PROVINCE OF BRITISH COLUMBIA

# REPORT

OF THE

# PROVINCIAL FISHERIES DEPARTMENT

FOR THE YEAR ENDED DECEMBER 31ST, 1942

WITH APPENDICES

PRINTED BY
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1943.

*To His Honour Colonel* W. C. WOODWARD,
*Lieutenant-Governor of the Province of British Columbia.*

MAY IT PLEASE YOUR HONOUR:

I beg to submit herewith the Report of the Provincial Fisheries Department for the year ended December 31st, 1942, 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, 1942, 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 1942.

## VALUE OF CANADIAN FISHERIES AND THE STANDING OF THE PROVINCES, 1941.

The value of the fisheries products of Canada for the year 1941 totalled $62,258,872. During that year British Columbia produced fisheries products to the value of $31,732,037, or 50.9 per cent. of Canada's total.

British Columbia in 1941 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 $12,634,832.

The market value of the fisheries products of British Columbia in 1941 was $10,021,870 more than in the previous year. There was an increase in the value of salmon amounting to $7,122,013.

The capital invested in the fisheries of British Columbia in 1941 was $29,314,179, 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 1941, $10,477,873 was employed in catching and handling the catches and $18,836,306 invested in canneries, fish-packing establishments, and fish-reduction plants.

The number of persons engaged in British Columbia fisheries in 1941 was 18,131, or 28.5 per cent. of Canada's total fishery-workers. Of those engaged in British Columbia, 10,217 were employed in catching and handling the catches and 7,914 in packing, curing, and in fish-reduction plants. The total number engaged in the fisheries in British Columbia in 1941 was 238 more than in the preceding year.

The following statement gives in the order of their rank the value of fishery products of the Provinces of Canada for the years 1937 to 1941, inclusive:—

| Province. | 1937. | 1938. | 1939. | 1940. | 1941. |
|---|---|---|---|---|---|
| British Columbia | $16,155,439 | $18,672,750 | $17,698,980 | $21,710,167 | $31,732,037 |
| Nova Scotia | 9,229,834 | 8,804,231 | 8,753,548 | 9,843,326 | 12,634,832 |
| New Brunswick | 4,447,688 | 3,996,064 | 5,082,393 | 4,956,618 | 6,484,831 |
| Ontario | 3,615,666 | 3,353,775 | 3,007,315 | 3,035,100 | 3,518,402 |
| Quebec | 1,892,036 | 1,957,279 | 2,010,953 | 2,002,053 | 3,233,115 |
| Manitoba | 1,796,012 | 1,811,124 | 1,655,273 | 1,988,545 | 2,842,041 |
| Prince Edward Island | 870,299 | 930,874 | 950,412 | 714,870 | 952,026 |
| Saskatchewan | 527,199 | 468,646 | 478,511 | 450,574 | 440,444 |
| Alberta | 433,354 | 492,943 | 430,724 | 403,510 | 414,942 |
| Yukon | 8,767 | 5,290 | 4,867 | 4,994 | 6,652 |
| Totals | $38,976,294 | $40,492,976 | $40,072,976 | $45,118,757 | $62,258,872 |

## 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 1937 to 1941, inclusive, is given in the following table:—

| Species. | 1937. | 1938. | 1939. | 1940. | 1941. |
|---|---|---|---|---|---|
| Salmon | $11,907,905 | $14,491,285 | $12,994,812 | $13,757,091 | $20,879,104 |
| Halibut | 1,094,214 | 1,041,165 | 1,305,542 | 1,397,999 | 1,650,731 |
| Halibut-livers | 95,842 | 231,220 | 193,148 | 172,999 | 470,958 |
| *Carried forward* | $13,097,961 | $15,763,670 | $14,493,502 | $15,328,089 | $23,000,793 |

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

| Species. | 1937. | 1938. | 1939. | 1940. | 1941. |
|---|---|---|---|---|---|
| *Brought forward* | $13,097,961 | $15,763,670 | $14,493,502 | $15,328,089 | $23,000,793 |
| Herring | 1,181,466 | 855,265 | 2,198,912 | 4,426,390 | 4,665,260 |
| Pilchard | 902,619 | 867,007 | 100,693 | 632,393 | 1,781,876 |
| Cod, ling | 318,769 | 351,324 | 357,990 | 359,798 | 398,316 |
| Clams | 95,371 | 162,508 | 50,937 | 77,944 | 98,970 |
| Black cod | 95,251 | 71,297 | 79,419 | 132,822 | 189,527 |
| Crabs | 52,188 | 54,572 | 61,633 | 80,628 | 83,253 |
| Soles | 33,201 | 37,679 | 39,826 | 46,866 | 30,470 |
| Shrimps | 15,430 | 18,985 | 12,246 | 16,354 | 8,115 |
| Oysters | 36,199 | 37,453 | 59,976 | 60,596 | 116,111 |
| Abalones | 477 | ..... | 1,340 | 2,002 | ..... |
| Flounders | 2,339 | 6,767 | 5,934 | 27,851 | 14,555 |
| Red cod | 7,990 | 22,286 | 10,693 | 14,574 | 15,832 |
| Perch | 3,722 | 3,942 | 3,752 | 3,235 | 3,095 |
| Smelt | 3,523 | 6,884 | 4,388 | 7,491 | 5,920 |
| Sturgeon | 1,386 | 3,013 | 2,459 | 2,460 | 3,675 |
| Octopus | 923 | 1,016 | 441 | 555 | 986 |
| Skate | 2,438 | 2,467 | 3,026 | 3,452 | 2,478 |
| Oolachans | 337 | 760 | 1,792 | 3,887 | 1,492 |
| Whiting | 50 | 62 | 32 | 88 | 25 |
| Sardines | ..... | ..... | ..... | ..... | 47,086 |
| Trout | ..... | ..... | ..... | ..... | ..... |
| Grayfish, etc.— | | | | | |
| Fresh | 1,274 | 2,310 | ..... | ..... | 13,117 |
| Livers | ..... | ..... | ..... | ..... | 29,328 |
| Liver-oil | ..... | ..... | ..... | ..... | 531,355 |
| Body-oil | ..... | ..... | ..... | ..... | 29,569 |
| Oil | 38,776 | 68,073 | 44,072 | 146,112 | ..... |
| Meal | 26,740 | 42,807 | 36,322 | 63,210 | 69,062 |
| Whales | 220,251 | 184,074 | ..... | 137,624 | 298,349 |
| Fur-seals | 12,431 | 3,076 | 1,465 | ..... | ..... |
| Miscellaneous | 4,327 | 105,453 | 77,515 | 14,050 | 61,686 |
| Anchovies | ..... | ..... | 10,417 | 119,035 | 162,159 |
| Tuna | ..... | ..... | 40,198 | 567 | 804 |
| Shark-livers | ..... | ..... | ..... | 2,094 | 44,860 |
| Shark-liver oil | ..... | ..... | ..... | ..... | 23,913 |
| Totals | $16,155,439 | $18,672,750 | $17,698,980 | $21,710,167 | $31,732,037 |

## VALUE OF BRITISH COLUMBIA FISHERIES REACHES RECORD HIGH.*

A new high level was reached in the value of the fisheries production of British Columbia in 1942. The total as marketed was $38,059,559, an increase over the year 1941 of $6,327,522 or 20 per cent. The salmon-fishery of British Columbia, which is the most important fishery in the Dominion, had a production value of $22,419,881, this amount accounting for 59 per cent. of the total fisheries output of the Province. Herring, which is second on the list of British Columbia's chief commercial fishes, had a value of $8,223,754, an increase over 1941 of $3,558,494 or 76 per cent. Halibut is third in order among the principal kinds of fish with a value of $2,228,818. The pilchard-fishery shows a value of $2,016,607, its most important products being oil and meal.

The total quantity of fish of all kinds, including shell-fish, taken by British Columbia fishermen during the year was 5,712,725 cwt., with a value at the point of landing of $18,415,044, compared with a catch of 5,418,891 cwt. and a landed value of $15,836,402 in 1941. Average prices per hundredweight paid to the fishermen for the principal kinds of fish in 1942, with figures for 1941 in brackets, were as follows:

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

Salmon, $7.89 ($6.01); herring, 54 cents (39 cents); halibut, $15.68 ($12.36); and pilchards, 51 cents (50 cents).

## CAPITAL, EQUIPMENT, AND EMPLOYEES.

*Capital.*—The amount of capital invested in the fisheries of British Columbia in 1942 recorded a total value of $34,848,940, compared with $29,319,198 in the preceding year. The total amount comprises $11,748,763 as the value of the vessels, boats, and gear, and $23,100,177 as 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 and had an investment of $16,601,054.

*Employees.*—The number of men employed during the year in catching and landing the fish was 12,199, compared with 10,217 in 1941, while the number of persons working in fish-processing establishments totalled only 6,939, compared with 7,914 in the preceding year. The total number of employees credited to the fishing industry of British Columbia in 1942 was 19,138, compared with 18,131 in the year 1941.

## CANNED-SALMON PACK FOR BRITISH COLUMBIA FOR 1942.

The total pack of canned salmon put up in British Columbia in 1942 amounted to 1,811,558 cases, according to returns made by the canners to the Provincial Fisheries Department. This was 483,875 cases less than were packed in 1941. The pack in that year, however, was the largest ever recorded in British Columbia. In 1942 the canned-salmon pack was 47,345 cases above the average for the previous five-year period.

In comparing the British Columbia canned-salmon pack figures for the war years with the pack figures for the years previous to the war, due allowance must be made for the effect of the war on the salmon-canning industry. This industry now is virtually a war industry. Canned salmon is a high-protein food, packed in containers which make it reasonably easy to handle. It does not require special facilities for shipment or storage, will keep without deterioration for a long period of time, and is ready for consumption without further preparation. The British Government was quick to recognize these qualities which make British Columbia canned salmon an ideal war ration, the result being a heavy increase in the demand for canned salmon for war purposes. In order to meet this increased demand, the Provincial and Federal Governments again exercised a certain amount of control in their respective jurisdictions with a view to diverting to the canners as much of the salmon-catch as possible. The controls exercised in 1942 were similar to those in effect in 1941 and, as a result, most of the salmon-catch, exclusive of troll-caught spring salmon, went into cans. These facts should be taken into consideration when comparing the canned-salmon pack of 1942 with the annual canned-salmon packs previous to 1941.

The 1942 canned-salmon pack consisted of 666,570 cases of sockeye, 24,744 cases of springs, 4,649 cases of steelheads, 211,138 cases of cohoe, 270,622 cases of pinks, and 633,834 cases of chums.

An examination of the pack figures by species shows that the sockeye pack of 666,570 cases was 211,272 cases above the 1941 figure and exceeded the previous five-year average by 225,429 cases. This was the largest sockeye-pack recorded in the Province since 1913, when the total pack amounted to 972,178 cases.

The spring-salmon pack of 24,744 cases in 1942 was 26,849 cases less than the large pack of this species put up in 1941, but was only 398 cases less than the previous five-year average.

Steelhead trout are not salmon, but a few are caught and canned incidental to salmon fishing and canning operations each year. In 1942 there were 4,649 cases of steelheads canned. This is compared with 3,454 cases in 1941, 1,207 cases in 1940, 796 cases in 1939, and 1,036 cases in 1938.

In 1942 the cohoe-pack amounted to 211,138 cases, which was 219,375 cases less than were packed in the previous record-breaking year for this variety. The cohoe-pack in 1942 was also less than the pack in 1939, the cycle-year, by 33,959 cases, and was 91,332 cases less than the average annual pack for the previous five years.

Included in this figure for the 1942 cohoe-pack are 23,265 cases of bluebacks.

The 1942 pink-salmon pack amounting to 270,622 cases, while 56,718 cases above the pack in 1940, the cycle-year, was disappointing when compared with the recent packs of this cycle. The 1942 pack was 116,132 cases less than the average pack for this species in the previous five years and was also 112,036 cases less than the average packs for the previous five cycle-years. Again, as in 1941, the 1942 pack of pinks was the second short pack in succession for this cycle and was definitely disappointing.

There were packed in British Columbia in 1942, 633,384 cases of chums, which were 292,967 cases less than were packed in the year previous. It must be remembered, however, that the chum-pack in 1941 was one of the largest ever recorded for this species in British Columbia. The 1942 pack was 7,337 cases greater than the average for the previous five-year period. The Government's policy of diverting as much of the salmon-catch as possible to the canning trade has probably a greater effect on chum salmon than any other species. Previous to the outbreak of the war large quantities of chum salmon found an outlet in the salt-fish and frozen-fish trade. When consideration is given to these facts, the pack figures for 1942 are not unduly large.

## 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 549,617 cases, composed of 446,371 cases of sockeye, 9,688 cases of spring, 309 cases of steelheads, 10,542 cases of cohoes, 134 cases of pinks, and 82,573 cases of chums.

*Sockeye Salmon.*—In 1941 the Fraser River produced a total pack of sockeye salmon, Canadian and American, amounting to 709,829 cases. This was the largest total pack of sockeye produced on this river system since 1913 and is the largest pack on record for this cycle, exceeding the previous record pack of 1902, when 633,033 cases were packed. Of the total 1942 catch by Canadian and American fishermen, the Canadian catch was 446,371 cases, while the American fishermen in the State of Washington took sockeye to the equivalent of 263,458 cases. The catch percentages are 62.8 and 37.2 respectively. The percentages for Fraser River sockeye caught by American and Canadian fishermen are tabulated below for convenience.

| | American. Per Cent. | Canadian. Per Cent. |
|---|---|---|
| 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 |
| 1942 | 37.2 | 62.8 |

The Canadian pack of sockeye on the Fraser River in 1942 was the largest pack caught by Canadian fishermen since 1913 and greatly exceeds any of the Canadian

catches in recent past years. In considering the production figures it will be recalled that in the previous cycle-year, 1938, there were 186,794 cases packed and the escapement to the spawning-grounds was excellent, especially to the Adams River spawning area. The pack in 1942 was made largely from fish running late in the season, proceeding to the Shuswap Lake-Adams River spawning areas. There is no doubt that the success of the spawning in 1938 in the Adams River Area and a favourable survival of young was responsible, in a large measure, for the splendid pack in the year under review. Notwithstanding the large catch, the Shuswap Lake-Adams River area was again exceptionally well seeded. The reader is referred to Major Motherwell's report on the spawning-grounds, which is included in the Appendix to this report, for details of the sockeye spawning in the various tributaries to this river system.

Mention was made in the pages of this report for the year 1941 of the water conditions at Hell's Gate during that season of the year in which the Adams River run of sockeye was passing this point. That water conditions at Hell's Gate in the year under review were not detrimental to the passage of sockeye is evidenced by the appearance of exceedingly large numbers of sockeye on the spawning-grounds in the Shuswap-Adams River area.

*Spring Salmon.*—There were 9,688 cases of spring salmon packed on the Fraser River in 1942 compared with a pack of 34,038 cases in 1941. In comparing the figures for these two pack-years it must be remembered, however, that the pack in 1941 was exceptionally large. The 1942 pack of springs was more in line with the average annual packs of this species for the years previous to 1941, which packs were as follows: 1940, 4,504 cases; 1939, 5,993 cases; 1938, 4,308 cases; 1937, 5,444 cases.

*Cohoe Salmon.*—In 1942 there were packed 10,542 cases of cohoe salmon on the Fraser River. This figure is compared with the year previous when 28,265 cases were packed and is also compared with the pack in 1939, the cycle-year, in which 13,557 cases were packed. The 1942 pack was somewhat disappointing as it fell below the packs for this species in recent past cycle-years and was also 7,962 cases below the average annual pack for the previous five years.

*Pink Salmon.*—The runs of pink salmon to the Fraser River coincide with the odd-numbered years. In 1942 there was no pink run to this river system.

*Chum Salmon.*—In 1942 there were packed on the Fraser River, 82,573 cases of chums. This was 12,497 cases less than were packed on this river system in 1941 but was 22,126 cases greater than the average annual pack for the previous five years and, exclusive of 1941, was the largest pack of chums on the Fraser River since 1934, when 104,092 cases were packed. The 1942 pack exceeds that of the cycle-year by 23,795 cases.

The comparatively large packs of chum salmon put up on the Fraser River in 1941 and again in 1942 do not necessarily mean that the runs in these years were greater than in previous years, but reflect Government policy in diverting as much of the salmon-catch as possible to the canneries for shipment to Great Britain. In pre-war years large quantities of Fraser River chum salmon were salted and frozen which, naturally, reduced the size of the canned-salmon packs in those years.

In considering the canned-salmon pack figures as an indication of the size of the run proceeding to a river system, attention must also be given to the escapement of salmon to the spawning-beds. In all cases where not specifically mentioned, the reader is referred to the spawning report published in the Appendix to this report, for conditions prevailing on the various spawning-beds.

### Skeena River.

The total pack of all varieties of salmon caught on the Skeena River in 1942 amounted to 152,418 cases. This is compared with the 1941 pack of 200,497 cases. As

will be noted in the following remarks, the difference is practically all in the sockeye-pack which, in 1942 was very disappointing indeed. The Skeena River pack was composed of 34,544 cases of sockeye, 6,374 cases of springs, 3,231 cases of steelheads, 44,081 cases of cohoe, 52,767 cases of pinks, and 11,421 cases of chums.

*Sockeye Salmon.*—The sockeye-pack on the Skeena River in 1942, amounting to 34,544 cases, was the smallest pack of sockeye canned on the Skeena River since the very short pack of 1933, when 30,506 cases were packed. The pack in 1942 was largely derived from the spawning of 1937 and 1938, in which years the packs amounted to 42,491 and 47,257 cases respectively. The spawning conditions in 1937 and 1938 were reported to have been quite satisfactory, which makes the small pack of 1942 doubly disappointing. As will be observed from the report covering the spawning-grounds in this area for 1942, while indications are that the numbers of salmon on the spawning-beds were reasonably satisfactory, taken in conjunction with the short pack, the outlook is anything but optimistic. The 1942 pack on this river system was 47,223 cases less than in the year previous and was 12,713 cases less than the cycle-year 1938. The 1942 pack was 35,168 cases less than the average annual pack for the previous five-year period. Considering recent annual packs of sockeye on this river system as a measure of its productivity and comparing same with the packs of past years, it is evident that this river is still in a period of low production and would seem to require drastic conservation measures if the Skeena River is not to be permanently damaged as a sockeye stream.

*Spring Salmon.*—The spring-salmon pack on the Skeena River in 1942, amounting to 6,374 cases, was somewhat larger than the packs for this species in recent past years. The canned-salmon pack figures for this species, however, do not necessarily indicate the size of the run as spring salmon find an outlet in the fresh- and frozen-fish trade. The pack in 1942 was 1,389 cases greater than in 1941 and was 1,044 cases above the average annual pack for the previous five-year period.

*Cohoe Salmon.*—The cohoe-pack on the Skeena River in 1942 amounted to 44,081 cases and was 6,524 cases less than were packed in 1941. The pack, however, compares favourably with the packs of recent past years, being 4,617 cases greater than the average annual pack for the years 1938–42, inclusive.

*Pink Salmon.*—Sufficient pink salmon were caught on the Skeena River in 1942 to fill 52,767 cases. While this was 5,466 cases greater than were packed in 1940, the cycle-year, it was, nevertheless, considerably short of what has been packed in this cycle in recent past corresponding years. The pack in 1938 amounted to 69,610 cases and in 1936, 91,389 cases, while the pack in 1934 was 126,163 cases. In 1932 the pack dropped to 58,261 cases from the 275,642 cases packed in 1930. The drop in 1932 reflects the economic conditions of the country at that time, rather than a shortage of fish. It will be noted from the above figures that this cycle of the pink run to the Skeena River requires greater conservation measures if the Skeena River is to continue as a substantial producer of pink salmon. Past experience indicates that this species responds very readily to favourable conservation efforts and is equally responsive to the effects of overfishing.

Reports from the spawning-grounds indicate that, while the pink-salmon seeding was heavy in certain areas, the numbers appearing on the spawning-beds in other areas were short of expectation. The canners and fishermen alike should insist on greater conservation measures for this river system for the next few years.

*Chum Salmon.*—The chum-salmon pack on the Skeena River is never a large factor and 1942 was no exception. The pack amounted to 11,421 cases. This is compared with 10,707 cases packed in 1941, 4,682 cases in 1940, 7,773 cases in 1939, and 16,758 cases in 1938.

The reader is referred to the report on the spawning areas by Major J. A. Motherwell, Chief Supervisor of Fisheries, which is printed in full in the Appendix to this report.

## Nass River.

The total pack of all species of salmon caught on the Nass River in 1942 amounted to 100,142 cases, compared with 71,330 cases caught and canned in 1941. The total 1942 pack consisted of 21,085 cases of sockeye, 1,515 cases of springs, 534 cases of steelheads, 15,487 cases of cohoes, 49,003 cases of pinks, and 12,518 cases of chums.

*Sockeye Salmon.*—The 1942 pack of sockeye salmon on the Nass River of 21,085 cases, while slightly less than the pack of this species for 1941, may be considered as reasonably satisfactory. On account of the many year-cycles comprising any run to this river system, it is difficult to compare the catch of any given year with its cycle-year. The sockeye-pack on the Nass River has fluctuated widely in past years, which makes comparison difficult. However, the 1942 pack was only 377 cases less than the 1938 pack, four years previous, and was 3,518 cases greater than the pack in 1937. The 1942 pack of Nass River sockeye was equal to the average annual pack of this species on the Nass River for the previous five years.

According to reports from the spawning-beds, there was an adequate escapement to all the areas frequented by sockeye. The seeding was reported as "excellent."

*Spring Salmon.*—There is never a large pack of springs on the Nass River, those canned, generally speaking, are caught incidental to fishing for other varieties. The pack in 1942 amounting to 1,515 cases, was considerably greater than the 519 cases packed in the previous year and exceeded the average annual pack of this species for the previous five years by 469 cases.

*Cohoe Salmon.*—There were sufficient cohoe salmon caught on the Nass River in 1942 to fill 15,487 cases. This was a comparatively large pack for this species on the Nass River and is compared with the 16,648 cases of this variety packed the previous year. The 1942 pack exceeded the average annual pack for the previous five years by 3,817 cases and, with the exception of 1941, was the largest pack of cohoe on the Nass River since 1935, when 21,810 cases were canned.

According to reports from the spawning area, the seeding was very heavy by this species.

*Pink Salmon.*—The Nass River produced a pack of 49,033 cases of pink salmon. This was considerably larger than the packs of this species produced on the Nass River in recent past cycle-years. In 1940 the pink-salmon pack amounted to 29,278 cases, while in the cycle-year 1938, 61,477 cases were canned on the Nass River. The previous cycle-year, 1936, produced a pack of 75,888 cases. The pink-salmon packs for the intervening years amounted to 22,667 cases in 1941, 26,370 cases in 1939, and 8,031 cases in 1937. The 1942 pack was 11,244 cases above the average for the previous five-year period.

According to reports from the spawning-grounds there was a good escapement of pink salmon and the seeding was heavy.

*Chum Salmon.*—The Nass River has never been a large producer of chum salmon and the 12,518 cases of this species packed in 1942 was considerably larger than any of the chum-packs on the Nass since 1938, when 15,911 cases were canned. The 1942 pack of chums exceeded the previous five-year average by 3,991 cases.

There was apparently an improvement in the escapement of chums to the spawning-grounds as the run was reported as being one of the heaviest in years.

## Rivers Inlet.

In 1942 there were caught in Rivers Inlet salmon of all varieties sufficient to produce a total pack of 105,539 cases. This pack was 33,111 cases less than the pack for

this inlet in 1941. The 1942 pack consisted of 79,199 cases of sockeye, 985 cases of springs, 60 cases of steelheads, 8,467 cases of cohoe, 954 cases of pinks, and 15,874 cases of chums.

*Sockeye Salmon.*—The sockeye-pack of 79,199 cases in Rivers Inlet in 1942 was somewhat disappointing, falling, as it did, considerably below the pack in 1941 and being smaller than either of the packs of 1937 or 1938, the cycle-years. The 1942 pack was 8,743 cases less than the pack in 1938 and 5,633 cases less than the pack of 1937. The 1942 pack was 3,573 cases above the average annual pack for the previous five years. This fact, however, should be considered in relation to the two very poor packs in the years 1939 and 1940.

According to reports from the spawning-areas, the escapement was very good.

*Spring Salmon.*—Spring salmon are caught and canned in Rivers Inlet incidental to fishing for and canning other varieties. In 1942 there were 985 cases of this species canned, compared with 1,692 cases in 1941, 1,226 cases in 1940, 745 cases in 1939, and 1,209 cases in 1938.

*Cohoe Salmon.*—The run of cohoe salmon to Rivers Inlet is never large and the 1942 pack of 8,467 cases, though considerably less than the pack in 1941, when 23,202 cases were canned, must be considered as reasonably satisfactory. The 1941 pack, with which the 1942 pack is compared, was one of the largest packs of this species put up on Rivers Inlet in many years. In 1939, the cycle-year, the pack amounted to 10,974 cases. The 1942 pack was 5,631 cases below the average annual pack for the previous five-year period.

The escapement of cohoe salmon to the spawning-areas in this district would seem to have been small.

*Pink Salmon.*—Pink salmon do not frequent Rivers Inlet in great numbers but are canned each year in varying amounts. In 1942, 954 cases were canned. This is compared with 4,807 cases in 1941, 3,329 cases in 1940, 12,095 cases in 1939, and 9,063 cases in 1938. The 1942 pack of pinks in Rivers Inlet was the smallest pack of this species recorded for many years.

*Chum Salmon.*—The comparatively large pack of chum salmon in 1941 was exceeded slightly in 1942, when 15,874 cases were canned. The comparatively large packs of chum salmon in Rivers Inlet for the years 1941 and 1942 no doubt reflect, in a large measure, the heavy demand for all varieties of salmon for canning during the war years. Previous to 1941 the chum-salmon pack in Rivers Inlet did not exceed 9,000 to 10,000 cases.

The escapement of chum salmon to the spawning-beds in the Rivers Inlet area was reported as having been good.

### Smith Inlet.

Smith Inlet is primarily a sockeye-fishing area and, while some seining for chum salmon is carried on in this inlet during the fall of the year, the catch of this species has never been large. Other varieties caught in Smith Inlet are caught incidental to the sockeye-fishery. The total pack of all varieties of salmon caught in Smith Inlet and canned in 1942 amounted to 23,777 cases. Of these, 15,939 cases were sockeye, 8 cases were springs, 1,813 cases were cohoe, 527 cases were pinks, and 5,490 cases were chums.

*Sockeye Salmon.*—The 15,939-case sockeye-pack of Smith Inlet caught fish in 1942 was disappointing. The pack four years previous, in 1938, amounted to 33,894 cases, while the run five years previous, or the run in 1937, produced a pack of 25,258 cases. It is well known that the run in Smith Inlet is composed of some four- and some five-year-old fish. Compared with the cycle-years the 1942 pack was quite small. The 1942 pack was also 7,082 cases below the average for the previous five years. An examination

of the sockeye-pack figures for Smith Inlet in recent past years indicates a continuous downward trend. There would seem to be ample justification for greater conservation effort in this inlet in order to rehabilitate the sockeye population frequenting the spawning-beds in this area, notwithstanding the fact that the report from the spawning in 1942 indicated that the escapement was good.

*Spring Salmon.*—In Smith Inlet, like Rivers Inlet, spring salmon are caught only incidental to fishing for other varieties. In 1942 only 8 cases were reported as having been canned from this area.

*Cohoe Salmon.*—Cohoe are never a large factor in the Smith Inlet catch and in 1942 the catch of cohoe was no exception, only 1,813 cases are reported as having been caught. This figure is compared with 1,955 cases in 1941, 1,102 cases in 1940, 3,880 cases in 1939, and 1,058 cases in 1938.

*Pink Salmon.*—As mentioned above, pinks are not a factor in the Smith Inlet catch, 527 cases having been caught in 1942 compared with 749 cases in 1941.

*Chum Salmon.*—Seining for chum salmon is done in Smith Inlet in the fall of the year. In 1942 the catch amounted to 5,490 cases. This is compared with 7,741 cases in 1941, 6,015 cases in 1940, and 2,771 cases in 1939. The pack in 1938 amounted to 8,076 cases.

The escapement to the spawning-grounds was reported to have been heavy.

## 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 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 1942 amounted to 144,145 cases, of which 83,329 cases were pink salmon and 43,801 cases were chum salmon. There were also packed 16,935 cases of cohoe, 41 cases of steelheads, 38 cases of springs, and 1 case of sockeye.

*Pink Salmon.*—In 1942 there was a run of pink salmon to the Queen Charlotte Islands. This run produced a pack of 83,329 cases. While this is considerably larger than the pink-salmon packs produced in the Queen Charlotte Islands in recent past years, it is, however, very much below the capabilities of this area when compared with the packs of a few years ago. In 1930 the pack of pink salmon amounted to 224,902 cases. In 1934 the pack had dropped to 53,398 cases. In 1936 conditions had improved to the extent that 89,355 cases were canned, while in 1938 the pack again dropped to 57,952 cases and, in 1940, still lower to 44,966 cases. The pink-salmon runs to the Queen Charlotte Islands should be a large factor in the total British Columbia salmon-pack. A study of the figures would seem to indicate that much greater conservation efforts are needed if this salmon run is to produce to its full capabilities. It might be argued that war-time is not the time to curtail fishing effort as the product is so largely needed for food. It should be remembered, however, that pink-salmon runs reflect the effects of overfishing very rapidly and it would seem to be a very shortsighted policy to continue overfishing in this area to the extent that depletion might take place beyond the powers of the species to rehabilitate itself.

*Chum Salmon.*—The 43,801 cases of chum salmon caught in the Queen Charlotte Islands area in 1942 is compared with 40,882 cases of this species caught in 1938, four years previous. In 1941 the catch of chums amounted to 76,745 cases, while in 1940 there were caught sufficient to fill 164,911 cases. The 1942 pack was 30,571 cases below the average annual pack for the previous five years.

*Cohoe Salmon.*—The 16,935 cases of cohoe canned from Queen Charlotte Islands caught fish in 1942 is compared with 27,421 cases in 1941, 8,897 cases in 1940, 3,020 cases in 1939, while in 1938 there were canned 16,616 cases.

The reader is referred to the report of the Chief Supervisor of Fisheries, published in the Appendix to this report, for details on the spawning conditions in the Queen Charlotte Islands area.

### Central Area.

The Central area, for statistical purposes, comprises all the salmon-fishing areas off the mainland coast between Cape Calvert and the Skeena River, except Rivers Inlet. The total pack of all species of salmon caught in this area in 1942 amounted to 198,408 cases, compared with a total pack for this area in 1941 of 244,579 cases. The 1942 pack consisted of 17,470 cases of sockeye, 723 cases of springs, 355 cases of steelheads, 31,274 cases of cohoe, 69,434 cases of pinks, and 79,152 cases of chums.

*Sockeye Salmon.*—Burke and Dean Channels and Fitzhugh Sound are the principal sockeye-fishing grounds in this area. Some sockeye are caught, however, in the vicinity of Banks Island and Principe Channel and a few are also taken in Gardner Canal. In 1942 the total sockeye-catch in the Central area amounted to 17,470 cases, which was 3,384 cases less than were canned in the year previous. The 1942 pack, however, was 18,708 cases less than were packed in this area four years previous. The 1942 pack was the smallest pack of sockeye put up in this area for many years, and was 9,070 cases less than the average pack for the previous five-year period.

The reader is referred to the spawning report, published in the Appendix to this report, for details of the escapement to 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. Also, much of the spring salmon caught in this area finds an outlet in other than the canning trade. In 1942, 723 cases of spring salmon were canned in this area.

*Cohoe Salmon.*—Sufficient numbers of cohoe salmon were caught in the Central area in 1942 to fill 31,274 cases. This was 13,944 cases less than were canned in the year previous and 13,152 cases less than were canned in 1939, the cycle-year. The 1942 catch was the smallest pack put up in the Central area since 1937, when 25,009 cases were canned. The 1942 pack was also 14,230 cases less than the average for the previous five years.

*Pink Salmon.*—The 1942 pack of pink salmon in the Central area amounted to 69,434 cases, which must be considered a failure for the pink-salmon run in this area. This was the third year in succession that the run of pink salmon in the Central area has not materialized. The cycle-year, 1940, to which this run belongs, produced a pack of 54,478 cases. Previous to 1940 the Central area had produced packs well over 300,000 cases. For convenience, the cycle-years 1930–42, inclusive, are listed below:—

| | Cases. |
|---|---|
| 1930 | 376,084 |
| 1932 | 80,034 |
| 1934 | 157,336 |
| 1936 | 246,378 |
| 1938 | 130,842 |
| 1940 | 54,478 |
| 1942 | 69,434 |

From this it will be observed that this district is capable of producing much larger packs of pink salmon than have been packed in recent past years. The pack in the past three years indicates definitely that depletion is taking place in this area at an alarming rate, and unless drastic measures for conservation are applied immediately

we may look for a further diminution of the pink-salmon runs to this area. No pressure should be permitted to further interfere with the imposition of whatever restrictions are necessary to rebuild this area commensurate with its potentialities.

Reports from the spawning-areas in the Central area in 1942 are encouraging.

*Chum Salmon.*—The Central area produced chum salmon in 1942 sufficient to fill 69,152 cases. This pack was quite disappointing and was the smallest pack produced from Central area caught fish since 1931. It will be remembered in that year the small pack was due largely to curtailment on the part of the canners, rather than the lack of fish. The 1942 chum-pack was 32,435 cases less than were canned in the year previous and 27,451 cases less than the average annual pack for the previous five years.

For particulars regarding the escapement of chum salmon in this area the reader is referred to the report on the spawning-beds of the Chief Supervisor of Fisheries, published in the Appendix to this report.

## Vancouver Island.

In 1942 a total of 536,803 cases of all varieties of salmon were canned and credited to the Vancouver Island district. This was 61,498 cases below the average annual pack credited to this district for the previous five-year period. In 1942 the Vancouver Island pack consisted of 51,961 cases of sockeye, 5,407 cases of springs, 119 cases of steelheads, 81,837 cases of cohoe, 14,474 cases of pinks, and 383,005 cases of chums.

*Sockeye Salmon.*—The 51,961 cases of sockeye salmon canned from Vancouver Island caught fish in 1942 was the largest sockeye-pack for this district in recent past years and exceeded the large pack of the previous year by 11,688 cases. The 1942 pack exceeded the average annual pack of sockeye salmon for this district for the previous five-year period by 21,634 cases. If one assumes a four-year cycle for the majority of the sockeye frequenting the various Vancouver Island streams, the 1942 pack exceeded that of the cycle-year of 1938 by 23,996 cases.

The reader is referred to the report on the spawning conditions by the Chief Supervisor of Fisheries, which is published in the Appendix to this report.

*Spring Salmon.*—There are large quantities of spring salmon caught in the waters off Vancouver Island each year. Most of these are taken by troll, however, and enter the fresh- and frozen-fish trade. The canned-salmon pack of springs consists principally of salmon taken in the seines while fishing for other varieties. In 1942 the pack of spring salmon amounted to 5,407 cases, compared with 8,038 cases caught and canned in the year previous. In 1940 the pack of this species amounted to 2,454 cases, while in 1938, 2,889 cases of spring salmon were canned.

*Cohoe Salmon.*—The 81,837 cases of cohoe salmon canned from Vancouver Island caught fish in 1942 were less than half the number of cases of this species canned in the year previous. The 1942 pack was 28,261 cases less than the average annual pack for this species for the previous five years. The figures for the Vancouver Island cohoe-pack included 23,265 cases of bluebacks which were canned from fish caught adjacent to Vancouver Island. Figures for the 1941 Vancouver Island cohoe-pack included 30,027 cases of bluebacks.

*Pink Salmon.*—Pink salmon were caught and canned in the Vancouver Island area in 1942 to the extent of 14,474 cases. This was 19,311 cases less than the pack in 1940, the cycle-year, and when compared with previous cycle-years, the 1942 pack of pinks was, to all intents and purposes, a failure. The small pack of pink salmon caught in the Vancouver Island District for the past two years would seem to warrant special attention by those responsible for conservation.

*Chum Salmon.*—The 383,005-case pack of chum salmon caught in the waters adjacent to Vancouver Island in 1942 was 210,011 cases less than were canned in 1941, in which year, however, the pack of this variety established something of a record for

this district. The 1942 pack, exclusive of the record pack of 1941, was the largest pack of this species canned from Vancouver Island caught fish in recent past years. Previous to the outbreak of hostilities, chum salmon caught in this district found an outlet in the salt-fish and frozen-fish trades and, in addition, there existed a considerable demand for this fish from the United States side of the International boundary. Since the outbreak of hostilities the Provincial Government, in order to divert as much salmon as possible from other channels into the canning industry, declined to issue salmon-saltery licences and, as a result, no salteries have operated. The Federal Government has also taken action which has restricted, to a considerable extent, the freezing of chum salmon and has also taken action to control or prohibit the export of fresh chum salmon. These measures have been taken for the purpose of adding to the total British Columbia canned-salmon pack, which pack is shipped in its entirety to the British Ministry of Food. The result of these measures is reflected in the size of the chum-salmon pack. The 1942 pack of chum salmon from Vancouver Island caught fish was 36,147 cases greater than the average annual pack for this species for the previous five years. In comparing the pack figures for the various species in the different districts with the previous years' packs, these comparisons must take into consideration the escapement to the spawning-beds. In all cases where these conditions are not specifically mentioned in the text, the reader is referred to the report of British Columbia's salmon-spawning beds, contributed by the Chief Supervisor of Fisheries and published in the Appendix to this report.

## REVIEW OF BRITISH COLUMBIA'S SALMON-CANNING INDUSTRY, 1942.

There were thirty salmon-canneries licensed to operate in British Columbia in 1942. This number was six less than operated in 1941. The operating canneries were situated in the various districts, as follows:—

| | |
|---|---|
| Queen Charlotte Islands | 1 |
| Nass River | 2 |
| Skeena River | 6 |
| Central area | 4 |
| Rivers Inlet | 1 |
| Johnston Strait | 2 |
| Fraser River and Lower Mainland | 12 |
| West coast of Vancouver Island | 2 |

Compared with the year previous, in 1942 one cannery less operated in the Queen Charlotte Islands District and the same number operated on the Nass River. On the Skeena River, in 1942 one cannery less operated than in 1941 and in the Central area the same number operated as in the year previous. In 1942 only one cannery operated on Rivers Inlet, whereas in 1941 there were two canneries. In Johnston Strait there were two canneries less operating in 1942 than in 1941, while on the Fraser River and Lower Mainland there was an increase of one cannery over the year previous. On the west coast of Vancouver Island four canneries operated in 1941, while in 1942 only two were in operation. The principal reason for fewer canneries operating, especially in the northern districts in 1942, was no doubt due in a large measure to the difficulty in securing experienced cannery labour. Under ordinary circumstances there is no doubt but that a greater number of canneries would have operated in the Queen Charlotte Islands in 1942, due to the fact that 1942 coincides with the run of pink salmon in that district. However, the pink salmon caught in the Queen Charlotte Islands area were transported to the mainland, with the exception of the pack of one cannery operating at Pacofi. In the Fraser River and Lower Mainland district all canneries operating in 1941 also operated in 1942 and, in addition, one new cannery was licensed on the Vancouver Harbour Commissioner's fish dock, namely, Clover Leaf Cannery, belonging to

the British Columbia Packers, Limited. The practice of closing down various canneries and packing salmon for longer distances was a growing practice before the war, but since the outbreak of hostilities the scarcity of experienced help has been an increasing problem and it is reasonable to expect that a greater concentration of operations will continue as long as the war lasts. A few years ago it was considered impractical to pack salmon over long distances for canning. The new, large, fast vessels, powered with economical Diesel engines which have been developed by the industry in the last few years, have made it practical and economical to carry salmon over increasingly longer distances which, together with modern refrigeration, have enabled the canners to operate fewer canneries and has tended to make for a more economical operation.

Probably the most outstanding feature of the salmon-canning operations in British Columbia was the exceptionally large pack of sockeye canned from Fraser River caught fish. The year 1942 coincided with the anticipated late run of sockeye to the Adams River tributary, which run, when it materialized, taxed the capacity of the canneries in the immediate vicinity to the utmost and made necessary the packing of considerable quantities to other areas for canning. The Fraser River, in 1942, produced the largest sockeye-pack in British Columbia since 1913. In that year, of course, many more canneries were in operation. There is no doubt but what the 1942 sockeye-pack might have been even larger except that near the end of the season a dispute arose between the fishermen and the operators as to the price of salmon, the operators claiming that on account of the lowering in quality toward the latter part of the season the salmon were not worth as much as those caught earlier in the season. The fishermen declined to return to fishing and as the season was nearly at an end fishing automatically ceased. However, several days heavy production were lost.

As in 1941, the Federal Government advised the British Columbia canners that the British Ministry of Food was anxious to obtain the whole of the British Columbia salmon-pack. In order that as much of the catch as possible would be canned, similar restrictions upon the disposal of salmon were in effect in 1942 as were so successful in diverting most of the catch to the canners in 1941. The Provincial Government again declined to permit the operation of salmon dry-salteries and the Federal Government again placed an embargo on the export of fresh salmon in certain categories. As a result of these measures, the 1942 salmon-pack, like that in 1941, was considerably enhanced. These facts should be taken into consideration when making the comparisons between the canned-salmon pack figures for British Columbia for the years 1941 and 1942 and the pack figures of previous years, otherwise the comparisons might lead to erroneous conclusions.

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

*Pilchard.*—The pilchard-canning industry in British Columbia is centred 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. Occasionally, however, some pilchards are canned in canneries located some distance from the fishing-grounds. One such pilchard-cannery was so located in 1942. While the bulk of the pilchard-catch is reduced to meal and oil, there is, however, a growing demand for canned pilchards. The quantity canned in any year, however, is not altogether indicative of the demand, as pilchards for canning are selected from the regular pilchard-catch and, due to the exigencies of this fishery, there is not always a sufficient quantity of pilchards of a quality suitable for canning.

In 1942 seven pilchard-canneries operated compared with five in 1941. The seven plants operating in 1942 produced 42,008 cases of canned pilchards compared with a production of 72,498 cases in 1941 and 73,000 cases in 1940.

*Herring.*—Previous to the outbreak of the war herring were canned in British Columbia to some extent, but the pack was never large, due to the limited market for canned herring. In 1939, principally on account of hostilities in Europe and the demand for a high-protein food, the canning of herring assumed the proportions of a major industry and in that year 418,021 cases of herring were canned in British Columbia. The continued demand from Britain for a low-cost high-protein food has resulted in elevating the herring-canning industry from a minor rôle to that of a major industry. In order to divert as much of the herring-catch as possible to the herring-canneries, the Provincial Government has maintained a policy of refusing to issue licences to plants utilizing herring, except herring-canneries and herring-reduction plants. In certain localities where herring-reduction plants are permitted to operate, the operation is restricted to herring not suitable for canning or to plants located in districts where canning-machinery is not available. The result of these restrictions, together with the increased effort on the part of the fishermen, has been to increase the canned-herring pack enormously.

In 1941 twenty-three canneries operated and produced a pack of 1,527,350 cases. In 1942 twenty-two herring canneries were licensed to operate. Four of these, however, did not commence operations, but the eighteen operated plants produced in 1942 a pack of 1,253,978 cases of canned herring.

In the pages of this Department's report for 1941 it was stated that the requirements of Great Britain for a low-cost high-protein food during war-time was an ideal opportunity for the herring-packers of British Columbia to demonstrate to the British consumer their ability to supply canned herring in large quantities and also, that if the operators insist on maintaining a high standard of quality, there would seem to be no good reason why a very large portion of this trade could not be retained after the war. It is felt that this statement is worthy of repeating. While there is no doubt that when the war is over there will again be some demand for British Columbia herring in a salted state, there is no doubt but that the canning of herring is the method to be preferred. British Columbia canners should make the most of this opportunity.

*Shell-fish.*—Shell-fish, principally clams and oysters, are canned in British Columbia to some extent. The operation, however, is never large, although in some years production is considerably higher than in others. In 1942 four canneries were licensed to can shell-fish. These four canneries produced a pack of 1,630 cases of crab and 20,637 cases of clams. One shell-fish cannery put up a small pack of canned abalone. In 1941 there were canned 6,773 cases of crabs and 11,560 cases of clams.

## MILD-CURED SALMON.

There were five tierced-salmon plants licensed to operate in British Columbia in 1942. Only three of these operated, however. These three plants produced 969 tierces of mild-cured salmon in 1942 compared with a pack of 1,481 tierces put up by four plants in 1941.

## DRY-SALT SALMON.

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

salmon dry-saltery licences in 1939. For similar reasons the licences covering salmon dry-salteries were again refused by the Provincial Government in 1940. In 1941, and again in 1942, the demand of the British Government for a very large portion of the British Columbia salmon-pack made it imperative that as much as possible of the salmon-catch be diverted to the canneries. For this reason the Provincial Government again refused to issue licences covering salt-salmon operations and, as a consequence, no salmon were legally dry-salted in British Columbia in 1942. A small operation, not licensed, resulted in the prosecution of the operator.

For the above-noted reasons the British Columbia Salt-fish Board was again inoperative during the 1942 season and, on that account, no report of the British Columbia Salt-fish Board is included in this report.

## DRY-SALT HERRING.

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

## PICKLED HERRING.

The pickling of herring in British Columbia has been revived since the beginning of the war, due to certain markets in the United States, which formerly obtained their supplies of this commodity from European markets, having to look elsewhere for this product. In 1940 there were 5,500 barrels of pickled herring put up in British Columbia. In 1941 three plants were licensed to operate, which produced a pack of 3,095 barrels. In 1942 only two pickled-herring plants were licensed to operate, these two plants having a combined production of 2,440 barrels.

In order to divert as much as possible of the east coast herring-catch to the herring-canneries for the production of canned herring for Britain, the Provincial Government again declined to permit pickled-herring plants to operate on fish caught on the east coast of Vancouver Island. This action, no doubt, had the effect of lessening the amount of herring that otherwise would have found an outlet in the pickling plants. Another factor which, no doubt, had an adverse effect on the size of the pickled-herring pack, was the lateness of the run of herring on the west coast of Vancouver Island. One plant located on the west coast and capable of handling a very much larger pack, was forced to remain idle for a considerable time during the early part of the season due to lack of fish.

## HALIBUT PRODUCTION.

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

comprises the waters from the northern boundary of Area No. 2 to the Aleutians. The other two areas, Nos. 1 and 4, from which production is very small, comprise the waters south of Area No. 2 and the Bering Sea, respectively.

In 1942 the catch-limits set by the International Fisheries Commission were: For Area No. 2, 22,700,000 lb. and for Area No. 3, 26,800,000 lb.—a total of 49,500,000 lb. of saleable halibut, exclusive of that quantity which is permitted to be taken incidental to fishing for other species under permit in Area No. 2 after its closure and before the closure of Area No. 3. The catch-limits in 1942 were 500,000 lb. greater than those allowed in 1941, all of which were taken in Area No. 3. There are no catch-limits set by the Commission for Areas Nos. 1 and 4. These areas automatically close when the catch-limit has been taken in Areas Nos. 2 and 3. In addition to the 49,500,000 lb. permitted to be taken from Areas Nos. 2 and 3, the International Fisheries Commission again issued permits which allowed vessels to land halibut caught incidental to fishing for other species in an area closed to halibut-fishing when halibut-fishing is permitted in another area.

The total landings of all vessels in 1942 amounted to 50,438,130 lb., exclusive of that amount landed under permit, as mentioned above. This was 1,679,870 lb. less than the total landings recorded in the year 1941. Of the total amount of halibut caught in 1942, 23,168,182 lb. were taken in Area No. 2 while 26,984,327 lb. were caught in Area No. 3. Area No. 1 produced 285,621 lb.

The total halibut-landings at Canadian ports by all vessels amounted to 24,559,216 lb., and of this total 11,343,578 lb. were caught in Area No. 2 while 13,215,638 lb. were caught in Area No. 3. These area totals are compared with 12,206,000 lb. caught in Area No. 2 and 10,631,000 lb. caught in Area No. 3 in 1941.

The Canadian halibut-fleet caught and landed in Canadian ports a total of 11,128,922 lb. Of the total Canadian landings in Canadian ports, 9,113,911 lb. were taken by Canadian vessels in Area No. 2 and 2,015,011 lb. were taken by Canadian vessels in Area No. 3. These figures are compared with 10,469,000 lb. from Area No. 2 and 2,334,000 lb. from Area No. 3 by Canadian vessels in Canadian ports in 1941. The total halibut-catch caught and landed in Canadian ports by Canadian vessels in 1942 was 1,674,078 lb. less than similar landings for the year previous. The total Canadian catch of halibut in 1942 was 1,685,398 lb. less than in the year previous.

In 1942 the weighted average price paid for Canadian halibut in Prince Rupert was 14.1 cents per pound. In 1941 the weighted price paid for Canadian halibut in Prince Rupert was 9.86 cents per pound. The average weighted price for all Canadian landings in Canadian ports in 1942 was 14.2 cents per pound.

Halibut-livers in 1942 were again in great demand by pharmaceutical houses as a valuable source of concentrated vitamins. These livers have been in increasing demand since the outbreak of the war. Heretofore we have been able to give the value received by the fishermen for this commodity but, due to marketing arrangements in 1942, settlement for halibut-livers had not been consummated at the time of going to press, hence values have had to be omitted.

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 a potent source of 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.

In addition to the vitamin oils, 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.

*Fish-liver Oils.*—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 1942 the Provincial Fisheries Department issued licences to nine plants operating on the production of fish-liver oils. According to returns made to the Provincial Fisheries Department, these nine plants produced 916,723 gallons of high vitamin-oils from fish-livers.

*Pilchard Reduction.*—The pilchard-fishery in British Columbia is conducted principally off the west coast of Vancouver Island and, while the bulk of the pilchard-catch is taken well offshore, there appear in certain seasons schools of pilchards in the inner passages and in the proximity of Queen Charlotte Sound. In 1942 much of the early production was caught off the Washington coast. There were eight pilchard-reduction plants licensed to operate in 1942, compared with nine similar operations in 1941. The eight plants produced 11,003 tons of edible fish-meal and 1,560,269 imperial gallons of oil in 1942, compared with a production of 11,437 tons of meal and 1,916,191 imperial gallons of oil by the nine plants in the year previous.

*Anchovies.*—Anchovies are occasionally taken in small quantities in the waters off the west coast of Vancouver Island. The Provincial Department of Fisheries does not license plants specifically for anchovy reduction. In 1942 plants on the west coast produced 618 tons of anchovy meal and 32,130 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 only by a large-scale production of canned 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 in 1942 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 ten herring-reduction plants which were licensed to operate in British Columbia in 1942 produced somewhat less meal and oil than the fifteen licensed plants did in 1941. In 1941 there were produced 8,780 tons of

herring-meal and 594,684 imperial gallons of herring-oil. The production in 1942 amounted to 4,633 tons of herring-meal and 323,379 imperial gallons of herring-oil.

*Whale Reduction.*—In 1942 only one whale-reduction plant was licensed to operate in British Columbia. This plant received 163 whales and produced therefrom 130 tons of meal and 205 tons of fertilizer, also 255,556 imperial gallons of oil. Of this total, 228,889 imperial gallons were sperm oil which is presently in great demand by armament-works. There is no doubt that whaling activity in British Columbia would have been on a much larger scale in 1942 were it not for special war conditions prevailing in the north Pacific.

*Miscellaneous Reduction.*—Dogfish and fish-offal reduction plants are licensed to operate each year in British Columbia. These plants produced meal and oil from cannery waste and from the carcasses of dogfish. The oil from the dogfish carcasses is not to be confused with dogfish-liver oil, which has been reported in another section of this report. In 1942 eleven licensed plants operated in British Columbia. These eleven plants produced 637 tons of dogfish-meal and 3,513 tons of fish-meal from cannery waste. They also produced 30,801 imperial gallons of oil from dogfish carcasses and 275,571 imperial gallons of oil principally from salmon and herring cannery waste.

## CONDITIONS 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. 28.)

There will be found in the Appendix to this report, Paper No. 28 in the series "Contributions to the Life-history of the Sockeye Salmon." This paper is again the work of Dr. W. A. Clemens, Department of Zoology, University of British Columbia.

In this latest paper Dr. Clemens points out that by using as a basis the pack figures, together with the escapement to the spawning-beds, one may judge the extent of the run of salmon to a river system and, in connection with the three areas under review, attention is drawn to the fact that the packs of Rivers Inlet and the Nass River were, to all intents and purposes, equal to the averages of the past years of record, and these facts, taken together with the occurrence of good escapements, provide grounds for considering that the runs to these two areas are quite satisfactory. On the Skeena River, however, the situation is quite different. The pack there was the second lowest on record in 1942 and as there is no indication of a correspondingly large escapement, taken together with other factors, would indicate that there is a problem in connection with the sockeye salmon of the Skeena River which warrants "very careful consideration."

Since this series of reports was commenced in 1913, the data have been carried forward each year until the tabular material has reached quite a considerable size and in order to avoid having the tabulations become unwieldy, it has been deemed desirable to consider the year 1941 as the end of the first section of this series and to commence a new section with the year 1942, or the present paper. It is the intention to summarize all of the data prior to 1941 and to make the conclusions available at an early date. Commencing with this paper a change has been made in the method of length

measurement of the fish. However, the material as presented will be comparable, as corrections are made to compensate for the change in method.

Commenting specifically on the sockeye-salmon runs to the particular river systems, Dr. Clemens remarks as follows:—

### Rivers Inlet Sockeye Salmon Run of 1942.

The pack of sockeye at Rivers Inlet in 1942 of 79,199 cases fell within the range of medium-sized packs and approached the average of the past thirty-five years. The 1942 run was composed largely of five-year-old fish derived from the spawning of 1937, which was a particularly productive brood-year in that it also produced a large percentage of four-year-old fish in 1941.

Commenting on the return in 1943 the author points out that this run will be the result of the spawnings of 1938 and 1939. In the former year the pack amounted to 87,942 cases and the escapement was reported as good, and since this brood-year produced only 8 per cent. of four-year-old fish in 1942 it is reasonable to expect a good return of five-year-old fish in 1943. It sometimes happens, however, that a low four-year-old percentage is followed in the succeeding year by a low five-year-old percentage, indicating a year of poor reproduction. In the case of Rivers Inlet, no reports being at hand to indicate adverse climatic conditions during the 1938 and 1939 incubation period, there should, therefore, be a reasonable expectation for large numbers of five-year-old fish in 1943.

In 1939 the pack was 54,143 cases and the escapement was reported at least as being an average one. However, the Fisheries Inspector referred to high-water conditions during the spawning period. In view of this and the small pack, it is possible that the production from the 1939 spawning may be low.

### Skeena River Sockeye Run of 1942.

In this river system in 1942 the pack was 34,544 cases and the escapement is reported as especially good to Lakelse Lake and reasonably satisfactory to the Babine area. This pack is the second lowest on record and, considering the size of the pack and the escapement, the run was probably all that could be expected from the spawnings of 1937 and 1938 under relatively uniform environmental conditions. Dr. Clemens points out that the return in 1943 will be the product of the 1938 and 1939 spawnings. In the former year the pack was 47,257 cases and the escapement was reported as very good. In the latter year the pack was 68,485 cases and the escapement stated as being exceptionally good, but unless unusually favourable conditions for reproduction have prevailed there would appear to be no ground for expecting a very large run in 1943.

### Nass River Sockeye Run of 1942.

Dealing with this river system Dr. Clemens points out that the run to the Nass River in 1942 produced a pack of 21,085 cases with the escapement reported as being very good. The pack was practically equal to the average of the packs for the past thirty years. The return in 1943 will be the product of the spawnings of 1938 and 1939. In 1938 the pack was 21,462 cases and the escapement reported as large with a heavy seeding. In 1939 the pack consisted of 24,357 cases and the escapement was reported as very satisfactory. This would seem to indicate a good return in 1943, but Dr. Clemens is particular to point out that predictions for the Nass River, due to many causes, are unsatisfactory.

The reader is referred to the report in full for the details of the analyses of the sockeye runs to these three river systems.

## PILCHARD INVESTIGATION.

The programme of pilchard investigation has included sampling and tag-recovery. Active work on pilchard-tagging has been brought to a close and a review of all the results of the seven years of the tagging programme has been prepared. All the information available on the occurrence in British Columbia waters of pilchards of the 1939 year-class has been brought together and the significance of the group from the point of view of the fishery estimated.

Sampling for length showed the size of pilchards to be less scattered during the 1942 season than in 1941 but more scattered than in any other recent year. Most of the pilchards encountered were between the lengths of 200 and 250 millimetres, with the numbers of fish fairly evenly distributed among the lengths between those limits. Fish taken north of Vancouver Island and apparently those taken during the winter fishery averaged smaller than the fish taken during the usual summer fishery off the west coast of Vancouver Island.

Fifteen pilchard-tags were recovered. Considerable interest attaches to the recovery by the Butedale plant of a tag put out in California. Evidently the fish carrying this tag was taken at the north end of Aristazabal Island and constitutes a northern record for the capture of a fish which is known to have been in California waters.

A review of the tagging results obtained since 1936 shows:—

The considerable interchange of pilchards between northern fishing-grounds and those off the California coast is too great to be the result of casual movements and definite migration is accordingly indicated.

During the first season following that of tagging, tagged fish appear to be more concentrated on northern fishing-grounds than off the California coast. Shortcomings in the techniques of recovering the tags and of making calculations contribute to this discrepancy, but it appears that some of the difference is due to incompleteness during the first year of the migration from northern fishing-grounds to California fishing-grounds.

During the first year after tagging tagged fish are more concentrated off southern California than off central California but in subsequent seasons this observation does not hold true.

The average minimum speeds of southward migration of pilchards were estimated as ranging from 3.4 to 7.7 nautical miles per day.

Estimates of pilchard mortality based on tag returns indicate a total annual death rate of approximately 71 per cent.

An examination of the available records shows that during the summer of 1940 pilchards hatched during 1939 were extraordinarily abundant in all the waters of British Columbia south of Pitt Island, with the exception of the heads of some of the long inlets, the northern end of the Strait of Georgia, and the northern channels leading into it. In the summer of 1939 considerable quantities of the small fish were captured and canned. During the winter which followed many tons of young pilchards died in Saanich Inlet and Pender Harbour.

In the summer of 1941 the fish were encountered as two-year-olds generally distributed in abundance in Canadian waters and they comprised about 25 per cent. of the individual fish taken off the west coast of Vancouver Island. At the same time survivors of the previous winter's mortality in the Strait of Georgia supplied a small fishery, and nearly 50 per cent. of the 6,000 cubic tons taken north of Vancouver Island were two-year-old fish. During the winter of 1941–42 considerable catches of pilchards were made off the west coast of Vancouver Island and nearly 80 per cent. of the fish taken at this time belonged to the group under discussion.

Pilchards of the 1939 year-class were prominent as three-year-olds in the British Columbia fisheries of 1942, but it is difficult to estimate the exact importance as the

group could no longer be certainly recognized by inspection. In the summer fishery off the west coast of Vancouver Island the three-year-old fish appeared to be relatively more important than in the previous year and in the summer fishery farther north 1939 year-class fish were definitely predominant. A few catches of three-year-old fish were made in the Strait of Georgia and Queen Charlotte Strait. It cannot be assumed that all of the 1939 year-class pilchards present off the west coast of Vancouver Island during 1942 were survivors of the original schools which were in the inlets and immediately offshore during the early summer of 1940. It is likely that the fishery on the west coast of Vancouver Island has drawn upon 1939 year-class fish produced over most of the north-east Pacific area and tag recoveries indicate that as early as the summer of 1941 one or more pilchards of the 1939 year-class present in California waters during 1940 had migrated to the Canadian fishing-grounds.

The pilchard investigation has been carried out by Dr. J. L. Hart and his assistants.

## HERRING INVESTIGATION.

The herring investigation was continued during the year under joint financial arrangement between the Fisheries Research Board of Canada and the Provincial Fisheries Department. The work was undertaken by Dr. A. L. Tester, Dr. R. V. Boughton, and their assistants. Dr. Boughton terminated his services at the end of 1942.

In spite of many difficulties in obtaining equipment and help under present war conditions, all of the important phases of the investigation were carried on during the year. Emphasis was placed on the herring-tagging and tag-recovery programme, a complete account of which appears in the Appendix to this report. In this programme, work was concentrated on two of the more accessible major areas, the Strait of Georgia and Queen Charlotte Strait, although recoveries from taggings of previous years yielded additional information on the runs to other areas. The results again showed that the populations in major areas may be considered to be practically independent, and that within major areas there is limited mixing of particular runs. However, both between major areas and between runs, the degree of mixing encountered in 1942–43 appeared to be somewhat greater than in previous years. The investigations revealed a complex situation within the Strait of Georgia. The more southern fishing-grounds (Satellite Channel and Nanoose Bay) were supplied mostly by fish which had spawned along the south-east coast of Vancouver Island; the more northern fishing-grounds (Deep Bay and Deepwater Bay) were supplied mostly by fish which had spawned in the northern part of the Strait of Georgia, but there were also indications of a considerable influx of fish which had spawned in the Queen Charlotte Strait area. On the west coast of Vancouver Island there was a movement, probably of considerable magnitude, of Quatsino Sound fish to Ououkinsh Inlet.

During the 1942 spawning period a mortality of herring took place in a limited area along the south-east coast of Vancouver Island (chiefly between Nanaimo and Comox). This was investigated but the causes could not be ascertained. Many of the fish were tagged during the period of mortality and the period of apparent recovery. Some of these taggings yielded no returns and others only a very few, indicating that the mortality involved a considerable tonnage of fish and that most of those fish that appeared to be recovering eventually died. A mortality of eggs which took place along the south-east coast of Vancouver Island in April, 1942, was also investigated. It appeared to be associated with unfavourable hydrographic conditions. No serious effect on the future of the fishery because of this egg mortality was anticipated, as there appeared to be an excellent showing of fish of the year during the summer.

The sampling programme was continued during 1942–43, with particular emphasis on the catches along the east coast of Vancouver Island. Sampling trips to other areas

were not attempted. Samples were preserved at plants in other areas and were sent to the Pacific Biological Station for examination. During the course of the year, length and age composition studies of the 1941–42 samples were completed.

Daily catch records of the herring-fishery were again collected through the medium of Pilot House Record Books. A manuscript report was prepared dealing with the relative success of the fishery in each statistical area, expressed in terms of availability (average catch per seine per day's fishing).

During the spring of 1942, a careful survey of the herring-spawning grounds in the Strait of Georgia and in Queen Charlotte Strait was attempted with the object of determining what quantitative data on egg deposition could be obtained and their accuracy in estimating the quantity of spawning fish. Many insuperable difficulties were encountered and the errors introduced by these were of such magnitude as to discourage any attempts at quantitative estimation. However, herring-spawning reports prepared by fisheries inspectors were again collected. These should provide useful qualitative data and should give indications of major changes in the abundance of the spawning populations.

An investigation of the possible use of the echo sounder (an automatic depth recorder) for locating schools of herring was made. By agreement with the Fisheries Research Board of Canada, British Columbia Packers, Limited, purchased this instrument and installed it on their boat, the "Nishga," with the understanding that it would be tested under scientific supervision and that the findings would be available to the industry at large. It was demonstrated that the instrument recorded the presence of herring schools at depths of from 5 to 60 fathoms, and that it gave some indications of the magnitude of these schools. A scouting trip to fishing-grounds in Central and Northern British Columbia was unsuccessful because of the failure of herring to enter inshore waters during February when the tests were made. Although it has been shown that the echo sounder is definitely superior to other methods in locating fish, its practical utility must still be determined by continued use of the instrument.

## THE CLAM INVESTIGATION.

The investigation into the clams of British Columbia was continued in 1942. This investigation was instituted in order to ascertain the conditions prevailing on some of the clam-beaches of British Columbia, particularly those which had been exploited commercially for some considerable 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 these two organizations. The work was commenced by Dr. Roy Elsey and is now being conducted by Mr. Ferris Neave, of the Pacific Biological Station, Nanaimo. 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.

In the Appendix to this report will be found a report "Biological Investigations of Commercial Clams," by Ferris Neave. In this paper Mr. Neave discusses the distribution, by species and by areas, of the commercial clam-catch of 1941–42. Figures are again presented for the purpose of comparing the availability of clams in different localities and in different seasons, based on the average catch made by a digger during one low-tide period.

Results of the second season's study of the butter-clam beach at Seal Island are summarized. Data are presented concerning the growth-rate of the clams and the composition of the population. The effect of these factors on future production is discussed.

## INTERNATIONAL FISHERIES COMMISSION, 1942.

The International Fisheries Commission continued the regulation of the Pacific halibut-fishery and carried on the observations of the fishery and of the stocks of halibut that are essential to regulation.

The members of the Commission were the same as in 1941—namely, Mr. L. W. Patmore and Mr. A. J. Whitmore for Canada, and Mr. Edward W. Allen and Mr. Charles E. Jackson for the United States. Mr. Allen and Mr. Patmore were chairman and secretary respectively.

Meetings of the Commission were held on April 14th at Vancouver and on December 10th, 11th, and 12th at Seattle. On December 11th the Commission met with the Conference Board, composed of representatives of the halibut-fishing fleets. At these meetings the results of investigations, the effect of regulation upon the condition of the stocks of halibut, and matters relating to future regulations were considered.

Halibut-fishing regulations, differing in a few respects from those of 1941, were issued on March 25th. They changed the end of the winter closed season from midnight of March 31st to midnight of April 15th. They increased the catch-limit in Area 3, where the stock showed continued improvement, from 26,300,000 to 26,800,000 lb., but retained the catch-limit of 22,700,000 lb. in Area 2. To aid enforcement they made the licence of any vessel with baited fishing-gear on board invalid for the possession of halibut in any area other than that for which the licence was validated.

The fishing season was opened on April 16th, fifteen days later than in 1941. Areas 1 and 2, including all grounds south of Cape Spencer, Alaska, were closed at midnight of June 29th, when the Area 2 catch-limit was attained. Areas 3 and 4, including all fishing-grounds north and west of Cape Spencer, were closed at midnight of September 25th, when the Area 3 catch-limit was taken. Permits for the retention of halibut caught incidentally by set-line vessels during fishing for other species in areas closed to halibut-fishing became invalid at midnight of October 15th.

Landings of halibut reported on the Pacific coast during the year amounted to 50,386,000 lb. Of this amount, 286,000 lb. were reported from Area 1, to the south of Willapa Harbor, Washington; 23,228,000 lb. from Area 2, between Willapa Harbor and Cape Spencer, Alaska; and 26,872,000 lb. from Area 3, between Cape Spencer and the Aleutian Islands. No halibut was caught in Area 4, which includes Bering Sea and the Aleutian Island region. The landings from Area 2 included 527,000 lb. taken under permit by set-line vessels fishing for other species after closure of the area to halibut-fishing.

The curtailment system, by which the fishing-fleets had for several years distributed their landings over a longer season of the year, was abandoned early in the fishing season. This had the effect of shortening the fishing season in all areas, although it was offset to some extent by reductions in the size of the fleets, by a temporary reduction in the availability of halibut on some of the most productive banks in Area 2, and by naval restrictions on fishing in Area 3.

The investigations of the Commission's scientific staff were continued where necessary for the purposes of the halibut treaty. They included the collection and analysis of current statistical and biological data by which the success of past and present regulations can be determined and on which future regulations must be based.

Study of the changes taking place in the size-composition and age-composition of the stocks of marketable halibut as a result of regulation was continued as well as wartime conditions would permit. Approximately 32,000 halibut from different banks were measured at the time of landing at Seattle. Of these, 24,000 were from banks in Area 2 and 12,000 from grounds in Area 3. Materials for the determination of age-composition were secured from the same landings.

Market measurements proved that halibut of spawning size were very abundant in Area 3 but present only in moderate numbers in Area 2. Measurements did not

reveal any significant increase in the number of spawners in Area 2 during the year but did show that small immature fish, upon which the future supply of spawners depends, were entering the fishery in greater numbers than in any recent year.

Quantitative investigations of the production of spawn, the best available method of determining changes in spawning conditions as soon as they occur, were continued in Area 2. A vessel was chartered and operated from early December in 1941 to the end of February in 1942, in the vicinity of Cape St. James, British Columbia. During this period, 344 net-hauls were made at 131 stations to determine the abundance of eggs and larvæ. Hydrographic samples were taken at fifteen stations to ascertain the conditions under which the eggs were developing. The spawning materials obtained were less adequate than usual, due to bad weather which precluded any net-work for a two-week period at the height of the spawning season, but indicate that eggs were produced in numbers comparable to those found in the previous winter.

The abundance of halibut, as indicated by the catch per unit of fishing effort, improved during the year. The average catch per unit of gear in Area 3 was 8 per cent. greater than in 1941 and 103 per cent. greater than in 1930. In Area 2, the average catch per unit of gear was 5 per cent. and 83 per cent. above the levels of 1941 and 1930 respectively.

The investigations of the Commission continued to explain the changes taking place in the stocks of halibut. They proved that the Area 3 stock is in good condition and is improving slowly but that the stock in Area 2 is still in unsound condition, despite the marked improvement that occurred between 1930 and 1938. However, they also provided good reason for believing that the Area 2 stock is entering a new period of improvement.

The biological and statistical work carried on by the Commission has demonstrated the existence of definite and understandable relationships between the abundance of halibut, the amount of fishing, and the amount of catch. It proves that current catches are the greatest that can be taken from the partly rebuilt stocks on the grounds without diminution of those stocks and of the catches from them in the immediate future. It shows that maintenance of the halibut regulations on the present rational basis will assure not only the greatest possible catch of halibut during the next few years but also the securing of that catch at the least possible cost.

## INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION, 1942.

There will be found in the Appendix to this report, a " Report on Investigations of the International Pacific Salmon Fisheries Commission for the Year 1942," by Dr. W. F. Thompson, Director of Investigations. In this report Dr. Thompson deals with the Commission's findings in connection with the migrations of the Fraser River sockeye past various temporary barriers on the way to the spawning-beds, more particularly with conditions prevailing at Hell's Gate. Dr. Thompson mentions briefly the evidence of a blockade at Hell's Gate obtained by the Commission in 1938, 1939, and 1940. The blockade at Hell's Gate in 1941 is referred to and also the remedial measures taken by the Commission in the event of a similar blockade in 1942.

According to the evidence obtained by the Commission, the 1942 run, especially that portion proceeding to Shuswap Lake spawning areas, had no difficulty in passing Hell's Gate, as did another run to the Stellako District, which passed Hell's Gate about the same time as the Shuswap run.

In his report on the activities of the Commission Dr. Thompson discusses the tagging programme in the river itself, the construction of a model of the Fraser River reach at Hell's Gate, together with the results of the tagging at Sooke. Dr. Thompson also mentions studies of the Quesnel District which have been commenced with a view to determining methods of rehabilitation there.

The reader is referred to Dr. Thompson's report for a more detailed account of the Commission's activities.

# APPENDICES.

## CONTRIBUTIONS TO THE LIFE-HISTORY OF THE SOCKEYE SALMON. (No. 28.)

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

### INTRODUCTION.

The sockeye-salmon pack in 1942 attributable to Rivers Inlet and the Skeena and Nass Rivers was 134,828 cases, being 20 per cent. of the sockeye-pack of the Province. The individual packs were as follows: Rivers Inlet, 79,199 cases; Skeena River, 34,544 cases; and Nass River, 21,085 cases. The escapements to Rivers Inlet and the Nass River were reported as very good while that to the Skeena as only fairly satisfactory.

The information on the pack and the escapement supplies the basis for judging the extent of a run to a river system. The packs on Rivers Inlet and the Nass River were practically equal to the averages of the past years of record and within the range of expectation for the cycle-years. These facts, together with the occurrences of good escapements, provide grounds for considering the runs in these two areas as satisfactory. The situation on the Skeena River is otherwise. The pack is the second lowest on record and there is no indication of a correspondingly large escapement. Although a large return was not expected from the brood-years 1937 and 1938, it was hoped that there would be some evidence of increased production. Apparently this has not been forthcoming. In view of the fact that the Skeena River has frequently produced packs of over 100,000 cases, it is evident that the problem of sockeye-salmon production in this river warrants very careful consideration.

### 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.

### CHANGES IN TABULAR MATERIAL.

Since the inception of this series of annual reports in 1913, the data have been carried forward from year to year until the tabular material has reached considerable

size. In order to avoid having the material become unwieldy it seems desirable to consider the year 1941 as the end of a section and to commence a new section with the year 1942. All the available data prior to 1941 will be summarized and the conclusions made available at an early date.

With the commencement of the second series of tabular data, a change has been made in the method of length measurement of the fish. All measurements prior to 1942 were made by tape. The method consisted in placing the tape over the side of the fish's body from the tip of the snout to the fork of the tail-fin. All measurements in the future will be made by placing the fish on a board on which is marked a linear scale and the distance from the tip of the snout to the fork of the tail-fin will be read on the board. The latter method thus gives a straight-line instead of an arched-line measurement.

In 1942, each collector took both measurements on approximately one hundred fish. Examination of the data showed that the average difference in the measurements was seven-tenths of an inch for the Skeena and Nass Rivers and eight-tenths of an inch for Rivers Inlet. Accordingly in the tables of average lengths, three sets of figures are given: (1) The average lengths for the previous period as obtained by the tape measurement; (2) the above lengths from which have been deducted the respective fractions; (3) the 1942 average lengths as obtained by the board measurement.

## 1. THE RIVERS INLET SOCKEYE RUN OF 1942.

### (1.) General Characteristics.

The pack of sockeye at Rivers Inlet in 1942 amounted to 79,199 cases and fell within the range of medium-size packs; that is, between 60,000 and 100,000 cases. The 1942 pack approached the average of the past thirty-five years; namely, 83,115 cases. The run of 1942 was composed of 91 per cent. of five-year-old fish and therefore derived from the spawning of 1937. This brood-year was particularly productive in that it also produced a large percentage of four-year-old fish in 1941.

The return in 1943 will be the result of spawnings in 1938 and 1939. In the former year the pack was 87,942 cases and the escapement was reported as good. Since this brood-year produced only 8 per cent. of four-year-old fish in 1942, a goodly return of five-year-old fish might be expected in 1943. However, sometimes a low four-year-old percentage is followed in the succeeding year by a low five-year-old percentage, indicating a year of poor reproduction. No reports are at hand to indicate adverse climatic conditions during the 1938–39 incubation period and there should therefore be a reasonable expectation for rather large numbers of five-year-old fish in 1943.

In 1939 the pack was 54,143 cases and the escapement was reported as at least an average one. The fisheries inspector referred to high-water conditions during the spawning period. In view of these facts it is possible that the production from the 1939 spawning will be relatively low.

### (2.) Age-groups.

The data for this year's study are obtained from 1,841 fish obtained in thirty-nine random samplings of the commercial catch from June 29th to August 7th. The $4_2$ age-group is represented by 153 individuals forming 8 per cent., the $5_2$ age-group by 1,672 individuals or 91 per cent., the $5_3$ by 4 fish and the $6_3$ by 12 fish or 1 per cent. In addition there is one $6_2$ individual not included in the tabulations or calculations.

The outstanding feature in the age-group distribution is the exceptionally high percentage of $5_2$'s. Only once in the past years of record has there been a comparable instance—namely, in 1920, when the percentage was 95. (Table I.)

### (3.) Lengths and Weights.

The average lengths of the males and females of the $4_2$ age-groups are 21.9 and 21.3 inches respectively and of the $5_2$ age-group 25.0 and 23.8 inches respectively. These are approximately equivalent to the averages of the past years of record. (Table IV.)

The average weights of the males and females of the $4_2$ age-group are 5.1 and 4.6 lb. respectively and for the $5_2$ age-group 7.2 and 6.4 lb. respectively. These are essentially equivalent to the averages of the past years of record. (Table V.)

The information concerning the distribution of lengths and weights in 1942 is given in Tables II. and III.

One male of the $6_2$ age-group occurs in the sampling. It is 27 inches in length and 8 lb. in weight.

### (4.) Distribution of the Sexes.

The total number of males in the samplings is 692 and of females 1,149, percentages of 38 and 62 respectively. While the percentage of females is very high, it is not exceptional, since the figure was exceeded in 1936 and in 1938. In the $4_2$ age-group the males predominate with a percentage of 61, while in the $5_2$ age-group the females predominate with a percentage of 65. This distribution of the sexes is characteristic of the Rivers Inlet sampling and may be related to gill-net selectivity, as pointed out in an earlier report. It is evident that the high total percentage of females is due to the predominance of the $5_2$ age-group. (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 | .... |
| 1942 (79,199 cases) | 8 | 91 | .... | 1 |

*Table II.—Rivers Inlet Sockeyes, 1942, grouped by Age, Sex, and Length, and by their Early History.*

| Length in Inches. | Number of Individuals. | | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|
| | $4_2$ | | $5_2$ | | $5_3$ | | $6_3$ | | |
| | M. | F. | M. | F. | M. | F. | M. | F. | |
| 19 | 2 | 1 | ..... | 1 | ..... | ..... | ..... | ..... | 4 |
| 19½ | 3 | 1 | ..... | 1 | ..... | ..... | ..... | ..... | 5 |
| 20 | 11 | 6 | ..... | ..... | ..... | ..... | ..... | ..... | 17 |
| 20½ | 6 | 10 | ..... | ..... | ..... | ..... | ..... | ..... | 16 |
| 21 | 9 | 12 | ..... | 3 | ..... | ..... | ..... | ..... | 24 |
| 21½ | 10 | 14 | ..... | 12 | ..... | ..... | ..... | ..... | 36 |
| 22 | 17 | 7 | 13 | 44 | ..... | 1 | ..... | ..... | 82 |
| 22½ | 4 | 5 | 22 | 69 | ..... | 1 | ..... | ..... | 101 |
| 23 | 16 | 1 | 31 | 131 | ..... | 1 | ..... | ..... | 180 |
| 23½ | 7 | 2 | 33 | 173 | 1 | ..... | ..... | ..... | 216 |
| 24 | 6 | 1 | 55 | 200 | ..... | ..... | ..... | 1 | 263 |
| 24½ | 2 | ..... | 71 | 215 | ..... | ..... | ..... | 1 | 289 |
| 25 | ..... | ..... | 83 | 131 | ..... | ..... | ..... | 1 | 215 |
| 25½ | ..... | ..... | 103 | 72 | ..... | ..... | 1 | 3 | 179 |
| 26 | ..... | ..... | 83 | 22 | ..... | ..... | 3 | 1 | 109 |
| 26½ | ..... | ..... | 59 | 3 | ..... | ..... | ..... | ..... | 62 |
| 27 | ..... | ..... | 26 | 1 | ..... | ..... | 1 | ..... | 28 |
| 27½ | ..... | ..... | 7 | 1 | ..... | ..... | ..... | ..... | 8 |
| 28 | ..... | ..... | 7 | ..... | ..... | ..... | ..... | ..... | 7 |
| Totals | 93 | 60 | 593 | 1,079 | 1 | 3 | 5 | 7 | 1,841 |
| Ave. lengths | 21.9 | 21.3 | 25.0 | 23.8 | 23.5 | 22.5 | 26.1 | 25.2 | ..... |

*Table III.—Rivers Inlet Sockeyes, 1942, 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. | |
| 2½ | ..... | ..... | ..... | 1 | ..... | ..... | ..... | ..... | 1 |
| 3 | 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1 |
| 3½ | 3 | 3 | ..... | 1 | ..... | ..... | ..... | ..... | 7 |
| 4 | 18 | 13 | ..... | 4 | ..... | ..... | ..... | ..... | 35 |
| 4½ | 11 | 22 | 5 | 34 | ..... | ..... | ..... | ..... | 72 |
| 5 | 23 | 16 | 19 | 87 | ..... | 1 | ..... | ..... | 146 |
| 5½ | 11 | 5 | 37 | 159 | ..... | 2 | ..... | ..... | 214 |
| 6 | 17 | ..... | 52 | 202 | 1 | ..... | ..... | ..... | 272 |
| 6½ | 5 | 1 | 76 | 211 | ..... | ..... | ..... | 1 | 294 |
| 7 | 3 | ..... | 77 | 195 | ..... | ..... | ..... | 2 | 277 |
| 7½ | 1 | ..... | 88 | 115 | ..... | ..... | 2 | ..... | 206 |
| 8 | ..... | ..... | 81 | 46 | ..... | ..... | 1 | 2 | 130 |
| 8½ | ..... | ..... | 64 | 14 | ..... | ..... | 1 | 2 | 81 |
| 9 | ..... | ..... | 51 | 9 | ..... | ..... | ..... | ..... | 60 |
| 9½ | ..... | ..... | 23 | 1 | ..... | ..... | ..... | ..... | 24 |
| 10 | ..... | ..... | 12 | ..... | ..... | ..... | 1 | ..... | 13 |
| 10½ | ..... | ..... | 6 | ..... | ..... | ..... | ..... | ..... | 6 |
| 11 | ..... | ..... | 2 | ..... | ..... | ..... | ..... | ..... | 2 |
| Totals | 93 | 60 | 593 | 1,079 | 1 | 3 | 5 | 7 | 1,841 |
| Ave. weights | 5.1 | 4.6 | 7.2 | 6.4 | 6 | 5.3 | 8.3 | 7.6 | ..... |

*Table IV.—Rivers Inlet Sockeyes, Average Lengths in Inches of the $4_2$ and $5_2$ Groups, 1912 to 1942.*

| Year. | $4_2$ | | $5_2$ | |
|---|---|---|---|---|
| | M. | F. | M. | F. |
| 1912–41 | 22.4 | 22.4 | 25.4 | 24.7 |
| 1912–41 (conversion) | 21.6 | 21.6 | 24.6 | 23.9 |
| 1942 | 21.9 | 21.3 | 25.0 | 23.8 |

*Table V.—Rivers Inlet Sockeyes, Average Weights in Pounds of the $4_2$ and $5_2$ Groups, 1914 to 1942.*

| Year. | $4_2$ | | $5_2$ | |
|---|---|---|---|---|
| | M. | F. | M. | F. |
| 1914–41 | 4.9 | 4.8 | 7.0 | 6.5 |
| 1942 | 5.1 | 4.6 | 7.2 | 6.4 |

*Table VI.—Rivers Inlet Sockeyes, Percentages of Males and Females, 1915 to 1942.*

| Year. | $4_2$ | | $5_2$ | | Per Cent. Total Males. | Per Cent. Total Females. |
|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | | |
| 1915–41 (average) | 63 | 37 | 34 | 66 | 50 | 50 |
| 1942 | 61 | 39 | 35 | 65 | 38 | 62 |

## 2. THE SKEENA RIVER SOCKEYE RUN OF 1942.

### (1.) General Characteristics.

The Skeena River sockeye salmon produced a pack of 34,544 cases and an escapement reported as especially good to Lakelse Lake and reasonably satisfactory to the Babine area. As stated previously the pack is the second lowest on record. Considering the pack and the escapement record, the run was probably all that could be expected from the spawnings of 1937 and 1938 under relatively uniform environmental conditions.

The return in 1943 will be the product of the 1938 and 1939 spawnings. In the former year the pack was 47,257 cases and the escapement was reported as very good. In the latter year the pack was 68,485 cases and the escapement stated as being exceptionally good. Unless unusually favourable conditions for reproduction prevailed, there would appear to be no grounds for expecting a very large return in 1943.

### (2.) Age-groups.

The length, weight, and sex data and scale collections were obtained from 1,393 fish in thirty-seven random samplings from June 29th to August 15th. The $4_2$ age-group is represented by 502 individuals or 36 per cent., the $5_2$ by 748 or 54 per cent.,

the $5_3$ by 106 or 7 per cent., and the $6_3$ by 37 or 3 per cent. (Table VII.). The percentage of five-year-old fish is thus fairly high but there is nothing exceptional in the distribution of the age-classes.

### (3.) Lengths and Weights.

The average lengths of the males and females in the $4_2$ age-group are 22.6 and 22.3 inches respectively and in the $5_2$ age-group 25.2 and 24.3 inches respectively. These lengths are essentially equivalent to the averages of the past years of record. On the other hand, the average lengths of the fish in the $5_3$ and $6_3$ age-groups are somewhat above the past years' averages. (Table X.)

The average weights of the males and females in the $4_2$ age-group are 4.9 and 4.7 lb. respectively and slightly below the average of the past years of record. Those of the five-year-old fish are approximately equivalent while those of the $6_3$ age-class are somewhat above the averages of the past years. (Table XI.)

A single individual of the $6_2$ age-group occurs in the samplings but has not been included in the tabulations or calculations. It is 27 inches in length and 8½ lb. in weight.

### (4.) Distribution of the Sexes.

The total number of males in the samplings is 461 and of females 932, percentages of 33 and 67 respectively. The percentage of females is the highest on record and continues the upward trend in number of females for the past eight years. The usual excess of females occurs in both the $4_2$ and $5_2$ age-classes, the percentages being 58 and 75 respectively. As in the case of Rivers Inlet the predominance of females is due to the large numbers of fish in the $5_2$ age-group.

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

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

*Table VIII.—Skeena River Sockeyes, 1942, 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 | 5 | 1 | ----- | ----- | ----- | ----- | ----- | ----- | 6 |
| 20½ | 7 | 2 | ----- | ----- | 2 | 1 | ----- | ----- | 12 |
| 21 | 10 | 26 | ----- | ----- | 2 | 1 | ----- | ----- | 39 |
| 21½ | 24 | 40 | ----- | ----- | 2 | 2 | ----- | ----- | 68 |
| 22 | 39 | 78 | ----- | 8 | 2 | 1 | ----- | ----- | 128 |
| 22½ | 26 | 68 | ----- | 14 | 2 | 6 | ----- | ----- | 116 |
| 23 | 27 | 54 | 4 | 53 | 4 | 9 | ----- | ----- | 151 |
| 23½ | 34 | 16 | 6 | 70 | 2 | 5 | ----- | 1 | 134 |
| 24 | 29 | 5 | 22 | 127 | 8 | 7 | ----- | 5 | 203 |
| 24½ | 3 | 3 | 22 | 120 | 7 | 10 | 1 | 4 | 170 |
| 25 | 5 | ----- | 43 | 109 | 10 | 8 | 3 | 6 | 184 |
| 25½ | ----- | ----- | 33 | 51 | 5 | 3 | 2 | 1 | 95 |
| 26 | ----- | ----- | 28 | 8 | 7 | ----- | 2 | 4 | 49 |
| 26½ | ----- | ----- | 17 | 3 | ----- | ----- | 1 | ----- | 21 |
| 27 | ----- | ----- | 8 | 1 | ----- | ----- | 4 | 1 | 14 |
| 27½ | ----- | ----- | 1 | ----- | ----- | ----- | ----- | ----- | 1 |
| 28 | ----- | ----- | ----- | ----- | ----- | ----- | 1 | ----- | 1 |
| 28½ | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 29 | ----- | ----- | ----- | ----- | ----- | ----- | 1 | ----- | 1 |
| Totals | 209 | 293 | 184 | 564 | 53 | 53 | 15 | 22 | 1,393 |
| Ave. lengths | 22.6 | 22.3 | 25.2 | 24.3 | 24.1 | 23.7 | 26.3 | 24.9 | ----- |

*Table IX.—Skeena River Sockeyes, 1942, 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 | 11 | 5 | ----- | ----- | 2 | 1 | ----- | ----- | 19 |
| 4 | 35 | 71 | ----- | 3 | 5 | 3 | ----- | ----- | 117 |
| 4½ | 42 | 84 | 1 | 24 | 1 | 3 | ----- | ----- | 155 |
| 5 | 45 | 98 | 9 | 81 | 4 | 14 | ----- | 1 | 252 |
| 5½ | 34 | 25 | 13 | 87 | 6 | 14 | ----- | 2 | 181 |
| 6 | 32 | 10 | 32 | 166 | 16 | 14 | 4 | 5 | 279 |
| 6½ | 8 | ----- | 36 | 93 | 8 | 4 | ----- | 6 | 155 |
| 7 | 2 | ----- | 44 | 87 | 10 | ----- | 4 | 3 | 150 |
| 7½ | ----- | ----- | 31 | 19 | 1 | ----- | 3 | 3 | 57 |
| 8 | ----- | ----- | 12 | 4 | ----- | ----- | 2 | 1 | 19 |
| 8½ | ----- | ----- | 3 | ----- | ----- | ----- | ----- | 1 | 4 |
| 9 | ----- | ----- | 3 | ----- | ----- | ----- | 2 | ----- | 5 |
| Totals | 209 | 293 | 184 | 564 | 53 | 53 | 15 | 22 | 1,393 |
| Ave. weights | 4.9 | 4.7 | 6.7 | 6.0 | 5.8 | 5.4 | 7.2 | 6.6 | ----- |

*Table X.—Skeena River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1942.*

| Year. | $4_2$ | | $5_2$ | | $5_3$ | | $6_3$ | |
|---|---|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | M. | F. | M. | F. |
| 1912–41 | 23.7 | 23.1 | 25.8 | 24.9 | 24.2 | 23.4 | 25.8 | 24.8 |
| 1912–41 (conversion) | 23.0 | 22.4 | 25.1 | 24.2 | 23.5 | 22.7 | 25.1 | 24.1 |
| 1942 | 22.6 | 22.3 | 25.2 | 24.3 | 24.1 | 23.7 | 26.3 | 24.9 |

*Table XI.—Skeena River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1942.*

| Year. | $4_2$ | | $5_2$ | | $5_3$ | | $6_3$ | |
|---|---|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | M. | F. | M. | F. |
| 1914–41 | 5.4 | 5.0 | 6.8 | 6.1 | 5.7 | 5.1 | 6.8 | 6.0 |
| 1942 | 4.9 | 4.7 | 6.7 | 6.0 | 5.8 | 5.4 | 7.2 | 6.6 |

*Table XII.—Skeena River Sockeyes, Percentages of Males and Females, 1915 to 1942.*

| Year. | $4_2$ | | $5_2$ | | Per Cent. Total Males. | Per Cent. Total Females. |
|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | | |
| 1915–41 (average) | 48 | 52 | 43 | 57 | 46 | 54 |
| 1942 | 42 | 58 | 25 | 75 | 33 | 67 |

## 3. THE NASS RIVER SOCKEYE RUN OF 1942.

### (1.) General Characteristics.

The run of sockeye salmon to the Nass River produced a pack of 21,085 cases and an escapement reported as very good. The pack was practically equal to the average of the packs of the past thirty years—namely, 21,936 cases.

The return in 1943 will be the product of the spawnings of 1938 and 1939. In the former year the pack was 21,462 cases and the escapement was recorded as large with a heavy seeding. In the latter year the pack consisted of 24,357 cases and the escapement was reported as very satisfactory, particularly heavy in the Meziadin Lake area. There would seem to be promise for a good return in 1943 but prediction is unsatisfactory for the Nass River.

### (2.) Age-groups.

The material for the 1942 study consists of data for 1,291 fish obtained in forty-five random samplings from June 30th to August 12th. The representation of the various age-classes is as follows: $4_2$, 281 fish or 22 per cent.; $5_2$, 86 fish or 7 per cent.; $5_3$, 858 fish or 66 per cent.; and $6_3$, 66 fish or 5 per cent. (Table XIII.). The $5_3$ age-group predominates as usual, with a percentage equal to that of the past thirty years. The distribution of the four age-groups in 1942 presents no unusual features.

### (3.) Lengths and Weights.

The average lengths of the males and females of the $4_2$ age-group is 23.9 and 23.2 inches respectively, which are very slightly greater than the averages of the past years of record. In the case of the $5_3$ age-group the average lengths are 24.9 and 24.3 inches respectively and somewhat less than the averages of the past years—namely, 25.4 and 24.6 inches. (Table XVI.)

The average weights of the males and females of all the age-groups are somewhat less than the averages of the past years of record. (Table XVII.)

### (4.) Proportions of the Sexes.

The total number of males in the samplings is 584 and of females 707, percentages of 45 and 55 respectively, and approximate the averages of the past twenty-seven years of record—namely, 47 and 53 per cent. The females slightly outnumber the males in the $4_2$, $5_2$, and $5_3$ age-groups, but the males predominate in the $6_3$ age-group. (Table XVIII.)

*Table XIII.—Nass River Sockeyes, Percentages of Principal Age-groups from 1912 to 1942 and Packs.*

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

*Table XIV.—Nass River Sockeyes, 1942, 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 | ----- | 2 | ----- | ----- | ----- | ----- | ----- | ----- | 2 |
| 21 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 21½ | ----- | 3 | ----- | ----- | ----- | ----- | ----- | ----- | 3 |
| 22 | 3 | 16 | ----- | ----- | 1 | 3 | ----- | ----- | 23 |
| 22½ | 8 | 26 | ----- | ----- | 4 | 14 | ----- | ----- | 52 |
| 23 | 13 | 43 | 1 | 2 | 18 | 40 | ----- | ----- | 117 |
| 23½ | 21 | 35 | ----- | 1 | 25 | 70 | ----- | ----- | 152 |
| 24 | 28 | 23 | ----- | 5 | 36 | 108 | ----- | 3 | 203 |
| 24½ | 19 | 9 | 5 | 12 | 76 | 100 | ----- | ----- | 221 |
| 25 | 17 | 4 | 6 | 11 | 92 | 92 | 1 | 2 | 225 |
| 25½ | 7 | 2 | 5 | 6 | 70 | 32 | 1 | 1 | 124 |
| 26 | 1 | ----- | 9 | 6 | 32 | 16 | 2 | 7 | 73 |
| 26½ | ----- | ----- | 6 | ----- | 18 | 2 | 16 | 1 | 43 |
| 27 | ----- | ----- | 4 | ----- | 6 | 2 | 16 | 4 | 32 |
| 27½ | ----- | ----- | 2 | 2 | 1 | ----- | 5 | 1 | 11 |
| 28 | ----- | ----- | 2 | ----- | ----- | ----- | 3 | 1 | 6 |
| 28½ | ----- | ----- | 1 | ----- | ----- | ----- | 1 | ----- | 2 |
| 29 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 29½ | ----- | ----- | ----- | ----- | ----- | ----- | 1 | ----- | 1 |
| Totals | 118 | 163 | 41 | 45 | 379 | 479 | 46 | 20 | 1,291 |
| Ave. lengths | 23.9 | 23.2 | 26.1 | 24.9 | 24.9 | 24.3 | 26.9 | 26.0 | ----- |

*Table XV.—Nass River Sockeyes, 1942, 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 | 3 | ----- | ----- | ----- | ----- | ----- | ----- | 4 |
| 4 | 3 | 16 | ----- | ----- | 2 | 5 | ----- | ----- | 26 |
| 4½ | 6 | 28 | ----- | 1 | 8 | 32 | ----- | ----- | 75 |
| 5 | 21 | 59 | 1 | 2 | 36 | 103 | ----- | ----- | 222 |
| 5½ | 23 | 32 | 2 | 4 | 44 | 137 | 1 | 2 | 245 |
| 6 | 31 | 18 | 5 | 22 | 119 | 149 | 1 | 4 | 349 |
| 6½ | 21 | 6 | 6 | 6 | 88 | 40 | 4 | 7 | 178 |
| 7 | 10 | 1 | 9 | 3 | 57 | 12 | 15 | 2 | 109 |
| 7½ | 2 | ----- | 7 | 6 | 18 | 1 | 6 | 4 | 44 |
| 8 | ----- | ----- | 7 | ----- | 6 | ----- | 13 | ----- | 26 |
| 8½ | ----- | ----- | 1 | ----- | 1 | ----- | 4 | 1 | 7 |
| 9 | ----- | ----- | 3 | ----- | ----- | ----- | 1 | ----- | 4 |
| 9½ | ----- | ----- | ----- | ----- | ----- | ----- | 1 | ----- | 1 |
| 10 | ----- | ----- | ----- | 1 | ----- | ----- | ----- | ----- | 1 |
| Totals | 118 | 163 | 41 | 45 | 379 | 479 | 46 | 20 | 1,291 |
| Ave. weights | 5.8 | 5.1 | 7.1 | 6.3 | 6.2 | 5.6 | 7.5 | 6.7 | ----- |

*Table XVI.—Nass River Sockeyes, Average Lengths in Inches of Principal Age-groups, 1912 to 1942.*

| Year. | $4_2$ | | $5_2$ | | $5_3$ | | $6_3$ | |
|---|---|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | M. | F. | M. | F. |
| 1912–41 | 24.5 | 23.7 | 26.3 | 25.2 | 26.1 | 25.3 | 27.7 | 26.4 |
| 1912–41 (conversion) | 23.8 | 23.0 | 25.6 | 24.5 | 25.4 | 24.6 | 27.0 | 25.7 |
| 1942 | 23.9 | 23.2 | 26.1 | 24.9 | 24.9 | 24.3 | 26.9 | 26.0 |

*Table XVII.—Nass River Sockeyes, Average Weights in Pounds of Principal Age-groups, 1914 to 1942.*

| Year. | $4_2$ | | $5_2$ | | $5_3$ | | $6_3$ | |
|---|---|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | M. | F. | M. | F. |
| 1914–41 | 6.0 | 5.4 | 7.3 | 6.4 | 6.9 | 6.2 | 8.0 | 7.0 |
| 1942 | 5.8 | 5.1 | 7.1 | 6.3 | 6.2 | 5.6 | 7.5 | 6.7 |

*Table XVIII.—Nass River Sockeyes, Percentages of Males and Females, 1915 to 1942.*

| Year. | $4_2$ | | $5_2$ | | $5_3$ | | $6_3$ | | Per Cent. Total Males. | Per Cent. Total Females. |
|---|---|---|---|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | M. | F. | M. | F. | | |
| 1915–41 (average) | 49 | 52 | 47 | 53 | 45 | 55 | 63 | 37 | 47 | 53 |
| 1942 | 42 | 58 | 48 | 52 | 44 | 56 | 70 | 30 | 45 | 55 |

# REPORT ON PILCHARD-TAG RECOVERY, 1942–43.

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

The recovery of pilchard-tags has been continued by the use of electromagnets installed in British Columbia reduction plants. This has been made possible through the active co-operation of the fishing companies which have allowed the installation of the magnets and of the reduction plant crews who have attended to the actual return of the tags.

Only fifteen tags were recovered. This small number is believed due to two causes: (1) A decrease in the efficiency of recovery and (2) the relatively small concentration of tags in the population. The small fish which were abundant in the fishery have been tagged less intensively than were the larger fish which predominated in the catch in former years, as the young fish have been liable to being tagged for fewer seasons and tagging operations have been curtailed somewhat in the years since they entered the fishery.

The sources and places of recovery of the tags dealt with in this report are shown in the following tabulation:—

| | Canada. | Washington. | Oregon. | California. | Total. |
|---|---|---|---|---|---|
| Canadian tags— | | | | | |
| 1939 tagging | 0 | 0 | 0 | 1* | 1 |
| 1940 tagging | 1† | 0 | 0 | 1 | 2 |
| Oregon tags | 5 | ---- | ---- | ---- | 5 |
| California tags | 7‡ | ---- | ---- | ---- | 7 |
| Totals | 13 | 0 | 0 | 2 | 15 |

* Hold over from 1941.

† Taken during the winter of 1942–43.

‡ Two taken during the winter of 1942–43, one taken at Butedale.

The presence of California tags in the winter fishery indicates that pilchards which had been in California attached themselves to (or constituted) the schools of fish which were wintering on the Canadian coast. Tags put out in Oregon were relatively much more abundant than in former years. The recovery by the Butedale plant of a California tag from pilchards caught at Aristazabal Island constitutes a northern recovery record for fish known to have been in California.

No tagging-work was carried out during 1942.

# TAGGING OF HERRING (*CLUPEA PALLASII*) IN BRITISH COLUMBIA: APPARATUS, INSERTIONS, AND RECOVERIES DURING 1942–43.

By Albert L. Tester, Ph.D., and R. V. Boughton, Ph.D.,
Pacific Biological Station, Nanaimo, B.C.

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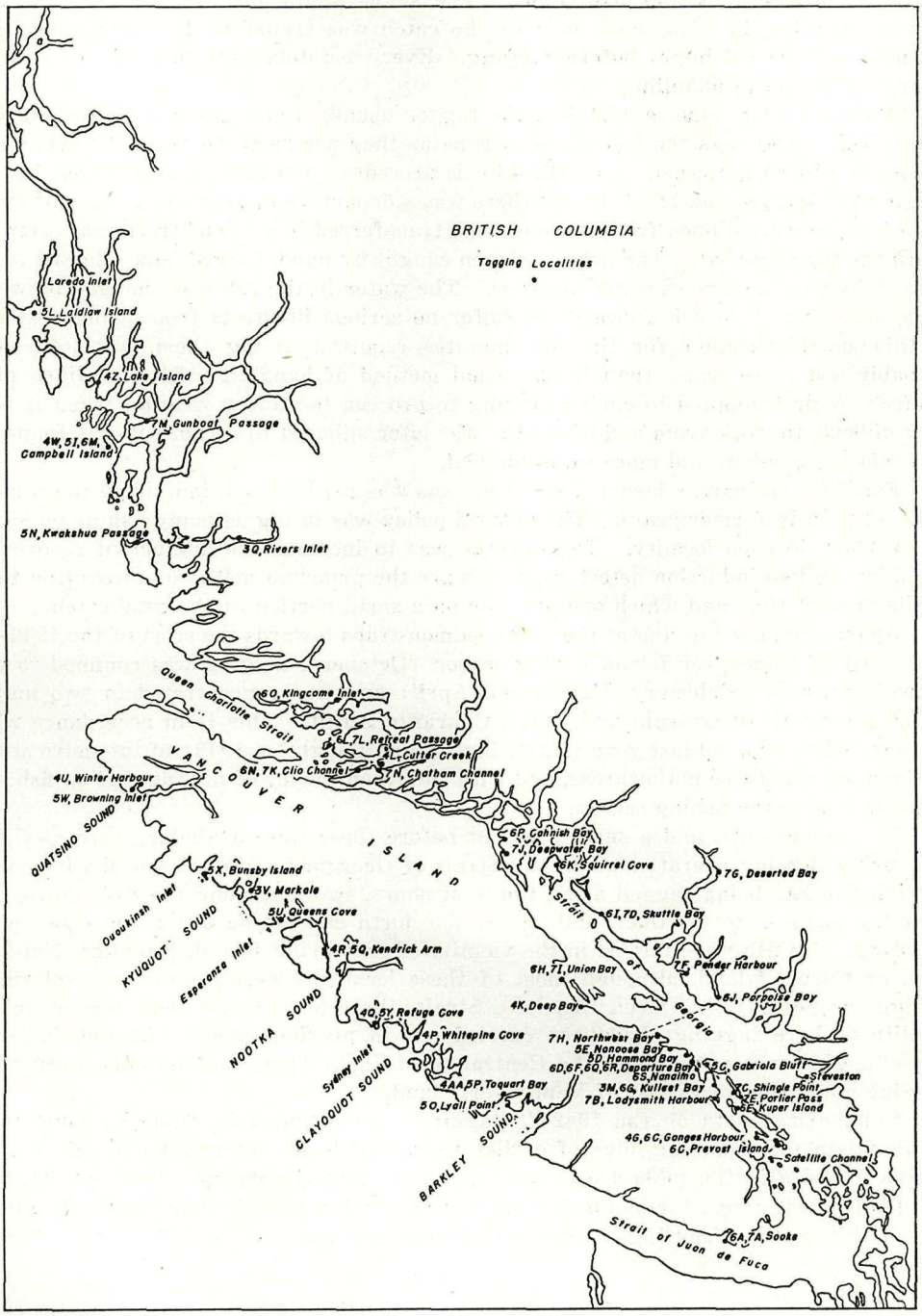
## INTRODUCTION.

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

For detailed information concerning the methods of tagging and recovery, the reader is referred to earlier reports in this series (Hart and Tester, 1937, 1938, 1939, and 1940; Hart, Tester, and McHugh, 1941; and Hart, Tester, and Boughton, 1942). The methods used in 1942–43 which are essentially similar to those used in earlier years, are briefly summarized in the following paragraphs.

## TAGGING.

As in previous years, nickel-plated iron "belly" tags, stamped with distinguishing numbers or letters, were used. These were inserted into the body-cavity of herring chiefly "by hand," using a special tagging-knife (Hart and Tester, 1937), or, in one case, using a "gun" (Hart and Tester, 1938).


BRITISH COLUMBIA
Tagging Localities
Laredo Inlet
5L, Laidlaw Island
4Z, Lake Island
7M, Gunboat Passage
4W, 5I, 6M, Campbell Island
5N, Kwakshua Passage
3Q, Rivers Inlet
Queen Charlotte Strait
6O, Kingcome Inlet
6L, 7L, Retreat Passage
4I, Cutter Creek
6N, 7K, Clio Channel
7N, Chatham Channel
4U, Winter Harbour
5W, Browning Inlet
QUATSINO SOUND
VANCOUVER ISLAND
6P, Cannish Bay
7J, Deepwater Bay
6K, Squirrel Cove
7G, Deserted Bay
5X, Bunsby Island
5V, Markale
5U, Queens Cove
Quaukinah Inlet
KYUQUOT SOUND
Esperanza Inlet
4R, 5Q, Kendrick Arm
NOOTKA SOUND
4Q, 5Y, Refuge Cove
4P, Whitepine Cove
Sydney Inlet
CLAYOQUOT SOUND
4AA, 5P, Toquart Bay
5O, Lyall Point
BARKLEY SOUND
Strait of Georgia
6I, 7D, Skuttle Bay
6H, 7I, Union Bay
4K, Deep Bay
7H, Northwest Bay
5E, Nanoose Bay
5D, Hammond Bay
6D, 6F, 6Q, 6R, Departure Bay
6S, Nanaimo
3M, 6G, Kulleet Bay
7B, Ladysmith Harbour
7F, Pender Harbour
5J, Porpoise Bay
5C, Gabriola Bluff
Steveston
7C, Shingle Point
7E, Porlier Pass
5F, Kuper Island
4G, 6C, Gonges Harbour
6C, Prevost Island
Satellite Channel
Strait of Juan de Fuca
6A, 7A, Sooke

Herring for tagging were obtained from a salmon-trap, from bait-pounds, and by means of shore-seines and bait-seines. The seine-caught fish were usually tagged immediately, but in some cases part of the catch was transferred to a live-box and retained for several hours before tagging. Every possible care was taken to avoid injury to the fish in handling.

When tagging seine-caught fish, the tagger usually works from a skiff alongside the cork-line, and tags the fish one at a time as they are removed from the seine and handed to him in a dip-net. In 1942–43 this procedure was used in most cases, but in tagging 7F, 7G, 7H, and 7I (Table I.) there was a departure in technique. Lots of from 50 to 100 fish were dipped from the seine and transferred to a tub of fresh sea-water on board the tagging-boat. The fish were then caught by hand, tagged, and released from the tub by two taggers working together. The water in the tub was changed between successive lots. The fish appeared to suffer no serious ill-effects from being confined in this small container for the few minutes required to tag them, although they probably lost more scales than in the usual method of handling. This modified procedure was first adopted to enable tagging to proceed in stormy weather when it was very difficult to work from a skiff, and it was later adhered to because it was found to be a more convenient and more rapid method.

For the most part, a larger number of tags was used in each individual tagging in 1942–43 than in former years. The general policy was to tag as many fish as possible, up to 3,000, in each locality. The purpose was to increase the number of recoveries made by the two induction detectors, which are the principal means of recovering tags at the present time and which operate only on a small portion of the total catch.

Apart from one tagging at the Sooke salmon-traps towards the start of the 1942–43 east coast of Vancouver Island fishing season (October), tagging was confined to the spawning season (February, March, and April) and was concentrated in two major areas, the Strait of Georgia and Queen Charlotte Strait. This is in accordance with the new policy adopted last year (Hart, Tester, and Boughton, 1942) of intensive study of the more accessible major areas, and with the recent policy of not tagging on fishing-grounds during the fishing season.

Two seine-boats, and a small gas-boat before these were available, were used for the spring tagging operations. In the Strait of Georgia tagging was moderately successful, five lots being tagged along the west shore, two lots along the east shore, one near the head of Jervis Inlet, and one at the north end of the strait above Seymour Narrows. No fish were tagged in the vicinity of Saltspring Island, Nanaimo, Nanoose Bay, or Cortes Island, although most of these localities were scouted several times during the period. In Queen Charlotte Strait, three lots of fish were tagged, all in localities where taggings had been carried out in previous years. In addition, one large tagging was made along the Central coast-line. There was no opportunity for tagging along the west coast of Vancouver Island.

Summarized data on the 1942–43 taggings are included in Table I., along with similar data for those taggings of earlier years which are referred to in this report. Places included in the table are shown on the accompanying map. Detailed data for the 1942–43 taggings, for use in identifying recoveries, are given in Table IX. at the end of this report, following the custom of former years.

*Table I.—Summary of the Tagging Data for Taggings producing Returns during the 1942–43 Fishing Season and for Tags inserted during the 1942–43 Fishing Season and the 1943 Spawning Season.*

| Tagging Code. | Date. | No. of Tags inserted. | Method of Capture of Fish.* | Tagging Method.† | Place of Tagging. |
|---|---|---|---|---|---|
| 3M | Mar. 9, 1939 | 997 | S.S. | G, K° | Kulleet Bay, near Ladysmith. |
| 3Q | Mar. 11, 1939 | 1,297 | B.S. | G, K° | Rivers Inlet Cannery. |
| 3V | Mar. 19, 1939 | 1,599 | B.S. | G, K′ | Off Markale, Kyuquot Sound. |
| 4G | Mar. 3, 1940 | 1,499 | B.S. | G, K′° | Ganges Harbour, Saltspring Island. |
| 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. |
| 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. |
| 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. |
| 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. |
| 5I | Mar. 17, 1941 | 1,488 | S.S. | G, K′ | Campbell Island, near Brown Narrows. |
| 5L | Mar. 28, 1941 | 1,697 | S.S. | G, K′ | Laidlaw Island, Laredo Sound. |
| 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. |
| 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. |
| 6C | Feb. 26, 1942 | 497 | B.S. | K′ | Ganges Harbour, Saltspring Island. |
| 6E | Mar. 6, 1942 | 993 | B.S. | K′ | East side Kuper Island. |
| 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. |
| 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. |
| 7A | Oct. 3, 1942 | 697 | S.T. | G | Sooke. |
| 7B | Feb. 25, 26, 1943 | 1,892 | B.S. | K′ | Ladysmith Harbour. |
| 7C | Mar. 1, 3, 1943 | 2,997 | B.S. | K′ | Shingle Point, Valdes Island. |
| 7D | Mar. 7, 8, 12, 13, 1943 | 2,495 | B.S. | K′ | Skuttle Bay, near Sliammon. |
| 7E | Mar. 16, 1943 | 2,004 | B.S. | K′ | Porlier Pass. |
| 7F | Mar. 27, 1943 | 2,500 | B.S. | K′ | Pender Harbour. |
| 7G | Mar. 29, 1943 | 2,989 | B.S. | K′ | Deserted Bay, Jervis Inlet. |
| 7H | Apr. 2, 1943 | 2,002 | B.S. | K′ | Northwest Bay. |
| 7I | Apr. 11, 1943 | 1,693 | B.S. | K′ | Union Bay, Baynes Sound. |
| 7J | Mar. 17, 18, 1943 | 2,989 | S.S. | K′ | Deepwater Bay. |
| 7K | Mar. 22, 1943 | 1,000 | B.P. | K′ | Bend Island, Clio Channel. |
| 7L | Mar. 28, 1943 | 1,099 | B.P. | K′ | Shoal Harbour, Retreat Passage. |
| 7M | Mar. 31, 1943 | 3,493 | B.S. | K′ | Gunboat Passage. |
| 7N | Apr. 5, 1943 | 2,978 | B.S. | K′ | Chatham Channel. |

* 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.

The following recapitulation shows the number of tags used in each area and year for the past five years of the investigation. Similar data for earlier years (1936–37 and 1937–38) are omitted (*see* Hart, Tester, and Boughton, 1942).

| Locality. | Number of Tags used in each Year. | | | | |
|---|---|---|---|---|---|
| | 1938–39. | 1939–40. | 1940–41. | 1941–42. | 1942–43. |
| *Fall and Winter.* | | | | | |
| Strait of Juan de Fuca | 1,454 | 897 | ..... | 496 | 697 |
| South-east coast of Vancouver Island | 2,525 | 495 | 1,197 | ..... | ..... |
| West coast of Vancouver Island | 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) | 6,587 | 9,077 | 4,947 | 15,559 | 21,561 |
| Queen Charlotte Strait and south to Nodales Channel | ..... | 3,796 | 200 | 5,465 | 5,077 |
| West coast of Vancouver Island | 5,947 | 8,437 | 9,759 | ..... | ..... |
| Central British Columbia | 3,489 | 2,497 | 5,877 | 1,497 | 3,493 |
| Northern British Columbia | 2,696 | 2,299 | 2,491 | ..... | ..... |
| Totals | 27,041 | 29,697 | 24,471 | 23,017 | 30,828 |

## RECOVERY METHODS.

As in previous years, tags were recovered mechanically by two methods, induction detectors and magnets. A third possible means of recovering tags, advertising in canneries where the fish are handled to some extent and where tags might be found by employees, was tried.

### Induction Detectors.

Two induction detectors were used throughout the 1942–43 fishing season, one at the Imperial Cannery and the other at the Gulf of Georgia Cannery, Steveston.

At the Imperial Cannery, the detector in operation last year was again used, but in a new position—i.e., it was moved from the unloading system formerly supplying both cannery and reduction plant to a new unloading system which supplied only the cannery. The general arrangement of the conveyers and the mechanical means of trapping the tagged fish were similar to those formerly used at Galiano Island (Hart and Tester, 1937) and at Ucluelet (Hart and Tester, 1938). The fish unloaded from the packers passed up a marine leg, along a pivoted overhead conveyer, down a sloping wooden chute and into a weighing-machine. In sliding down the chute, the fish passed through a "pick-up" detector coil and over a trap-door which was pivoted transversely at its centre on an axle, and was operated by a compressed-air piston, controlled electrically. When an impulse was transmitted from the detector coil, the trap-door momentarily opened to a position at right angles to the flow, allowing about a pailful of fish, including the tagged one, to fall to a bin below.

The substitution of an A.C. solonoid (Ross) air-valve and an A.C. latching relay for former D.C. equipment in the Imperial detector enabled the set to be run entirely on alternating current (*cf.* Hart and Tester, 1937). The Ross valve gave more positive action than the old D.C. valve but apparently created an electrical interference which was not eliminated during the course of the season and which caused the trap-door to operate more than once on each impulse, thus spilling more fish than necessary.

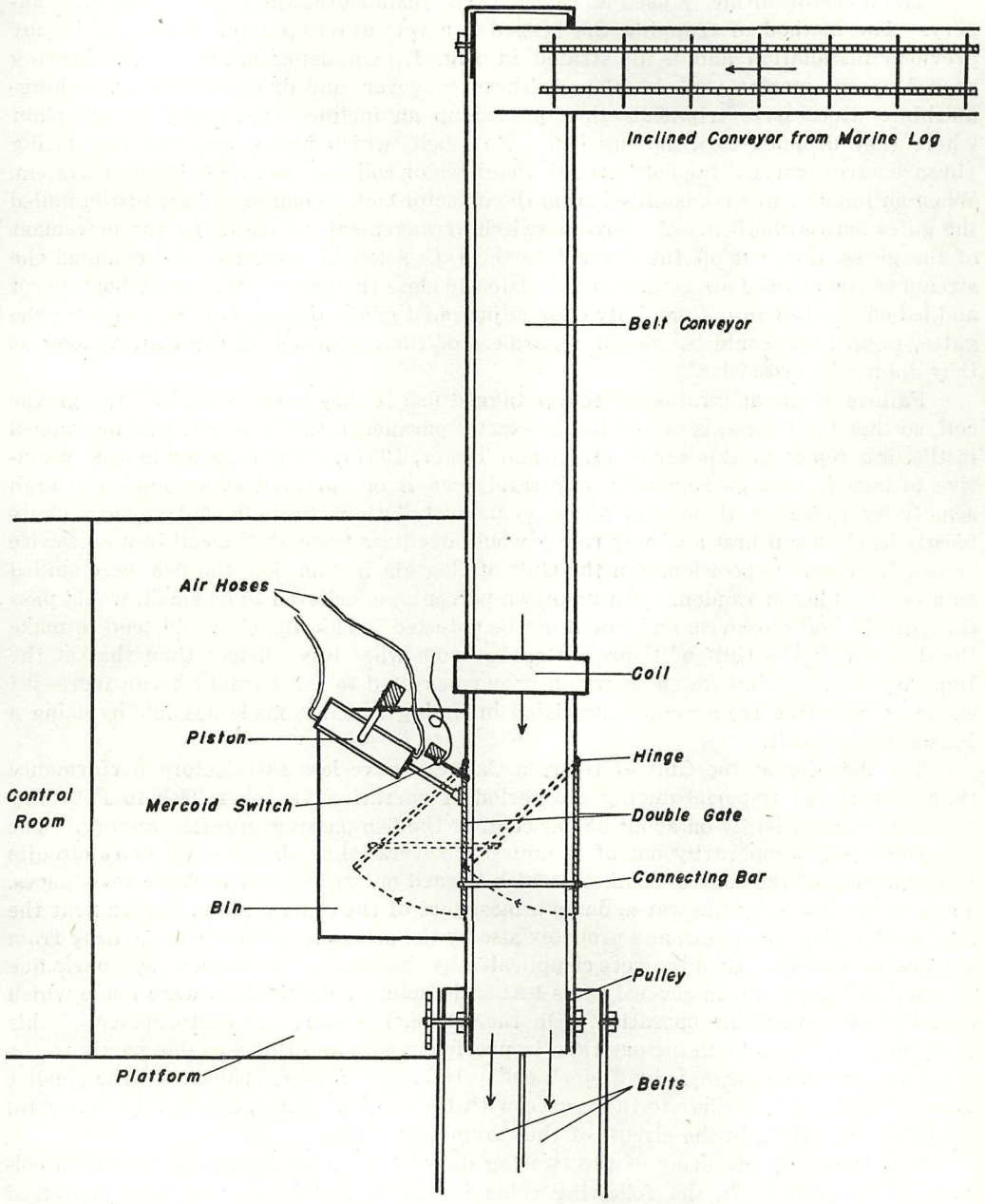



Fig. 1. Diagram of the induction detector trap system at the Gulf of Georgia Cannery.

The Imperial detector gave very satisfactory performance during the period of operation (October 23rd to February 2nd), apart from minor breakdowns, and operated efficiently on about 75 per cent. of the fish passing into the cannery.

The detector formerly used at Ucluelet was installed at the Gulf of Georgia Cannery. The method of trapping the tagged fish was different from that used in any previous installation and is illustrated in Fig. 1. On being unloaded, the herring passed up the marine leg, along an overhead conveyer, and dropped into a weighing-machine. Successive trip-loads then passed up an inclined conveyer into the plant where they dropped to a moving belt. This belt, which had a non-magnetic lacing (bronze wire), carried the fish through the detector coil and past a double gate system. When an impulse was transmitted from the detector coil, a compressed-air piston pulled the gates across the belt. A mercoid switch arrangement, activated by the movement of the gates, then cut off the current to the D.C. solonoid air-valve, and changed the stream of compressed air acting on the piston to close the gates. Fish were both swept and led off the belt into a bin. By close adjustment of the distance of the coil from the gates, tagged fish could be caught regardless of their position on the belt, as long as they did not lie crosswise.

Failure of the apparatus to recover tagged fish if they pass crosswise through the coil, so that the long axis of the tag is exactly parallel to the coil face, was mentioned in the first report of this series (Hart and Tester, 1937). The detector is least sensitive to tags in this position and only rarely can it be operated at a sufficiently high sensitivity to detect them. In all previous installations the fish slid down a chute mostly head or tail first and only rarely would one pass through the coil in a crosswise or nearly crosswise position. In the Gulf of Georgia installation, the fish were spilled on a belt and lay at random. An unknown percentage, believed to be small, would pass through the coil crosswise and would not be detected. This factor would tend to make the detector at the Gulf of Georgia Cannery somewhat less efficient than that at the Imperial Cannery, but its effect would be compensated to some extent by an increased efficiency resulting from greater precision in timing which is made possible by using a constant-speed belt.

The detector at the Gulf of Georgia Cannery gave less satisfactory performance than that at the Imperial during the period of operation (October 28th to February 3rd) and ran efficiently on about 65 per cent. of the fish passing into the cannery. The apparatus was temporarily out of commission several times because of short circuits in the wiring of the control-cabinets, which burned out relays and variable resistances. These were caused by the warm, damp atmosphere of the control-room, located near the roof of the reduction plant, and probably also by the action of ammonia emanating from a near-by offal-bin. Repairs were complicated by the shortage of replacement parts due to war conditions and in several cases less satisfactory substitutions were made which contributed to unstable operation. On the whole, however, the performance of this equipment was more satisfactory than in previous years and this was due partly to the replacement of the large 7- by 21-inch coils (Hart and Tester, 1938) with the smaller 7- by 16-inch coils, similar to those used with the other detector, and partly to several minor modifications in the circuit of the "amplifier" unit.

The operating efficiency of the two tag detectors can be compared from data collected in 1942–43. In the following table is shown the number of tags recovered per hundred tons of fish examined "efficiently" from each fishing-ground by each detector:—

| Fishing-ground. | Imperial Detector. | Gulf of Georgia Detector. |
|---|---|---|
| Satellite Channel | 0.66 | 0.53 |
| Nanoose Bay | 0.30 | 0.20 |
| Deep Bay | 0.45 | 0.30 |
| Deepwater Bay | 0.66 | 0.29 |

The Imperial detector consistently recovered more tags per hundred tons of fish than the Gulf of Georgia detector; on the average (weighted to the number of tons caught in each locality) its operating efficiency was 1.4 times as great. The lower efficiency of the Gulf of Georgia detector is believed due partly to fish passing crosswise through the coil but mostly to a lower average sensitivity during periods of unstable performance, factors which have already been discussed.

### Magnets.

Electromagnets already installed in the meal-lines of reduction plants were again instrumental in recovering tags. A new installation was made in the offal-reduction plant of the Gulf of Georgia Cannery. The Tuck Inlet magnet was removed when the reduction plant was dismantled. That at Kildonan failed to give satisfactory service throughout the season in a new installation made necessary by plant renovations. This condition has since been remedied.

As pointed out in all previous reports, magnets are less satisfactory than induction detectors because of the uncertainty regarding the fishing locality from which the fish bearing the tag originated. Recoveries from cracks and crevices in the plant machinery, from traps for tramp metal, and from other sources where doubt surrounds the origin of the tag are included as magnet returns.

A good example of the possibility for error in interpreting returns from these sources occurred among the 1942–43 recoveries. Several tags were found in the machinery of one reduction plant during cleaning up operations at the close of the season. Presumably these had originated with fish run through the plant in 1942–43. However, one (H96934) was a test tag which had been used to test the efficiency of the magnet on February 4th, 1940. It was thus returned three years after it had been planted in a fish and thrown into the conveyer.

The reduced opportunity for recovering tags on magnets in reduction plants because of extensive canning operations still pertained in 1942–43 (Hart, Tester, and Boughton, 1942).

### Reward Placards.

Following a suggestion made in the report for last year, placards offering a reward for tags and describing places in which they might be found were distributed to all canneries and reduction plants.

In the case of canneries it was hoped that tags which might fall out of the body-cavity of the fish in the heading-machines or on the packing-tables might be found by cannery-workers. No returns resulted. Although several tags which were found when preparing herring for the table and for bait were sent in, none of these returns could be directly attributed to the result of placard advertising. It would seem that the chances of tags being found in canneries are very small. Possibly some success might result from displaying the placards in kippering-houses where the fish are handled individually.

The reward placards were also exhibited in reduction plants and there they probably stimulated the search for tags on magnets and in the plant machinery.

## RECOVERIES.

Qualifications which must be considered in interpreting the recoveries and in drawing conclusions regarding the populations involved have already been discussed fully (Hart, Tester, and McHugh, 1941) and summarized (Hart, Tester, and Boughton, 1942).

### Induction Detectors.

The results of tag-recoveries by the two detectors are summarized in Table II. Seventy-seven tagged fish were taken, fifty-five by the Imperial and twenty-two by the

Gulf of Georgia detector. Of these, sixty-two had been out for more than six months and fifteen had been out for a comparatively short period.

Of the 7A tags used at Sooke on October 3rd, 1942, eleven were recovered at Satellite Channel, three at Nanoose Bay, and one at Deep Bay. These confirm the results of previous years in showing a movement of herring from the Strait of Juan de Fuca to various fishing-grounds along the south-east coast of Vancouver Island, and extend the known range of this movement from Nanoose Bay, as observed last year, to Deep Bay, some 30 nautical miles to the north-west. A consideration of the number of 7A recoveries per hundred tons of fish effectively operated on by the detectors (Satellite Channel, 0.15; Nanoose Bay, 0.06; and Deep Bay, 0.03), and the times at which the recoveries were made, suggests a gradual dispersal of these tagged fish rather than a mass movement from one fishing-ground to another.

*Table II.—Tags recovered by Induction Detectors during 1942–43.*

| Code. | Place and Month of Tagging. | Place of Capture. | | | | Total. |
|---|---|---|---|---|---|---|
| | | Satellite Channel. | Nanoose Bay. | Deep Bay. | Deepwater Bay. | |
| 4U | Winter Harbour, March, 1940 | 1 | ---- | ---- | ---- | 1 |
| 5P | Toquart Bay, March, 1941 | 1 | ---- | ---- | ---- | 1 |
| 7A | Sooke, October, 1942 | 11 | 3 | 1 | ---- | 15 |
| 6A | Sooke, October, 1941 | 1 | ---- | ---- | ---- | 1 |
| 6C | Ganges Harbour, February, 1942 | 2 | 1 | 1 | ---- | 4 |
| 6E | Kuper Island, March, 1942 | 9 | 4 | ---- | ---- | 13 |
| 3M | Kulleet Bay, March, 1939 | 1 | ---- | ---- | ---- | 1 |
| 6G | Kulleet Bay, March, 1942 | 12 | 1 | ---- | ---- | 13 |
| 5C | Gabriola Bluff, March, 1941 | 1 | ---- | ---- | ---- | 1 |
| 6F | Departure Bay, March, 1942 | 1 | ---- | 1 | ---- | 2 |
| 6Q | Departure Bay, April, 1942 | 1 | ---- | ---- | ---- | 1 |
| 5D | Hammond Bay, March, 1941 | 1 | ---- | ---- | ---- | 1 |
| 5E | Nanoose Bay, March, 1941 | 3 | ---- | ---- | ---- | 3 |
| 6H | Baynes Sound, March, 1942 | ---- | 1 | ---- | ---- | 1 |
| 6I | Skuttle Bay, March, 1942 | 1 | 1 | 4 | ---- | 6 |
| 6K | Squirrel Cove, March, 1942 | ---- | ---- | 2 | 1 | 3 |
| 6P | Cahnish Bay, April, 1942 | ---- | 2 | 2 | 1 | 5 |
| 4L | Cutter Creek, March, 1940 | ---- | ---- | 1 | ---- | 1 |
| 6N | Clio Channel, March, 1942 | ---- | ---- | 2 | 1 | 3 |
| 6O | Kingcome Inlet, March, 1942 | ---- | ---- | ---- | 1 | 1 |
| | Totals | 46 | 13 | 14 | 4 | 77 |

Of the sixty-two tags out for more than six months, fifty-five (89 per cent.) were originally used in the same general area in which they were recovered—i.e., the Strait of Georgia (including the southern part of Discovery Passage)—and seven (11 per cent.) were from "outside" areas. Of the latter, two were from the west coast of Vancouver Island and showed some influx of Quatsino Sound fish (4U) and Barkley Sound fish (5P) to Satellite Channel in the southern part of the strait. Five were from Queen Charlotte Strait and showed some influx of fish from various localities in this area (Cutter Creek, 4L; Clio Channel, 6N; and Kingcome Inlet, 6O) to Deep Bay and Deepwater Bay in the northern part of the Strait of Georgia.

Considering only the tags out for at least six months which were both used and recovered in the Strait of Georgia, there is some evidence of partial segregation of the populations fished along the east coast of Vancouver Island. The following table shows the number of recoveries from each fishing-ground and the percentage originally used in the southern part (Sooke to Nanoose Bay) and the northern part of the Strait of

Georgia (north of Nanoose Bay to Discovery Passage, including the east shore of the strait) :—

| Fishing-ground. | Number of Recoveries. | Per Cent. Recoveries. | |
|---|---|---|---|
| | | Southern. | Northern. |
| Satellite Channel | 33 | 97 | 3 |
| Nanoose Bay | 10 | 60 | 40 |
| Deep Bay | 10 | 20 | 80 |
| Deepwater Bay | 2 | — | 100 |

These results suggest that fish which spawn in the southern part of the strait are more likely to be caught on southern fishing-grounds and fish which spawn in the northern part are more likely to be caught on northern fishing-grounds. It might be pointed out that recoveries of current Sooke tags (7A) indicate that the majority, if not all, of the fish supplying the southern fishing-grounds entered the strait by way of the Strait of Juan de Fuca. Those supplying the northern fishing-grounds may have come either from Discovery Passage or from the Strait of Juan de Fuca. The recovery of one 7A tag at Deep Bay shows that some at least followed the latter route, whereas the recovery of Queen Charlotte Strait tags (4L, 6N, 6O) at both Deep Bay and Deepwater Bay, and not at either Nanoose Bay or Satellite Channel, suggests that others may have come by way of Discovery Passage; although there are other possible explanations that might be advanced.

From data on hand it is possible to make an approximate calculation of the percentage recovery of tags which were used originally in the Strait of Georgia during the 1942 spawning season (" 6 " series) and which were recovered from the Strait of Georgia fishing-grounds during the 1942–43 fishing season. For each tagging, the following procedure was used: (1) Determine the number of tags recovered from each fishing-ground by the two detectors, multiplying those for the Gulf of Georgia detector by 1.4 to correct for its lower operating efficiency (page 51); (2) multiply each of these figures by the tonnage of fish caught on the particular fishing-ground (Satellite Channel, 20,497; Nanoose Bay, 23,411; Deep Bay, 7,760; Deepwater Bay, 3,084) and divide by the tonnage of fish " efficiently " examined for tags by the two detectors (Satellite Channel, 7,356; Nanoose Bay, 5,024; Deep Bay, 3,688; Deepwater Bay, 798); (3) express the sum of the recoveries from the various fishing-grounds as a percentage of the number of tags originally used. The absolute accuracy of these calculations depends on the assumptions, believed to be approximately correct, that the Imperial detector is 100 per cent. efficient at recovering tags, that the recoveries from each fishing-ground were distributed in the total catch in the same proportion as in the part of the catch operated on by the two detectors, and that each of the detectors operated on a similar proportion of the catch from each fishing-ground. The results are shown in Table III.

Considerable variation in percentage recovery was found. Three of the four taggings, made fairly close to the Satellite Channel fishing-grounds (6C, 6E, and 6G), yielded the highest percentage recoveries but no returns resulted from the fourth (6B). The 6B and 6C taggings (Prevost Island and Ganges Harbour) were separated in time by only a week (February 19th and 26th) and in distance by only 3 nautical miles, yet this difference in the returns resulted. Previous taggings at Ganges Harbour (2N and 4G) have been singularly unproductive in former years. The average recovery from the four 1942 taggings in this southern area was 3 per cent.

*Table III.—Calculation of Percentage Recovery for Tags used in the Strait of Georgia during the Spring of 1942 and recovered from Satellite Channel (A), Nanoose Bay (B), Deep Bay (C), and Deepwater Bay (D).*

(For explanation *see* text.)

| Code. | Place and Date of Tagging, 1942. | Number of Detector Recoveries from Fishing-grounds at | | | | | Calculated Total Number of Recoveries from Fishing-grounds at | | | | | Number of Tags used. | Percentage Recovery. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A. | B. | C. | D. | Total. | A. | B. | C. | D. | Total. | | |
| 6B | Prevost Island, February 19 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 997 | ..... |
| 6C | Ganges Harbour, February 26 | 2.8 | 1.4 | 1.0 | ..... | 5.2 | 7.8 | 6.5 | 2.1 | ..... | 16.4 | 497 | 3.3 |
| 6E | Kuper Island, March 6 | 10.2 | 4.0 | ..... | ..... | 14.2 | 27.9 | 18.6 | ..... | ..... | 46.5 | 993 | 4.7 |
| 6G | Kulleet Bay, March 9 | 13.2 | 1.0 | ..... | ..... | 14.2 | 36.8 | 4.7 | ..... | ..... | 41.5 | 1,000 | 4.2 |
| 6D | Departure Bay, March 2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 500 | ..... |
| 6F | Departure Bay, March 7 | 1.0 | ..... | 1.4 | ..... | 2.4 | 2.8 | ..... | 2.1 | ..... | 4.9 | 1,004 | 0.5 |
| 6Q | Departure Bay, April 24 | 1.0 | ..... | ..... | ..... | 1.0 | 2.8 | ..... | ..... | ..... | 2.8 | 1,005 | 0.3 |
| 6R | Departure Bay, May 2 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 698 | ..... |
| 6S | Nanaimo Harbour, June 3, 4 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 800 | ..... |
| 6H | Union Bay, March 9 | ..... | 1.0 | ..... | ..... | 1.0 | ..... | 4.7 | ..... | ..... | 4.7 | 2,000 | 0.2 |
| 6I | Skuttle Bay, March 10 | 1.4 | 1.4 | 4.8 | ..... | 7.6 | 3.9 | 6.5 | 10.1 | ..... | 20.5 | 1,489 | 1.4 |
| 6K | Squirrel Cove, March 27 | ..... | ..... | 2.0 | 1.4 | 3.4 | ..... | ..... | 4.2 | 5.4 | 9.6 | 1,499 | 0.6 |
| 6P | Cahnish Bay, April 21, 22 | ..... | 2.8 | 2.0 | 1.0 | 5.8 | ..... | 13.0 | 4.2 | 3.9 | 21.1 | 1,498 | 1.4 |
| 6J | Porpoise Bay, March 12 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1,579 | ..... |

Returns from the taggings made between Nanaimo Harbour and Union Bay (6D, 6F, 6Q, 6R, 6S, and 6H) were very meagre, averaging but 0.2 per cent. (Table III.). Three of the taggings (6D, 6R, and 6S) failed to produce any recoveries on either the tag detectors, or, as will be noted later, on magnets. In contrast, taggings made in this area in previous years have produced substantial returns. The reason for the low percentage recovery in 1942–43 is most probably related to the unusual mortality of herring which took place mostly between Dodd Narrows and Deep Bay, but which may have extended to Union Bay, during March and April of 1942 (Hart, Tester, and Boughton, 1942; Tester, 1942). Although a positive statement cannot be made on one year's recoveries, the results indicate that most of the fish tagged during the period of mortality (6D, 6F, and 6H) and also during the period of " recovery " when the fish were in a peculiar lethargic condition (6Q, 6R, and 6S) died, presumably along with a fair percentage of the spawning population. It is interesting to note that in spite of the mortality there was a high availability and a good catch of herring at both Nanoose Bay and Deep Bay, fishing-grounds which would be expected to be most directly affected. Table III. shows that the former received substantial contributions from other spawning-grounds chiefly in the southern part, and the latter received substantial contributions from other spawning-grounds chiefly in the northern part of the strait. However, these known contributions would not necessarily account entirely for the excellent fishing.

The average recovery from taggings in the extreme northern part of the strait (6I, 6K, and 6P), 1.1 per cent., was greater than that in localities from Nanaimo to Union Bay but less than that in localities south of Dodd Narrows. The most logical explanation is that the groups of fish tagged in the northern part of the strait were not as intensively fished as those in the last-mentioned locality.

No returns were received from the tagging at Porpoise Bay, Seechelt Inlet (6J). This was not unexpected as the fish tagged were the small, slow-growing type typical of the mainland inlets and, as such, would be classed as a local population. Evidently they did not contribute to the populations which supply the main fishing-grounds of the Strait of Georgia.

Calculations similar to those in Table III. for tags inserted in the Strait of Georgia during the spring of 1941 at Gabriola Bluff (5C), Hammond Bay (5D), Nanoose Bay (5E), Breakwater Island (5F), and Bargain Harbour (5G) can be made. Only three of these taggings produced returns (5C, 5D, and 5E) and all of these came from Satellite Channel. The average percentage recovery was 0.33 per cent.

*Table IV.—Tags from each Tagging recovered by each Plant making Magnet Recoveries during the 1942–43 Season.*

| Code. | Locality and Month of Tagging. | Plant making Recovery. (*See* foot-note for fish processed.) | | | | | | | Total. |
|---|---|---|---|---|---|---|---|---|---|
| | | Ucluelet. | Nootka. | Ceepeecee. | Imperial. | Namu. | Butedale. | Miscellaneous. | |
| 4AA | Barkley Sound, March, 1940 | .... | 1 | .... | .... | .... | .... | .... | 1 |
| 5O | Barkley Sound, March, 1941 | 1 | 2 | 1 | .... | .... | .... | .... | 4 |
| 5P | Barkley Sound, March, 1941 | 1 | 1 | 1 | .... | .... | .... | .... | 3 |
| 4P | Whitepine Cove, March, 1940 | .... | .... | 2 | .... | .... | .... | .... | 2 |
| 4Q | Refuge Cove, March, 1940 | .... | 1 | 1 | .... | .... | .... | .... | 2 |
| 5Y | Refuge Cove, March, 1941 | .... | 1 | 1 | .... | .... | .... | .... | 2 |
| 4R | Nootka Sound, March, 1940 | .... | 3 | 2 | .... | .... | .... | .... | 5 |
| 5Q | Nootka Sound, March, 1941 | .... | 9 | 4 | .... | .... | .... | .... | 13 |
| 5U | Esperanza Inlet, March, 1941 | .... | 2 | 2 | .... | .... | .... | .... | 4 |
| 3V | Kyuquot Sound, March, 1939 | .... | .... | 1 | .... | .... | .... | .... | 1 |
| 5X | Bunsby Islands, March, 1941 | 5 | 16 | 17 | .... | .... | .... | .... | 38 |
| 4U | Quatsino Sound, March, 1940 | .... | 9 | 10 | .... | 1 | 3 | .... | 23 |
| 5W | Quatsino Sound, March, 1941 | 2 | 17 | 11 | .... | 1 | 2 | .... | 33 |
| 4G | Ganges Harbour, March, 1940 | .... | .... | .... | 1 | .... | .... | .... | 1 |
| 6C | Ganges Harbour, February, 1942 | 1 | .... | .... | .... | .... | .... | .... | 1 |
| 6E | Kuper Island, March, 1942 | 1 | .... | .... | 3 | .... | .... | .... | 4 |
| 6G | Kulleet Bay, March, 1942 | 1 | .... | .... | 1 | .... | .... | .... | 2 |
| 7A | Sooke, October, 1942 | 2 | .... | .... | 1 | .... | .... | 1 | 4 |
| 5D | Hammond Bay, March, 1941 | 1 | .... | .... | 1 | .... | .... | .... | 2 |
| 5E | Nanoose Bay, March, 1941 | 1 | .... | .... | .... | .... | .... | .... | 1 |
| 4K | Deep Bay, March, 1940 | .... | 1 | .... | .... | .... | .... | .... | 1 |
| 6I | Skuttle Bay, March, 1942 | 1 | .... | .... | 2 | .... | .... | .... | 3 |
| 6K | Squirrel Cove, March, 1942 | .... | .... | .... | 1 | 1 | .... | .... | 2 |
| 6P | Cahnish Bay, April, 1942 | .... | .... | .... | 4 | .... | .... | .... | 4 |
| 6L | Retreat Passage, March, 1942 | .... | .... | .... | .... | 1 | .... | .... | 1 |
| 6N | Clio Channel, March, 1942 | .... | .... | 1 | 3 | 2 | 1 | 1 | 8 |
| 6O | Kingcome Inlet, March, 1942 | .... | .... | .... | 6 | 1 | .... | 2 | 9 |
| 3Q | Rivers Inlet, March, 1939 | .... | .... | .... | .... | 1 | .... | .... | 1 |
| 4W | Campbell Island, March, 1940 | .... | .... | 1 | .... | .... | .... | .... | 1 |
| 4Z | Lake Island, March, 1940 | .... | .... | .... | 1 | .... | .... | .... | 1 |
| 5I | Campbell Island, March, 1941 | .... | .... | .... | .... | 1 | .... | .... | 1 |
| 5L | Laidlaw Island, March, 1941 | .... | .... | .... | .... | .... | 2 | .... | 2 |
| 5N | Kwakshua Passage, March, 1941 | .... | .... | 1 | .... | .... | .... | .... | 1 |
| 6M | Campbell Island, March, 1942 | .... | 1 | 3 | .... | 3 | 1 | 1 | 9 |
| | Totals | 17 | 64 | 59 | 24 | 12 | 9 | 5 | 190 |

Ucluelet: East coast of Vancouver Island, Clayoquot Sound, Barkley Sound, Kyuquot Sound, Quatsino Sound, Nootka Sound.

Nootka: Kyuquot Sound, Nootka Sound, Quatsino Sound, Clayoquot Sound.

Ceepeecee: Kyuquot Sound (including Ououkinsh Inlet and Malksope Inlet), Quatsino Sound, Nootka Sound and Esperanza Inlet, Clayoquot Sound, east coast of Vancouver Island.

Imperial: East coast of Vancouver Island (Satellite Channel, Nanoose Bay, Deep Bay), Queen Charlotte Strait (Clio Channel and Knight Inlet), Deepwater Bay.

Namu: Rivers Inlet, Laredo Inlet, Queen Charlotte Strait (mostly Knight Inlet), localities in Central area, Quatsino Sound, Queen Charlotte Islands.

Butedale: East coast of Vancouver Island (including Deepwater Bay), Laredo Inlet, Quatsino Sound, Queen Charlotte Strait.

## Magnets.

As shown in Table IV., magnets or comparable methods of recovery in six reduction plants resulted in the return of 185 tags. In this table have also been included five tags recovered from miscellaneous sources (preparing fish for table use, etc.), to

make a total of 190 recoveries. The number recovered from reduction plants is less than that of last year (399) for several known reasons: (1) Failure in the operation of the Kildonan magnet, (2) no taggings were made on the west coast of Vancouver Island in the spring of 1942, and (3) no fish were caught along the northern coast-line. Large-scale canning operations reduced the opportunity for recovering tags, and small catches along the central coast-line also lowered the recoveries in both 1941–42 and 1942–43.

It is evident from Table IV. that in most cases the majority of the tags recovered by each reduction plant were inserted in the same general area as that from which the majority of the fish passing through the plant were caught. The best example is that of the two west coast of Vancouver Island reduction plants, Nootka and Ceepeecee, the former of which operated entirely and the latter almost entirely on west coast of Vancouver Island fish. In the former 98 per cent. and in the latter 90 per cent. of the recoveries resulted from taggings made on the west coast of Vancouver Island.

As in past years, each return listed in Table IV. has been considered individually in relation to the daily deliveries of fish to the plant and the behaviour of the magnet in recovering tags. An attempt has been made to present an unbiased interpretation of the probable origin of each tag. In some cases the fishing-ground from which the tag originated can be stated with certainty, in others with a fair degree of certainty; whereas in still others, where several alternative fishing-grounds are equally possible, no interpretation is offered. A discussion of the returns from each individual tagging is included in the following paragraphs and the results are presented in Table V. Contrary to the custom of past years, only "magnet" returns, as listed in Table IV., are included in the discussion.

Rivers Inlet (3Q): One recovery reported, probably correctly, from fish caught at Rivers Inlet. Laredo Inlet and Meyers Passage, other localities in the Central area, Quatsino Sound, Queen Charlotte Islands, and localities in the Queen Charlotte Strait area are possible but unlikely sources of this tag.

Kyuquot Sound (3V): One recovery reported, probably correctly, from Ououkinsh Inlet. The east coast of Vancouver Island and Sydney Inlet are possible alternatives.

Ganges Harbour (4G): One recovery reported, probably correctly, from Deepwater Bay. A likely possible alternative is Deep Bay, and less likely alternatives are other east coast of Vancouver Island and Queen Charlotte Strait localities.

Deep Bay (4K): One recovery correctly reported from Ououkinsh Inlet.

Whitepine Cove (4P): Two tags recovered which may have originated in any west coast of Vancouver Island locality except Barkley Sound, or, less likely, the east coast of Vancouver Island. These were found in plant machinery at the close of the season.

Refuge Cove (4Q): Two tags recovered. It is certain that one of these originated with fish from Ououkinsh Inlet. The other was reported from Quatsino Sound, but, according to the records of the plant making the return, it is equally likely to have come from the Nootka Sound area, with the Kyuquot Sound and east coast of Vancouver Island areas as less likely possibilities. However, from other evidence, the tag is considered to have probably originated from Nootka Sound rather than from Quatsino Sound. Two plants which operated on Quatsino Sound fish, but not on fish from any other locality on the west coast of Vancouver Island, recovered Quatsino Sound tags, but none from any other west coast locality. This evidence will be used and referred to in discussions which follow.

Kendrick Arm (4R): Five recoveries, three of which were reported from Ououkinsh Inlet and two from Nootka Sound. Of the three reported from Ououkinsh Inlet, one came from there for certain and the other two most probably also, but with the east coast of Vancouver Island and Clayoquot Sound areas as less likely alternatives. The two reported from Nootka Sound are equally likely to have come from Quatsino Sound,

with the Clayoquot Sound and Kyuquot Sound areas as remote possibilities. However, in view of the evidence given in the preceding paragraph, the two tags are considered to have probably come from Nootka Sound as reported.

Winter Harbour (4U): Twenty-three recoveries, reported from the following localities: Ououkinsh Inlet, eleven; Quatsino Sound, eight; Nootka Sound, three; and Queens Cove, one. Of the recoveries reported from Ououkinsh Inlet, four are correct; seven are probably correct, with the east coast of Vancouver Island and Clayoquot Sound areas as remote possibilities for five, and the Clayoquot Sound area as a somewhat likely possibility for the other two. Of the recoveries reported from Quatsino Sound, there is but little doubt that at least four originated with Quatsino Sound fish as they were recovered immediately following the processing of fish from that locality by plants which had not operated previously on west coast of Vancouver Island herring. However, three of the four have east coast of Vancouver Island and Queen Charlotte Strait localities as remote alternatives and the remaining one has Fish Egg Inlet and Queen Charlotte Strait localities as remote alternatives. The remaining four tags reported from Quatsino Sound fish are also considered to have originated there, although Clayoquot Sound and Nootka Sound are likely alternatives for two, and Nootka Sound is a likely alternative for the other two, while Kyuquot Sound and the east coast of Vancouver Island are remote possible alternatives for all four. The 4U tags reported from the Nootka Sound area may have originated there, but Quatsino Sound is an equally likely alternative for three, with Clayoquot Sound and Kyuquot Sound as less likely alternatives. The fourth tag from the Nootka area, reported from Queens Cove fish, is most likely to have originated there, although Kyuquot Sound, Quatsino Sound, and Clayoquot Sound are possible sources and the east coast of Vancouver Island is a remote possibility.

Campbell Island (4W): One tag reported, probably correctly, from Ououkinsh Inlet. The east coast of Vancouver Island and Clayoquot Sound are possible alternatives.

Lake Island (4Z): One recovery reported, probably correctly, from Deepwater Bay. A likely possible alternative is Deep Bay, and less likely alternatives are other east coast of Vancouver Island and Queen Charlotte Strait localities.

Toquart Bay (4AA): One recovery, correctly reported, from Ououkinsh Inlet.

Hammond Bay (5D): Two returns, one reported, probably correctly, from the east coast of Vancouver Island (Satellite Channel or Nanoose Bay) and the other, probably correctly, from "Cowichan" (Satellite Channel). A possible alternative for the first is Barkley Sound and possible alternatives for the second are Bones Bay, Nanoose Bay, Knight Inlet, and Minstrel Island.

Nanoose Bay (5E): One recovery reported, probably correctly, from the east coast of Vancouver Island (Satellite Channel or Nanoose Bay). Barkley Sound is a less likely alternative.

Campbell Island (5I): One recovery reported to have come from a load of pilchards from Bullock Channel, August 22nd, 1942. As pilchards had been processed prior to that date, this was probably not a "hang-over" from the previous herring season and may be assumed to have come from herring caught with the pilchards either in Bullock Channel or in other localities in the Central area.

Laidlaw Island (5L): Two tags returned, both probably coming from fish caught in Laredo Inlet. This was the locality reported for one; the other was found while cleaning the grinder after running on three lots of Laredo Inlet fish. For both, less likely alternatives are Quatsino Sound and various localities in Queen Charlotte Strait and the Strait of Georgia.

Kwakshua Passage (5N): One recovery reported from Quatsino Sound. This is probably correct, although there is a good chance that it may have come from either Nootka Sound or Clayoquot Sound areas, and a remote chance that it may have come from either the Kyuquot Sound or east coast of Vancouver Island areas.

*Table V.—Summarizing the Supposed Sources of Tags from each Tagging producing Returns, listed in Table IV., during the 1942–43 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. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sydney Inlet. | Nootka Sound and Esperanza Inlet. | Ououkinsh Inlet. | Quatsino Sound. | West Coast of Vancouver Island, north of Barkley Sound. | Satellite Channel and Nanoose Bay. | Deep Bay and Deepwater Bay. | Strait of Georgia or Queen Charlotte Strait. | Clio Channel and Knight Inlet. | Rivers Inlet. | Meyers Passage and Laredo Inlet. | Central Area. | |
| 4AA | Barkley Sound, March, 1940 | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| 5O | Barkley Sound, March, 1941 | 1 | 1 | 2 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4 |
| 5P | Barkley Sound, March, 1941 | 1 | .... | .... | .... | 2 | .... | .... | .... | .... | .... | .... | .... | 3 |
| 4P | Whitepine Cove, March, 1940 | .... | .... | .... | .... | 2 | .... | .... | .... | .... | .... | .... | .... | 2 |
| 4Q | Refuge Cove, March, 1940 | .... | 1 | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 |
| 5Y | Refuge Cove, March, 1941 | .... | 1 | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | 2 |
| 4R | Nootka Sound, March, 1940 | .... | 2 | 3 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 5 |
| 5Q | Nootka Sound, March, 1941 | .... | 9 | 3 | .... | 1 | .... | .... | .... | .... | .... | .... | .... | 13 |
| 5U | Esperanza Inlet, March, 1941 | .... | 2 | 1 | .... | 1 | .... | .... | .... | .... | .... | .... | .... | 4 |
| 3V | Kyuquot Sound, March, 1939 | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| 5X | Bunsby Islands, March, 1941 | .... | 7 | 26 | .... | 5 | .... | .... | .... | .... | .... | .... | .... | 38 |
| 4U | Quatsino Sound, March, 1940 | .... | 1 | 11 | 8 | 3 | .... | .... | .... | .... | .... | .... | .... | 23 |
| 5W | Quatsino Sound, March, 1941 | 1 | 1 | 8 | 3 | 19 | .... | .... | .... | .... | .... | .... | 1 | 33 |
| 4G | Ganges Harbour, March, 1940 | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | 1 |
| 6C | Ganges Harbour, February, 1942 | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | 1 |
| 6E | Kuper Island, March, 1942 | .... | .... | .... | .... | .... | 3 | .... | 1 | .... | .... | .... | .... | 4 |
| 6G | Kulleet Bay, March, 1942 | .... | .... | .... | .... | .... | 1 | .... | 1 | .... | .... | .... | .... | 2 |
| 7A | Sooke, October, 1942 | .... | .... | .... | .... | .... | 3 | 1 | .... | .... | .... | .... | .... | 4 |
| 5D | Hammond Bay, March, 1941 | .... | .... | .... | .... | .... | 2 | .... | .... | .... | .... | .... | .... | 2 |
| 5E | Nanoose Bay, March, 1941 | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | 1 |
| 4K | Deep Bay, March, 1940 | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| 6I | Skuttle Bay, March, 1942 | .... | .... | .... | .... | .... | 1 | 2 | .... | .... | .... | .... | .... | 3 |
| 6K | Squirrel Cove, March, 1942 | .... | .... | .... | .... | .... | .... | 1 | .... | .... | 1 | .... | .... | 2 |
| 6P | Cahnish Bay, April, 1942 | .... | .... | .... | .... | .... | .... | 2 | 2 | .... | .... | .... | .... | 4 |
| 6L | Retreat Passage, March, 1942 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | 1 |
| 6N | Clio Channel, March, 1942 | .... | .... | 1 | .... | .... | .... | 3 | .... | 2 | 1 | .... | 1 | 8 |
| 6O | Kingcome Inlet, March, 1942 | .... | .... | .... | .... | .... | .... | 2 | 2 | 4 | 1 | .... | .... | 9 |
| 3Q | Rivers Inlet, March, 1939 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | .... | 1 |
| 4W | Campbell Island, March, 1940 | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| 4Z | Lake Island, March, 1940 | .... | .... | .... | .... | .... | .... | 1 | .... | .... | .... | .... | .... | 1 |
| 5I | Campbell Island, March, 1941 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | 1 |
| 5L | Laidlaw Island, March, 1941 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 2 | .... | 2 |
| 5N | Kwakshua Passage, March, 1941 | .... | .... | .... | 1 | .... | .... | .... | .... | .... | .... | .... | .... | 1 |
| 6M | Campbell Island, March, 1942 | .... | .... | 2 | 1 | 2 | .... | 1 | .... | .... | 3 | .... | .... | 9 |
| | Totals | 3 | 21 | 62 | 13 | 40 | 12 | 14 | 6 | 6 | 8 | 2 | 3 | 190 |

Lyall Point (5O): Four recoveries, two reported from Ououkinsh Inlet, one from Nootka Sound, and one from Sydney Inlet. One of the two reported from Ououkinsh Inlet is correct, and the other probably so but with the east coast of Vancouver Island and Clayoquot Sound areas as possible alternatives. Although Quatsino Sound appears to be a likely alternative for the recovery reported from Nootka Sound, in view of the discussion given in a preceding paragraph (4Q), it is considered to have come from the Nootka Sound area, with the Clayoquot Sound and Kyuquot Sound areas as less likely possibilities. The return reported from Sydney Inlet most probably originated there

but had all other west coast fishing-grounds and the east coast of Vancouver Island as less likely alternatives.

Toquart Bay (5P): Three recoveries, reportedly from Sydney Inlet, Queens Cove, and Quatsino Sound. The first is probably correct, with all other west coast localities and the east coast of Vancouver Island as possible alternatives. The second is equally likely to have come from the Clayoquot Sound area, with Quatsino Sound and Kyuquot Sound also as possibilities. The third is equally likely to have come from either Clayoquot Sound or Nootka Sound, with Ououkinsh Inlet and the east coast of Vancouver Island as remote possibilities.

Kendrick Arm (5Q): Thirteen recoveries, three reported from Ououkinsh Inlet, one from Quatsino Sound, and nine from Nootka Sound or Queens Cove. Two reported from Ououkinsh Inlet are certainly correct and the third is probably so, with the east coast of Vancouver Island and Sydney Inlet as possible alternatives. The tag reported from Quatsino Sound may equally well have come from any of the west coast fishing-grounds north of Barkley Sound or, as a remote possibility, from the east coast of Vancouver Island.

Of the nine reported from Nootka Sound area, at least four probably originated there, but with the following less likely alternatives for one: Clayoquot Sound and Kyuquot Sound areas; for another: these two areas and Quatsino Sound; and for the remaining two: all three areas and the east coast of Vancouver Island. The remaining five, while reported from Nootka Sound might equally well have come from Quatsino Sound fish, or, as a remote possibility, from either the Clayoquot Sound or Kyuquot Sound areas. However, in view of the discussion given in a preceding paragraph (4Q), they are considered to have originated with fish from the Nootka Sound area.

Queens Cove (5U): Four recoveries. One, reported from Ououkinsh Inlet, probably originated there, with the east coast of Vancouver Island and the Clayoquot Sound areas as less likely alternatives. One, reported from Queens Cove, probably originated there or in Nootka Sound, with the Kyuquot Sound, Quatsino Sound, Clayoquot Sound areas as less likely alternatives and the east coast of Vancouver Island as a remote possibility. One of the remaining two recoveries is reported from Queens Cove and the other from Nootka Sound. The former is equally likely to have come from the Clayoquot Sound area with the Quatsino Sound and Kyuquot Sound areas as less likely possibilities. The other, judging from plant records, is equally likely to have come from Quatsino Sound, but in view of the discussion above (4Q) it is considered to have come from the Nootka Sound area, as reported, with the Clayoquot and Kyuquot Sound areas as remote possibilities.

Browning Inlet (5W): Thirty-three recoveries reported from the following localities: Quatsino Sound, eight; Ououkinsh Inlet, seven; Kyuquot Sound, one; Queens Cove, nine; Nootka Sound, five; Sydney Inlet, two; Meyers Passage or Pacofi or Laredo Inlet, one.

Of the eight recoveries reported from Quatsino Sound three are considered as correct, two of which have localities in the Queen Charlotte Strait and east coast of Vancouver Island areas as less likely alternatives and one of which has other west coast of Vancouver Island areas, except Barkley Sound, as less likely alternatives and the east coast of Vancouver Island as a remote possibility. The remaining five may equally well have come from the Nootka Sound area or from other west coast areas except Barkley Sound, or from the east coast of Vancouver Island as a remote possibility.

Four of the seven recoveries reported from Ououkinsh Inlet came from that fishing-ground for certain, and the remaining three very probably also originated there, with the east coast of Vancouver Island and Sydney Inlet as possible alternatives. The recovery reported from Kyuquot Sound also probably came from Ououkinsh Inlet, with the east coast of Vancouver Island and Barkley Sound as less likely alternatives.

One of the recoveries reported from Queens Cove probably originated there, although all other west coast areas except Barkley Sound are likely possibilities and the south-east coast of Vancouver Island is a remote alternative. Of the remaining thirteen returns reported from Queens Cove or from Nootka Sound, nine were equally likely to have come from Quatsino Sound, with the Clayoquot Sound and Kyuquot Sound areas as less likely possibilities, and four were equally likely to have come from either Clayoquot Sound or Quatsino Sound, with the Kyuquot Sound area as a remote possibility. All thirteen returns were from one plant in which the magnet-tender evidently failed to realize that Quatsino Sound fish were being processed. It is considered likely that most of these thirteen tags actually originated with Quatsino Sound fish, although this interpretation is not used in summarizing the results. (Table V.)

Of the two tags reported from Sydney Inlet, one is likely to have come from there or other places in the Clayoquot Sound area, but with the following less likely alternatives: the Quatsino Sound, Nootka Sound, Barkley Sound, east coast of Vancouver Island, and Kyuquot Sound areas. The other is equally likely to have originated from the Quatsino Sound or Nootka Sound areas or, as remote possibilities, the Kyuquot Sound and east coast of Vancouver Island areas.

The recovery reported from Meyers Passage, Pacofi or Laredo Inlet, is considered to have probably originated with Central British Columbia fish, although it may have come from a small quantity (10 tons) of Queen Charlotte Island fish processed at the time or from Quatsino Sound fish which were processed a few days previous to the time of the recovery.

Bunsby Islands (5X): Thirty-eight recoveries reported from the following localities: Ououkinsh Inlet, twenty-one; "Kyuquot," five; Quatsino Sound, four; Queens Cove, three; Nootka Sound, four; and "unknown," one.

It is certain that eight of the recoveries came from Ououkinsh Inlet as reported and it is most probable that the remaining thirteen reported from Ououkinsh Inlet and the five reported from "Kyuquot" also originated there. Of these eighteen recoveries, twelve have the east coast of Vancouver Island or Sydney Inlet as remote alternatives; one has the Clayoquot Sound area as less likely alternative, and five have the east coast of Vancouver Island and Barkley Sound as less likely alternatives.

The four tags reported from Quatsino Sound may have originated there, but all are almost equally likely to have come from the Nootka Sound area, the Clayoquot Sound area, and, in one case, the Kyuquot Sound area; with Ououkinsh Inlet and the east coast of Vancouver Island as remote possibilities in all cases.

Of the seven tags reported from Queens Cove or Nootka Sound, at least three are probably correct, with Clayoquot Sound and Quatsino Sound as less likely alternatives for two and these localities and Kyuquot Sound as less likely alternatives for the third, which also has the east coast of Vancouver Island and Ououkinsh Inlet as remote possibilities. Three more can be considered as probably correct, with Clayoquot Sound and Kyuquot Sound as less likely alternatives. The remaining tag reported from Nootka Sound is considered to have come from that area from considerations given above (4Q), with the Clayoquot Sound and Kyuquot Sound areas as less likely possibilities.

One tag, picked up from the plant machinery after the close of the season, may have originated from any of the west coast areas, except Barkley Sound, or, less likely, from the east coast of Vancouver Island.

Refuge Cove (5Y): Two tags recovered. One reported from Ououkinsh Inlet may have originated there or in the Clayoquot Sound area. The other, reported from Quatsino Sound, is equally likely to have come from the Nootka Sound area. This is considered to be the most probable origin, in view of a previous discussion (4Q), with the Clayoquot Sound and Kyuquot Sound areas as less likely alternatives and the east coast of Vancouver Island as a remote possibility.

Ganges Harbour (6C): One recovery reported, evidently in error, from Sydney Inlet. It most probably came from the east coast of Vancouver Island (Nanoose Bay or Satellite Channel) or possibly from Barkley Sound.

Kuper Island (6E): Four recoveries, one certainly and two probably coming from Satellite Channel or Nanoose Bay on the east coast of Vancouver Island. Of the latter, one has Barkley Sound, and the other, various localities in the Queen Charlotte Strait area as less likely alternatives. The fourth tag, one of two recovered during a run on offal from east coast of Vancouver Island fish, may equally well have originated either from east coast fish or from fish reduced the day previously from Bones Bay.

Kulleet Bay (6G): Two recoveries, both reported from east coast of Vancouver Island fish. One probably came from either Satellite Channel or Nanoose Bay, with Barkley Sound as a possible alternative, but the other may equally well have originated with fish from the Queen Charlotte Strait area.

Skuttle Bay (6 I): Three recoveries. One is certain to have come from Nanoose Bay fish as reported. The other two are both reported from Deepwater Bay and one of these is probably correct. The other may have come from either Deepwater Bay or Deep Bay. Both, however, have various localities in Queen Charlotte Strait as remote alternatives.

Squirrel Cove (6K): Two recoveries, one reported from Rivers Inlet and the other from Deepwater Bay. It is fairly certain that the Rivers Inlet record is correct, with less likely alternatives of other localities in the Central area, the Queen Charlotte Islands, Quatsino Sound, and Queen Charlotte Strait. It is fairly certain that the tag reported from Deepwater Bay came from east coast of Vancouver Island fish, probably from either Deepwater Bay or Deep Bay, but other east coast of Vancouver Island and Queen Charlotte Strait localities are remote possibilities.

Retreat Passage (6L): One recovery reported, probably correctly, from Rivers Inlet, but with a variety of remote alternatives in other localities of the Central area, Queen Charlotte Islands, Quatsino Sound, and Queen Charlotte Strait.

Campbell Island (6M): Nine recoveries. Three reported from Rivers Inlet are almost certainly correct, with remote alternatives as listed under 6L. Of two reported from Quatsino Sound, one probably came from there, with less likely alternatives in the Queen Charlotte Strait and east coast of Vancouver Island areas; the other may have come from either Quatsino Sound or Nootka Sound, or, as less likely possibilities, the Clayoquot Sound, Kyuquot Sound, or east coast of Vancouver Island areas. Two reported from Ououkinsh Inlet most probably originated there, with the east coast of Vancouver Island and Sydney Inlet as remote possibilities. One reported from Queens Cove probably came from there or from Clayoquot Sound or Quatsino Sound, with Ououkinsh Inlet as a much less likely alternative. One tag was recovered when cleaning herring reported to have been caught at Deep Bay.

Clio Channel (6N): Eight recoveries. One reported from Rivers Inlet is considered to have come from there, but with less likely alternatives in the Central area, Queen Charlotte Islands, and Quatsino Sound. One reported from Meyers Passage or Pacofi or Laredo Channel certainly came from some locality outside of Queen Charlotte Strait, probably the Central area, but with the Queen Charlotte Islands and Quatsino Sound as alternatives. One reported from "Deepwater Bay or Bones Bay," probably came from Deepwater Bay with Nanoose Bay as a less likely alternative. One reported from Ououkinsh Inlet probably came from there, with the east coast of Vancouver Island and Sydney Inlet as less likely alternatives. Two reported from Bones Bay were found in the grinder following the processing of Bones Bay fish and are considered to have more likely come from that locality or from some other fishing-ground in the Queen Charlotte Strait area than from the offal of herring from Satellite Channel and Nanoose Bay. One reported from Deepwater Bay is probably correct, with Deep Bay

a less likely alternative and with other east coast of Vancouver Island localities and Queen Charlotte Strait localities as remote possibilities. One tag was recovered when cleaning herring reported to have been caught at Deep Bay.

Kingcome Inlet (6O): Nine recoveries. One is considered to have originated with Rivers Inlet fish, as reported, with alternatives similar to the 6N recovery listed previously. Four are reported from Bones Bay, two under circumstances similar to those for the 6N recoveries discussed above. This locality is accepted as the most probable for all four, with other localities in Queen Charlotte Strait and fishing-grounds on the lower east coast as less likely sources. Two tags, one reported from "Cowichan" and the other from Nanoose Bay, may have come from the offal of fish from those localities but both are equally likely to have come from some fishing-ground in the Queen Charlotte Strait area. Two tags were found when cleaning herring reported to have come from Deep Bay.

Cahnish Bay (6P): Four recoveries. One reported from Deepwater Bay and another reported from the "Gulf area" may have come from either Deepwater Bay or Deep Bay, with Queen Charlotte Strait and lower east coast of Vancouver Island localities as less likely possible sources. One report from Deep Bay and another from "Bones Bay" (?) may have come from those places, or from other east coast of Vancouver Island or Queen Charlotte Strait fishing-grounds with equal probability.

Sooke (7A): Four recoveries. Two reported from the east coast of Vancouver Island probably came from either Nanoose Bay or Satellite Channel fish, or, as a less likely alternative, from Barkley Sound. One, reported from Nanoose Bay, certainly came either from there or from Satellite Channel. The remaining one, reported from Deepwater Bay, is equally likely to have come from Deep Bay, and is somewhat less likely to have come from Satellite Channel, with Nanoose Bay and some locality in the Queen Charlotte Strait area as more remote alternatives.

## STABILITY OF POPULATIONS AND MOVEMENTS.

### Major Areas.

Table VI. gives a summary of the number of tags recovered from major areas from both magnets, as interpreted in Table V., and induction detectors, as shown in Table II., but excluding Sooke (7A) recoveries, which were out for less than six months. Considering magnet returns only, 158 out of 180, or 88 per cent., are interpreted as coming from the same general area in which they were used (as compared with 96 per cent. in both 1941–42 and 1940–41, and 98 per cent. in 1939–40). If detector returns are included, the figures are 213 out of 242, or, again, 88 per cent. These data do not give so fair an impression of the degree of interchange between general areas as did similar figures for early years. They are greatly influenced by differences between areas in the quantity of fish caught and the proportions canned.

To obtain somewhat more comparable data the concentration of tags per hundred tons of fish has been calculated (Table VII.). For the Strait of Georgia, where practically the entire catch was canned, detector recoveries only were used, those for the Gulf of Georgia detector being corrected as explained in a preceding section. For all other areas magnet recoveries were used and the returns were considered as having come from the weight of fish reduced plus half the weight of fish canned. It is believed that errors introduced by inaccuracy in the latter arbitrary correction would be small. The data are not corrected for efficiency of the magnets in returning tags, nor for variation in this efficiency between plants. No correction for differences between areas in the number of tags originally used has been attempted.

From Table VII. it may be seen that the concentration of tags per hundred tons of fish is greatest in the fish caught in the major area in which the tags were originally

used. This shows that the 1942–43 results are in essential agreement with those of former years in indicating the relative independence of the fish of major areas. However, some of the figures also suggest that the extent of mixing between major areas, while limited, was somewhat greater than in former years. Particular cases of mixing will be discussed in the following sections.

### West Coast of Vancouver Island.

All of the tags recovered on the west coast of Vancouver Island came from fishing-grounds to the north-west of Barkley Sound. Lack of recoveries from Barkley Sound fish may be due to lack of opportunity for recovery, for the catch was small and the fish were mostly canned by the one plant submitting returns, or it may be due to a scarcity or absence of tags in the catch.

Magnet returns (Table V.) indicate some movement, probably small in extent, of Strait of Georgia (4K) and Queen Charlotte Strait (6N) fish to Ououkinsh Inlet, and a movement, probably of greater magnitude, of Central British Columbia fish (4W, 5N, and 6M) to Ououkinsh Inlet and Quatsino Sound. As shown by detector returns (Table II.) there was also a movement, probably small, of Quatsino Sound fish (4U) and Barkley Sound fish (5P) to Satellite Channel, on the east coast of Vancouver Island.

The independence of individual fishing areas on the west coast of Vancouver Island was maintained only imperfectly, possibly even less so than in former years. This is shown by the summary of results, based on the returns as interpreted in Table V. and as shown in Table II., which is given in Table VIII. From the latter table it may be calculated that of the tags used and recovered on the west coast of Vancouver Island (for which interpretations are offered), 51 out of 96, or 53 per cent., are considered as having come from the same area in which they were used; or, combining the Nootka Sound-Esperanza Inlet and the Ououkinsh Inlet areas, the figures are 65 out of 96 or 68 per cent. These may be compared with similar calculations made in 1941–42—60 per cent. and 77 per cent.; and 1940–41—63 per cent. and 71 per cent.

The returns from Ououkinsh Inlet are of particular interest in that they represent mostly "certain" recoveries. It is shown that all other areas on the west coast of Vancouver Island and, in addition, three "outside" general areas, contributed to this fishery which took place during December and early January. However, the majority of the recoveries were of tags originally used either in that area (43 per cent.) or in Quatsino Sound (31 per cent.). The latter demonstrates a substantial movement of Quatsino Sound fish (4U and 5W) to the Kyuquot Sound-Ououkinsh Inlet area similar to that reported in 1940–41 (4U). However, as found in both 1940–41 and 1941–42, there are indications of an even greater concentration of Quatsino Sound tags among fish caught in Quatsino Sound. According to the records of two plants which did not operate on fish from other grounds on the west coast of Vancouver Island, the concentration amounted to 1.35 per hundred tons; this may be compared with 0.36 per hundred tons as calculated for Ououkinsh Inlet fish. Therefore the extent of mixing between the two areas may not be as great as might be judged from the tabulation.

Results for previous years have been based mostly on tags out for nearly a year, and partly on tags out for nearly two years or longer. As there was no tagging on the west coast of Vancouver Island in the spring of 1942, the present results are based entirely on tags out for nearly two years or longer. It is probable that the greater degree of mixing indicated by the 1942–43 recoveries is related to the greater opportunity for mixing afforded by the longer period of freedom of the tagged fish. This is illustrated by an analysis of the results for last year. Including the recoveries given in the Postscript (Hart, Tester, and Boughton, 1942), 95 out of 144 recoveries, or 66 per cent., were of tags used and recovered in the same area, out for nearly a year; 44 out of 77 recoveries, or 58 per cent., were of tags used and recovered in the same

area, but out for nearly two years or longer. Therefore, the results for 1942–43 (52 per cent.) agree more closely with those for 1941–42 than might be judged on first consideration.

*Table VI.—Summary, according to Major Areas, of the Supposed Sources of all Tags from Taggings producing Returns on Magnets (M) and Induction Detectors (D) during the 1942–43 Season. (For Qualifications,* see *Table V. and Text.)*

| General Locality of Tagging. | General Locality of Recovery. | | | | | |
|---|---|---|---|---|---|---|
| | West Coast of Vancouver Island. | Strait of Georgia (including Discovery Passage). | | Queen Charlotte Strait. | Central British Columbia. | No Interpretations offered. |
| | M. | M. | D. | M. | M. | M. |
| West Coast of Vancouver Island | 130 | ---- | 2 | ---- | 1 | ---- |
| Strait of Georgia (including Discovery Passage) | 1 | 15 | 55 | ---- | 1 | 4 |
| Queen Charlotte Strait | 1 | 5 | 5 | 6 | 4 | 2 |
| Central British Columbia | 7 | 2 | ---- | ---- | 7 | ---- |

*Table VII.—Concentration of Tags per Hundred Tons of Fish according to Major Areas for Magnet Recoveries (M) and Detector Recoveries (D). (For Explanation,* see *Text.)*

| General Locality of Tagging. | General Locality of Recovery. | | | |
|---|---|---|---|---|
| | West Coast of Vancouver Island. | Strait of Georgia (including Discovery Passage). | Queen Charlotte Strait. | Central British Columbia. |
| | M. | D. | M. | M. |
| West Coast of Vancouver Island | 0.99 | 0.01 | ------ | 0.02 |
| Strait of Georgia (including Discovery Passage) | 0.01 | 0.36 | ------ | 0.02 |
| Queen Charlotte Strait | 0.01 | 0.03 | 0.31 | 0.10 |
| Central British Columbia | 0.05 | ------ | ------ | 0.17 |

*Table VIII.—Summary of the Supposed Sources of all Tags recovered during the 1942–43 Fishing Season which were used on the West Coast of Vancouver Island or which are interpreted as having been returned from that Major Area. (For Qualifications,* see *Table V. and Text.)*

| Area of Tagging. | Interpreted Area of Recovery. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Barkley Sound. | Sydney Inlet. | Nootka Sound and Esperanza Inlet. | Ououkinsh Inlet. | Quatsino Sound. | Areas not on the West Coast of Vancouver Island. | No Interpretations offered. |
| Barkley Sound | ---- | 2 | 1 | 3 | ---- | 1 | 2 |
| Clayoquot Sound and Sydney Inlet | ---- | ---- | 2 | 1 | ---- | ---- | 3 |
| Nootka Sound and Esperanza Inlet | ---- | ---- | 13 | 7 | ---- | ---- | 2 |
| Kyuquot Sound and Ououkinsh Inlet | ---- | ---- | 7 | 27 | ---- | ---- | 5 |
| Quatsino Sound | ---- | 1 | 2 | 19 | 11 | 2 | 22 |
| Areas not on the West Coast of Vancouver Island | ---- | ---- | ---- | 5 | 2 | 106 | 2 |

In 1942–43, as in 1941–42, there was an exceptionally large number of tags recovered on the west coast of Vancouver Island as compared with the east coast and other areas. In 1942–43 the number of west coast tags recovered on the west coast (130) was less than in 1941–42 (346) although the tonnage operated on was approximately the same (1942–43, 13,095 tons; 1941–42, 13,822 tons; both including weight of fish reduced plus half of weight canned). The decrease is to be expected, however, as no additional tags were used, and as there would be a dilution of the concentration of tagged fish by recruitment.

A rough calculation of the percentage recovery of 5-series tags used in the spring of 1941 on the west coast of Vancouver Island and recovered there in 1942–43 can be made by multiplying the number of recoveries (96) by the total catch (16,989 tons), dividing by the tonnage considered to have yielded the tags (13,095 tons), and expressing the result (124) as a percentage of the total number of tags used (9,759). This rough calculation indicates a recovery of 1.27 per cent. for 5-series tags, which may be compared with 0.33 per cent. as estimated for the east coast of Vancouver Island. The difference might be due to a variety of causes: (1) more efficient recovery on the west coast of Vancouver Island; (2) more efficient tagging on the west coast; (3) more intensive fishing on the west coast; (4) smaller recovery on the east coast because of the mortality in the spring of 1942; (5) the movement of tagged fish away from the east coast; (6) factors connected with lack of random distribution of the tagged fish.

A complete discussion of these various possible factors will not be attempted at the present time. The difference seems unlikely to have resulted from (1), (2), or (5). Factor (4) may have contributed to the difference if some of the fish tagged in the spring of 1941 died during the mortality which took place in the spring of 1942 along a section of the south-east coast of Vancouver Island. Factor (6) may also have contributed to the difference in a way which is not yet clear. Factor (3), a more intensive fishery on the west coast of Vancouver Island, is, on first consideration, a likely cause but rough calculations of the total recoveries of 5-series tags on the east coast of Vancouver Island (lower east coast including Nanoose Bay) in 1941–42 and 1942–43 (171 and 21) and of 5-series tags on the west coast of Vancouver Island (all areas) in 1941–42 and 1942–43 (273 and 124) indicate a higher total mortality rate on the east coast (88 per cent. per annum) than on the west coast (55 per cent. per annum). It would seem from these results that either natural mortality was much higher, possibly because of (4), or that mortality due to fishing was greater on the east than on the west coast.

### East Coast of Vancouver Island.

As mentioned in a previous section, two west coast of Vancouver Island tags were recovered from Satellite Channel in the southern part and five Queen Charlotte Strait tags were recovered from Deep Bay and Deepwater Bay in the northern part of the Strait of Georgia by induction detectors. To these instances of mixing may be added five Queen Charlotte Strait tags and two Central British Columbia tags probably recovered from Deep Bay and (or) Deepwater Bay in the northern part of the Strait, and one Strait of Georgia tag probably recovered on the west coast of Vancouver Island and one probably recovered at Rivers Inlet (Table V.). Of these results, the most interesting and most important is the recovery of the Queen Charlotte Strait tags, which demonstrates a substantial movement of fish from that area to Deep Bay and Deepwater Bay in the northern part of Strait of Georgia. These fish may have come by way of Discovery Passage or, less likely, by way of the Strait of Juan de Fuca.

Magnet recoveries (M) confirm the detector recoveries (D) in showing a tendency towards independence of the more southerly from the more northerly components of

the Strait of Georgia population as shown by the following tabulation (omitting 7A recoveries).

| Area of Tagging in Strait of Georgia. | Area of Recovery. | | | | | |
|---|---|---|---|---|---|---|
| | Satellite Channel and Nanoose Bay. | | | Deep Bay and Deepwater Bay. | | |
| | D. | M. | Total. | D. | M. | Total. |
| Southern part | 38 | 8 | 46 | 5 | --- | 5 |
| Northern part | 1 | 1 | 2 | 10 | 5 | 15 |

Application of the Chi-square test shows the heterogeneity in the data to be highly significant statistically. The arbitrary division between the "southern part" and the "northern part" of the Strait of Georgia (page 52) might be taken as a straight line between Parksville and Sechelt (*see* map). It might be noted that the northern part includes Deepwater Bay and Okisollo Channel, localities which have been grouped as "Discovery Passage" and treated as a separate area in previous reports. Although this arbitrary division has been made to illustrate tendencies noted in the 1942–43 results, without doubt the situation along the east coast of Vancouver Island is one of considerable complexity which varies from year to year (*cf.* Hart and Tester, 1940; Hart, Tester, and McHugh, 1941; Hart, Tester, and Boughton, 1942).

The recovery of Sooke tags (7A) by magnets supplements the detector recoveries in showing an extension of the movement of these fish from the Strait of Juan de Fuca to north of Nanoose Bay (Deep Bay or Deepwater Bay).

It may be noted that no additional tags were recovered by magnets from taggings made within the area of mortality along the south-east coast of Vancouver Island (6D, 6F, 6Q, 6R, 6S, 6H), thus confirming the conclusion drawn from detector returns that a large portion of the fish tagged in this area died. It may also be noted that there were no recoveries from Porpoise Bay (6J), thus supporting the suggestion that the fish from this area (Seechelt Inlet) did not enter the east coast of Vancouver Island fishery. Likewise there were no recoveries from the early tagging at Prevost Island (6B).

### Queen Charlotte Strait.

The recovery of Queen Charlotte Strait tags (4L, 6N, 6O) at Deep Bay and Deepwater Bay in the northern part of the Strait of Georgia, indicating a movement of some magnitude, has already been discussed. It was also noted that one Queen Charlotte Strait tag (6N) was recovered from Ououkinsh Inlet, on the west coast of Vancouver Island. In addition, Table V. indicates a movement, also of some magnitude, of Queen Charlotte Strait tags (6L, 6N, and 6O) to Rivers Inlet, which is considered to be part of the Central British Columbia area. It is interesting to note that fish from not one but from several taggings took part in these movements to the northern part of the Strait of Georgia and to Rivers Inlet, indicating mixture of the fish originally tagged in separate localities in Queen Charlotte Strait (Clio Channel, Cutter Creek, Retreat Passage, and Kingcome Inlet). One Clio Channel tag (6N) was also recovered from some locality in the Central area other than Rivers Inlet.

Without doubt there was a considerable dispersal of fish originally tagged in the Queen Charlotte Strait area to localities near the boundaries of adjoining major areas. However, calculations (Table VII.) show that the concentration of Queen Charlotte Strait tags in fish caught in Queen Charlotte Strait (chiefly at Clio Channel) was greater than in these other localities, indicating that the movements away from the area might not be so great as might be assumed from a consideration of the untreated data.

### Central British Columbia.

As mentioned previously, several tags originally used in Central British Columbia (4W, 5N, and 6M) were recovered from Ououkinsh Inlet and Quatsino Sound, and possibly from other west coast of Vancouver Island localities; two Central British Columbia tags (4Z and 6M) were probably recovered from Deep Bay in the Strait of Georgia; one west coast of Vancouver Island tag (5W) was probably recovered from some locality in the Central area; and one east coast of Vancouver Island tag was probably recovered from Rivers Inlet. The movements of Central British Columbia fish away from the area (particularly to the west coast of Vancouver Island) and the movements of "outside" fish into the area (particularly from Queen Charlotte Strait) are probably of greater extent than has been indicated by the results of previous years. However, the calculations of Table VII. again show that there was a higher concentration of Central British Columbia tags taken in that area than in other major areas.

It is interesting to note (Table V.) that tags used at Campbell Island (6M) and Rivers Inlet (3Q) were probably returned from Rivers Inlet, and that tags used at Laidlaw Island (5I) were probably returned from Meyers Passage and Laredo Inlet. There has been only one other recovery from Rivers Inlet (3Q)—one tag was recovered, probably from Kwakshua Passage, in 1939–40.

The small number of returns from Central British Columbia is doubtless related in part to the small catch and the small number of tags used there as compared with major areas to the south.

### Northern British Columbia.

No catches were made in Northern British Columbia during the regular 1942–43 fishing season and no tags were recovered from that area. No tags originally used in Northern British Columbia were recovered elsewhere.

## SUMMARY OF RESULTS.

The results of the herring-tagging and recovery programme in 1942–43, in general, agree with those of previous years in showing the relative independence of the populations in major areas. However, the degree of mixing which took place in 1942–43 was apparently greater than in previous years. There was a dispersal, probably of considerable magnitude, of Queen Charlotte Strait fish to the northern fishing-grounds of the Strait of Georgia and the southern fishing-grounds of Central British Columbia. Likewise there was a dispersal of some Central British Columbia fish to the more westerly fishing-grounds of the west coast of Vancouver Island.

As in past years, within major areas there was a tendency towards segregation of populations. This was the case in the Strait of Georgia, where fish in the northern part were relatively independent of those in the southern part. In general, it was also the case on the west coast of Vancouver Island, although there was a considerable movement of Quatsino Sound fish to Ououkinsh Inlet.

Probably a large portion of the fish which spawned in a limited area along the east coast of Vancouver Island during the spring of 1942 died during a mortality which took place there during the spawning period.

*Table IX.—Detailed List of Tags inserted during 1942–43.*

| Identification Marks. | Date released. | Tagging Code. | Where released. | No. of Tags used. |
|---|---|---|---|---|
| P28001–P28100 | Apr. 5, 1943 | 7N | Chatham Channel | 96 |
| P28101–P28200 | Mar. 28, 1943 | 7L | Retreat Passage | 99 |
| P28201–P29600 | Apr. 5, 1943 | 7N | Chatham Channel | 1,390 |
| AAUU | Feb. 25, 1943 | 7B | Ladysmith Harbour | 991 |
| BBMM | Mar. 29, 1943 | 7G | Deserted Bay | 497 |
| HHHH | Feb. 26, 1943 | 7B | Ladysmith Harbour | 200 |
| HHMM* | Apr. 11, 1943 | 7I | Baynes Sound | 193 |
| IIUU | Oct. 3, 1942 | 7A | Sooke | 100 |
| IIZZ | Oct. 3, 1942 | 7A | Sooke | 98 |
| JJHH | Feb. 26, 1943 | 7B | Ladysmith Harbour | 100 |
| JJJJ | Feb. 26, 1943 | 7B | Ladysmith Harbour | 99 |
| JJPP | Mar. 1, 1943 | 7C | Valdes Island | 998 |
| JJTT | Mar. 16, 1943 | 7E | Porlier Pass | 1,002 |
| JJUU | Mar. 16, 1943 | 7E | Porlier Pass | 1,002 |
| JJXX | Apr. 11, 1943 | 7I | Union Bay | 1,000 |
| JJZZ | Mar. 27, 1943 | 7F | Pender Harbour | 1,000 |
| JJ44 | Mar. 3, 1943 | 7C | Valdes Island | 1,000 |
| KKAA | Mar. 17, 1943 | 7J | Deepwater Bay | 1,000 |
| KKBB | Mar. 28, 1943 | 7L | Retreat Passage | 1,000 |
| KKJJ | Mar. 22, 1943 | 7K | Clio Channel | 1,000 |
| KKLL | Mar. 18, 1943 | 7J | Deepwater Bay | 1,000 |
| KKNN | Mar. 17, 1943 | 7J | Deepwater Bay | 989 |
| KKPP | Apr. 2, 1943 | 7H | Northwest Bay | 1,005 |
| KKTT | Mar. 27, 1943 | 7F | Pender Harbour | 1,000 |
| KKUU | Mar. 12, 1943 | 7D | Skuttle Bay | 1,005 |
| KK44 | Apr. 2, 1943 | 7H | Northwest Bay | 498 |
| KK66 | Oct. 3, 1942 | 7A | Sooke | 499 |
| LLAA | Mar. 31, 1943 | 7M | Gunboat Passage | 499 |
| LLBB | Apr. 5, 1943 | 7N | Chatham Channel | 499 |
| LLHH | Mar. 31, 1943 | 7M | Gunboat Passage | 499 |
| LLII | Mar. 31, 1943 | 7M | Gunboat Passage | 496 |
| LLXX | Apr. 5, 1943 | 7N | Chatham Channel | 497 |
| LL44 | Mar. 31, 1943 | 7M | Gunboat Passage | 499 |
| LL66 | Apr. 5, 1943 | 7N | Chatham Channel | 496 |
| MMAA | Mar. 27, 1943 | 7F | Pender Harbour | 500 |
| MMHH | Mar. 29, 1943 | 7G | Deserted Bay | 498 |
| MMII | Mar. 29, 1943 | 7G | Deserted Bay | 500 |
| MMJJ | Mar. 8, 1943 | 7D | Skuttle Bay | 499 |
| MMKK | Mar. 29, 1943 | 7G | Deserted Bay | 499 |
| MMLL | Mar. 29, 1943 | 7G | Deserted Bay | 500 |
| MMMM | Mar. 13, 1943 | 7D | Skuttle Bay | 489 |
| MMNN | Mar. 1, 1943 | 7C | Valdes Island | 499 |
| MMOO | Apr. 2, 1943 | 7H | Northwest Bay | 499 |
| MMUU | Feb. 26, 1943 | 7B | Ladysmith Harbour | 502 |
| MMXX | Apr. 11, 1943 | 7I | Union Bay | 500 |
| MM44 | Mar. 7, 1943 | 7D | Skuttle Bay | 502 |
| MM66 | Mar. 3, 1943 | 7C | Valdes Island | 500 |
| NNAA | Mar. 31, 1943 | 7M | Gunboat Passage | 498 |
| NNBB | Mar. 31, 1943 | 7M | Gunboat Passage | 502 |
| NNZZ | Mar. 31, 1943 | 7M | Gunboat Passage | 500 |
| PPHH | Mar. 29, 1943 | 7G | Deserted Bay | 495 |

* Tagged while under way as an experiment.

## ACKNOWLEDGMENTS.

As in former years, the investigation has received the co-operation of many individuals and agencies. British Columbia Packers, Limited, and the Canadian Fishing Company, Limited, designed the unloading systems at their canneries (Imperial and Gulf of Georgia) at Steveston to accommodate the induction detectors and gave considerable assistance in the installation and operation of these. Plant crews of these and other companies attended magnets and returned tags during the course of the season.

A pair of coils, used with the detector at the Gulf of Georgia Cannery, was loaned through the courtesy of Dr. E. H. Dahlgren, Alaska Fishery Investigation (U.S. Department of the Interior, Fish and Wildlife Service), Seattle, U.S.A.

The seine-boats "Gospak" and "Cape Russell" were loaned for spring tagging operations by British Columbia Packers, Limited, and the Canadian Fishing Company, Limited. The crews of these boats—Captains C. Coffin and E. Bostrom, and Messrs. R. Hoover, A. Somers, G. McGregor, and E. Gregory—co-operated fully. Assistance was also rendered by Mr. S. Vollmers, Nanaimo, during the spring and by Dr. J. L. Hart, Pacific Biological Station, who conducted the tagging at Sooke.

The co-operation and assistance of all of the above is gratefully acknowledged. Their help has been essential to the continuance of the programme.

The investigation has been carried on under joint agreement by the Fisheries Research Board of Canada and the Fisheries Department of the Province of British Columbia. Thanks are extended to Dr. R. E. Foerster and to Mr. G. J. Alexander, of the respective organizations, for their support and assistance.

The senior author who prepared this report assumes responsibility for the accuracy of the presentation and for the interpretations of the data which have been included. The services of the junior author, R. V. Boughton, terminated on December 31st, 1942.

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# BIOLOGICAL INVESTIGATIONS OF COMMERCIAL CLAMS.

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

During the past season investigations have been continued on the more important commercial species of shell-fish, especially in relation to (1) the productivity of different areas and (2) the factors, such as growth-rate and amount of annual seeding, which affect the size of the catch from year to year. While much of this work is still incomplete, certain phases are dealt with in the present report.

The investigation, conducted under the auspices of the Pacific Biological Station, Nanaimo, has received much assistance, financial and otherwise, from the Provincial Fisheries Department, through the Assistant Commissioner, Mr. George J. Alexander.

## COMMERCIAL CLAM-CATCH.

Through the active co-operation of the Dominion Department of Fisheries and the industry, statistical information has been obtained concerning the quantities of various species of clams landed during the season of 1941–42 and the distribution and relative availability of these species in various areas of the Province.

For the purposes of the present report, the year is taken as beginning on October 1st, which is the opening of the season for butter-clams. These constitute the major portion of the British Columbia catch.

### Production by Species during 1941–42.

The following estimates are based on reports submitted to the Pacific Biological Station. In view of possible omissions and inaccuracies the figures should be regarded as approximate only, but they serve to indicate the scope of the industry and the relative importance of the species concerned.

| Species. | Lb. |
|---|---|
| Butter-clams | 3,032,397 |
| Razor-clams | 590,200 |
| Little-neck clams | (ca.) 200,000 |
| Horse-clams | 8,418 |

Production of butter and little-neck clams was lower than in the previous season (1940–41), probably due in large measure to a relative scarcity of diggers and, in the case of little-necks, to a temporary closure of the market during the summer of 1942, following cases of shell-fish poisoning on the west coast of Vancouver Island. The horse-clam is of little importance at the present time, the production reported being taken incidentally in the course of digging for butter-clams. This species is frequently discarded from catches. After an interval of four years razor-clam production was resumed on the north shore of Graham Island (the only present source of supply in British Columbia) in 1942.

### Comparison of Areas.

*Butter-clams.*—The reported catch was distributed geographically as follows:—

| Area. | Lb. |
|---|---|
| Prince Rupert district | 1,382,124 |
| Bella Bella district | 140,000 |
| Alert Bay district | 923,055 |
| Quathiaski district | 20,160 |
| Seal Island, near Comox | 235,757 |
| Chemainus district | 290,010 |
| Sidney district | 40,891 |

These figures emphasize the northward shift which has taken place in recent years in the centre of production. About four-fifths of the catch, according to these data, came from north of Seymour Narrows.

As in previous seasons, the average quantity of clams dug by one man during one low-tide period has been calculated for most of the areas concerned as a guide to the trend of productivity from year to year. Average catches, as estimated for the three seasons for which data are available, are shown in the following table:—

| Area. | Average Catch (Lb.) per Man-tide. | | |
|---|---|---|---|
| | 1939–40. | 1940–41. | 1941–42. |
| Prince Rupert district | ..... | ..... | 558.1 |
| Bella Bella district | ..... | 182.7 | 272.3 |
| Alert Bay district | 200.7 | 198.2 | 186.7 |
| Seal Island | ..... | ..... | 599.9 |
| Chemainus district | 120.0 | 124.7 | 153.8 |
| Sidney district | 138.0 | 149.9 | 159.1 |

The productivity of beaches in the Alert Bay district appears to have fallen off, while a rise in productivity is indicated for the Chemainus-Sidney area during the three years covered by the investigation.

*Little-neck Clams.*—The reported production was as follows:—

| Area. | Lb. |
|---|---|
| Vancouver district | 10,800 |
| Jervis Inlet district | 2,560 |
| Milbanke Sound district | (ca.) 28,000 |
| Chemainus district | 158,180 |

Average catches per man-tide have been calculated as follows:—

| Area. | Average Catch (Lb.) per Man-tide. | |
|---|---|---|
| | 1940–41. | 1941–42. |
| Vancouver district | 74.7 | 73.8 |
| Jervis Inlet district | 77.3 | 92.3 |
| Milbanke Sound district | 70.7 | 54.4 |
| Chemainus district | 122.5 | 127.0 |

"Chemainus district" includes various localities along the south-east coast of Vancouver Island and among the Gulf Islands. This area, in addition to providing the greater part of the British Columbia catch during the past two years, shows the highest yield per unit of effort.

## INVESTIGATIONS AT SEAL ISLAND.

The investigation of the large butter-clam beach at Seal Island, near Comox, initiated in 1942 (*see* Rept. B.C. Fish. Dept., 1941), was continued in February, 1943. Digging is not permitted at this locality except for these experimental operations.

As in the previous year, operations were conducted in co-operation with British Columbia Packers.

A record was kept of the catch made and the man-hours expended during a specified number of low tides on each of four defined areas, covering a large proportion of the most productive parts of the beach. From three of these areas (A, B, and C)

known quantities of clams had been taken in 1942. The fourth area (D) had not been previously dug. A summary of the statistics obtained is presented.

| Area. | No. of Tides. | No. of Man-tides. | Man-hours. | Catch. | Average Catch. | | Amount removed in 1942. |
|---|---|---|---|---|---|---|---|
| | | | | | Per Man-tide. | Per Man-hour. | |
| | | | | Lb. | | | Lb. |
| A | 3 | 151 | 699.65 | 87,489 | 579.50 | 125.00 | 111,292 |
| B | 1 | 57 | 218.48 | 36,133 | 633.91 | 165.38 | 25,920 |
| C | 1 | 45 | 123.75 | 11,478 | 255.07 | 92.75 | 98,545 |
| D | 3 | 141 | 546.59 | 101,725 | 721.45 | 186.11 | ---------- |
| All areas | 8 | 394 | 1588.47 | 236,825 | 601.08 | 149.09 | 235,757 |

The total catch and the effort expended in terms of man-tides and man-hours were almost exactly the same as in 1942. The smaller production of the two areas which were heavily dug in 1942 was offset by the large catches made on Area D.

### Growth of Clams and Size Composition of the Population.

The annual production which can be sustained over a period of years depends of course on the rate of replacement of the clams removed. This in turn is dependent on the growth-rate of the clams, the amount of seeding which takes place, and the survival of the young clams.

The age of butter-clams can be read with varying degrees of facility by counting the number of "winter-rings" on the shell. Fig. 1 shows the average length of the shell in successive winters. The values were obtained by measuring the winter-rings of a large number of individuals taken at various seasons of the year and from various locations on the Seal Island beach. They were confirmed by measurements of the total length of winter-caught clams of various ages. It will be seen that, on the average, the legal length of 2½ inches is attained in this locality by the sixth winter; that is, at an age of something over five years, since spawning appears to take place in the summer.

A study of the sizes and ages of clams dug from this beach has indicated that the amount of spawning and (or) survival varies greatly in different years. In twelve samples (each consisting of from 200 to 900 individuals) taken from various locations on the Seal Island beach between 1940 and 1943, only two year-classes (those spawned in 1934 and 1935) have appeared as the most numerous age-groups represented in any sample. The size composition of a typical sample is shown in Fig. 2. In this graph about 50 per cent. of the clams are within a narrow length range of from 7.0 to 8.0 cm. (2.75 to 3.15 inches), this corresponding approximately to the 1934 and 1935 year-classes. The 1936 year-class is fairly well represented in most samples, but there appears to be a definite deficiency of more recent age-groups. Recruitments to the present stock of legal-size clams can therefore be expected to be on a small scale for several years.

### Effect of Digging.

Although the 1943 catches from the experimental areas remained high in comparison with other localities in Southern British Columbia, certain marked effects of the previous year's digging were apparent. In the following table the quantities of clams removed in 1942 are expressed in pounds per square yard; i.e., total weight of clams produced, divided by the number of square yards in each area:—

| Area. | Lb. per Sq. Yd. removed in 1942. | Effect in 1943, as measured by Average Catch per Man-hour. |
|---|---|---|
| A | 10 | Production considerably reduced. |
| B | 2 | Production increased. |
| C | 13 | Production much reduced. |

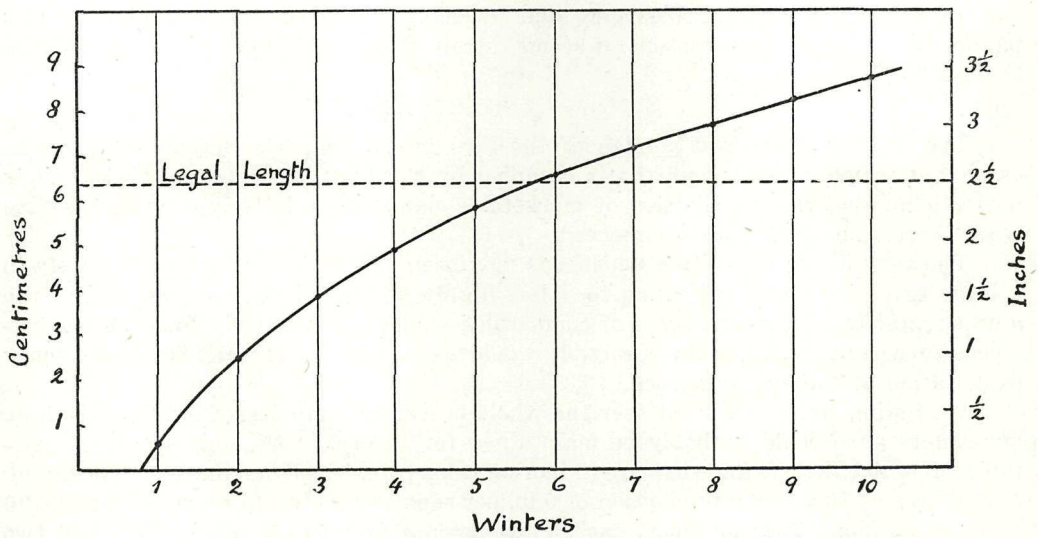


Fig. 1. Growth of butter-clams at Seal Island. Average lengths in successive winters.

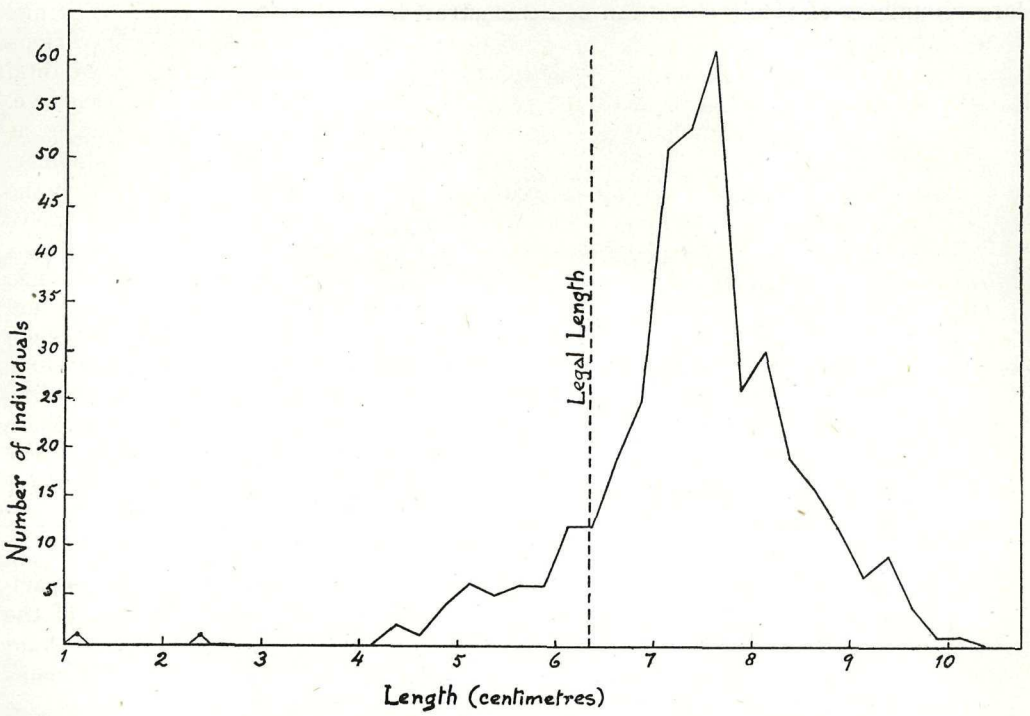


Fig. 2. Length-composition of a sample of butter-clams taken at Seal Island in July, 1942.

It is evident that with the existing rate of replacement a production of 10–13 lb. on areas A and C cannot be sustained (during three nights' digging of Area A in 1943, the average catch per man-hour fell from 167 to 97 lb.). While the increased production of Area B was perhaps largely due to changes in the personnel digging this particular area in the two seasons, it seems certain that the 1942 catch had not reduced the availability of clams.

## Summary and Outlook.

The heavily productive portion of the Seal Island beach is roughly 10 acres in extent, of which about four-fifths is occupied by the four experimental areas. It is now evident that the distribution of marketable clams was relatively even at the time when large-scale operations commenced.

The very heavy population which has now been tapped in two seasons consists to a large extent of clams belonging to a few highly successful year-classes. Since the data suggest that no year-classes of comparable abundance are likely to reach marketable size within the next few years, it would seem wise to refrain from too heavy exploitation of the existing stock.

If digging were permitted over the whole beach, an annual production up to 5 lb. per square yard could probably be maintained for several years, unless natural mortality, of which little is known, were to increase sharply with advancing age. Assuming a total area of 10 acres, a production of 5 lb. per square yard would represent about 120 tons per annum. This is almost exactly the amount produced in each of the last two seasons, although this catch has not, of course, been spread evenly over the beach.

While these conclusions are subject to modification, it is suggested that annual production at Seal Island should not greatly exceed 100 tons, until the presence of larger numbers of young clams can be demonstrated.

# REPORT ON INVESTIGATIONS OF THE INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION FOR THE YEAR 1942.

By W. F. Thompson, Director.

During 1942 the blockade in Hell's Gate Canyon was again the centre of interest. It will be remembered that there was a heavy mortality in 1941 during water-levels at which the fish could not pass. The dangerous levels lasted from the last days of July to nearly the end of the period of sockeye migration. A brief opening about September 1st allowed the major part of the escapement for the season to the up-river spawning-grounds, an escapement which in itself was considerable to certain districts.

It had long been known that sockeye were delayed in passage at various points in the river, and especially at Hell's Gate. The Commission itself had in 1938, 1939, and 1940 good evidence of this delay. But there was no evidence that the fish did not later proceed. There was lacking necessary proof of the mortality which resulted. In 1941 this proof was supplied in conclusive fashion by concentration of the Commission's work upon an adequate tagging programme, with a new technique of interpretation of the results. It was successful in proving the very high percentage of deaths among the delayed fish and in showing the manner in which it affected the individual races which passed Hell's Gate at the time of blockade.

Attention was immediately given to remedial measures. In fact, before the investigation was complete, steps had been taken to put them in effect. Delay in doing so could be expected because of the magnitude of the engineering problem involved in any permanent alteration of the reach or of the conditions of passage. To care for the immediate future as well as possible, during this delay, it was decided to construct a small fish-pass through the rock and around the obstruction on the east bank. The entrances to this could not be placed to take care of all parts of the blocked levels of the river, nor could it be made of sufficient size to care for all levels and any anticipated number of fish. Hence it is not regarded as more than a partial solution at best.

A report was submitted to the two Governments recommending its construction. But even with this approval funds could not be secured in time for construction during the low water immediately following the run of 1941. It was, however, begun as the water-level fell in the fall of 1942, and it was completed in that year, ready for the run of 1943.

The run of 1942 was in large part bound for the Shuswap district and was the largest of recent years, a recurrence of the four-year cycle which has grown up there since the '30s. It seemed imperative to provide some means of salvaging this run in case the river was blocked during its progress past Hell's Gate. The temporary rock-cut could not be finished in time. In case a prolonged blockade developed, great mortality might be caused. Accordingly, the Commission considered methods of salvaging eggs from fish held below the block and of transporting fish over it. It was finally decided to capture the fish in the eddy immediately below the obstruction on the east bank. A large-sized brail-net was operated by a derrick, the fish were dropped into a tank and flushed down a flume opening 750 feet up-stream. It was a procedure which could be very useful in case the sockeye accumulated in dense masses, but might not be so if they were sparse in number. Certainly but a small fraction of the total run could be handled. This equipment was ready for use before the heavy run of the year commenced.

At the same time another extensive tagging experiment was carried out, over 8,000 tags being placed. This was to further test the upper limits of the obstruction, and to determine any possible difference between opposite sides of the river which might indicate the necessity of remedial action on both sides.

It was also to provide a record of the mortality caused, especially if the period of the block happened to be short. It was obvious that in 1941 the period was exceptionally long, and the question might be raised fairly as to whether it was not a most unusual year. A test to see if mortalities were caused by an average or short period of dangerous river-levels was badly needed. With the technique developed this could be done.

Fortunately both for the run of fish and for the desired test, the river fell rapidly through the levels at which the block was present. It remained but twenty-eight days between 40 and 25 feet on the gauge, and was below the dangerous levels by September 1st. The great Shuswap run of fish went through without delay, the bulk subsequent to September 15th, and a run to the Stellako district passed in early September. The fishing equipment and flume, while ready for use before the heavy run commenced, was used very little and its efficiency remains to be determined by use.

In consequence, in 1942 the mortalities during a short period of block were determined, a large uninterrupted run to one main locality was observed, and the conditions to be remedied were given the necessary more detailed study.

The evidence now at hand must be analysed in detail, but thus far it has indicated that there was a heavy mortality rate in the small number of fish which presented themselves at the Gate during the blockade. This increased with the length of time the individual was delayed. The delay began considerably before the 40-foot level was reached and the mortality was graduated in effect, not abruptly greater after twelve days or thereabouts of delay. Full analysis must be awaited as to these points before they can be stated precisely without reservation.

The tagged fish retaken at Adams and Little Rivers indicated that the early fish in a run had a slower time of migration and a longer period on the grounds before death than the later fish. Indeed, at the end of the run it was difficult to see how any delay could be endured without bringing death before reaching the grounds or before spawning. If so, it can be expected that the results of delay will vary, not only with the time of year the block occurs but with the race which happens to be passing and with the early or late fish of the same race. It may, indeed, be worthy of investigation to see whether the early-running up-river races are not more seriously affected than the late runs, because the block usually occurs in mid-season and would affect the latter part in one case and the early part in the other, with corresponding difference in effect. During the year, detailed surveys were made of Hell's Gate reach, and a model on the scale of one to fifty was constructed at the University of Washington, where the nearest available facilities for such work were found. The model was constructed and tests run under the supervision of Mr. Milo C. Bell by Professors E. S. Pretious of the University of British Columbia and Walter Hiltner of the University of Washington, with the advice and assistance of Professor C. W. Harris of the latter institution.

As a result of the tests run on this model, and of detailed studies made otherwise, it is hoped to make recommendations to the two Governments—Canadian and the United States—for complete and permanent remedies.

Tagging was also continued at Sooke, on the southern end of Vancouver Island. A total of 1,802 sockeye were tagged, with a recovery of 41 per cent. The results for the five years this has been done follow:—

| Year. | No. tagged. | No. recovered. | Per Cent. recovered. |
|---|---|---|---|
| 1938 | 980 | 431 | 44 |
| 1939 | 1,051 | 547 | 51 |
| 1940 | 930 | 417 | 45 |
| 1941 | 849 | 485 | 58 |
| 1942 | 1,802 | 735 | 41 |

It is interesting to observe the alternation of low returns in even years, with high in odd years. The odd years are those in which pink salmon are abundant.

The programme of the Commission was carried on as usual. The enumeration of migrants, both adults and young, was continued at Cultus Lake. Statistics of the commercial catch were gathered by cannery observers who collected biological data. Estimations of escapement were made by stream observers in addition to their duties of recovering tags, etc. Studies of the Quesnel district were begun to determine methods of rehabilitation to be undertaken as soon as possible.

The Commission is faced with two additional major projects—the collection of proper statistics for regulating purposes and the beginning of rehabilitation in the Quesnel district as well as in others. It has also a third, the preparation of scientific reports on the great mass of data now in hand. These must be given attention at the earliest possible moment.

# SPAWNING REPORT, BRITISH COLUMBIA, 1942.

By J. A. Motherwell.

The following are the outstanding features apparent from this year's examination of the salmon-spawning grounds of the Province:—

(1.) There was an immense return of sockeye to the spawning-grounds of the Adams River, Little River, and other Shuswap areas frequented by this variety, notwithstanding the fact that the run had produced an unusually large pack for District No. 1.

(2.) The return of sockeye to the Chilco system exceeded that of the brood-year of 1938 by 400 per cent. This cycle, in common with others of the Chilco area, has been increasing most satisfactorily.

(3.) A seeding by approximately 3,000 sockeye salmon in the Stellako River, in the Francois Lake area, produced this year a return estimated at just under 40,000 fish—a remarkable showing.
(The above are all portions of the Fraser River watershed.)

(4.) The excellent supplies of spawning salmon found in the watersheds above mentioned are unassailable evidence that there was no real blockade at Hell's Gate this year. Water conditions were most favourable, particularly during the sockeye run, and the salmon passed safely through without any assistance.

(5.) In the very considerable spawning area of Yakoun River, Masset Inlet, Queen Charlotte Islands, the return of pink salmon to the spawning-grounds this year was the greatest since the large run of 1930, notwithstanding a most satisfactory commercial catch.

The usual details follow:—

## QUEEN CHARLOTTE ISLANDS.

The escapement of springs to the Yakoun River was larger than usual. Cohoe were found to be very plentiful in the Yakoun and, in fact, in all the streams usually frequented by this variety. The Inspector speaks of the escapement as the heaviest in his fourteen years' experience.

This has been what is usually known as the "big" pink year in the Masset Inlet area. Since 1930 the runs have been more or less unsatisfactory. However, this year the spawning-grounds were found to be crowded with pinks. The seeding of this variety in the Yakoun system and in the two other larger streams is reported as being very heavy and extremely satisfactory. In the streams along the easterly coast of the islands it was found that Skedans was the only area well seeded.

The escapement of chums in Masset Inlet was very poor. In Naden Harbour, however, there was a good supply. In the streams along the east coast the escapement is reported as being heavier than for some years. This applies even more so to the west coast streams.

## NASS AREA.

In the Meziadin Lake area a very good run of early sockeye occurred, and the seeding was heavy, under ideal conditions. The same conditions are reported with regard to the late run. The whole seeding is reported as excellent.

The fishway at the outlet of Meziadin Lake has been damaged to some extent. What was possible in the way of correcting conditions was done by the inspecting officer and there is reason to believe that the structure will be efficient for at least another year.

In the lower reaches of the Nass River the escapement of the several varieties of salmon is reported as showing marked improvement. The escapement of springs is

reported as very heavy. This is the second year that such satisfactory conditions have obtained. The seeding of cohoe is reported as being very heavy, although the fish were late in arriving. The pink seeding at Quinnimaas River, Khutzeymateen River, and Ikginik River, and several other smaller streams, is reported as being very heavy. The chum seeding also showed a marked improvement, the total run being reported as one of the heaviest in years.

## SKEENA AREA.

The sockeye seeding in Williams Creek, which is the principal area frequented by this variety, is reported as heavy and better than that of the cycle-year of 1938. The other sockeye-spawning grounds of the Lakelse Lake system were satisfactorily seeded. A good spawning of cohoe occurred in Williams Creek, and the supply of pinks on the usual spawning-grounds is reported as being heavy and compares favourably with the brood-year of 1940.

In the Ocstahl River watershed the sockeye-supply is reported as medium, although it is not a particularly valuable sockeye area. The spring seeding at Johnson Creek was heavy. The cohoe-supply was heavy and better than that of the cycle-year of 1939. Pinks were found in good quantities, better than the cycle-year. The chum-supply was medium only.

In the important Babine Lake section of this area the quantities of sockeye found on the spawning-grounds were hardly equal to those of the year 1938, for instance, although they are considered as reasonably satisfactory. A larger seeding was expected. At several streams tributary to the lake, conditions were very encouraging. For instance, at Pierre Creek, the quantity observed was three times that of the brood-year of 1938. There was also an improvement at Twin Creek. The seeding, however, was not up to expectations at Fulton River and Fifteen-mile Creek. The spring-salmon supply was found to be quite satisfactory. The cohoe seeding is reported as fairly heavy. The pink-supply, however, was short of that of the brood-year of 1940.

## LOWE INLET AREA.

It was found impossible to inspect several of the spawning areas in this district, due to very heavy rains during the run up-stream. All the lakes and streams were in flood at spawning-time. The conclusions reached with regard to the spawning conditions are, therefore, the result of what observations were possible on the spawning-grounds, together with an estimate of the run judged by the commercial fishing results. The sockeye escapement is estimated as being satisfactory. During the early part of the season there was little rain and the streams shrunk to such an extent as to be impassable for salmon. This necessitated fishing-closures to preserve a reasonable portion of the run for the spawning-grounds. The cohoe escapement to all streams is reported as heavy. The pink-supply showed a decided improvement over the brood-year of 1940. This condition was assisted greatly by the above-mentioned extra closed periods. All chum salmon spawning-grounds were well supplied with that variety; in fact, the escapement was larger than usual.

## BUTEDALE AREA.

This was reported as the driest season for many years. Many of the small streams dried up completely. Only light supplies of sockeye were observed on the spawning-grounds, generally speaking, although some of the larger streams which were not so much affected by the dry weather showed fair supplies of sockeye. The cohoe seeding was the heaviest in recent years. The pink-supply showed an increase over 1940, although some of the smaller streams suffered, due to the dry weather. The escapement to Quaal and Kainet Rivers was exceptionally heavy. The escapement of pinks

for the area generally is reported as much greater than that of 1940. Chums, however, were scarcer than usual.

## BELLA BELLA AREA.

The prolonged dry weather also experienced in this area caused a considerable loss of pinks, which were unable to reach their spawning-grounds, due to the low level of water in the streams. However, the seeding is reported as an average one, generally speaking. The showing of cohoes and chums was much more satisfactory.

Owing to the absence of the regular Inspector on military duty, and the illness of the relieving officer, the inspection was made by an officer who, not having had previous experience in the district, was not able to make comparisons with other years.

## BELLA COOLA AREA.

Notwithstanding an unusually long period of very dry weather, most of the streams in this area contained sufficient water on the arrival of the salmon to permit of their passing safely to the spawning-grounds. The only exceptions were several of the smaller creeks flowing into Dean Channel. The season has been very free of freshets and spawning conditions generally are reported as being very favourable.

A very satisfactory supply of sockeye salmon reached the spawning-grounds of the Bella Coola and Atnarko River systems, comparing favourably with the run of the brood-year. An unusually large number of "runts" was observed, however. The spring-salmon supply is reported as being excellent, for the fifth successive year. The inspecting officer reports that this run has been built up beyond expectations. The supply of cohoes was quite satisfactory. A surprisingly good supply of pinks was found, which was remarkable in view of the failure of the run in the cycle-year. A good supply of chums also was present on the spawning-grounds.

## RIVERS INLET AREA.

The sockeye escapement to this area is reported as being very good. Quap River is reported as being filled with spawning sockeye. Asklum River is reported as being abnormally well seeded. The supplies found in Genesi River were good, equal to the year 1938, but better than the year 1937. The Shumahault River received an average seeding. At Indian River the escapement was good, being better than 1938 and much better than 1937. The same conditions apply to the Waukwahs River. Good seedings were observed at Cheo, Nookins, Markwell, and Dallec Rivers, and Hatchery Creek. The spawning in the Whonnock River, which drains Owikeno Lake system to the sea, was very good. Spring salmon were observed in good quantities in the Indian and Waukwash Rivers.

Summarizing the conditions in the Owikeno Lake district the Inspector states that he considers the escapement of salmon for 1942 to be at least on a par with the year 1938, and much better than 1937.

In the areas directly tributary to salt water, such as Moses Inlet, Kildala Bay, Hole in the Wall, and Draney Inlet, the seeding of cohoes was only a medium one. There was, however, a good escapement of chums.

## SMITH INLET AREA.

The sockeye spawning is reported as being good; very good in relation to the commercial catch. The only two important sockeye streams are the Geluck and Delabah Rivers. These were well supplied with sockeye. The seeding of cohoes was only an average one, but fairly heavy in the case of chums.

## FRASER RIVER WATERSHED.

*Prince George Area.*—The sockeye seeding in the Stuart Lake system is reported as being two-thirds greater than that of the brood-year. There were good runs, comparatively speaking, to Forfar Creek and Kynoch Creek, tributary to Middle River. Better supplies were found in Rossette and Gluske Creeks. The later run to the Fraser-Francois Lake watershed showed a remarkable increase over the brood-year. In 1938 approximately 3,000 sockeye were observed in the Stellako River, and from this seeding between 35,000 and 40,000 sockeye arrived in the river this fall. Their condition was reported as splendid, thousands showing no outside scars or abrasions, and the individual size of the fish being a good average, with a number of fine large specimens. Spawning conditions were excellent. The supply of spring salmon on the several spawning-grounds of the Prince George area was hardly up to expectations.

*Quesnel Area.*—The large increase in the number of spawning sockeye found in the Chilco River and Lake system is the outstanding feature in the report for this particular district. The increase in the number of spawners over the brood-year of 1938 is estimated at over 400 per cent. The conditions in this particular system during recent years have been extremely encouraging. The Bowron River system contained a small quantity of spawning sockeye, equal to the seeding of 1938. No salmon of this variety were found in the Horsefly River or Quesnel Lake systems. The spring-salmon spawners were found in quantities, generally speaking, comparable with those of recent years.

*Kamloops Area.*—The return this year of sockeye was the result of the very heavy seeding of 1938, and proved up to expectations. The principal sockeye-spawning grounds are the Adams River and Lake system, Little River, and several of the streams tributary to Shuswap Lake. Every foot of Little River and Adams River was crowded with spawning sockeye and others passed in a continuous stream through the fishway constructed on the left side of Adams River, in the dam erected about one-half mile below the foot of the lake. This one-half mile above the dam was also covered with spawning sockeye, and there is reason to believe that many passed up into the lake area, although it would appear from the information at hand that there are few valuable sockeye-streams tributary to Adams Lake. There is evidence, however, that a certain quantity of sockeye spawned along the lake-shore. Scotch Creek, Seymour River, and Shuswap River also received a good supply, although the spawning areas are not comparable in size with those of the above-mentioned district.

The water-levels at Hell's Gate during the time the Adams-Shuswap run was passing through were such as to permit the easy passage of the salmon without any assistance. There would appear to be reason to believe, therefore, that all salmon heading for the above-mentioned system safely reached the spawning-grounds. They arrived in excellent condition.

The spring-salmon supply was quite a satisfactory one, in comparison with that of other years. The individual fish were unusually large and arrived in excellent condition. The cohoe-supply was also an average one, although the fish were individually smaller than usual.

*Pemberton Area.*—There was a remarkable return of sockeye to the spawning-grounds of the Birkenhead River system, the estimated quantity of parent fish being 83,000 compared with 30,000 in the brood-year of 1938. This is an increase of approximately 180 per cent. The streams tributary to the Lillooet Lake system also contained an unusually large number of spawning sockeye. There was also a seeding of this same variety in the Anderson-Seton Lake system, the quantity being in the vicinity of 1,000 salmon, compared with approximately 450 in the brood-year. It has been observed that when the water conditions make the rapids in the Fraser River at the outlet of Bridge River unusually difficult, greater numbers of sockeye appear in the Anderson-Seton Lake system.

The supply of spring salmon was similar to that of 1939, in the Birkenhead system. It is estimated at approximately 45,000 fish. The cohoe seeding is considered satisfactory throughout the whole of the Pemberton-Squamish area. This has been the "off" year for the pink variety. The supply of chums in the Squamish system was found quite satisfactory.

*Chilliwack Area.*—The run of sockeye reaching the Chilliwack system is always a light one and is reported this year as average. The Cultus Lake run, however, up to November 23rd, the date of inspection, by actual count had reached a total of 18,620 and was expected to exceed 20,000 fish. There were a few showing in Kawkawa Lake. No distressed salmon of this variety were found in the Coquihalla River or at the outlet of other streams, which occurs when there is a serious blockade at Hell's Gate. The spring seeding is reported as only fair. The cohoe-supply to the Chilliwack River was good but the Vedder River was not so well stocked, although conditions were better in several of the smaller tributaries. The chum seeding in the Chilliwack and Vedder systems was quite good. Sweltzer Creek was unusually heavily stocked. The steelhead seeding is reported as satisfactory.

*Harrison Area.*—In the Harrison Lake system sockeye spawning at Hatchery Creek, Silver Creek, and Douglas Creek, tributary to Harrison Lake, was very similar to that of the brood-year. There was the usual quantity in the Harrison River at what is known as "The Rapids." At Morris Creek there was a good spawning, an increase over that of 1938. In the Harrison Rapids the spring spawning was heavier than usual, and was reported as being the best in years. The cohoe-supply can be considered only as medium. Chums, on the other hand, were present in larger quantities than for some years. The supply is reported as being heavy in the Stave and Harrison Rivers.

*Pitt Lake Area.*—In the Pitt River watershed the sockeye spawning was somewhat greater than that of the brood-year. There was an average supply of cohoe, with a heavy seeding of chums.

*Lower Fraser Area.*—In the Serpentine and Nicomekl Rivers the supply of cohoe salmon on the spawning-grounds compared very favourably with that of the brood-year of 1939. Spawning was late, due to lack of rain. The supplies of this variety in the Alouette, Coquitlam, Bear, and Salmon Rivers were only medium, whereas the seeding of chums was excellent.

*North Vancouver Area.*—The cohoe seeding was good and the quantities of spawning chum salmon were satisfactory.

## ALERT BAY AREA.

Very satisfactory supplies of sockeye were found on the main Nimpkish River spawning-grounds, being estimated at 25 per cent. greater than that of the brood-year. Satisfactory quantities were also observed at Fulmore River, Port Neville, Keough River, and other sockeye-streams. The spring seeding is reported as fairly satisfactory, with a heavy seeding at Nimpkish River. The cohoe-supply was medium, except at Viner Sound, Salmon River, and Seymour River, where it is reported as heavy. The pink-supply was disappointing, generally speaking, although a satisfactory seeding occurred at Embley River, Wakeman River, Keough River, and Kingcome River. The chum seeding was good at Salmon River and in the streams draining into Seymour Inlet. Heavy supplies were observed at Viner River, Adams River, and Nimpkish River. The supplies of this variety generally were satisfactory.

## QUATHIASKI AREA.

The sockeye seeding at Hayden Bay, Loughborough Inlet, and Phillips Arm was quite satisfactory, that at Hayden Bay particularly being reported as excellent and an

improvement over the brood-year by at least 30 per cent. The spring seeding was a fair average only, although conditions were somewhat better at Campbell River. The cohoe-supplies were poor, with the exception of the streams draining into Loughborough Inlet, Phillips Arm, and Bute Inlet, where the escapement was somewhat better. The pink escapement was very poor at Bear River, although the streams draining into Loughborough Inlet received more satisfactory supplies. The chum seeding was only fair.

## COMOX AREA.

This is not a sockeye area. The spring-salmon supplies are reported as light, compared with the seasons 1936 to 1939, but an improvement over the years 1940 and 1941. The cohoe seeding was very satisfactory, generally speaking. The pink-supply was found to be entirely inadequate. The chum escapement is reported as good, particularly at Little Qualicum River, where a heavy seeding occurred. The supply at Big Qualicum, however, did not come up to expectations. Conditions at Courtenay River were satisfactory.

## PENDER HARBOUR AREA.

The sockeye-supplies in the Saginaw system were somewhat better than the brood-year, which, however, was reported as the lightest of any year on record. The spring and cohoe supplies were normal. This also applies to the pink seeding, in so far as the streams draining into Toba Inlet and Narrows Arm are concerned. In all other sections, however, the seeding was unsatisfactory. Chums were found in satisfactory quantities in most of the streams in the area.

## LADYSMITH AREA.

The supplies of springs and cohoes were found to be quite up to a good average. This is not an important pink area but the usual number were found on the spawning-grounds. There was an improvement in the chum spawning over the seasons of 1938 and 1939, but not equal to the unusually good seeding of 1941.

## COWICHAN AREA.

It is estimated that between 30,000 and 40,000 spring salmon reached the spawning-grounds of the Cowichan River, above Skutz Falls. In addition, there was a good seeding in the lower part of the river. The number of cohoes is estimated at between 40,000 and 60,000 above Skutz Falls fishway and a considerable seeding in the area below the falls. The seeding of cohoes was also very satisfactory in the Koksilah River, as well as Kelvin, Glenora, and Norie Creeks. A satisfactory quantity of chums was observed.

## VICTORIA AREA.

This is a fall-salmon area, with no large streams which can be utilized for spawning purposes. The cohoe and chum seeding is estimated as a fair average.

## ALBERNI AREA.

In the principal sockeye areas of the Somass-Stamp River system there was a splendid supply of sockeye found. The count through the fishway at Stamp Falls was the largest of any season. At Anderson River the escapement was fair but the spawning-beds were reasonably well seeded. The supply on the Hobarton River beds was larger than usual. The seeding of springs in the main streams such as the Somass, Nahmint, Sarita, Toquart, and Nitinat Rivers was found to be good. The escapement of cohoes to the main spawning areas of the system is reported as very satisfactory. The chum seeding has also been very good.

## CLAYOQUOT AREA.

The sockeye-supplies on the spawning-grounds are reported as being considerably heavier than during the brood-year of 1938, and at least equal to the heavy seeding of last year, which was the best in the past fifteen years. The supply of pinks and cohoes was an average one. The chum spawning is reported as heavy in practically all streams. Spawning conditions were excellent.

## NOOTKA AREA.

The spring and cohoe supplies on the spawning-grounds were found to be normal. The area is more important as a chum district. Supplies of this variety are reported as being very good and much better than in the years 1938, 1939, and 1940, although not as good as the unusually good year of 1941.

## KYUQUOT AREA.

The spring-salmon seeding is reported as being very good, comparing very favourably with that of previous years. The cohoe-supplies were average and about equal to the brood-year of 1939. The chum-supplies were excellent and the size of the individual fish was large.

## QUATSINO AREA.

The usual small seeding of sockeye was observed in the few streams frequented by this variety. This fishery is not an important one. In Marble Creek, frequented by approximately 75 per cent. of the springs which go to the Quatsino area, there was an average supply of this variety. The escapement to the other creeks frequented by springs showed an improvement over recent seasons. The cohoe seeding throughout the whole area was heavy, the largest quantities being observed in Marble Creek, Rupert Creek, and Spruce River. The pink seeding was better than usual in Rupert River and East Creek. The other small streams received average supplies. The chum escapement was good in proportion to the run and is considered satisfactory.

# STATISTICAL TABLES.

## PACK OF BRITISH COLUMBIA SALMON, SEASON 1942.

### SHOWING THE ORIGIN OF SALMON CAUGHT IN EACH DISTRICT.

| District. | Sockeye. | Springs. | Steel-heads. | Cohoe. | Pinks. | Chums. | Total. |
|---|---|---|---|---|---|---|---|
| Fraser River | 446,371 | 9,688 | 309 | 10,542 | 134 | 82,573 | 549,617 |
| Queen Charlotte Islands | 1 | 38 | 41 | 16,935 | 83,329 | 43,801 | 144,145 |
| Nass River | 21,085 | 1,515 | 534 | 15,487 | 49,003½ | 12,518 | 100,142½ |
| Skeena River | 34,544 | 6,374 | 3,231 | 44,081½ | 52,767 | 11,421 | 152,418½ |
| Rivers Inlet | 79,199 | 985 | 60 | 8,467 | 954 | 15,874 | 105,539 |
| Smith Inlet | 15,939 | 8 | ..... | 1,813 | 527 | 5,490 | 23,777 |
| Central Area | 17,470 | 723½ | 355 | 31,274 | 69,434 | 79,152 | 198,408½ |
| Vancouver Island* | 51,961 | 5,407 | 119 | 81,837½ | 14,474 | 383,005 | 536,803½ |
| Alaska | ..... | 6 | ..... | 701 | ..... | ..... | 707 |
| Totals | 666,570 | 24,744½ | 4,649 | 211,138 | 270,622½ | 633,834 | 1,811,558 |

* 23,265½ cases of bluebacks are included with the cohoe-pack for Vancouver Island.

## STATEMENT SHOWING THE TOTAL SALMON-PACK BY SPECIES FROM 1934 TO 1942.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. | 1934. |
|---|---|---|---|---|---|---|---|---|---|
| Sockeye | 666,570 | 455,298 | 366,402 | 269,887 | 447,450 | 325,836 | 414,809 | 350,444 | 377,844 |
| Spring | 24,744½ | 51,593 | 17,740 | 16,098 | 15,356 | 16,174 | 29,853 | 21,920 | 29,776 |
| Chum | 633,834 | 926,801 | 643,441 | 386,590 | 541,819 | 447,760 | 597,488 | 409,604 | 513,181 |
| Pink | 270,622½ | 427,774 | 213,904 | 620,595 | 400,876 | 585,574 | 591,535½ | 514,966 | 436,354 |
| Cohoe | 211,138 | 430,513 | 224,522 | 245,097 | 301,081 | 133,489 | 229,750 | 231,492 | 225,431 |
| Steelhead | 4,649 | 3,454 | 1,207 | 796 | 1,036 | 844 | 1,068 | 596 | 1,280 |
| Totals | 1,811,558 | 2,295,433 | 1,467,216 | 1,539,063 | 1,707,798 | 1,509,677 | 1,864,503½ | 1,529,022 | 1,583,866 |

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

### TOTAL PACKED BY DISTRICTS IN 1934 TO 1942, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. | 1934. |
|---|---|---|---|---|---|---|---|---|---|
| Fraser | 549,617 | 431,299 | 152,363 | 199,241 | 277,084 | 231,848 | 260,261 | 216,728 | 273,139 |
| Skeena | 152,418½ | 200,497 | 195,355 | 205,604 | 223,413 | 133,165 | 218,634 | 170,420 | 284,096 |
| Rivers Inlet | 105,539 | 138,650 | 88,665 | 83,502 | 122,363 | 108,782 | 72,011½ | 155,571 | 86,000 |
| Smith Inlet | 23,777 | 32,109 | 33,998 | 28,727 | 44,921 | 35,502 | 14,888 | 49,928 | 41,256 |
| Nass River | 100,142½ | 71,330 | 60,441 | 55,946 | 113,970 | 49,042 | 139,575½ | 78,214 | 75,213 |
| Vancouver Island | 536,803½ | 985,835 | 419,579 | 590,736 | 458,554 | 608,798 | 559,746½ | 469,427 | 372,347 |
| Other Districts | 343,260½ | 398,152 | 516,815 | 375,307 | 467,493 | 342,350 | 599,387 | 388,734 | 451,815 |
| Cold storage | ..... | 46,561 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Grand totals | 1,811,558 | 2,295,433 | 1,467,216 | 1,539,063 | 1,707,798† | 1,509,677* | 1,864,503½ | 1,529,022 | 1,583,866 |

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

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

## TABLE SHOWING THE TOTAL SOCKEYE-PACK OF THE FRASER RIVER, ARRANGED IN ACCORDANCE WITH THE FOUR-YEAR CYCLE, 1895–1942.

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

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

## FRASER RIVER, 1927–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 446,371 | 171,290 | 99,009 | 54,296 | 186,794 | 100,272 | 184,854 | 62,822 |
| Springs | 9,688 | 34,038 | 4,504 | 5,993 | 4,308 | 5,444 | 15,126 | 9,401 |
| Chums | 82,573 | 95,070 | 35,665 | 30,150 | 58,778 | 20,878 | 31,565 | 8,227 |
| Pinks | 134 | 102,388 | 12 | 95,176 | 63 | 94,010 | ..... | 111,328 |
| Cohoes | 10,542 | 28,265 | 13,028 | 13,557 | 27,127 | 11,244 | 28,716 | 24,950 |
| Steelheads | 309 | 248 | 145 | 69 | 14 | ..... | ..... | ..... |
| Totals | 549,617 | 431,299 | 152,363 | 199,241 | 277,084 | 231,848 | 260,261 | 216,728 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 139,238 | 52,465 | 65,769 | 40,947 | 103,692 | 61,569 | 29,299 | 61,393 |
| Springs | 16,218 | 5,579 | 28,701 | 9,740 | 21,127 | 10,004 | 5,082 | 18,453 |
| Chums | 104,092 | 34,391 | 14,948 | 251 | 68,946 | 144,159 | 193,106 | 67,259 |
| Pinks | 2,199 | 92,746 | 385 | 13,307 | 30,754 | 158,208 | 2,881 | 102,536 |
| Cohoes | 11,392 | 13,901 | 16,815 | 8,165 | 25,585 | 40,520 | 27,061 | 24,079 |
| Steelheads | ..... | ..... | 23 | 657 | 27,879 | 12,013 | 795 | 10,658 |
| Totals | 273,139 | 199,082 | 126,641 | 73,067 | 277,983 | 426,473 | 258,224 | 284,378 |

## SKEENA RIVER, 1927–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 34,544 | 81,767 | 116,507 | 68,485 | 47,257 | 42,491 | 81,973 | 52,879 |
| Springs | 6,374 | 4,985 | 6,118 | 4,857 | 4,318 | 4,401 | 4,551½ | 4,039 |
| Chums | 11,421 | 10,707 | 4,682 | 7,773 | 16,758 | 10,811 | 15,297½ | 8,122 |
| Pinks | 52,767 | 50,537 | 47,301 | 95,236 | 69,610 | 59,400 | 91,389 | 81,868 |
| Cohoes | 44,081½ | 50,605 | 20,614 | 29,198 | 52,821 | 15,514 | 25,390 | 23,498 |
| Steelheads | 3,231 | 1,896 | 133 | 55 | 42 | 21 | 33 | 14 |
| Totals | 152,418½ | 200,497 | 195,355 | 205,604 | 190,806 | 132,638 | 218,634 | 170,420 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 70,655 | 30,506 | 59,916 | 93,023 | 132,372 | 78,017 | 34,559 | 83,996 |
| Springs | 8,300 | 3,297 | 28,269 | 9,857 | 7,501 | 4,324 | 6,420 | 19,038 |
| Chums | 24,388 | 15,714 | 38,549 | 3,893 | 5,187 | 4,908 | 17,716 | 19,006 |
| Pinks | 126,163 | 95,783 | 58,261 | 44,807 | 275,642 | 95,305 | 209,579 | 38,768 |
| Cohoes | 54,456 | 39,896 | 48,312 | 10,637 | 29,617 | 37,678 | 30,194 | 26,326 |
| Steelheads | 114 | 267 | 404 | 768 | 58 | 13 | 241 | 582 |
| Totals | 284,096 | 185,463 | 233,711 | 162,986 | 450,377 | 220,245 | 298,709 | 187,716 |

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

### RIVERS INLET, 1927–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 79,199 | 93,378 | 63,469 | 54,143 | 87,942 | 84,832 | 46,351 | 135,038 |
| Springs | 985 | 1,692 | 1,226 | 745 | 1,209 | 917 | 581½ | 429 |
| Chums | 15,874 | 15,442 | 9,025 | 5,462 | 7,759 | 9,415 | 11,505 | 7,136 |
| Pinks | 954 | 4,807 | 3,329 | 12,095 | 9,063 | 7,536 | 6,432½ | 4,554 |
| Cohoes | 8,467 | 23,202 | 11,561 | 10,974 | 16,285 | 6,012 | 7,122½ | 8,375 |
| Steelheads | 60 | 129 | 55 | 83 | 105 | 70 | 19 | 39 |
| Totals | 105,539 | 138,650 | 88,665 | 83,502 | 122,363 | 108,782 | 72,011½ | 155,571 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 76,923 | 83,507 | 69,732 | 76,428 | 119,170 | 70,260 | 60,044 | 65,269 |
| Springs | 436 | 449 | 459 | 325 | 434 | 342 | 468 | 608 |
| Chums | 895 | 677 | 944 | 429 | 492 | 989 | 3,594 | 1,122 |
| Pinks | 2,815 | 5,059 | 3,483 | 5,089 | 18,023 | 2,386 | 16,546 | 671 |
| Cohoes | 4,852 | 3,446 | 7,062 | 6,571 | 756 | 1,120 | 868 | 2,094 |
| Steelheads | 79 | 82 | 29 | 32 | 105 | 29 | 7 | 9 |
| Totals | 86,000 | 93,220 | 81,709 | 88,874 | 138,980 | 75,126 | 81,527 | 69,773 |

### SMITH INLET, 1927–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 15,939 | 21,495 | 25,947 | 17,833 | 33,894 | 25,258 | 12,788 | 31,648 |
| Springs | 8 | 124 | 142 | 215 | 68 | 21 | 30 | 216 |
| Cohoes | 1,813 | 1,955 | 1,102 | 3,880 | 1,058 | 241 | 310 | 1,201 |
| Pinks | 527 | 749 | 755 | 3,978 | 1,761 | 483 | 65 | 4,412 |
| Chums | 5,490 | 7,741 | 6,015 | 2,771 | 8,076 | 9,494 | 1,653 | 12,427 |
| Steelheads | ..... | 45 | 37 | 50 | 64 | 5 | 42 | 24 |
| Totals | 23,777 | 32,109 | 33,998 | 28,727 | 44,921 | 35,502 | 14,888 | 49,928 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 14,607 | 37,369 | 25,488 | 12,867 | 32,057 | 9,683 | 33,442 | 22,682 |
| Springs | 164 | 354 | 48 | 122 | 290 | 78 | 286 | 349 |
| Cohoes | 3,941 | 5,068 | 273 | 112 | 1,460 | 275 | 230 | 2,990 |
| Pinks | 6,953 | 19,995 | 1,148 | 824 | 16,615 | 853 | 167 | 732 |
| Chums | 15,548 | 8,841 | 165 | 133 | 1,660 | 113 | 19 | 2,605 |
| Steelheads | 43 | 87 | 20 | 36 | 103 | 12 | 6 | 8 |
| Totals | 41,256 | 71,714 | 27,142 | 14,094 | 52,185 | 11,014 | 34,150 | 29,366 |

* Previously reported in Queen Charlotte and other districts.

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

### NASS RIVER, 1927–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 21,085 | 24,876 | 13,809 | 24,357 | 21,462 | 17,567 | 28,562½ | 12,712 |
| Springs | 1,515 | 519 | 1,716 | 708 | 773 | 1,251 | 2,167 | 560 |
| Chums | 12,518 | 6,246 | 5,461 | 2,500 | 15,911 | 10,080 | 20,620½ | 17,481 |
| Pinks | 49,003½ | 22,667 | 29,278 | 26,370 | 61,477 | 8,031 | 75,887½ | 25,508 |
| Cohoes | 15,487 | 16,648 | 10,060 | 1,996 | 14,159 | 12,067 | 11,842 | 21,810 |
| Steelheads | 534 | 374 | 117 | 15 | 188 | 46 | 496 | 143 |
| Totals | 100,142½ | 71,330 | 60,441 | 55,946 | 113,970 | 49,042 | 139,575½ | 78,214 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 28,701 | 9,757 | 14,154 | 16,929 | 26,405 | 16,077 | 5,540 | 12,026 |
| Springs | 654 | 1,296 | 4,408 | 1,439 | 1,891 | 352 | 1,846 | 3,824 |
| Chums | 2,648 | 1,775 | 14,515 | 392 | 3,978 | 1,212 | 3,538 | 3,307 |
| Pinks | 32,964 | 44,306 | 44,629 | 5,178 | 79,976 | 10,342 | 83,183 | 16,609 |
| Cohoes | 9,935 | 3,251 | 7,955 | 8,943 | 1,126 | 1,202 | 10,734 | 3,966 |
| Steelheads | 311 | 49 | 10 | ..... | 84 | ..... | 36 | 96 |
| Totals | 75,213 | 60,434 | 85,671 | 32,881 | 113,460 | 29,185 | 104,877 | 39,828 |

### VANCOUVER ISLAND DISTRICT, 1927–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 51,961 | 40,273 | 15,177 | 16,259 | 27,965 | 25,427 | 32,696½ | 22,928 |
| Springs | 5,407 | 8,038 | 2,454 | 2,889 | 4,254 | 2,359 | 6,340 | 6,525 |
| Chums | 383,005 | 593,016 | 279,064 | 212,949 | 266,566 | 203,900 | 347,951 | 143,960 |
| Pinks | 14,474 | 177,292 | 33,785 | 235,119 | 70,108 | 318,780 | 82,028½ | 191,627 |
| Cohoes | 81,837½ | 166,908 | 88,885* | 123,388 | 62,054 | 52,244 | 90,625 | 104,366 |
| Steelheads | 119 | 308 | 214 | 132 | 27,607 | 88 | 105 | 21 |
| Totals | 536,803½ | 985,835 | 419,579 | 590,736 | 458,554 | 608,798 | 559,746 | 469,427 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Sockeyes | 27,282 | 18,397 | 27,611 | 22,199 | 24,784 | 10,340 | 14,248 | 24,835 |
| Springs | 1,630 | 4,875 | 10,559 | 4,055 | 3,431 | 1,645 | 2,269 | 6,769 |
| Chums | 210,239 | 96,642 | 70,629 | 16,329 | 177,856 | 162,246 | 303,474 | 220,270 |
| Pinks | 54,526 | 172,945 | 33,403 | 81,965 | 89,941 | 74,001 | 41,885 | 52,561 |
| Cohoes | 78,670 | 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 | 372,347 | 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 BRITISH COLUMBIA, BY DISTRICTS AND SPECIES—*Continued.*

### QUEEN CHARLOTTE ISLANDS, 1933–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. | 1934. | 1933. |
|---|---|---|---|---|---|---|---|---|---|---|
| Sockeyes | 1 | 149 | 16 | 1 | 179 | 2 | 85 | ..... | ..... | ..... |
| Springs | 38 | 236 | 62 | 36 | 66 | 140 | 227 | 63 | 258 | 3,575 |
| Chums | 43,801 | 76,745 | 164,911 | 45,519 | 40,882 | 72,689 | 69,304 | 86,298 | 38,062 | 6,988 |
| Pinks | 83,329 | 524 | 44,966 | 2,123 | 57,952 | 13 | 89,355 | 1,479 | 53,398 | ..... |
| Cohoes | 16,935 | 27,421 | 8,897 | 3,020 | 16,616 | 4,631 | 19,920 | 5,461 | 8,315 | ..... |
| Steelheads | 41 | 11 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Totals | 144,145 | 105,086 | 218,852 | 50,699 | 115,695 | 77,475 | 178,891 | 93,301 | 100,033 | 10,563 |

### CENTRAL AREA, 1933–42, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. | 1934. | 1933. |
|---|---|---|---|---|---|---|---|---|---|---|
| Sockeyes | 17,470 | 20,854 | 32,042 | 26,158 | 36,178 | 29,987 | 27,499 | 32,417 | 20,438 | 26,106 |
| Springs | 723½ | 460 | 1,518 | 655 | 540 | 1,641 | 830 | 687 | 2,116 | 841 |
| Chums | 79,152 | 111,587 | 135,802 | 79,384 | 127,089 | 110,493 | 99,592 | 125,953 | 117,309 | 128,602 |
| Pinks | 69,434 | 66,130 | 54,478 | 150,498 | 130,842 | 97,321 | 246,378 | 94,190 | 157,336 | 101,701 |
| Cohoes | 31,274 | 45,218 | 49,886 | 44,426 | 56,716 | 25,009 | 45,824 | 41,831 | 53,850 | 33,471 |
| Steelheads | 355 | 330 | 506 | 392 | 433 | 614 | 373 | 355 | 733 | 827 |
| Totals | 198,408½ | 244,579 | 274,232 | 301,513 | 351,798 | 265,065 | 420,496 | 295,433 | 351,782 | 291,548 |

## STATEMENT SHOWING THE SOCKEYE-PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1927 TO 1942, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. | 1936. | 1935. |
|---|---|---|---|---|---|---|---|---|
| Fraser River | 446,371 | 171,290 | 99,009 | 54,296 | 186,794 | 100,272 | 183,120 | 62,822 |
| Skeena River | 34,544 | 81,767 | 116,507 | 68,485 | 47,257 | 42,491 | 81,973 | 52,879 |
| Rivers Inlet | 79,199 | 93,378 | 63,469 | 54,143 | 87,942 | 84,832 | 46,351 | 135,038 |
| Smith Inlet | 15,939 | 21,495 | 25,947 | 17,833 | 33,894 | 25,258 | 12,788 | 31,648 |
| Nass River | 21,085 | 24,876 | 13,809 | 24,357 | 21,462 | 17,567 | 28,562½ | 12,712 |
| Vancouver Island | 51,961 | 40,273 | 15,177 | 16,259 | 27,965 | 25,427 | 34,430½ | 22,928 |
| Other Districts | 17,471 | 22,219 | 32,484 | 34,514 | 36,357 | 29,989 | 27,584 | 32,417 |
| Totals | 666,570 | 455,298 | 366,402 | 269,887 | 441,671* | 325,836 | 414,809 | 350,444 |

| | 1934. | 1933. | 1932. | 1931. | 1930. | 1929. | 1928. | 1927. |
|---|---|---|---|---|---|---|---|---|
| Fraser River | 139,238 | 52,465 | 65,769 | 40,947 | 103,692 | 61,569 | 29,299 | 61,393 |
| Skeena River | 70,655 | 30,506 | 59,916 | 93,023 | 132,372 | 78,017 | 34,559 | 83,996 |
| Rivers Inlet | 76,923 | 83,507 | 69,732 | 76,428 | 119,170 | 70,260 | 60,044 | 65,269 |
| Smith Inlet | 14,607 | 37,369 | 25,488 | 12,867 | 32,057 | 9,683 | 33,442 | 22,682 |
| Nass River | 28,701 | 9,757 | 14,154 | 16,929 | 26,405 | 16,077 | 5,540 | 12,026 |
| Vancouver Island | 27,282 | 18,397 | 27,611 | 22,199 | 24,784 | 10,340 | 14,248 | 24,835 |
| Other Districts | 20,438 | 26,106 | 21,685 | 29,071 | 39,198 | 35,331 | 26,410 | 37,851 |
| Totals | 377,844 | 258,107 | 284,355 | 291,464 | 477,678 | 281,277 | 203,542 | 308,052 |

216 cases of Alaska sockeye packed in British Columbia canneries are not shown in the above table for the year 1936.

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

## STATEMENT SHOWING THE SPRING-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1931 TO 1942, INCLUSIVE.

| | 1942. | 1941.* | 1940. | 1939. | 1938. | 1937. |
|---|---|---|---|---|---|---|
| Fraser River | 9,688 | 34,038 | 4,504 | 5,993 | 4,308 | 5,444 |
| Queen Charlotte Islands | 38 | 236 | 62 | 36 | 66 | 140 |
| Nass River | 1,515 | 519 | 1,716 | 708 | 773 | 1,251 |
| Skeena River | 6,374 | 4,985 | 6,118 | 4,857 | 4,318 | 4,401 |
| Rivers Inlet | 985 | 1,692 | 1,226 | 745 | 1,209 | 917 |
| Smith Inlet | 8 | 124 | 142 | 215 | 68 | 21 |
| Central Area | 723½ | 460 | 1,518 | 655 | 540 | 1,641 |
| Vancouver Island | 5,407 | 8,038 | 2,454 | 2,889 | 4,254 | 2,359 |
| Alaska | 6 | 383 | ---------- | ---------- | ---------- | ---------- |
| Totals | 24,744½ | 50,475 | 17,740 | 16,098 | 15,536 | 16,174 |

| | 1936. | 1935. | 1934. | 1933. | 1932. | 1931. |
|---|---|---|---|---|---|---|
| Fraser River | 15,126 | 9,401 | 16,218 | 5,579 | 28,701 | 9,740 |
| Queen Charlotte Islands | 227 | 63 | 258 | 3,575 | 278 | 854 |
| Nass River | 2,167 | 560 | 654 | 1,296 | 4,408 | 1,439 |
| Skeena River | 4,551½ | 4,039 | 8,300 | 3,297 | 28,269 | 9,858 |
| Rivers Inlet | 581½ | 429 | 436 | 449 | 459 | 325 |
| Smith Inlet | 30 | 216 | 164 | 354 | 48 | 122 |
| Central Area | 830 | 687 | 2,116 | 841 | 3,236 | 754 |
| Vancouver Island | 6,340 | 6,525 | 1,630 | 4,875 | 10,559 | 4,055 |
| Totals | 29,853 | 21,920 | 29,776 | 20,266 | 75,958 | 27,147 |

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

## STATEMENT SHOWING THE COHOE-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1931 TO 1942, INCLUSIVE.

| | 1942. | 1941.* | 1940. | 1939. | 1938. | 1937. |
|---|---|---|---|---|---|---|
| Fraser River | 10,542 | 28,265 | 13,028 | 13,557 | 27,127 | 11,244 |
| Queen Charlotte Islands | 16,935 | 27,421 | 8,897 | 3,020 | 16,616 | 4,631 |
| Nass River | 15,487 | 16,648 | 10,060 | 1,996 | 14,159 | 12,067 |
| Skeena River | 44,081½ | 50,605 | 20,614 | 29,198 | 52,821 | 15,514 |
| Rivers Inlet | 8,467 | 23,202 | 11,561 | 10,974 | 16,285 | 6,012 |
| Smith Inlet | 1,813 | 1,955 | 1,102 | 3,880 | 1,058 | 241 |
| Central Area | 31,274 | 45,218 | 49,886 | 44,426 | 56,716 | 25,009 |
| Vancouver Island | 81,837½ | 166,908 | 88,885 | 123,388 | 89,471 | 58,244 |
| Alaska | 701 | 31,187 | 20,489 | 14,658 | 26,828 | 527 |
| Totals | 211,138 | 391,409 | 224,522 | 245,097 | 301,081 | 133,489 |

| | 1936. | 1935. | 1934. | 1933. | 1932. | 1931. |
|---|---|---|---|---|---|---|
| Fraser River | 28,716 | 24,950 | 11,392 | 13,901 | 16,815 | 8,818 |
| Queen Charlotte Islands | 19,920 | 5,461 | 8,315 | ---------- | 3,805 | 5,335 |
| Nass River | 11,842 | 21,810 | 9,935 | 3,251 | 7,955 | 8,943 |
| Skeena River | 25,390 | 23,498 | 54,476 | 39,896 | 48,312 | 10,637 |
| Rivers Inlet | 7,122½ | 8,375 | 4,852 | 3,446 | 7,062 | 6,571 |
| Smith Inlet | 310 | 1,201 | 3,941 | 5,068 | 273 | 112 |
| Central Area | 45,824 | 41,831 | 53,850 | 33,471 | 41,172 | 10,806 |
| Vancouver Island | 90,625½ | 104,366 | 78,670 | 60,019 | 63,637 | 50,953 |
| Totals | 229,750 | 231,492 | 225,431 | 159,052 | 189,031 | 102,175 |

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

## STATEMENT SHOWING THE PINK-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1931 TO 1942, INCLUSIVE.

| | 1942. | 1941. | 1940. | 1939. | 1938. | 1937. |
|---|---|---|---|---|---|---|
| Fraser River | 134 | 102,388 | 12 | 95,176 | 63 | 94,010 |
| Queen Charlotte Islands | 83,329 | 524 | 44,966 | 2,123 | 57,952 | 13 |
| Nass River | 49,003½ | 22,667 | 29,278 | 26,370 | 61,477 | 8,031 |
| Skeena River | 52,767 | 50,537 | 47,301 | 95,236 | 69,610 | 59,400 |
| Rivers Inlet | 954 | 4,807 | 3,329 | 12,095 | 9,063 | 7,536 |
| Smith Inlet | 527 | 749 | 755 | 3,978 | 1,761 | 483 |
| Central Area | 69,434 | 66,130 | 54,478 | 150,498 | 130,842 | 97,321 |
| Vancouver Island | 14,474 | 177,292 | 33,785 | 235,119 | 70,108 | 318,780 |
| Alaska | ..... | 2,680 | ..... | ..... | ..... | ..... |
| Totals | 270,622½ | 427,774 | 213,904 | 620,595 | 400,876 | 585,574 |

| | 1936. | 1935. | 1934. | 1933. | 1932. | 1931. |
|---|---|---|---|---|---|---|
| Fraser River | ..... | 111,328 | 2,199 | 92,746 | 385 | 13,307 |
| Queen Charlotte Islands | 89,355 | 1,479 | 53,398 | ..... | 2,415 | ... |
| Nass River | 75,887½ | 25,508 | 32,964 | 44,306 | 44,629 | 5,178 |
| Skeena River | 91,389 | 81,868 | 126,163 | 95,783 | 58,261 | 44,807 |
| Rivers Inlet | 6,432½ | 4,554 | 2,815 | 5,059 | 3,483 | 5,089 |
| Smith Inlet | 65 | 4,412 | 6,953 | 19,995 | 1,148 | 824 |
| Central Area | 246,378 | 94,190 | 157,336 | 101,701 | 80,034 | 55,825 |
| Vancouver Island | 82,028½ | 191,627 | 54,526 | 172,945 | 33,403 | 81,965 |
| Totals | 591,535½ | 514,966 | 436,354 | 532,535 | 223,758 | 206,995 |

## STATEMENT SHOWING THE CHUM-SALMON PACK OF BRITISH COLUMBIA, BY DISTRICTS, 1931 TO 1942, INCLUSIVE.

| | 1942. | 1941.* | 1940. | 1939. | 1938. | 1937. |
|---|---|---|---|---|---|---|
| Fraser River | 82,573 | 95,070 | 35,665 | 30,150 | 58,778 | 20,878 |
| Queen Charlotte Islands | 43,801 | 76,745 | 164,911 | 45,519 | 40,882 | 72,689 |
| Nass River | 12,518 | 6,246 | 5,461 | 2,500 | 15,911 | 10,080 |
| Skeena River | 11,421 | 10,707 | 4,682 | 7,773 | 16,758 | 10,811 |
| Rivers Inlet | 15,874 | 15,442 | 9,025 | 5,462 | 7,759 | 9,415 |
| Smith Inlet | 5,490 | 7,741 | 6,015 | 2,771 | 8,076 | 9,494 |
| Central Area | 79,152 | 111,587 | 135,802 | 79,384 | 127,089 | 110,493 |
| Vancouver Island | 383,005 | 593,016 | 279,064 | 212,949 | 266,566 | 203,900 |
| Alaska | ..... | 3,908 | 2,816 | 82 | ..... | ..... |
| Totals | 633,834 | 920,462 | 643,441 | 386,590 | 541,819 | 447,760 |

| | 1936. | 1935. | 1934. | 1933. | 1932. | 1931. |
|---|---|---|---|---|---|---|
| Fraser River | 31,565 | 8,227 | 104,092 | 34,391 | 14,948 | 251 |
| Queen Charlotte Islands | 69,304 | 86,298 | 38,062 | 6,988 | 358 | ..... |
| Nass River | 20,620½ | 17,481 | 2,648 | 1,775 | 14,515 | 392 |
| Skeena River | 15,297½ | 8,122 | 24,388 | 15,714 | 38,549 | 3,893 |
| Rivers Inlet | 11,505 | 7,136 | 895 | 677 | 944 | 429 |
| Smith Inlet | 1,653 | 12,427 | 15,548 | 8,841 | 165 | 113 |
| Central Area | 99,592 | 125,953 | 117,309 | 128,602 | 166,653 | 34,570 |
| Vancouver Island | 347,951 | 143,960 | 210,239 | 96,642 | 70,629 | 16,239 |
| Totals | 597,488 | 409,604 | 513,181 | 293,630 | 306,761 | 55,997 |

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

## STATEMENT SHOWING THE QUANTITY OF PILCHARD PRODUCTS PRODUCED IN BRITISH COLUMBIA, 1930 TO 1942.

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

## STATEMENT SHOWING THE QUANTITY OF HERRING PRODUCTS PRODUCED IN BRITISH COLUMBIA, 1935 TO 1942.

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

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

## STATEMENT SHOWING THE QUANTITY OF MEAL, OIL, AND FERTILIZER, PRODUCED FROM SOURCES OTHER THAN HERRING AND PILCHARD, 1935 TO 1942.

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

* Includes 916,723 gallons fish-liver oil.

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