585
Queen Charlotte Islands	5,461	8,315	.....	3,805	5,335	7,091
Nass River	21,810	9,935	3,251	7,955	8,943	1,126
Skeena River	23,498	54,476	39,896	48,312	10,637	29,617
Rivers Inlet	8,375	4,852	3,446	7,062	6,571	756
Smith Inlet	1,201	3,941	5,068	273	112	1,460
Central Area	41,831	53,850	33,471	41,172	10,806	54,327
Vancouver Island	104,366	78,670	60,019	63,637	50,953	30,206
Totals	231,492	225,431	159,052	189,031	102,175	150,168

* 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 THE PROVINCE, BY DISTRICTS, 1930 TO 1941, INCLUSIVE.

	1941.	1940.	1939.	1938.	1937.	1936.
Fraser River	102,388	12	95,176	63	94,010	.....
Queen Charlotte Islands	524	44,966	2,123	57,952	13	89,355
Nass River	22,667	29,278	26,370	61,477	8,031	75,887½
Skeena River	50,537	47,301	95,236	69,610	59,400	91,389
Rivers Inlet	4,807	3,329	12,095	9,063	7,536	6,432½
Smith Inlet	749	755	3,978	1,761	483	65
Central Area	66,130	54,478	150,498	130,842	97,321	246,378
Vancouver Island	177,292	33,785	235,119	70,108	318,780	82,028½
Alaska	2,680	.....	.....	.....	.....	.....
Totals	427,774	213,904	620,595	400,876	585,574	591,535½

	1935.	1934.	1933.	1932.	1931.	1930.
Fraser River	111,328	2,199	92,746	385	13,307	30,754
Queen Charlotte Islands	1,479	53,398	.....	2,415	.....	224,902
Nass River	25,508	32,964	44,306	44,629	5,178	79,976
Skeena River	81,868	126,163	95,783	58,261	44,807	275,642
Rivers Inlet	4,554	2,815	5,059	3,483	5,089	18,023
Smith Inlet	4,412	6,953	19,995	1,148	824	16,615
Central Area	94,190	157,336	101,701	80,034	55,825	376,084
Vancouver Island	191,627	54,526	172,945	33,403	81,965	89,941
Totals	514,966	436,354	532,535	223,758	206,995	1,111,937

STATEMENT SHOWING THE CHUM-SALMON PACK OF THE PROVINCE, BY DISTRICTS, 1930 TO 1941, INCLUSIVE.

	1941.*	1940.	1939.	1938.	1937.	1936.
Fraser River	95,070	35,665	30,150	58,778	20,878	31,565
Queen Charlotte Islands	76,745	164,911	45,519	40,882	72,689	69,304
Nass River	6,246	5,461	2,500	15,911	10,080	20,620½
Skeena River	10,707	4,682	7,773	16,758	10,811	15,297½
Rivers Inlet	15,442	9,025	5,462	7,759	9,415	11,505
Smith Inlet	7,741	6,015	2,771	8,076	9,494	1,653
Central Area	111,587	135,802	79,384	127,089	110,493	99,592
Vancouver Island	593,016	279,064	212,949	266,566	203,900	347,951
Alaska	3,908	2,816	82	.....	.....	.....
Totals	920,462	643,441	386,590	541,819	447,760	597,488

	1935.	1934.	1933.	1932.	1931.	1930.
Fraser River	8,227	104,092	34,391	14,948	251	68,946
Queen Charlotte Islands	86,298	38,062	6,988	358	.....	39,010
Nass River	17,481	2,648	1,775	14,515	392	3,978
Skeena River	8,122	24,388	15,714	38,549	3,893	5,187
Rivers Inlet	7,136	895	677	944	429	492
Smith Inlet	12,427	15,548	8,841	165	113	1,660
Central Area	125,953	117,309	128,602	166,653	34,570	104,771
Vancouver Island	143,960	210,239	96,642	70,629	16,239	177,856
Totals	409,604	513,181	293,630	306,761	55,997	401,900

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

STATEMENT SHOWING THE PILCHARD INDUSTRY OF THE PROVINCE, 1920 TO 1940, INCLUSIVE.*

Year.	Total Catch.	Canned.	Used in Reduction.	Oil.	Meal.	Bait.
	Cwt.	Cases.	Cwt.	Gals.	Tons.	Bbls.
1920	88,050	91,929	.....	.....	.....	9,937
1921	19,737	16,091	.....	.....	.....	4,232
1922	20,342	19,186	.....	.....	.....	3,125
1923	19,492	17,195	.....	.....	.....	3,625
1924	27,485	14,898	.....	.....	.....	923
1925	318,973	37,182	220,000	495,653	2,083	4,045
1926	969,958	26,731	940,000	1,898,721	8,481	2,950
1927	1,368,582	58,501	1,310,000	2,610,120	12,145	1,737
1928	1,610,252	65,097	1,560,000	3,997,656	14,502	2,149
1929	1,726,851	98,821	1,654,575	2,856,579	15,826	1,538
1930	1,501,404	55,166	1,468,840	3,204,058	13,934	926
1931	1,472,085	17,336	1,456,846	2,551,914	14,200	1,552
1932	886,964	4,622	876,700	1,315,864	8,842	1,603
1933	120,999	2,946	119,545	275,879	1,108	20
1934	860,103	35,437	845,849	1,635,123	7,628	40
1935	911,411	27,184	896,586	1,634,592	8,666	521
1936	889,037	35,007	863,373	1,217,097	8,715	580
1937	961,485	40,975	930,713	1,707,276	8,483	1,045
1938	1,035,369	69,473	986,118	2,195,850	8,891	310
1939	110,453	7,300	105,303	178,305	906	20
1940	575,399	59,166	533,983	890,296	4,853	.....

* Authority: Advance Report of the Fisheries of British Columbia, Ottawa.

PRODUCTION OF FISH OIL AND MEAL, 1920 TO 1941 (OTHER THAN FROM PILCHARD).

Year.	From Whales.			From other Sources.	
	Whalebone and Meal.	Fertilizer.	Oil.	Meal and Fertilizer.	Oil.
	Tons.	Tons.	Gals.	Tons.	Gals.
1920	503	1,035	604,070	466	55,669
1921	----	------	----------	489	44,700
1922	326	230	283,314	911	75,461
1923	485	910	706,514	823	180,318
1924	292	926	645,657	1,709	241,376
1925	347	835	556,939	2,468	354,853
1926	340	666	468,206	1,752	217,150
1927	345	651	437,967	1,948	250,811
1928	376	754	571,914	3,205	387,276
1929	417	780	712,597	3,626	459,575
1930	273	581	525,533	3,335	243,009
1931	-----	------	----------	5,647	352,492
1932	-----	------	----------	6,608	231,690
1933	249	223	509,310	5,583	497,643
1934	340	631	813,724	5,028	441,735
1935	211	354	426,772	7,509	588,629
1936	332	687	763,740	13,197	1,143,206
1937	268	527	662,355	17,147	1,578,204
1938	273	512	543,378	12,115	1,157,315
1939	-----	------	----------	26,129	1,990,901
1940	181	434	361,820	15,884	1,338,993
1941	270	561	619,025	25,619	1,000,198

STATEMENT SHOWING THE HERRING INDUSTRY OF THE PROVINCE, 1935 TO 1941.

Year.	Canned.	Dry-salted.	Pickled.	Oil.	Meal.
	Cases.	Tons.	Tons.	Gals.	Tons.
1935	26,143	14,983	-----	328,639	5,313
1936	20,914	16,454	-----	786,742	10,340
1937	27,365	10,230	-----	1,333,245	14,643
1938	23,353	7,600	-----	1,526,117	18,028
1939	418,021	7,596	-----	1,677,736	22,870
1940	640,252	5,039	892	923,137	10,886
1941	1,527,350	------	779	594,684	8,780

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

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