SALMON OF THE NORTH PACIFIC OCEAN—PART IV
SPAWNING POPULATIONS OF NORTH PACIFIC SALMON

5. PACIFIC SALMON IN CANADA

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INTRODUCTION

The streams of Canada’s Pacific coast support populations of five of the six major species of Pacific salmon (genus Oncorhynchus). These are the sockeye (O. nerka), pink (O. gorbuscha), chum (O. keta), coho (O. kisutch), and chinook (O. tshawytscha). The sixth species, the chum salmon (O. masou) is native to Asia only. Canadian streams provide about 12% of the total North Pacific salmon catch by numbers and 17% by weight. On the basis of catch statistics for the period 1952–1963, salmon caught on approaches to Canadian rivers have provided roughly one-quarter of the total North Pacific catches of sockeye, coho, and chinook salmon but only 9% and 6% of the total pink and chum production, respectively. Canadian streams have annually yielded about one-third of the total catch made in North American waters, providing between 27% and 36% of the total North American sockeye, pink, and chum catches. Roughly 48% and 30% of the total North American coho and chinook catches, respectively, have been made off the British Columbia coast.

Production of the five species in Canadian waters is distributed in more than 1,500 streams and tributaries spread along the coast of the Province of British Columbia. In addition, a few rivers draining into the Arctic Ocean (notably the Mackenzie) contain small numbers of salmon and there are several rivers with spawning grounds in Canada which flow into the sea through the United States (Figure 1). The latter group includes the Yukon, Alsek, Taku, Stikine, and Unuk Rivers which flow from northern British Columbia or the Yukon Territory to the sea through Alaska, and the Okanagan River which flows south from southern British Columbia to join the Columbia River in the State of Washington.

Information on the distribution and abundance of Canadian salmon stocks includes relatively accurate statistics of catch in various coastal areas and more approximate data on the abundance of spawners reaching the rivers.

From 1951 to 1962 (the period given detailed consideration in this report), spawning ground information for different British Columbia rivers varied greatly with respect to thoroughness of coverage and accuracy. For some areas (notably the sockeye- and pink-producing streams of the Fraser and Skeena drainages), estimates were derived by actual counts of runs through weirs on some tributaries, by extensive tag and recovery programs or by well-developed year-to-year index count procedures in others. These estimates, requiring large-scale field programs (see annual reports of the International Pacific Salmon Fisheries Commission and of the Skeena Salmon Management Committee), provided reasonably precise measures of escapement. For most other areas, however, except for occasional large-scale programs (for example, for

Figure 1. Drainages of major western North American rivers originating in Canada.
Johnstone Strait area pink salmon in 1959 and 1961—Vernon et al., 1964, and Hourston et al., 1965; for chums in the Fraser River—Canada Dept. Fish., 1962a, 1962b, and 1963a), approximate estimates were obtained through visual counts by officers of the Protection Branch of the Canadian Department of Fisheries.

The number of streams covered by each officer was often large and many of the streams were very difficult to reach. Estimates for most of these streams were usually derived from counts of live and dead fish made during foot surveys by the officers. In some particularly inaccessible streams, coverage only by aircraft was feasible. The accuracy of such surveys varies greatly from stream to stream and from species to species; without special studies the degree of reliability of such estimates cannot be assessed accurately.

There is little doubt that the information does indicate the relative importance of streams within an area and relative changes in year-to-year abundance of spawners within an area. However, the data are probably not accurate enough for use in making more precise comparisons (especially between streams in areas covered by different officers) or for determining accurately rates of removal by the fisheries.

In recent years increasing emphasis has been placed by the Department of Fisheries on obtaining accurate estimates of spawning escapements. Since 1963, special programs involving tag and recovery experiments, fishway counts, tower counts, or test fishing by gillnet boats have been conducted to estimate escapements of sockeye in the Nass River, pink salmon in the Yakoun River, sockeye in Rivers Inlet, and chums and chinooks in the Fraser system.

Figure 2. Salmon net fishing areas in southern British Columbia and in adjacent International Pacific Salmon Fisheries Convention Waters in the United States. Stippling indicates areas in which net fishing occurs; black patches indicate where net fishing is more concentrated. Boundary lines are those of the British Columbia Statistical Areas shown in Figure 4.
Figure 3. Salmon net fishing areas in northern British Columbia. Stippling indicates areas in which net fishing occurs; black patches indicate where net fishing is more concentrated. Boundary lines are those of the British Columbia Statistical Areas shown in Figure 4.
Figure 4. British Columbia statistical area division.
In Canadian coastal waters, almost all sockeye, pinks, and chums caught are maturing individuals taken by nets (gillnets and purse seines) operating along inside passages and in inlets and estuaries close to spawning grounds (Figures 2 and 3). These net fisheries are very efficient and remove large fractions of the runs. Most salmon taken in net fisheries are bound for streams relatively close to the fishing sites. Therefore, because intensive net fisheries extend almost everywhere along the British Columbia coastline, statistics of catch reflect the abundance of runs within broad areas of the coast. Accurate statistics, based on a mandatory sales-slip system, are available from 1951 onwards for the 30 Statistical Areas shown in Figure 4. In the detailed discussion of the distribution of sockeye, pink, and chum stocks to follow later, catch statistics are the main source of information used to characterize the relative abundance and timing of migration of stocks bound for different parts of the

1 In those areas where accurate statistics of both catch and escapement have been obtained in recent years (e.g., for sockeye and pinks on the Fraser and Skeena Rivers, for pinks in Johnstone Strait in 1959 and 1961, in the Bella Coola area in 1963), unless special restrictions have been applied or tie-ups of the fleet during price negotiations have occurred, rates of removal have usually exceeded 50% and have often been as high as 75%.

2 Notable exceptions are some salmon caught at the entrances to the long passages between Vancouver Island and the mainland—Queen Charlotte and Johnstone Straits on the east and Juan de Fuca Strait on the south. Along these passages salmon may travel up to 300 miles to reach their destinations. However, movements of salmon in the latter areas have been studied in considerable detail (e.g., Chatiwin, 1953; Klick, 1955; Verhoeven and Daviddoff, 1962; Vernon et al., 1964; and Hourston et al., 1965) and the destinations of salmon caught in the passages at different times during the fishing season are fairly well known.

Figure 5. Troll fishing areas in southern British Columbia. Stippling indicates areas in which troll fishing occurs; black patches indicate where troll fishing is more concentrated. Boundary lines are those of the British Columbia Statistical Areas shown in Figure 4.
Figure 6. Troll fishing areas in northern British Columbia. Stippling indicates areas in which troll fishing occurs; black patches indicate where troll fishing is more concentrated. Boundary lines are those of the British Columbia Statistical Areas shown in Figure 4.
coast. The less precise information on escapements is used mainly to point out the location of the main producing streams within general areas of the coast and to rank these streams in their approximate order of importance.

Coho and chinook salmon are exploited by troll fisheries operating in coastal waters up to 30 miles offshore as well as by the net fisheries described above. The most important troll fishing areas are off the west coast of Vancouver Island, in Queen Charlotte Strait and in Hecate Strait (Figures 5 and 6). These troll fisheries account for 64% of the total Canadian catch of coho and 73% of the chinook catch. Tagging has shown that the troll fisheries exploit a mixture of stocks bound for different areas (Milne, 1957), thus making catches by statistical area less reliable indices of the abundance of different stocks than similar statistics for the three species exploited almost entirely by the inshore net fisheries.

On the northern and southern borders of British Columbia, both United States and Canadian fishermen fish a mixture of stocks bound for the two countries. In the south, United States and Canadian fishermen operating on respective sides of the border in Juan de Fuca Strait and the Strait of Georgia jointly exploit mainly pink and sockeye salmon bound for the Fraser River (some adjacent rivers) in Canada and pinks going to the streams of Puget Sound in the United States (Int. Pac. Salmon Fish. Comm., Annual Reports for 1946 to 1963; Hourston et al., 1963). Off the west coast of Vancouver and Queen Charlotte Islands, troll fishermen of both countries exploit chinooks bound for streams from British Columbia southward to California, including important numbers bound for the Columbia River (Milne, 1957). In the north, United States net fishermen intercept pink and sockeye salmon bound for northern British Columbia and Canadian net fishermen intercept Alaskan salmon in the Dundas Island area (Shepard et al., 1962). Fishermen of both countries exploit a mixture of stocks in Portland Canal. In describing the distribution of stocks in Canadian rivers consideration has therefore been given to catches in nearby United States fishing areas.

The present paper is concerned primarily with the distribution of stocks. More detailed information on the life history of the five species in Canadian waters has been presented in recent reviews on sockeye (Ricker, 1966), pinks and chums (Neave, 1966a and 1966b), coho (Godfrey, 1963), and chinook (Mason, 1965). Detailed catch statistics are provided in annual compilations by the Canadian Department of Fisheries (Canada Dept. Fish., 1952 to 1964). Since 1908, catches of sockeye in the most important commercial fishing areas have been sampled to provide annual estimates of the age, size, and sex compositions of the runs, and since 1957 coverage has been extended to include chums and pinks (see summaries by Bilton et al., 1967a and 1967b).

Details on the abundance of salmon spawners throughout British Columbia are provided in Appendix A; details of spawning salmon in Canadian areas of rivers which drain through the United States are given in Appendix B.

SOCKEYE SALMON

Traditionally, sockeye are the most highly prized of the five species of Pacific salmon found in Canada. The first commercial fisheries, beginning in the latter part of the nineteenth century, and the native food fisheries which were in existence for hundreds of years prior to that time, depended almost entirely on sockeye. From 1951 to 1963 the annual catch of sockeye in British Columbia and adjacent waters in Washington has average 6.44 million fish weighing 39.64 million pounds.

In British Columbia most sockeye spawn at the outlets or in the tributaries to lakes in the late summer or autumn. The young, emerging from the gravel the following spring, usually spend one year in the lake (in a few areas the sockeye typically spend two years in the lake) before migrating to sea (Ricker, 1966).

Four drainage areas support most of Canada's sockeye (Figures 7 and 8). These are (in order of importance) the Fraser River (one of the world's largest sockeye-producing systems), Owikeno and Long Lakes (tributary to Rivers and Smith Inlets), the Skeena River, and the Nass River. Since 1951, fisheries in the Fraser estuary and in the approaches to the Fraser River have provided annual catches averaging 4.34 million sockeye, 67% of the total Canadian and Washington State sockeye catch. During the same period, catches of sockeye bound for Rivers and Smith Inlets tributaries (made mainly in British Columbia

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2 Based on the timing of the runs and on tagging (Verhoeven and Davidoff, 1962; Killick and Clemens, 1963) and age composition data, almost all sockeye taken in United States waters in Juan de Fuca and Georgia Straits and northern Puget Sound are bound for the Fraser system. In Canada, in most years the majority of sockeye in Johnstone Strait are probably Fraser-bound, although substantial numbers also are destined for the Nimpkish system.

4 Rivers and Smith Inlets sockeye are considered together because the two stocks intermingle and are fished together off the mouths of Rivers Inlet (Area 9) and Smith Inlet (Area 10). A few sockeye bound for Rivers and Smith Inlets may also be intercepted in the adjacent Areas 8 and 11.
Figure 7. Average catches of sockeye salmon in the various British Columbia Statistical Areas and in the United States section of the Fraser River Convention Area in the period 1951 to 1963, inclusive.
Figure 8. Estimated average annual numbers, in thousands, of sockeye salmon spawners in British Columbia streams from 1951 to 1962. Major drainage areas are labelled.
Figure 9. Average weekly catches (expressed as percentages of the total seasonal catch) of the five species of Pacific salmon in British Columbia waters during the period 1951 to 1963. For sockeye and odd-year pinks, catches made in the United States section of the Fraser River Convention Area have been included.
Figure 10. The Fraser River Convention Area and the Fraser River drainage.
Figure 11. Pack of sockeye salmon from 1873 to 1963 in the four major sockeye-producing areas of British Columbia. Pack figures for the Fraser River prior to 1891 (indicated by cross-hatching) do not include catches of Fraser River sockeye made in United States waters. Pack figures for the Nass and Skeena Rivers, and for Rivers-Smith Inlets, prior to 1903 (indicated by cross-hatching) include some salmon of other species.
Figure 12. Fraser River sockeye salmon pack, 1876 to 1963, plotted by cycles. Pack figures prior to 1891 do not include catches of Fraser River sockeye made in United States waters.
Statistical Areas 9 and 10) averaged 1.06 million sockeye, 16% of the total, whereas catches in the vicinity of the Skeena (Area 4) averaged 485,500, 8% of the total. Figures for the latter two areas are low because some sockeye bound for Rivers-Smith Inlets and the Skeena are intercepted in adjacent areas. The catch in the Nass area has averaged 203,700 sockeye, 3% of the total. The remaining areas have provided in toto an average catch of 358,300, only 6% of the total.

Combining catch data for all Canadian areas plus the State of Washington for the period 1951–1963, sockeye are caught in substantial numbers from mid-June through to the end of September with July being the month of peak catches (Figure 9). A second peak in late August reflects the dramatic appearance every four years of the very large run to the Shuswap Lake area of the Fraser system (see later section describing the Fraser sockeye in detail).

**Fraser River Sockeye**

Most maturing sockeye bound for the Fraser system approach the river through Juan de Fuca Strait, passing eastward through the Gulf Islands and Georgia Strait. Along this route, the sockeye are exploited by a series of United States and Canadian net fisheries (Figure 2). Occasionally a substantial number of the Fraser sockeye also approach from the north through Queen Charlotte and Johnstone Straits, but usually this fraction is small5.

Sockeye forming the Fraser River run originate in

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5 In 1958 it was estimated that approximately 4.28 million sockeye of the run destined for the Fraser River were taken in the Johnstone Strait fishery (see Int. Pac. Salmon Fish. Comm., Annual Report for 1958).

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Table 1: Average estimated escapements of sockeye (four-year-olds and older) to different Fraser River spawning grounds, 1938 to 1963. From annual reports of the International Pacific Salmon Fisheries Commission.

<table>
<thead>
<tr>
<th>Run</th>
<th>1901 cycle</th>
<th></th>
<th>1902 cycle</th>
<th></th>
<th>1903 cycle</th>
<th></th>
<th>1904 cycle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Lower Fraser</td>
<td>22.9</td>
<td>2.5</td>
<td>41.3</td>
<td>1.8</td>
<td>53.8</td>
<td>8.9</td>
<td>52.1</td>
<td>7.6</td>
</tr>
<tr>
<td>Harrison</td>
<td>37.0</td>
<td>4.1</td>
<td>41.9</td>
<td>1.8</td>
<td>23.0</td>
<td>3.8</td>
<td>37.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Lillooet</td>
<td>48.0</td>
<td>5.3</td>
<td>43.8</td>
<td>1.9</td>
<td>40.3</td>
<td>6.6</td>
<td>49.3</td>
<td>7.2</td>
</tr>
<tr>
<td>Shuswap</td>
<td>8.4</td>
<td>0.9</td>
<td>1932.2</td>
<td>84.8</td>
<td>129.4</td>
<td>21.3</td>
<td>9.8</td>
<td>1.4</td>
</tr>
<tr>
<td>North Thompson</td>
<td>5.5</td>
<td>0.6</td>
<td>5.5</td>
<td>0.2</td>
<td>6.8</td>
<td>1.1</td>
<td>9.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Seton-Anderson</td>
<td>0.3</td>
<td>&lt;0.1</td>
<td>2.9</td>
<td>0.1</td>
<td>1.1</td>
<td>0.2</td>
<td>3.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Chilko</td>
<td>152.5</td>
<td>16.7</td>
<td>52.1</td>
<td>2.3</td>
<td>256.6</td>
<td>42.3</td>
<td>476.6</td>
<td>69.4</td>
</tr>
<tr>
<td>Quesnel</td>
<td>110.6</td>
<td>12.1</td>
<td>0.5</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>&lt;0.1</td>
<td>0.2</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Francois</td>
<td>71.1</td>
<td>7.8</td>
<td>118.9</td>
<td>5.2</td>
<td>64.2</td>
<td>10.6</td>
<td>24.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Early Stuart</td>
<td>202.6</td>
<td>22.2</td>
<td>25.3</td>
<td>1.1</td>
<td>12.5</td>
<td>2.1</td>
<td>13.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Late Stuart</td>
<td>242.5</td>
<td>26.6</td>
<td>7.2</td>
<td>0.3</td>
<td>2.7</td>
<td>0.4</td>
<td>0.6</td>
<td>0.1</td>
</tr>
<tr>
<td>Bowron</td>
<td>10.1</td>
<td>1.1</td>
<td>8.3</td>
<td>0.4</td>
<td>16.9</td>
<td>2.8</td>
<td>10.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Total escapement</td>
<td>911.5</td>
<td>99.9</td>
<td>2279.9</td>
<td>99.9</td>
<td>607.3</td>
<td>100.1</td>
<td>687.2</td>
<td>100.1</td>
</tr>
</tbody>
</table>
Figure 13. Average weekly catches (expressed as percentages of the total seasonal catch) of sockeye in the Fraser River Convention Area, 1951 to 1963, plotted by cycles.
Figure 14. Average weekly catches (expressed as percentages of the total seasonal catch) of sockeye in the four major sockeye-producing areas of British Columbia, 1951 to 1963. For Rivers-Smith Inlets, the solid portion of the histogram indicates catch in Rivers Inlet and the cross-hatched portion indicates catch in Smith Inlet.
regulation of the fisheries. Associated with these measures, some of the depleted upriver areas have begun to produce at a high level once more. During the 1956 to 1963 period the average annual yield of the Fraser increased to about half the pre-slide level. In some areas substantial runs are produced in three or even in all four years during each four-year period, whereas in others dominance has reappeared with large runs being produced in only one year out of four. In the latter, unlike in the pre-1914 period, the dominant cycle year appears in different years in different areas. Each year, therefore, the stock composition of the Fraser run tends to differ, with consequent differences in the abundance and timing of the runs.

In Table I, estimated escapements to the different Fraser systems are listed for the period 1938 to 1963. These figures are for sockeye four years old and older (i.e., three-year-old precocious males or jacks are omitted) and are derived from data presented in annual reports of the International Pacific Salmon Fisheries Commission. Data for the earlier years are more approximate and less complete than those for the more recent years. The data have been arranged by cycle.

The "1901 cycle" (1901, 1905, ..., 1957, 1961) was the largest of the four during the pre-slide period. Recently it has provided the second highest yield of the four cycles (Figure 12), with an average annual catch in the Convention Area during the 26-year period 1938–1963 amounting to 2.87 million sockeye. Currently this cycle is supported mainly by the late-run to the Stuart Lake system and by a substantial run to Chilko Lake. Together the Stuart system (both early and late runs) and Chilko have accommodated, on the average, about 65% of the total escapement in this cycle. Spawners utilizing the tributaries of the famous Shuswap system number only a few thousand; the run to the once productive Quesnel system is becoming increasingly important.

The "1902 cycle" (1902, 1906, ..., 1958, 1962) is currently the largest, providing an average yield in the Convention Area of 6.12 million sockeye during the 1938–1963 period (Figure 12). The run is supported mainly by the dominant Adams River run to the Shuswap system, accommodating 85% of the average total escapement in this cycle. An important run which occurs in the Francois Lake area supports a substantial fishery in the early part of the season and recently Chilko Lake has received an increased number of spawners in this cycle. The Adams River run is very late, passing through the coastal fishing areas during late August and early September. In the 1902 cycle this latency results in a catch pattern in southern British Columbia waters very different from that in the intervening three-year periods (Figure 13).

The "1903 cycle" (1903, 1907, ..., 1959, 1963) has recently been the smallest of the four cycles, providing average annual catches in the Convention Area in the years 1938 to 1963 of 1.73 million sockeye. Recently the Chilko has been the most important area but the Shuswap also has produced significant numbers of sockeye in this cycle.

The "1904 cycle" (1904, 1908, ..., 1956, 1960) is the third largest of the four cycles, with an average annual catch in the Convention Area during the 1938–1963 period of 1.92 million sockeye. It is supported mainly by a large run to Chilko Lake. The runs to the other upriver areas are small.

RIVERS AND SMITH INLETS SOCKEYE

In the central part of the British Columbia coast, sockeye production is concentrated in two relatively small lake systems, Owikeno Lake (30 square miles or 77.7 square kilometers) and Long Lake (7.5 square miles or 19.4 square kilometers), which flow into Rivers and Smith Inlets, respectively. Despite their small size, considering production per unit area these two areas are among the most productive in the world, providing an average annual yield from 1951 to 1963 of 1.06 million sockeye, 16% of the British Columbia-Washington State total (Figures 7 and 11). Unlike those of the Fraser, many Rivers and Smith Inlets sockeye mature as five-year-olds and over the years the average numbers of four- and five-year-olds have been about equal. There has been no evidence of dominance in this area and the yield over the 70-year history of intensive fishing has been rather constant from year to year (Figure 11). The fishery for Rivers and Smith Inlets sockeye begins in late June and ends early in August. The peak catch is usually made in the third or fourth week of July (Figure 14).

SKEEA RIVER SOCKEYE

The Skeena River system is the main sockeye producing area in northern British Columbia, having provided in the period 1951 to 1963 an average annual yield to the fishery of 485,500 sockeye, 8% of the total (Figures 7 and 11). The commercial catch in some

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4 Since 1937 the International Pacific Salmon Fisheries Commission, representing the governments of the United States and Canada, has had the Fraser sockeye stocks under close study and has, since 1946, been responsible for recommending regulations for both the United States and Canadian fisheries on the approaches to the Fraser system. The area covered by the Convention is shown in Figure 10.

5 See footnote 4, page 232.
of these years was reduced because of severe fishing restrictions imposed in an attempt to build up the runs to Babine Lake following a disastrous rock slide which severely depleted the 1951 and 1952 spawning runs. Skeena-bound sockeye are present in the commercial fishing area (Area 4) from mid-June to mid-August, with peak catches occurring in late July or early August (Figure 14). Tagging experiments indicate that in some years large numbers of Skeena River sockeye may be caught in adjacent Area 3 and that lesser numbers of Skeena sockeye may be caught in Ogden Channel in Area 5 (Aro and McDonald, MS 1967). Taggings carried out in southeast Alaska have indicated that in some years substantial numbers of Skeena-bound sockeye have been caught in the west coast district of southeast Alaska (Shepard et al., 1962).

Some 20 lake systems in the Skeena drainage (Figure 15) support sockeye but by far the most important is the Babine system which accommodates approximately 89% of the total Skeena sockeye spawners (Table II).

**Nass River Sockeye**

The Nass is the smallest of British Columbia’s four main sockeye-producing areas, providing annual yields since 1951 averaging 203,700 sockeye, 3% of the total (Figures 7 and 11). Tagging has shown that some Nass-bound sockeye are intercepted in adjacent Area 4 and in southeast Alaska, but on the other hand many of the sockeye caught in Area 3, especially
TABLE II. Average estimated escapements (in thousands of fish) of commercial-sized sockeye (four-year-olds and older) to various tributaries of the Skeena River, 1950 to 1963 (excluding figures for 1951 and 1952 when a slide in the Babine River destroyed a large fraction of the spawning stock).

<table>
<thead>
<tr>
<th>Lake system</th>
<th>Escapement</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Babine</td>
<td>505.0</td>
<td>88.6</td>
</tr>
<tr>
<td>Alastair</td>
<td>21.9</td>
<td>3.8</td>
</tr>
<tr>
<td>Morice</td>
<td>13.6</td>
<td>2.4</td>
</tr>
<tr>
<td>Lakelse</td>
<td>7.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Bear</td>
<td>7.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Swan Stephens Club</td>
<td>4.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Kitsumkalum</td>
<td>3.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Kitwanga</td>
<td>3.3</td>
<td>0.6</td>
</tr>
<tr>
<td>McDonell</td>
<td>1.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Sustut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johanson</td>
<td>0.9</td>
<td>0.1</td>
</tr>
<tr>
<td>Asitka</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johnston</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>569.8</td>
<td>100.0</td>
</tr>
</tbody>
</table>

during July, are Skeena-bound fish and in some years some Alaska-bound sockeye are also taken in the outside part of Area 3.

In the Nass drainage five tributaries (Figure 15) support significant numbers of sockeye. The most important is Meziadin Lake which probably accommodates about 100,000 sockeye spawners annually.

The Nass sockeye run is the earliest on the Canadian coast (Figure 14), peaking in late June or early July. As mentioned above it is likely that many sockeye taken in July in Area 3 are bound for the adjacent Skeena area rather than the Nass.

OTHER SOCKEYE RUNS

The remainder of the areas in British Columbia have provided annual yields since 1951 averaging 358,300 sockeye, 6% of the total (Figure 7). Most of these sockeye are produced in numerous local streams but some of them may have been destined for the four major sockeye-producing areas.

Several sockeye runs spawn in Canada in rivers which drain into the sea through the United States. In northern British Columbia and the Yukon Territory small runs spawn in drainages of the Aseik, Chilkat, Taku, and Stikine Rivers. In southern British Columbia a moderate run spawns above Osoyoos Lake in the Okanagan River, a tributary of the Columbia River.

PINK SALMON

Pink salmon are the most abundant of the five species of Pacific salmon spawning in British Columbia waters. From 1951 to 1963 the average annual yield to Canadian fishermen has been 10.10 million pinks weighing 48.85 million pounds. In British Columbia, pinks spawn mainly in rivers and streams near the coast (Figures 16 and 17) from late August to late October. Although pinks are considerably more widespread than sockeye, nevertheless a relatively few major river systems still account for the largest part of the province's pink production; roughly speaking about 75% of all spawners are accommodated by some 57 rivers or streams, about 8% of the total number of streams utilized by pinks.

Pink fry emerge from the gravel mainly in April and May and immediately migrate to sea. Virtually all pinks spend about 18 months at sea, returning to the rivers of origin at the end of their second year of life. This virtually invariable two-year life cycle results in an almost complete genetic separation of stocks spawning in even- and odd-numbered years (Neave, 1952, 1953, 1966a; Ricker, 1962; Bilton and Ricker, 1965). In many British Columbia areas, pink salmon are abundant in both even- and odd-year lines (the central and northern parts of the coast—see Figures 16 and 17), but in some areas either the even- or odd-year stock vastly outnumber that of the opposite line. The most dramatic disparity occurs in the Fraser River system and adjacent mainland streams both in British Columbia and the State of Washington. Here, pinks are very numerous in the odd-numbered years but are virtually absent in the even-numbered years (Figures 16 and 17). The opposite case occurs in the Masset Inlet and Naden Harbour areas of the Queen Charlotte Islands. Here, odd-year stocks are virtually absent whereas even-year stocks are relatively abundant. Even within systems that support runs in both even- and odd-numbered years, the distribution and timing of runs may be different. For example, on the Skeena system, recent surveys (Smith and Lucop, 1967) indicate that runs to the tributary Kispiox River utilize about 40 miles of stream in the odd-numbered years but occupy only the lower part of the river (about 20 miles) in the even-numbered years. In two other tributaries of the Skeena, the Lakelse and Babine Rivers, odd-year runs tend to arrive on the spawning grounds a week to ten days earlier than do even-year runs.

Because of differences in their constitution, the odd- and even-year lines are considered separately in the following account. Because runs bound for streams in the State of Washington intermingle and are fished together with runs bound for southern British Columbia, pink salmon stocks of the State of Washington are included in the discussion.
Figure 16. Estimated average annual numbers, in thousands, of pink salmon spawners in British Columbia streams in odd-numbered years from 1951 to 1961.
Figure 17. Estimated average annual numbers, in thousands, of pink salmon spawners in British Columbia streams in even-numbered years from 1952 to 1962.
Figure 18. Average weekly catches of pink salmon in odd-numbered years, 1951 to 1963, in different parts of the British Columbia coast.
Odd-Year Line

The catch of pink salmon in British Columbia and the United States part of the Fraser Convention Area in the odd-numbered years from 1951 to 1963 averaged 13.95 million fish weighing 42.36 million pounds. As is shown in Figure 18, the commercial run in British Columbia begins in late July, peaking from early August to early September. In the odd-numbered years, runs to the southern part of the province and to streams of Puget Sound in Washington State are the most important (Figures 16, 18, and 19), with areas from Vancouver Island southward (Areas 12 to 29 and the Fraser Convention Area within the State of Washington) providing over 70% (9.68 million) of the odd-year catch. The principal fishing areas in the south (Figure 2) are Juan de Fuca Strait (primarily a Canadian net fishing area), the San Juan Islands (a
United States net fishing area), and Johnstone Strait (a Canadian area). In all three of these areas, the pinks caught represent a mixture of stocks bound for the Fraser River (the most important producer), other Canadian streams immediately north of the Fraser, and streams of the State of Washington (mainly in Puget Sound).

Intensive tagging studies from 1945 to 1961 (summarized by Vernon et al., 1964; and Hourston et al., 1965) have provided much detailed information on the movements of pinks in these southern areas. In waters off Vancouver Island and Washington State, pinks bound for Canadian streams north of the Fraser River approach the coast first, beginning in late July, and reach their peak in Johnstone and Juan de Fuca Straits in mid-August (Figures 20 and 21). Currently, the most important of these streams are the Indian River (in Burrard Inlet), the Squamish-Cheak-
Figure 21. Estimated times of passage through the Strait of Juan de Fuca in 1959 of pink salmon bound for the Fraser River, Canadian streams immediately north of the Fraser River, and streams in the State of Washington. (From Vernon et al., 1964, fig. 29.)
amus system (in Howe Sound), the Skwawka River (in Jervis Inlet), and the Glendale River (in Knight Inlet). Half or more of the Indian River pinks come through the southern passage through Juan de Fuca Strait with the rest approaching from the north through the Queen Charlotte-Johnstone Straits area. Moving northward, the proportion of pinks approaching from the north increases, with two-thirds or more of those bound for the streams of Howe Sound and Jervis Inlet entering through Johnstone Strait. Virtually none of the pinks bound for streams north of Jervis Inlet approach from the south through Juan de Fuca Strait. Pinks bound for southern British Columbia streams north of the Fraser enter the streams in the latter half of August and early September and spawn mainly in mid-September.

In Juan de Fuca and Johnstone Straits runs to Canadian streams north of the Fraser decline towards the end of August and the run to the Fraser itself builds rapidly to reach its peak early in September. During the latter half of August runs to United States streams in Puget Sound are mixed with the runs to the Fraser and other Canadian streams. Over two-thirds of the pinks bound for the Fraser and the great majority of those bound for Puget Sound approach from the south through Juan de Fuca Strait.

Pinks migrate up the Fraser throughout the month of September. The earliest arrivals spawn mainly in the main stem of the lower Fraser River and in two tributaries upstream from Hell's Gate Canyon, the Thompson River and Seton Creek, at the end of September and in early October. Most later-arriving pinks spawn in streams tributary to the lower Fraser, principally the Harrison and Vedder Rivers, in the latter half of October. As indicated by catch and spawning ground data it is likely that in the early years of the century the abundance of pinks spawning in the Fraser and its tributaries was even greater than at present (Rounsefell and Kelez, 1938; INPFC, 1962); the Hell's Gate slide of 1913 completely blocked the migration of pinks to important upstream spawning areas, resulting in a substantial lowering of the productive capacity of the Fraser system. Completion of fishways at Hell's Gate in 1946 has once again permitted upstream passage, and recolonization of the upper tributaries has proceeded rapidly over the past three cycles; approximately 12% of the Fraser spawners have spawned upstream from Hell's Gate.

On the basis of data presented by Hourston et al. (1965) the Fraser currently provides somewhat over half of the average catch of 9.68 million pinks in southern British Columbia and the United States Convention Area in recent odd-numbered years (1951 to 1963). Other southern British Columbia streams provide an average of over a quarter of the total and Washington State streams less than 20%.

Northward from Vancouver Island, odd-year pink runs tend to be earlier than those to the Fraser and adjacent Canadian and Puget Sound streams (Figure 18). The northernmost ones are the earliest of all.

As noted earlier, pink salmon are very scarce in the Queen Charlotte Islands in odd-numbered years (Figures 16, 18, and 19), the catch landed in the Islands averaging only 59,000, taken mostly by trollers operating offshore. Many of these fish could easily be bound for other areas. Only a few thousand spawners are found in streams in the Queen Charlotte Islands during odd-numbered years, most of them in one stream—Copper Creek.

Catches along the northern mainland coast (Areas 3, 4, 5, and 6) have averaged 2.59 million pinks over the seven odd-year cycles from 1951 to 1963 and have remained at a relatively steady level over the 13-year period. Runs to these northern areas approach the coast in mid-July and reach their peak in the commercial fisheries in early August (Figure 18). The Skeena River with its tributaries, Lakelse, Kispiox, Kitwanga, and Babine Rivers, is the most important system in the north, providing an average annual yield of 933,000 in Statistical Area 4 at the mouth of the river, and in some years substantial parts of the pink catch in adjacent Areas 3 (the Nass area) and 5 (the Grenville-Prinncipe Channel area) and off the west coast of southeast Alaska (Shepard et al., 1962). Historical catch statistics indicate that prior to the mid-1930's, the pink salmon yield from the Skeena River was considerably higher than at present.

The Nass River is probably the most important producing system in Area 3, immediately north of the Skeena. The Kumealon, Mussel, Canoona, and Quaal Rivers are the most important in Areas 5 and 6. Spawning in the Skeena system occurs from early September (in the upstream tributaries) to late September (in the tributaries to the lower river). Spawning in the other northern areas takes place mostly in late August and early September.

Catches along the central part of the British Columbia coast (Areas 7 to 11) have averaged 1.62 million in the odd-numbered years from 1951 to 1963 (Figures 18 and 19). In the central area, catches are made slightly later than those along the north coast, with the peak occurring, on the average, in the second week of August. The largest catches are made in the Bella Coola area (Area 8, average 1.09 million), with the Bella Bella area (Area 7) providing the bulk of the remainder. Few pinks are caught in Rivers and Smith Inlets (Areas 9 and 10) and in Area 11.
Figure 22. Average weekly catches of pink salmon in even-numbered years, 1952 to 1962, in different parts of the British Columbia coast.
most important central area system is the Bella Coola, with most spawning there occurring in the main tributary—the Atnarko River. A number of other medium-sized producers are important. These include the Kainet, Clatse, and Neekis Rivers in Area 7 and the Koeve and Kwatna Rivers in Area 8. Spawning occurs at about the same time as in the north—mainly in September, peaking about the middle of the month.

**Even-Year Pinks**

Figure 23. Average catches of pink salmon in the various British Columbia Statistical Areas in the even-numbered years from 1952 to 1962.

**Even-Year Line**

During the 1951–1963 period pink salmon catches in British Columbia and the United States part of the Fraser Convention Area in the even-numbered years averaged 9.74 million pinks weighing 19.22 million pounds, about 70% of the average for the odd-numbered years. The even-year average would have been even less had there not been a record-breaking run in
central British Columbia in 1962 (1962 total 23.43 million pinks). Excluding the 1962 figure, the even-year average was 7.01 million, only about 50% of the average catch in the odd-numbered years.

For the area as a whole, commercial runs begin to arrive in coastal waters in substantial numbers in mid-July and remain at high levels of abundance until the end of August (Figures 9 and 22). Unlike the odd-year cycle (compare Figures 22 and 18), even-year catches in September are small.

In contrast to the odd-year line, in even years pink salmon in the Queen Charlottes are quite abundant, providing an average annual yield of 1.23 million during the 1952 to 1962 period (Figure 23). The peak of the even-year run usually passes through the fishing area in the third week of August, and the run extends into early September. The run is supported by a number of medium-sized rivers, the most important of which are the Yakoun River, Copper Creek, Naden River, Deena River, and Kaisun Creek. Spawning in these rivers is mainly in September.

Catches along the north coast in the even-numbered years (averaging 3.68 million) are not greatly different than those in the odd-numbered years but are, in general, provided by different streams. The Skeena is important in both cycles, but in the 1952 to 1962 period the bulk of the even-year run was provided by the tributary Lakelse River whereas the odd-year runs were supported mainly by other tributaries. In Area 5 the Kumealon River is important in both cycles. In Area 6 the Quaaal and Mussel Rivers are relatively large in both cycles, but in even-numbered years the Kitimat and Kildala Rivers are important contributors also. The timing of the even-year runs to the north coast is about the same as in the odd years, beginning in mid-July and peaking early in August (Figure 22).

Catches in the recent even-numbered years in the central area of British Columbia are dominated by the record catch of 14.28 million in 1962. In previous even-numbered years from 1952 to 1960 the annual pink catch for Areas 7 to 11 averaged only 1.51 million, about the same as in the odd-numbered years (1.62 million). Catches in the even-numbered years tend to be made somewhat earlier (near the end of July) than in the odd-numbered years (early August). In both even- and odd-numbered years, the Bella Coola area (Area 8) provides the greatest part of the catch along the central coast and the tributaries to the Bella Coola River itself (mainly the Atmarsh) are the most important spawning grounds. Spawning takes place in September.

From Vancouver Island southward, pink salmon are much less abundant in the even-numbered than in the odd-numbered years and are virtually absent in streams on the mainland shore south of Knight Inlet. During the 1952–1962 period, the even-year catch in Statistical Areas 12 to 29, plus in the United States section of the Fraser Convention Area, has averaged 1.21 million, compared to an odd-year average over a comparable period of 9.68 million. The bulk of the even-year catch is made in the Johnstone Strait area (Areas 12 and 13) where the peak of pink fishing occurs early in August. Most of the catch is provided by runs to streams near Johnstone Strait, of which the Keogh, Amor de Cosmos, Glendale, Oyster, Quatsat, and Puntledge Rivers have the largest runs. Spawning occurs mainly in September. Small numbers of pinks occur in even-numbered years in some streams along the west coast of Vancouver Island from Nootka Sound northward, an area which provides almost no pinks in odd-numbered years. The Kopino River is the most important even-year producer along the west coast of the island.

Small numbers of pink salmon have been reported above the International Boundary in the Taku and Stikine Rivers. A few pink salmon have been caught in the estuary of the Mackenzie River (Dymond, 1940).

CHUM SALMON

Over the 1951 to 1963 period chums have been British Columbia's fourth most abundant species, providing annual commercial catches averaging 2.80 million fish weighing 32.82 million pounds. However, within this period there has been a drastic decline so that catches since 1955 have averaged only 2.01 million compared to 4.07 million for 1951 to 1955 (Figure 24).

In British Columbia, chums spawn mainly in rivers and streams relatively close to the sea (Neave, 1966b). In contrast to sockeye and pinks, where a relatively few systems support most of the runs, chums tend to be spread more evenly over a large number of moderate-sized streams (Figure 25). Chums are known to occur in at least 880 British Columbia streams. On the basis of estimates of escapements made by fisheries officers the top 58 streams accommodate only 50% of the estimated total escapement (for pinks, the top 58 streams accommodate 75% of the total and for sockeye, three-quarters of the spawners are accommodated by only 29 streams concentrated mainly in four drainages).

In the commercial fisheries, chums are taken mainly by nets in the inside passages and inlets, relatively close to the spawning grounds. Based on average figures for the period 1951–1963 (Figures 9 and 26),
Figure 24. Annual catches of chum salmon in different parts of the British Columbia coast, 1951 to 1963.
Figure 25. Estimated average annual numbers, in thousands, of chum salmon spawners in British Columbia streams from 1951 to 1962.
Figure 26. Average weekly catches of chum salmon in different parts of the British Columbia coast, 1951 to 1963. The weekly catches in November and December are derived from monthly catch data.
chums contribute to commercial catches in British Columbia coastal waters from mid-June to the end of November, with the largest catches occurring in October, considerably later than the peak for other species. There is a marked difference in the timing of runs to the northern and southern halves of the coast (Figure 26). In areas north of Vancouver Island (Areas 1 to 11) chums enter coastal waters from mid-July to early September, whereas those taken in waters adjacent to Vancouver Island and the lower mainland (Areas 12 to 29) are caught mainly in October.

On the average, over the 1951 to 1963 period the greatest catches have been made in waters of the southern part of the province (Figure 27), in particular in the Johnstone Strait area (Statistical Areas 12 and 13, which provide 28% of the average total catch). During this period the catch of chum salmon in southern British Columbia averaged 1.04 million in
Johnstone, Juan de Fuca, and Georgia Straits, 210,800 in the estuary of the Fraser River (Area 29), and 387,000 along the west coast of Vancouver Island. Tagging (Chatwin, 1953; Manzer, MS 1958) indicated that the chums passing through Johnstone Strait represented a mixture of stocks bound for streams adjacent to the Strait and to rivers farther south, particularly the Fraser. In general, chums bound for streams in the inlets adjacent to Johnstone and Georgia Straits pass through Johnstone Strait earlier than does the run to the Fraser. On the basis of spawning ground reports the run to the Fraser system (spawning mainly in the main stem of the river and in the tributary Chilliwack-Vedder, Harrison, and Chehalis Rivers) is the largest in the southern part of the province, but runs to a large number of moderate-sized streams along both the inner and outer coasts of Vancouver Island and in the mainland inlets (Figure 25) collectively provide an important part of the catch. The most important of the latter streams are the Klinaklini River draining into Knight Inlet, the Viner Sound River draining into Tribune Channel, the Toba River draining into Toba Inlet, the Cheakamus River draining through the Squamish River into Howe Sound, the Indian River draining into Burrard Inlet, and the Nimpkish, Qualicum, Little Qualicum, Puntledge, Chemainus, Nanaimo, and Cowichan Rivers on Vancouver Island.

In the south, spawning takes place mainly from October to January. In the Fraser system, the run to the Chehalis tends to be relatively early (October) whereas those to the main stem of the Fraser River and to the Chilliwack-Vedder and Harrison Rivers are later (December). Spawning in other streams adjacent to Johnstone and Georgia Straits tends to vary from runs with peaks as early as October (in some northern rivers such as the streams in Knight Inlet) to as late as December (in some southern streams such as the Cowichan).

In contrast to pinks and sockeye, few chums are taken in Juan de Fuca Strait at the south end of Vancouver Island (compare Figure 27 with Figures 19 and 7).

Along the south and west coast of Vancouver Island (Areas 19 to 27) fishing, prosecuted mainly in bays and inlets near spawning grounds, peaks in mid-October. Production is divided between a number of moderate-sized runs, the largest of which are reported to be those to the Sooke River near Victoria, the Nitinat River draining through Nitinat Lake into Juan de Fuca Strait, and the Nahmint, Sarita, and Toquart Rivers draining into Barkley Sound. The peak of spawning in these west coast rivers occurs in October.

As outlined earlier, runs to the northern part of British Columbia are considerably earlier than those in the south. In the Queen Charlotte Islands (Areas 1 and 2), catches are made mainly in August and September (Figure 26) in the inlets adjacent to the spawning grounds. From 1951 to 1963 the catch averaged 164,400 chums, 6% of the provincial total. Chum spawners are distributed widely throughout the Islands in a large number of streams (Figure 25). Spawning takes place mainly in October.

Chums bound for streams on the northern mainland coast (Areas 3 to 6) pass through the inshore fishing areas somewhat earlier (mainly in July and August—see Figure 26) than do chums in the Queen Charlottes. Catches in the northern coast region have averaged 434,500 in the 1951–1963 period, with Area 3 (Portland Inlet and the Nass) being the largest individual producer. The latter area borders on Alaska and tagging (Fisheries Research Board, 1957) has shown that along the International Boundary United States and Canadian fishermen are exploiting fish bound for the other country. This is particularly true in Portland Canal where the International Boundary runs up the approximate mid-line of the channel and where chum salmon spawning streams are located on both shores of the waterway. Spawning ground information is very sparse in these northern areas, but spawning in Area 3 tends to be early (August and early September) whereas farther south, spawning takes place somewhat later, mainly in September.

Along the central part of the British Columbia coast (Areas 7 to 11) peak catches are made in August. From 1951 to 1963 the annual catch averaged 567,300 chums. Most of the catch was taken in the Bella Bella and Bella Coola areas (Areas 7 and 8). The catches are based on a number of moderate-sized runs rather than on a few large ones. The most important systems are the Kainet, Neekis, and Noota Rivers in Area 7 and the Bella Coola system and Kimsquit River in Area 8. Spawning takes place mainly in September.

Substantial runs of chum salmon are known to spawn in tributaries of the Yukon River within the Yukon Territory (Canada Dept. Fish., 1963b; Summers, 1966). No estimates are available of the total population but it is of interest to note that the Canadian catch along the Yukon River in the years 1959 to 1963 averaged about 13,000 chum salmon. Some chum salmon spawn in Canadian sections of other rivers which flow through Alaska to the sea. Occasional chum salmon have been caught in the Mackenzie River system (Dymond, 1940).

COHO SALMON

From 1951 to 1963, the annual catch of cohos in
Figure 26. Estimated average annual numbers, in thousands, of coho salmon spawners in British Columbia streams from 1951 to 1962.
British Columbia has averaged 3.04 million fish weighing 21.54 million pounds.

In general, cohos spawn late in the year (October, November) when autumn rains raise creek levels and make observation of spawners difficult. For this reason accurate information on distribution and abundance of spawners is difficult to obtain. Nevertheless, even with the scanty records available it is apparent that in British Columbia cohos are the most widespread of the five species of Pacific salmon (Figures 28 and 29). Of some 1,500 streams in the province for which records are available, cohos are known to occur in about 970, over 64%. The main production appears to be spread over a large number of moderate-sized systems rather than a few large ones. The top 25 coho streams in the province are estimated to support only 34% of the total provincial escapement, in contrast to comparable figures of 71% for
sockeye, 59% for pinks, and 64% for chinooks (the figure for chums—33%—is about the same as for cohos). Cohos are concentrated mainly in the near coastal rivers and streams, although some go as far as the Shuswap system in the Fraser and Babine Lake on the Skeena (Figure 28). Cohos landed in Canada are caught mainly by trollers rather than by net fishermen. From 1951 to 1963 trollers took an average of 64% of the total British Columbia coho catch. The major trolling areas are off the west coasts of Vancouver Island and the Queen Charlotte Islands, and in Queen Charlotte and Hecate Straits (Figures 5, 6, and 30). Tagging (e.g., Milne, 1957) has shown that in these trolling areas, cohos caught represent a mixture of stocks bound for different rivers both in Canada and in the United States. Because so many cohos are
taken remotely from their spawning grounds where stocks are still mixed, catch statistics provide only a poor reflection of the relative importance of runs originating in different sections of the coast.

Troll fishing for cohos begins in June with the greatest part of the catch being made between mid-July and mid-August (Milne, 1964; Godfrey, 1965). In August, catches in nets in inshore waters increase, reflecting the movement of the maturing cohos toward the spawning streams. The major areas in which cohos are caught by net fisheries are Juan de Fuca Strait (Area 20) and upper Johnstone Strait (Area 12)—see Figure 31. Substantial catches are also made in the Bella Coola area (Area 8), the Butedale area (Area 6), the Fraser River estuary (Area 29), and the Skeena River area (Area 4).
Figure 32. Average weekly catches of coho salmon by the net fisheries in British Columbia Statistical Areas 4, 8, 12, 20, and 29 in the period from 1951 to 1963, inclusive. The weekly catches in November and December are derived from monthly catch data.
In addition to the commercial catch, sport fishermen (operating mainly in inshore waters between southern Vancouver Island and the adjacent mainland) take an average of approximately 85,000 cohos during their last year at sea and about 110,000 in their penultimate year at sea (Canada Dept. Fish., 1956 to 1966).

As in the case of odd-year pink salmon in the southern part of the province, net fisheries of Juan de Fuca and Johnstone Straits intercept coho runs on their way to rivers draining into the extensive waterways between Vancouver Island and the adjacent mainland. Tagging (Milne et al., 1959) has shown that cohos intercepted in Juan de Fuca Strait represent a mixture of stocks bound for streams tributary to the Strait of Georgia (including the Fraser River), Juan de Fuca Strait, and Puget Sound. Information is lacking on the constitution of the run passing southward through Johnstone Strait, but there is little doubt that many cohos caught there are bound for the spawning streams adjacent to Johnstone and Georgia Straits on the British Columbia mainland and on Vancouver Island. In both Juan de Fuca and Johnstone Straits, the largest catches are made in the latter part of August and in September with the peak catches in early or mid-September (Figure 32). The Fraser River supports a substantial net fishery for cohos in some years with peak catches occurring in September or October.

Spawning ground surveys indicate that the most important individual spawning streams in southern British Columbia are the Kingcome, Kakweiken, and Nimpkish Rivers in Area 12, the Oyster River in Area 14, the Toba River in Area 15, the Cowichan River in Area 18, the San Juan River in Area 20, the Squamish River in Area 28, and the Chilliwack River in the Fraser system (Area 29). However, as mentioned above, observation conditions make accurate assessments of the abundance of spawners in different systems very difficult and the foregoing list must be considered as incomplete. Time of spawning in these rivers varies considerably but occurs mainly in October and November.

Along the west coast of Vancouver Island there are numerous small producers of coho salmon. The Somass River system tributary to Barkley Sound is recorded as being the most important of these rivers.

In the northern part of the province cohos are also spread widely. Gillnet fisheries operating in inlets, estuaries, and inside passages make moderate catches, mainly in August and early September (Figures 31 and 32). In the Queen Charlotte Islands, the Tll River and Copper Creek on the east coasts of Graham and Moresby Islands are important coho spawning streams. Along the northern mainland of British Columbia the most important coho producers are the Lakelse River, a tributary of the Skeena River, and the Bella Coola-Atikun River system. Spawning in these rivers varies but takes place mostly in October and slightly later.

Substantial runs of cohos are believed to spawn in the Taku, Stikine, and other Canadian rivers which flow into Alaskan waters.

**CHINOOK SALMON**

From 1951 to 1963, the average annual catch of chinooks in British Columbia has averaged 874,100 fish weighing 11.19 million pounds.

Young chinooks hatch from the gravel in the spring, migrating to sea after spending from a few days up to a year in their natal streams. Most Canadian chinooks return to spawn after spending two or three winters at sea, although some return as jacks (mostly precocious males) after one winter at sea whereas others return after four or five winters. Chinooks are the largest of the five species found in Canada with some individuals weighing more than 100 pounds. Further details on the life history of chinooks are presented by Mason (1965).

Chinook spawning areas are scattered throughout British Columbia (see Figure 33) although spawning is reported to take place in less than 260 streams, fewer than for the other species of Pacific salmon found in British Columbia. Chinooks spawn in significant numbers in areas located from immediately above the tidal limit to locations as far away as the Fraser River at Tete Jaune Cache, over 600 miles upriver from the sea. The bulk of the chinook escapement, as with sockeye and pink salmon, is accommodated by a very few streams; about 50% of the escapement is accommodated in only 14 streams, about 5.5% of the total number of streams in which spawning takes place.

The largest catches of chinooks are made in southern British Columbia (Figure 34). As with cohos, most chinooks are taken by trollers operating on mixed stocks (both Canadian and United States) away from the river mouths (trollers took an average of 73% of the total British Columbia chinook catch from 1951 to 1963). The most important trolling area is off the west coast of Vancouver Island (Figures 5, 6, and 35). Chinooks can be caught throughout most of the year but the bulk of the catch is made in the five-month period from May through to September, over which period the catch is fairly evenly distributed.

Maturing chinooks move inshore and into the rivers throughout much of the year. Net fisheries operate in a number of inshore areas to intercept these maturing fish (Figure 36). By far the most important of
Figure 33. Estimated average annual numbers, in thousands, of chinook salmon spawners in British Columbia streams from 1951 to 1962.
these net fisheries is that in the Fraser River (Area 29). There, some chinooks move upstream throughout most of the year. Large catches are made in Area 29 from early June to early October with peak catches occurring usually in August or September (Figure 37). The extensive net fisheries in Juan de Fuca and Johnstone Straits, which are the most important in British Columbia for cohos, catch relatively few chinooks. In these latter two fishing areas most chinooks are taken in July and August (Figure 37). In addition to the commercial catch, sport fishermen (operating mainly in inshore waters between southern Vancouver Island and the adjacent mainland) take an average of approximately 59,000 chinooks older than two years and about 35,000 during their first year at sea (Canada Dept. Fish., 1956 to 1966).
Runs of chinooks spawn in many of the tributaries of the Fraser River. The largest of these runs migrate into the Harrison, Nicola, and Shuswap Rivers. The peak period of chinook spawning in Fraser River tributaries varies from as early as July to as late as November.

In southern British Columbia, aside from the Fraser River, the most important chinook spawning grounds in order of importance are the Squamish River (Area 28), the Nimpkish and Klinaklini Rivers (Area 12), the Somass River (Area 23), the Cowichan River (Area 18), the Homathko River (Area 13), the Puntledge River (Area 14), and the Southgate River (Area 13). Most of the spawning takes place in August and September in the mainland streams and in October in the Vancouver Island streams.
In northern British Columbia net fishing provides small catches of chinooks in the estuaries of the Nass and Skeena Rivers and in Area 8 near the Bella Coola River system. In these northern areas, the runs are relatively earlier than in the south with most chinooks being taken in June and July (Figure 37). The largest chinook runs in northern British Columbia migrate into the Bella Coola River system (Area 8), the Kitimat River at the head of Douglas Channel (Area 6), and into the Bear, Morice, Babine, and Kispiox Rivers, which are all tributaries of the Skeena River (Area 4). The peak period of spawning in these northern rivers is in September.

Substantial numbers of chinooks have been reported to spawn in the Canadian section of the Yukon River drainage (Canada Dept. Fish., 1963b; Summers,
Figure 37. Average weekly catches of chinook salmon by the net fisheries in British Columbia Statistical Areas 3, 4, 8, 12, 20, and 29 in the period 1951 to 1963, inclusive. The weekly catches in February, March, April, November, and December are derived from monthly catch data.
1966). In the years 1959 to 1963 the Canadian catch on the Yukon River averaged about 11,300 chinooks. It was estimated that in 1961 over 28,000 chinooks spawned in the Canadian tributaries of the Yukon River. In other rivers which drain from Canada to the sea through Alaska, substantial numbers of chinooks are reported in the Canadian sections of the Taku and Stikine River drainages and small numbers in the Canadian portions of the Alsek and Unuk Rivers.

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APPENDIX A. THE ABUNDANCE OF SPAWNS IN BRITISH COLUMBIA RIVERS

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In the main section of the present report, the general features of salmon distribution in British Columbia were outlined. In this appendix, more detailed information on the abundance of spawners is provided.

As outlined earlier, for most streams in British Columbia, estimates of spawning escapements are obtained by officers of the Protection Branch of the Canada Department of Fisheries. In the field, officers are required to provide annual escapement estimates according to a system of letter categories:

O  Nil
A  1–50 spawners
B  50–100
C  100–300
D  300–500
E  500–1,000
F  1,000–2,000
G  2,000–5,000
H  5,000–10,000
K  10,000–20,000
L  20,000–50,000
M 50,000–100,000 spawners
N Over 100,000

(Recently, attempts have been made to provide more precise figures for escapements in the M and N categories.)

In the Skeena and Fraser areas, large-scale management research programs on sockeye and pinks have been underway for a number of years and more accurate estimates of escapements based on weir counts, special tagging programs, and other systematic indexing systems are available. Similar information is available for a few years for pink salmon in the Queen Charlotte Strait, Johnstone Strait, and Georgia Strait areas (1959 and 1961), for Fraser chums (1959–1963), and for Nass River sockeye (1956–1958). A review was made of escapement data from all sources to identify the more important streams and gain some picture of their relative contributions to the runs. For each stream for which records are available, average estimated escapements during the period 1951 to 1962 were calculated and formed the bases for Figures 8, 16, 17, 23, 28, and 33. The average estimated escapements for the more important spawning streams are listed for sockeye in Appendix Tables A-I and A-II, and for pink, chum, coho, and chinook in Appendix Tables A-III, A-IV, A-V, and A-VI, respectively. In the tables, data are given for all streams where in more than one year during the 1951–1962 period escapements of sockeye were in excess of 5,000, of pinks in excess of 20,000, of chums in excess of 10,000, of cohos in excess of 2,000, and of chinooks in excess of 500. In later accounts streams containing populations of the above levels of one or more of the five species are termed "major" streams. Escapements to these streams probably accounted for over 90% of all British Columbia spawners. Appendix Table A-VII lists the 347 streams classified as "major" streams. The location of the streams which support major runs of sockeye, odd-year pinks, even-year pinks, chums, cohos, and chinooks are shown in Appendix Figures A-1, A-2, A-3, A-4, A-5, and A-6, respectively.

In the following sections a brief account is given of commercial catches and the distribution of spawners in different British Columbia statistical areas, with particular emphasis on the location of major streams.

SOCKEYE SALMON

Some sockeye salmon are caught in all of the British Columbia statistical areas but most are taken in relatively few areas. As mentioned in the preceding text, large runs of sockeye occur only in the Nass, Skeena, and Fraser Rivers, and the lake systems adjacent to Rivers and Smith Inlets. Sockeye returning to spawn in these systems may be caught in adjacent statistical areas as well as in the statistical area into which these drainage systems discharge. The average catches of sockeye in the various statistical areas are illustrated in Figure 7.

Queen Charlotte Islands (Areas 1, 2A, and 2B)
The catch of sockeye in the Queen Charlotte Islands, which during the period 1951 to 1963 averaged 6,900 fish, was probably composed mainly of local fish although some sockeye bound for mainland streams may have been intercepted by the fishery particularly in Virago Sound and McIntyre Bay late in the season by which time most of the local runs have entered the streams. The largest catches of sockeye are made in the latter half of June in Area 2 whereas in Area 1 almost constant numbers of sockeye are caught weekly from early June to early September. Only four significant spawning runs occur in the Queen Charlotte Islands (Figure 8 and Appendix Figure A-1; Appendix Table A-I); those to the Naden and Yakoun Rivers (average 5,000 to 10,000 spawners) in Area 1, and Copper Creek (20,000 to 50,000) and Mercer Creek (5,000 to 10,000) in Area 2A. The peak of spawning occurs in August in the Naden and Yakoun River systems and in September in Copper and Mercer Creeks.

Nass River (Area 3)
The annual catch of sockeye in the Nass area averaged about 206,000 fish in the period 1951 to 1963 (Figure 7). The sockeye run to the Nass River is one of the earliest sockeye runs in British Columbia with peak catches being made in the last week of June and the first week of July. Taggings of sockeye carried out in 1957 and 1958 in Areas 3 and 4 indicated that Skeena-bound sockeye were present in July and early August in substantial numbers in subareas 3X and 3Y, the outer portions of Area 3, and in minor numbers in the western part of subarea 3Z (Aro and McDonald, MS 1967). Taggings have also demonstrated that some Nass-bound sockeye are taken in Area 4. A tagging carried out at Cape Fox in 1926 (Rich and Suomela, 1927) indicated that some Nass-bound sockeye are intercepted by the Alaskan fishery in the vicinity of Cape Fox.

Spawning ground estimations in the Nass River system have been limited owing to the inaccessibility of the spawning grounds and to the difficulty of mak-
ing observations due to the turbidity of some spawning streams. Significant runs of sockeye enter Bowser, Damdochax, Kwinageese, and Meziaden Lakes, and Gingit Creek (Figure 8 and Appendix Figure A-1; Appendix Table A-1). Estimates of escapements to Damdochax, Kwinageese, and Meziaden Lakes are based on tagging and recovery programs supplemented in some instances by weir counts and visual observations of spawners in streams. These estimates were made by the Resource Development Service of the Department of Fisheries in 1956, 1957, and 1958 (Canada Dept. Fish., 1958, 1959a, and 1959b). Sockeye at Bowser Lake spawn exclusively in the lake rather than in tributary streams. Spawning is believed to take place mainly in October. The average escapement of 97,500 sockeye to Meziaden Lake in 1956, 1957, and 1958 was based on tagging and recovery programs, fishway counts, weir counts, and stream surveys. Sockeye spawn in Meziaden Lake itself, in the Meziaden River at the outlet of the lake, and in two tributary streams, Hanna and McLeod Creeks. The average estimate of 12,500 spawners in the Damdochax system was based on visual surveys and a tagging and recovery program. Both stream and lake spawning occurs in the Damdochax system. The sockeye run to the Kwinageese watershed was estimated in 1957 to have been about 60,000 fish. In 1958 about 1,000 sockeye were seen at Kwinageese Lake but a population estimate was not made. At Meziaden Lake the peak of spawning takes place in September in the tributary streams and in October in the lake. Spawning in the Damdochax and Kwinageese systems takes place in September.

Sockeye escapements to Gingit Creek, estimated by officers of the Protection Branch of the Department of Fisheries, have averaged between 5,000 and 10,000. The peak of spawning occurs in August. The sockeye run in Gingit Creek is unique in northern British Columbia inasmuch as most of the young migrate to sea as fry without a period of freshwater residence. Some sockeye also migrate to sea directly as fry from some lower Fraser River tributaries in southern British Columbia.

**Skeena River (Area 4)**

From 1951 to 1963, sockeye catches in the Skeena area averaged 485,000 (Figure 7). The commercial fishery for sockeye in the Skeena Gillnet Area extends from mid-June to mid-August with peak catches in the last two weeks of July and the first week of August. The Skeena sockeye run is composed of several stocks (Figure 8 and Appendix Figure A-1; Table II and Appendix Table A-1), the largest of which is that to Babine Lake, which during 1951 to 1963 accom-modated about 89% of the total Skeena sockeye escapement. The numbers of sockeye entering Babine and Nilkitkwa Lakes have been counted annually since 1946 at the Babine River counting weir (Appendix Table A-VIII). The 1951 and 1952 sockeye runs to Babine Lake were severely reduced in size by a disastrous rock slide in the Babine River. It was estimated that only one-third of each of the runs managed to surmount the obstruction (Godfrey et al., 1954) and of these only about one-third of the sockeye which reached the Babine fence in 1952 spawned successfully. The sockeye run to the Babine watershed spawns in the lower Babine River (immediately below Nilkitkwa Lake), the upper Babine River (between Babine and Nilkitkwa Lakes), some 22 tributary streams and in Babine Lake itself (Figure 8 and Appendix Figure A-1; Appendix Table A-1). Many of these streams, because of their small size and unstable water conditions, support only small runs and only in some years. The amount of lake spawning at Babine Lake is not known although it is less than 18% (see below). From 1951 to 1962 escapements averaged about 116,000 in the upper Babine River, 86,000 in the Fulton River, 84,000 in the lower Babine River, 29,000 in Pinkut Creek, 24,000 in Pierre Creek, 11,000 in the Morrison River, 9,900 in Grizzly Creek, 7,900 in Twin Creek, 7,000 in Tahlol Creek, 2,300 in Four Mile Creek, and 2,200 in Tachek Creek. Of the sockeye counted through the Babine River counting weir 81% spawned in these larger streams, 1% spawned in the remaining smaller streams and 18% were unaccounted for. Some of the latter undoubtedly spawned in the lake itself. Most of the spawning occurs during August in Four Mile, Tachek, Twin, Tahlol, and other small creeks. In the Fulton and Morrison Rivers, and in Pierre, Pinkut, and Grizzly Creeks, all larger streams adjacent to the main basin of Babine Lake, the peak of spawning is in September. In the outlet rivers, the upper and lower Babine Rivers, most of the spawning takes place in October.

In recent years the second largest producer of sockeye in the Skeena River drainage has been Alastair Lake (Table II) where the sockeye spawn mainly in South-end Creek, the main tributary to the lake, and in the lake itself (Figure 8 and Appendix Figure A-1; Appendix Table A-1). In the years 1951 to 1962 the escapements have ranged between 10,000 and 20,000 in South-end Creek and between 2,000 and 5,000 in Alastair Lake. Most of the spawning takes place during September in Alastair Lake and in South-end Creek.

The Morice Lake system formerly was the second largest producer of sockeye in the Skeena watershed but the runs have declined markedly since 1954 (Table
II). The escapement to the Nanika River, the most important stream in the Morice system, has averaged between 10,000 and 20,000 in the period 1951 to 1962 (Figure 8 and Appendix Figure A-1; Appendix Table A-I); most of these sockeye spawned in September.

Other significant runs of sockeye in the Skeena watershed are at Bear Lake and in Williams Creek (a tributary of Lakelse Lake), each with 5,000 to 10,000 spawners; and in Falls Creek (a tributary of Swan Lake), with 2,000 to 5,000 spawners (Figure 8 and Appendix Figure A-1; Appendix Table A-I). Peak spawning is during August in Williams Creek, during September in Falls Creek, and during October at Bear Lake.

In addition to the Skeena River, two other watersheds which drain into Area 4 support sockeye: the Shawatans River, which has a minor run, and the Kloia Creek system where a significant run spawns in Diana Creek, one of the tributaries of Prudhomme Lake (Figure 8 and Appendix Figure A-1; Appendix Table A-I). The Diana Creek run, which enters Prudhomme Lake in late June and early July and spawns mainly in September, has averaged between 2,000 and 5,000 sockeye in the years 1951 to 1962.

Grenville-Princepe, Butedale, and Bella Bella (Areas 5, 6, and 7)

These areas produce small numbers of sockeye. From 1951 to 1963 the commercial catch has averaged 77,000, 68,000, and 16,000 sockeye in Areas 5, 6, and 7, respectively (Figure 7). Largest catches were made in early July in Area 5, in mid-July in Area 6, and in late July in Area 7. Taggings carried out in Ogden Channel in Area 5 have indicated that some Skeena-bound sockeye are intercepted in Ogden Channel (Aro and McDonald, MS 1967). It is possible that some sockeye bound for Areas 8, 9, and 10 may be caught in Area 7.

In these areas sockeye have been reported to spawn in 83 streams of which only seven have significant runs (Figure 8 and Appendix Figure A-1; Appendix Table A-I); in Area 5, from 1951 to 1962, the average escapement was from 2,000 to 5,000 in Kingkown Inlet Creek, in the Survey Bay River, and in the Keecha Lake system, and from 5,000 to 10,000 in Curtis Inlet Creek. In the Butedale area, the average escapement in the same period was 2,000 to 5,000 in Kwakwa Creek and from 20,000 to 50,000 in the Kitlope River. The Tinkey River, the only significant run in the Bella Bella area, had an average escapement of 2,000 to 5,000 in the 1951 to 1962 period. Most of the sockeye spawning occurs in August in the Kitlope and Tinkey Rivers and in Kingkown Inlet and Curtis Inlet Creeks, and in September in the Keecha Lake system, in Kwakwa Creek, and in the Survey Bay River.

**Bella Coola (Area 8)**

The commercial catch in the Bella Coola area averaged about 128,000 sockeye from 1951 to 1963 (Figure 7) with the largest catches being made in the first half of July. Some sockeye bound for Rivers and Smith Inlets probably are caught in the southwestern part of Area 8. The majority of Area 8 sockeye spawn in the Atarko-Bella Coola system which, from 1951 to 1962, was reported to have had an escapement in excess of 100,000 in one year and an average escapement between 50,000 and 100,000 in the other eleven years. The only other significant sockeye run in the Bella Coola area, the Kimsquit River, had an average escapement in the 5,000 to 10,000 range in the same period (Figure 8 and Appendix Figure A-1; Appendix Table A-I). The peak period of spawning in both the Atarko-Bella Coola and Kimsquit is reported to be in September.

**Rivers and Smith Inlets (Areas 9 and 10)**

Rivers and Smith Inlets are the largest producers of sockeye along the central part of the British Columbia coast. From 1951 to 1963 the commercial catch averaged 798,000 sockeye in Rivers Inlet and 259,000 sockeye in Smith Inlet (Figure 7). The fishery in both inlets commences in late June and ends early in August with peak catches usually in the third week of July. Stocks bound for Rivers and Smith Inlets intermingle and are fished together off the mouths of the inlets and some fish bound for these areas may be intercepted in adjacent Areas 8 and 11.

**Rivers Inlet sockeye** spawned in streams adjacent to Owikeno Lake, eleven of which have significant runs of sockeye (Figure 8 and Appendix Figure A-1; Appendix Table A-I). From 1951 to 1962 escapements in excess of 100,000 were reported in Dallary Creek in three years, in the Washwash River in two years and in the Wannock River in one year. In the other years the average escapement to the three streams averaged between 20,000 and 50,000 sockeye. The average escapement in the same period to other Rivers Inlet streams was between 50,000 and 100,000 in the Wannock River, between 20,000 and 50,000 in Ambback Creek and in the Inziana and Sheemahant Rivers, between 10,000 and 20,000 in Ashlum Creek and the Neechanz River, and between 5,000 and 10,000 in Genesee Creek and the Tzeo River. Estimates of the number of spawners in the Machmell River have not been possible because of the extreme turbidity of the water. The peak period of spawning occurs in September in the Inziana, Neechanz, Sheemahant, Tzeo, and Washwash Rivers, and in October in the other streams.

Smith Inlet sockeye spawn in significant numbers in two streams, the Canoe River and Smokehouse
Creek, both tributary to Long Lake. From 1951 to 1962, escapements in these streams averaged from 20,000 to 50,000 sockeye (Figure 8 and Appendix Figure A-1; Appendix Table A-1). Most spawning occurs in October.

Seymour Inlet (Area 11)

Commercial catches of sockeye in this area, which averaged less than 15,000 in the years 1951 to 1963, are made outside the inlet in Queen Charlotte Sound and are composed entirely of sockeye bound for other areas (Area 11 has no local spawning stocks of sockeye).

Johnstone Strait (Areas 12 and 13)

Commercial catches of sockeye in the Johnstone Strait areas are composed of sockeye bound not only to the local streams but also for the Fraser River (Verhoeven and Davidoff, 1962). The size and timing of the commercial catch in Johnstone Strait varies considerably from year to year depending upon the proportion of the Fraser River run which enters the Strait of Georgia through Johnstone Strait. From 1951 to 1963 the catch has ranged from 151,000 sockeye (in 1954) to 4,333,000 sockeye (in 1958), with an average of 639,000 (Figure 7). The high catch in 1958 was associated with an unusually large movement of Fraser sockeye (mainly the Adams River run) through the area (Int. Pac. Salmon Fish. Comm., Ann. Rept, for 1958). Sockeye are caught in Johnstone Strait from May through to November with largest weekly catches occurring as early as the second week of July and as late as the first week of September.

Four river systems in Area 12 have significant runs (Figure 8 and Appendix Figure A-1; Appendix Table A-1): the Nimpkish River which from 1951 to 1962 accommodated more than 100,000 sockeye in five years and averaged between 50,000 and 100,000 sockeye in the other seven years, and the Kakweiken, Mackenzie Sound, and Klinaklini Rivers, in which escapements averaged between 2,000 and 5,000 sockeye.

From 1951 to 1962 the two significant runs in Area 13, Heydon Creek and the Phillips River, averaged from 1,000 to 2,000 sockeye and from 2,000 to 5,000 sockeye, respectively.

The peak of spawning is reported to occur in August in the Kakweiken River and during September in the other Area 12 and 13 streams.

Comox, Toba Inlet, Pender Harbour, and Howe Sound (Areas 14, 15, 16, and 28)

These areas, which comprise the northern part of the Strait of Georgia and the adjacent mainland inlets, have very few spawning runs of sockeye. The commercial catch, which has averaged about 14,000 sockeye per year in the years 1951 to 1963 (Figure 7), probably consists mainly of sockeye bound for the Fraser River. The only significant run in these areas is that to the Sakinaw Lake system (Figure 8 and Appendix Figure A-1; Appendix Table A-1) where from 1951 to 1962 the escapement averaged from 2,000 to 5,000 sockeye, most of them spawning in October.

Nanaimo, Cowichan, Victoria, and Juan de Fuca Strait (Areas 17, 18, 19, 20, and 21)

These areas, along with the Fraser River (Area 29) and that portion of Area 23 westward of a line drawn between Cape Beale and Amphitrite Point, form the Canadian section of the Fraser Convention Area (Figure 10) as defined by the Sockeye Salmon Fisheries Convention between Canada and the United States. With the exception of a few sockeye bound for other British Columbia streams adjacent to the Strait of Georgia, to streams in the State of Washington, and to Nitinat (Area 22), the commercial catch in Areas 17, 18, 19, 20, and 21, which from 1951 to 1963 averaged 9,000, 76,000, 8,000, 704,000, and 15,000 sockeye, respectively (Figure 7), consists of sockeye bound for the Fraser River (Verhoeven and Davidoff, 1962).

No runs of sockeye of significant size spawn in these areas.

Nitinat (Area 22)

The commercial catch in the Nitinat area averaged 13,200 sockeye from 1951 to 1956. A commercial fishery has not operated in the area since 1956. The commercial fishery prior to 1956 operated from early May to the end of June with peak catches in May or early June. The only significant sockeye run in the area spawns in the Hobiton River, where escapements averaged between 2,000 and 5,000 sockeye from 1951 to 1962 (Figure 8 and Appendix Figure A-1; Appendix Table A-1). Most spawning occurs in October.

Barkley Sound (Area 23)

As outlined above, the portion of Area 23 westward of a line drawn from Cape Beale to Amphitrite Point is part of the Fraser Convention Area. The line between Cape Beale and Amphitrite Point coincides with the “outside net fishing line” or “surf line” which came into effect in 1957. The commercial catch in Area 23 averaged 48,800 sockeye from 1951 to 1956, the years prior to the establishment of the “surf line”. From 1957 to 1963, the years following establishment of the “surf line”, the catch has averaged only 17,500 sockeye. Part of the catch outside the present “surf line” probably were Fraser River sockeye whereas
fish caught inside the line probably were bound for local streams. Peak catches occurred from mid-June to mid-July. Area 23 has two river systems, the Anderson and Somass Rivers, which support significant runs of sockeye (Figure 8 and Appendix Figure A-1; Appendix Table A-1). From 1951 to 1962 the escape-
ment to the Somass River exceeded 100,000 sockeye in two years and averaged between 20,000 and 50,000 sockeye in nine years. Anderson River sockeye spawners averaged between 10,000 and 20,000. Peak spawning occurs during October in both systems.

**Clayoquot, Nootka, Kyuquot, and Quatsino (Areas 24, 25, 26, and 27)**

The commercial catch in these areas (Figure 7) averaged 51,000 sockeye, the majority in Area 24, from 1951 to 1963. Largest catches were in late July and early August in Areas 24, 25, and 26, and in early July in Area 27. Significant runs spawned in the Kennedy Lake and Mahatta River systems (Figure 8 and Appendix Figure A-1; Appendix Table A-1). The run to the Kennedy Lake system spawns in signifi-
cant numbers in four locations: Clayoquot and Up-
per Kennedy Rivers, Cold Creek, and Kennedy Lake itself. Average sockeye escapements from 1951 to 1962 were estimated as 2,000 to 5,000 in Clayoquot River; 5,000 to 10,000 in Cold Creek and Upper Kennedy River; and 10,000 to 20,000 in Kennedy Lake. Most of the spawning takes place in November but in October in the Upper Kennedy River. Average escapement to the Mahatta River from 1951 to 1962 was 2,000 to 5,000 sockeye with peak spawning in October.

**Fraser River (Area 29)**

In the main text, the main features of Fraser spawning stocks are outlined in detail. In general, the composition of runs tends to vary in four-year cycles. Average escapements to different Fraser River spawning areas in four-year cycles from 1951 to 1962 (Ap-
pendix Table A-II) are for sockeye four years old and older, and are derived from annual reports of the International Pacific Salmon Fisheries Commission. Spawning area locations are illustrated in Figure 8 and Appendix Figure A-1.

(a) **Lower Fraser River.** Significant runs of sockeye spawn in two drainage systems in the lower reaches of the Fraser—Cultus Lake and Upper Pitt River. These runs have fairly consistent escapements in all cycles. Average escapements in the four cycles have varied from 15,100 sockeye to 28,800 sockeye at Cultus Lake and from 14,100 sockeye to 35,200 sockeye on the Up-

per Pitt River. The peak of spawning occurs on the Upper Pitt River in mid-September and at Cultus Lake in late November.

(b) **Harrison River.** Sockeye spawn in significant numbers in three streams in the Harrison Lake system—Harrison River, Big Silver and Weaver Creeks. The runs to the Harrison River and to Weaver Creek have fairly consistent escapements every year. Since 1951 average escapements to the Harrison River varied in the four cycles from 15,400 to 32,500 sockeye. Similar cyclic escapements to Weaver Creek have varied between 11,200 and 26,800 sockeye. In Big Silver Creek sizeable escapements have occurred only in the 1904 cycle (an average of 5,600 sockeye in 1952, 1956, and 1960) with escapements of only a few hundred in the other three cycles. The peak of spawning occurs in mid-September in Big Silver Creek, late October in Weaver Creek, and mid-November in the Harrison River.

(c) **Lillooet.** The sockeye run to the Birkenhead River system has shown little indication of cyclical dominance since 1951 although the average escapement (47,000 sockeye) in the 1904 cycle (1952, 1956, and 1960) was somewhat higher than the average escapements in the other three cycles (20,200 to 28,900 sockeye). The peak of spawning of Birkenhead sockeye is in late September.

(d) **South Thompson River.** The runs to the South Thompson River system are dominant in the 1902 cycle (1954, 1958, and 1962). The system also has small runs in the 1903 cycle but has only a few thousand spawners in the 1901 and 1904 cycles. Since 1951 average escapements to the important spawning grounds in the South Thompson system in the 1902 cycle were: Lower Adams River, 1,411,800 sockeye; Little River, 316,200; South Thompson River, 76,700; Seymour River, 54,100; and Lower Shuswap River, 19,300. Average escapements in the 1903 cycle during the period 1951 to 1962 were: Lower Adams River, 100,400; Seymour River, 28,700; and Little River, 13,000. In the South Thompson system the peak of spawning is in late October with the excep-
tion of the run in the Seymour River which spawns in late August and early September.

(e) **North Thompson River.** Average escapements from 1951 to 1962 to the Raft River, the only significant sockeye run along the North Thompson, ranged from 7,600 sockeye (1901 cycle) to 10,300 sockeye (1904 cycle). The peak of spawning is in late August.

(f) **Chilcotin River.** The Chilcotin River system has two sockeye runs, the Chilko River run, which presently produces most of the Fraser River sockeye catch in the 1904 cycle, and the smaller Taseko River run. The Chilko River run in the 1904 cycle had an

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3 Three-year-old precocious males or "jacks" have been omitted.
average escapement of 518,100 sockeye in the years 1952, 1956 and 1960. The average escapement in the 1903 cycle has recently increased (average 226,810 in 1951, 1953, and 1959), replacing the 1901 cycle as the second largest for the system. In the period 1951 to 1962 the average escapements to the Chilko River in the 1901 and 1902 cycles have been 124,900 and 77,500 sockeye, respectively. For 1951 to 1962 average escapements to the Taseko River have varied from 2,700 sockeye in the 1901 and 1904 cycles to 7,100 sockeye in the 1903 cycle. The peak of spawning occurs in early September in the Taseko River and in late September in the Chilko River.

(g) *Quesnel River.* The only significant run to the Quesnel River system is that to the Horseshy River in the 1901 cycle, where the average escapement in 1953, 1957, and 1961 was 209,100 sockeye. The Quesnel sockeye run in the 1901 cycle has shown a remarkable increase from an estimated escapement of 3,000 or less in 1945 and earlier to escapements in the order of 300,000 sockeye in recent years. From 1951 to 1962 in the other three cycles, the average escapement was 1,000 or less. Most spawning occurs in late August.

(h) *Nechako River.* The Nadina and Stellako Rivers accommodate most of the sockeye in the Nechako system. From 1951 to 1962, average escapements to the Nadina River were 44,600 sockeye in the 1901 cycle and less than 2,000 in the other three cycles. Average escapements to the Stellako River were 126,400 sockeye in the 1902 cycle and between 39,200 and 75,800 in other cycles. The sockeye run to the Nadina River is composed of two parts: an early run, most of which spawns in late August, and a late run, most of which spawns in late September. The peak spawning period in the Stellako River is in late September.

(i) *Stuart Lake.* The run to the Stuart Lake system spawns in numerous streams of which 16 support major stocks. From 1951 to 1962 spawners were most numerous in the 1901 cycle (1953, 1957, and 1961). Largest spawning runs to the Stuart Lake system were in the Middle, Tachie, and Driftwood Rivers, and Kuzkwa Creek, where escapements in the 1901 cycle since 1951 have averaged 248,300, 134,200, 45,300, and 31,000 sockeye, respectively. Average escapements in the other “major” streams in the 1901 cycle have been from 5,600 to 16,500 sockeye. In years other than the dominant one, some streams, e.g., Forfar, Kynoch, and Rossette Creeks, support sockeye in moderate numbers but in most streams off-year spawners are few in number or totally absent. The runs to the Stuart Lake system may be classified into early and late runs on the basis of their time of passage through the fishery and of their time of spawning.

The early runs, which spawn in early August, include those to Ankwill, Bivouac, Dust, Forfar, Forsythe, Gluske, Kynoch, Leo, Narrows, Rossette, and Sakeniche Creeks, and the Driftwood River. The late runs, which include runs into Kazchek and Kuzkwa Creeks, and the Middle and Tachie Rivers, spawn in mid-September. A portion of the run into Sakeniche Creek also spawns in mid-September.

(j) *Bowron River.* From 1951 to 1962, the average escapement to the Bowron River was 20,100 sockeye in the 1903 cycle (1951, 1955, and 1959), almost twice the average escapement in the other three cycles during the same period. In the Bowron River the peak of sockeye spawning occurs in late August.

**Pink Salmon**

Pink salmon, spawning mostly in near-coastal areas, are more widespread than sockeye. Nevertheless, most of the pink escapement spawns in a relatively few major drainage systems. As discussed in the main text the pink salmon runs in the even- and odd-numbered years are quite distinct and in some areas one of the two cycles may be either very small or even totally absent. Average catches of pink salmon in the various statistical areas are illustrated in Figure 19 for the odd-numbered years from 1951 to 1963, and in Figure 23 for the even-numbered years from 1952 to 1962.

**Queen Charlotte Islands (Areas 1 and 2)**

Pink salmon occur in the Queen Charlotte Islands in large numbers only in the even-numbered years (compare Figures 17 and 23 with Figures 16 and 19). The catch of pink salmon in Areas 1 and 2 averaged 438,000 and 782,000 pinks, respectively, in the even-numbered years 1952 to 1962, and only 27,000 and 32,000 fish, respectively, in the odd-numbered years 1951 to 1963. The bulk of the pink catch in the even-numbered years is made in inshore waters by purse seines whereas in the odd-numbered years most are caught in offshore areas by trollers. Although precise data are lacking, it is likely that many of these troll-caught pinks were fish bound for mainland streams. In both even- and odd-numbered years, the largest catches of pinks are usually made in mid- and late August.

In the even-numbered years 1952 to 1962 pink salmon spawned in significant numbers in 16 streams in the Queen Charlotte Islands (Figure 17 and Appendix Figure A-3; Appendix Table A-III). The escapements in this period exceeded 100,000 pinks in one year in Brown’s Cabin, Riley, Mathers, and Windy Bay Creeks, and the Tl’etn River; in two years in the Mamin River and in Datlaman and Pallant
Creeks; in three years in the Naden and Deena Rivers, and Kaisun Creek; and in four years in the Yakoun River and Copper Creek. In 1954 the escapement to the Yakoun River was estimated to have exceeded 400,000 pink salmon. In the other even years the escapements averaged between 50,000 and 100,000 pinks in the Naden River and in Copper and Kaisun Creeks; between 20,000 and 50,000 in the Mamin, Yakoun, Deena, and Tell Rivers, and in Browns Cabin, Datlamen, Mathers, Pallant, and Windy Bay Creeks; and between 10,000 and 20,000 in Riley Creek. Other streams in the Queen Charlotte Islands which had significant runs in the even-numbered years 1952 to 1962 include Skedans, Security Inlet, and Otard Creeks. The average escapements in these years were between 50,000 and 100,000 in Skedans Creek and between 10,000 and 20,000 in Security Inlet and Otard Creeks. Copper Creek, the only stream in the Queen Charlotte Islands with a significant run of pink salmon in the odd-numbered years, had an average escapement between 20,000 and 50,000 fish in the odd-numbered years 1951 to 1961 (Figure 16 and Appendix Figure A-2; Appendix Table A-III). Most pinks in the Queen Charlotte Islands streams spawned in September.

Nass River (Area 3)

The catch of pink salmon in Area 3 has fluctuated widely within both the odd- and even-numbered cycles. Neither run has dominated over the other for any extended period of years. In the period 1951 to 1963 the commercial catch in the Nass area averaged 475,000 pinks in the odd-numbered years and 481,000 pinks in the even-numbered years (Figures 19 and 23). Largest catches of pinks are usually made in late July and early August. Taggings carried out in 1957 and 1958 demonstrated that large numbers of pink salmon bound for other areas may be caught in subareas 3X and 3Y, the seaward portions of the Nass area (Shepard et al., 1962).

In Area 3, pink salmon spawn in significant numbers in Dogfish Bay Creek and in the Kwinamass River (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). Although firm data are lacking, the largest producer of pink salmon in the area is probably the main stem of the Nass River. Unfortunately, high turbidity of the river prevents visual assessment of the runs there and no special programs have yet been instituted to provide estimates of the numbers of spawners. However, fishery officers report that substantial catches are made in the estuary of the Nass, probably consisting mainly of pinks bound for the river itself.

Escapements in the Kwinamass River between 1951 and 1962 exceeded 100,000 pinks in one odd-numbered year and averaged between 10,000 and 20,000 pinks in the other odd-numbered years and between 20,000 and 50,000 pinks in the even-numbered years. During the same period, escapements to Dogfish Bay Creek averaged between 10,000 and 20,000 pinks in the odd-numbered years and between 5,000 and 10,000 fish in the even-numbered years. The peak of spawning in Dogfish Bay Creek and the Kwinamass River takes place in August. The peak spawning period in the main stem of the Nass River would probably occur later.

Skeena River (Area 4)

In the Skeena area both odd- and even-numbered years have produced substantial runs of pink salmon with commercial catches in the odd-numbered years averaging 953,000 pinks (Figure 19) and in the even-numbered years 707,000 pinks (Figure 23). Tagging has demonstrated that in some years large numbers of Skeena-bound pinks have been caught in southeast Alaska and in Areas 3 and 5 (Shepard et al., 1962; Aro and McDonald, MS 1967). Peak catches in the commercial fishery are made usually in early August.

In Area 4 significant runs of pink salmon spawn in Moore Cove Creek, the Oona River, and at five locations within the Skeena River watershed (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). In the years 1951 to 1962 the escapement to Moore Cove Creek exceeded 100,000 pinks in one even-numbered year and averaged between 20,000 and 50,000 pinks in the other even-numbered years and in the odd-numbered years. The average escapement of pinks to the Oona River between 1951 and 1962 was between 2,000 and 5,000 in the odd-numbered years and between 10,000 and 20,000 in the even-numbered years. On the Skeena watershed significant runs of pinks spawn in the lower Babine, Kispiox, Kitwanga, and Lakelse Rivers, and in the main stem of the Skeena River between the upper tidal limit and the village of Terrace. Since 1955 escapements to these spawning areas have been largest generally in the odd-numbered years but large escapements have occurred also in the even-numbered years (Appendix Table A-IX). As indicated by weir counts (conducted annually since 1946), pink spawners in the upper part of the lower Babine River have averaged 28,134 in the odd-numbered years and 15,733 in the even-numbered years. The runs in both 1951 and 1952 were reduced to very low levels by the rock slide in the Babine River. However, following removal of the rock slide both runs have built up to and even exceeded pre-slide levels. From 1955 to 1962 odd-year runs have consistently been more abundant.
than even-year runs in the Kispiox River (average 457,500 in the odd-year cycle and 39,000 in the even-numbered years). In the Kitwanga River the odd-year escapements also exceeded the even-year escapements with one exception (1958) when the escapement was equal to the average escapement in the odd-numbered years (escapement from 1955 to 1962 averaged 158,000 pinks in the odd-year cycle and 71,300 in the even-numbered years). Lakelse River pink spawners have been more abundant in the even-numbered years (average 273,500) than in the odd-numbered years (average 206,300). Enumeration of the pink run in the main stem of the Skeena River is particularly difficult but the best information available suggests that the average escapements there from 1955 to 1962 were 165,000 in the odd-numbered years and 25,500 in the even-year cycle. Taggings carried out at sea and in the river close to the upriver commercial boundary have indicated that the order in which the various runs appear in the fishery is related to the distance the fish must migrate upstream to their spawning grounds. The farthest upstream lower Babine and Kispiox River runs are most abundant in the commercial fishery in late July with the closest downstream runs to the Lakelse River and the main stem of the Skeena River following in early August. The run to the Kitwanga River is intermediate in distance from the sea and in timing. Spawning, most of which takes place in September, occurs in the same order as the time of entry of the different runs into the river with upriver runs generally spawning earlier than runs to rivers closer to the sea.

Grenville-Prinçipe (Area 5)

Like other areas along the northern mainland coast of British Columbia the Grenville-Prinçipe area produces pink salmon in substantial numbers in both odd- and even-numbered years (Figures 19 and 23). Commercial catches in Area 5 in the years 1951 to 1963 averaged 522,000 pinks in the odd-numbered years and 824,000 pinks in the even-numbered years. The largest catches in the commercial fishery usually have been made in mid-August although the peak week may occur as early as the fourth week of July and as late as the last week of August. Taggings have shown that in some years large numbers of Skeena-bound pink salmon approach Area 4 through Ogden Channel in the northern part of the Grenville-Prinçipe area (Aro and McDonald, MS 1967). It is likely that the fishery in the southern portion of Area 5 intercepts pinks bound for streams in Area 6.

Some 55 streams in the Grenville-Prinçipe area produce pink salmon but only two, Kumealon and Turn Creeks, support significant numbers of spawners (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). From 1951 to 1962 the escapement to Kumealon Creek in the even-numbered years exceeded 100,000 pinks in one year and averaged between 20,000 and 50,000 pinks in the other years. Escapements in Turn Creek averaged between 10,000 and 20,000 fish in the even-numbered years and between one and two thousand in the odd-numbered years. The peak of spawning in these streams takes place in September.

Butedale (Area 6)

In the Butedale area since 1951 catch and escapement of pinks in the even-numbered years have been larger than in the odd-numbered years. Between 1951 and 1963 the catch in Area 6 averaged 638,000 pinks in the odd-numbered years (Figure 19) and 1,540,000 pinks in the even-numbered years (Figure 23). Peak catches of pinks in the Area 6 fishery have been made usually in early August.

Pink salmon are reported to spawn in some 114 streams in Area 6. However, from 1951 to 1962 only 11 of these streams supported significant runs (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III): the Canoona River in the odd-numbered years only; the Kildala and Kitimat Rivers, and Bish, Evelyn, and Nalbeelah Creeks in even-numbered years only; and the Mussel, Kishkosh, Kitkia, and Quaal Rivers, and Scow Bay Creek in both cycles. In the even-numbered years the largest single producer in the area, the Quaal River, had an estimated escapement of 1,500,000 pinks in one year, an escapement in excess of 100,000 pinks in another year, and an average escapement between 50,000 and 100,000 pinks in the other four years. In the odd-numbered years the Quaal River had an escapement in excess of 100,000 pinks in one year and an average escapement between 20,000 and 50,000 pinks in four other years. Between 1951 and 1962 the average escapement was between 10,000 and 20,000 pinks in the Mussel River and in Scow Bay Creek in both the odd- and even-numbered years and in the Kitkia River in the even-numbered years. During the same period the average escapement of pinks was between 10,000 and 20,000 in the Kishkosh River in both cycles and in the Kitkia River in the odd-numbered years. The Kitimat River, an even-year producer only, had escapements in excess of 100,000 pinks in three even-numbered years and an average escapement between 20,000 and 50,000 pinks in the other three even-numbered years. The escapement to Nalbeelah Creek, a tributary of the Kitimat River, exceeded 100,000 pinks in one even-numbered year and averaged between 10,000 and 20,000 pinks in two other even-numbered years. From
1951 to 1962 average escapements to other streams which supported significant runs in the even-numbered years only were between 20,000 and 50,000 pinks in Evelyn Creek and the Kildala River and between 10,000 and 20,000 pinks in Bish Creek. The Canoona River, the only stream in the area which produced a sizeable run in the odd-numbered years, had an average escapement between 20,000 and 50,000 pinks in the odd-numbered years. The peak of spawning occurred during August in all these streams with the exception of the Kitkia River, Quaal River, and Scoil Bay Creek where it was reported to have occurred during September.

**Bella Bella (Area 7)**

Since 1951 the average catches and escapements of pink salmon in the Bella Bella area in the odd- and even-year cycles were almost of equal size. From 1951 to 1963 the average catch in Area 7 was 413,000 pinks in the odd-numbered years and 527,000 pinks in the even-numbered years (Figures 19 and 23). Peak catches are made in the fishery in the first half of August.

Significant runs of pink salmon spawn in four Bella Bella streams: the Kainet, Clatse, and Neekis Rivers, and Salmon Bay Creek (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). From 1951 to 1962 the Kainet River had escapements exceeding 100,000 pinks in three odd-numbered years and in two even-numbered years. In another odd-numbered year the Kainet River had an estimated escapement of 75,000 pinks and an average escapement in the other four even-numbered years from 20,000 to 50,000. Escapements in the Clatse River averaged between 20,000 and 50,000 pinks in both the even- and odd-numbered years. The Neekis River had an escapement in excess of 100,000 pinks in one odd-numbered year, and average escapements in the 10,000 to 20,000 range in three other odd-numbered years and in the 20,000 to 50,000 range in the even-numbered years. Average escapements to Salmon Bay Creek were between 20,000 and 50,000 pinks in even-numbered years and between 5,000 and 10,000 pinks in odd-numbered years. In the Clatse and Neekis Rivers, and in Salmon Bay Creek, most pinks spawn in September while in the Kainet River spawning is mainly in August.

**Bella Coola (Area 8)**

Like the other areas along the northern mainland coast of British Columbia the Bella Coola area has substantial pink runs in both the odd- and even-year cycles. However, in recent years both the catch and escapement of pinks has been larger in the even-numbered years than in the odd-numbered years; average catches of pink salmon in Area 8 in the years 1951 to 1963 were 1,087,000 fish in odd-numbered years and 2,725,000 in even-numbered years (Figures 19 and 23). The large average catch in the even-numbered years was due mainly to the exceptionally large catch in Area 8 of 12,192,000 pinks in 1962. Peak catches in the commercial fishery have been made usually in late July in the even-numbered years and in early August in the odd-numbered years.

Significant numbers of pink salmon spawn in seven stream systems in the Bella Coola area: in the Dean River in the odd-numbered years; in the Jenny Bay streams, Hook Nose Creek, and Nootum River in even-numbered years; and in the Koeeye, Kwatna, and Attnarko-Bella Coola Rivers in both odd- and even-numbered years (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). The pink run to the Attnarko-Bella Coola River system has in recent years been the largest in northern British Columbia with escapements in the even years 1952 to 1962 of 2,500,000 in one year, 1,000,000 in another year, in excess of 100,000 in three years and 75,000 in the sixth year. In odd-numbered years the escapement to the Attnarko-Bella Coola system was estimated to have been 1,000,000 pinks in one year and in excess of 100,000 pinks in the other five years. The Koeeye River which supports the second largest run in the area had escapements in excess of 100,000 in two odd-numbered years and in one even-numbered year. In the other years between 1951 and 1962 the average escapement to the Koeeye River was between 50,000 and 100,000 pinks in odd-numbered years and between 20,000 and 50,000 pinks in even-numbered years. In the Kwatna River, the third stream which had major runs in both odd- and even-numbered years, average escapements were between 50,000 to 100,000 in odd-numbered years and between 20,000 to 50,000 in even-numbered years. From 1951 to 1962 even-year escapements to Hook Nose Creek and the Nootum River, which had significant runs in the even-numbered years only, were between 10,000 and 20,000 pinks. The Jenny Bay streams, which also have had major runs only in even-numbered years, had total average escapements in the 20,000 to 50,000 range. The Dean River, which had significant numbers of spawners in odd-numbered years only, had an average escapement between 20,000 and 50,000 pinks. The peak of spawning occurred in August in the Dean, Kwatna, and Nootum Rivers and in September in the Koeeye River, Hook Nose Creek, and Jenny Bay streams. In the Attnarko-Bella Coola Rivers the peak spawning period is reported to have occurred in September in odd-numbered years and in August in even-numbered years.
Rivers, Smith, and Seymour Inlets (Areas 9, 10, and 11)

Rivers and Smith Inlets produce few pink salmon. The average catch in the years 1951 to 1963 in Rivers Inlet was 101,000 pinks in odd-numbered years and 196,000 pinks in even-numbered years (Figures 19 and 23). During the same period the average catch in Smith Inlet was 17,000 pinks in odd-numbered years and 45,000 pinks in even-numbered years (Figures 19 and 23). Because few pinks are observed to spawn in these areas (only two runs are of significant size) it is likely that the bulk of the catch consists of fish bound for other areas (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). In the years 1951 to 1962 the escapements average between 10,000 and 20,000 pinks in Johnston Creek at Rivers Inlet in the even-numbered years and in Nekite Creek at Smith Inlet in both the odd- and even-numbered years. Only small runs have spawned in Johnston Creek in the odd-numbered years. Most of the spawning takes place in September.

Pinks are virtually absent from Seymour Inlet streams and Area 11 catches are low, having averaged from 1952 to 1963 less than 4,000 in the odd-numbered years and less than 300 in the even-numbered years.

Upper Johnstone Strait (Area 12)

Taggings of pink salmon in Area 12 have shown that the pink runs migrating through the area are a mixture of pinks bound not only to local streams but also to streams draining into lower Johnstone Strait and the Strait of Georgia (Vernon et al., 1964; Hourston et al., 1965). In the odd-numbered years the Area 12 catches contain, besides local fish, varying numbers of pinks bound for the Fraser River, for other streams along the southern mainland coast, and for streams along the east coast of central Vancouver Island. In the even-numbered years the Area 12 pink catch consists of local fish as well as of pinks bound for streams along the eastern shore of Vancouver Island in Areas 13 and 14. From 1951 to 1963 the commercial catch in upper Johnstone Strait averaged 2,202,000 pinks in odd-numbered years and 936,000 pinks in even-numbered years (Figures 19 and 23). The peak catch in the commercial fishery in Area 12 usually occurs in the second or third week of August.

Significant numbers of pink salmon spawn in nine streams in Area 12 (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). Four of these streams, the Adam, Keogh, Quatse, and Shushartie Rivers, are located on Vancouver Island, while the other five, the Kakweiken, Kingcome, and Wakeman Rivers, and Glendale and Waterfall Creeks, drain into mainland inlets. From 1951 to 1962 Vancouver Island streams (with the exception of the Adam River) had larger escapements in even-numbered years than in odd-numbered years. The Keogh River in this period had escapements in excess of 100,000 pinks in two even-numbered years, an average escapement between 50,000 and 100,000 pinks in the four other even-numbered years, and an average escapement in the 10,000 to 20,000 range in the odd-numbered years. Between 1951 and 1962 the Quatse River had an escapement in excess of 100,000 pinks in one even-numbered year and an average escapement in the 20,000 to 50,000 range in the other even-numbered years. In the same even-numbered years the average escapement of pinks was between 10,000 and 20,000 in the Shushartie River. In the odd-numbered years 1951 to 1961, the average escapement to the Quats and Shushartie Rivers was less than 10,000 pinks. The average escapements of pinks into the Adam River in the years 1951 to 1962 were between 20,000 and 50,000 in odd-numbered years and between 10,000 and 20,000 in even-numbered years.

During the years 1951 to 1962 pinks spawned in both the odd- and even-numbered years in the five mainland streams. However, the escapements to the Kingcome River were insignificant in odd-numbered years and small in the Wakeman River in even-numbered years. Glendale Creek had escapements in excess of 100,000 pinks in two odd-numbered years and one even-numbered year, and an average escapement between 20,000 and 50,000 pinks in the other odd- and even-numbered years. The Kakweiken River had over 100,000 pink spawners in one odd-numbered year and an average escapement of 20,000 to 50,000 in the other odd- and even-numbered years. The average escapements in Waterfall Creek were between 10,000 and 20,000 pinks in both the odd- and even-numbered years. In the Kingcome River in even-numbered years and in the Wakeman River in odd-numbered years, escapements averaged between 20,000 and 50,000 pinks. Most spawning takes place in August in the Kingcome, Wakeman, and Shushartie Rivers, and in September in the Adam, Kakweiken, Keogh, and Quatse Rivers, and in Glendale and Waterfall Creeks.

Lower Johnstone Strait (Area 13)

As in Area 12 the pink catches in Area 13 are composed of both local fish and fish migrating through the area to more southerly streams. From 1951 to 1963 catches averaged 684,000 pinks in odd-numbered years and 136,000 pinks in even-numbered years (Figures 19 and 23).

From 1951 to 1962 three streams in Area 13 had significant runs of pink salmon: Amor de Cosmos Creek in even-numbered years only and the Phillips and Quatnum Rivers in odd-numbered years only.
The commercial catch in Area 14 in the years 1951 to 1963 averaged only 5,000 pinks in the odd-numbered years and 2,000 pinks in the even-numbered years (Figures 19 and 23). During this period significant numbers of pinks spawned in two Area 14 streams, the Tsolum River in both odd- and even-numbered years and the Oyster River in even-numbered years only (Figures 16 and 17; Appendix Figures A-2 and A-3; Appendix Table A-III). The escapement to the latter river exceeded 100,000 pinks in two even-numbered years and averaged between 20,000 and 50,000 pinks in the other even-numbered years. The Tsolum River had escapements greater than 100,000 pinks in one odd- and one even-numbered year and average escapements in the 20,000 to 50,000 range in the other years in both cycles. Most spawning takes place in September in the Tsolum and Oyster Rivers.

**Toba Inlet and Pender Harbour (Areas 15 and 16)**

These areas support pink runs only in odd-numbered years. The commercial catch in the odd-numbered years between 1951 and 1963 averaged 13,000 pinks in Area 15 and 118,000 pinks in Area 16 (Figure 19). During the same period the commercial catch in even-numbered years was less than 100,000 in Area 15 and less than 300 pinks in Area 16 (Figure 23). From 1951 to 1961, two streams in Area 15, the Brem and Toba Rivers, and one stream in Area 16, the Skwawka River, had significant escapements of pinks in odd-numbered years (Figure 16 and Appendix Figure A-2; Appendix Table A-III); average escapements were between 10,000 and 20,000 pinks in the Brem River and between 20,000 and 50,000 pinks in the Toba River. In the same period the Skwawka River had escapements in excess of 100,000 pinks in three years and an average escapement between 50,000 and 100,000 pinks in the other two odd-numbered years. The peak of spawning in these streams occurs in September.

**Nanaimo, Cowichan, Victoria, Juan de Fuca Strait, Nitinat, and Barkley Sound (Areas 17, 18, 19, 20, 21, 22, and 23)**

Pink salmon spawn in only six streams in these areas and in none of them in significant numbers. The pink catch in these areas probably consists of fish bound for the Fraser River, other streams adjacent to the Strait of Georgia, and streams in the State of Washington. The total average catch in these areas in the years 1951 to 1963 was 2,312,000 pinks in the odd-numbered years and only 2,900 in the even-numbered years (Figures 19 and 23). The bulk of the catch in the odd-numbered years was made in Area 20. Peak catches in this fishery were made in the last week of July and the first week of August.

**Clayoquot, Nootka, Kyuquot, and Quatsino (Areas 24, 25, 26, and 27)**

Pink salmon spawn in streams in Areas 24, 25, 26, and 27 in both odd- and even-numbered years but those spawning in even-numbered years far exceed those in odd-numbered years. From 1951 to 1963 the average catch in these areas in odd-numbered years was 104,000 pinks (Figure 19). As very few pinks spawn in these areas in odd-numbered years the majority of the pink catch in these years, made mainly by trolls, probably consisted of pinks bound for other areas, mainly the Fraser River. From 1952 to 1962 the average even-year catch in Areas 24, 25, 26, and 27 was 116,900 pinks of which 106,500 were caught in Area 27 (Figure 23). Most of the catch in even-numbered years was probably of local origin as the bulk of the catch was made by purse seiners which operate close to shore in bays and inlets. Part of the troll catch may have contained some pinks destined for streams in other areas. Peak catches in even-numbered years in Area 27 were made in the first part of August.

Significant numbers of pink salmon spawn in only two streams along the west coast of Vancouver Island and only in the even-numbered years (Figure 17 and Appendix Figure A-3; Appendix Table A-III). From 1952 to 1962, in the even-numbered years, the average escapements were between 20,000 and 50,000 pinks in the Koprino River and between 10,000 and 20,000 pinks in the Kwatse River. Most spawning takes place in September.

**Hove Sound (Area 28)**

Pink salmon runs occur in this area only in odd-numbered years (Figure 19). In the four odd-numbered years between 1951 and 1963 when a commercial net fishery operated in the area, the catch, which was taken mainly in late August, averaged 68,000 pinks. A large number of pink salmon bound for Area 28 are caught in the Straits of Juan de Fuca and Georgia, and in Johnstone Strait (Vernon et al., 1964;
Hourston et al., 1963).

From 1951 to 1962 two streams in Area 28, the Cheakamus and Indian Rivers, had significant numbers of pinks in the odd-numbered years (Figure 16 and Appendix Figure A-2; Appendix Table A-III). The escapement in the Cheakamus River exceeded 100,000 pinks in one year and averaged between 20,000 and 50,000 pinks in four other odd-numbered years. The Indian River had escapements greater than 100,000 pinks in three odd-numbered years and average escapements in the 50,000 to 100,000 range in the other three odd-numbered years. Most spawning takes place in September.

Fraser River (Area 29)

Pink salmon runs occur in the Fraser River in odd-numbered years only. From 1951 to 1963 the average catch in Area 29, the Fraser River and the adjacent part of the Strait of Georgia, in the odd-numbered years was 649,000 pinks (Figure 19). However, as discussed earlier, large numbers of Fraser River pink salmon are caught off the west coast of Vancouver Island, in the Straits of Juan de Fuca and Georgia, and in Johnstone Strait (Vernon et al., 1964; Hourston et al., 1965). From 1951 to 1962, the average catch of pinks in the Fraser Convention Area in odd-numbered years was 6,181,098 fish (Appendix Table A-X). This figure includes some pink salmon bound for other streams draining into the Strait of Georgia and for streams in the State of Washington but does not include Fraser River pinks caught outside the Fraser Convention Area. Substantial numbers of Fraser River pink salmon are caught in Johnstone Strait. The largest catches of pinks in the commercial fishery in Area 29 are usually made in early September.

Estimates of the pink escapement to the Fraser River have been made by the International Pacific Salmon Fisheries Commission since 1957. In the odd-numbered years 1957, 1959, and 1961 significant numbers of pink salmon spawned in six of the 47 areas where pinks are known to spawn in the Fraser drainage (Figure 16 and Appendix Figure A-2; Appendix Table A-III). The average number of pinks estimated to have spawned in the main stem of the Fraser River below Hope in these years was 849,000 pinks, the largest average escapement of pinks to any single spawning area in British Columbia. The other “major” runs were those to the Harrison, Chilliwack, and Thompson Rivers, Seton Creek, and Chehalis River with average escapements of 294,100, 164,000, 140,600, 44,100, and 9,300 pinks, respectively. Peak spawning in the main stem of the Fraser River is in late September and early October, in the Chehalis and Thompson Rivers and Seton Creek in early October, and in the Chilliwack and Harrison Rivers in mid-October.

Chum Salmon

Chum salmon are similar to pink salmon in that they are widely distributed along the length of the British Columbia coast and in that they spawn mainly in areas close to the sea. Unlike pinks and sockeye, where a relatively few spawning areas support most of the runs, chums are spread more evenly over a larger number of spawning streams.

Queen Charlotte Islands (Areas 1, 2A, and 2B)

From 1951 to 1963 chum salmon catches in the Queen Charlotte Islands averaged about 164,000 fish, about one-third of which was made in Area 2AW, one-third in Area 2BE, and the remaining one-third elsewhere in the Islands (Figure 27). Peak catches were made in the latter part of September in Area 2 and in the first week of October in Area 1. Since 1957 the fishery has often been severely restricted to permit greater escapements. From 1951 to 1962 significant numbers of chum salmon spawned in three streams (Ain, Awun, and Naden Rivers) in Area 1, in eight streams (Deena, Honna, and Long Arm Rivers, Peel Inlet and Seal Inlet streams, and Athlou, Canoe Point, and Mercer Creeks) in Area 2A, and in nine streams (Salmon and Sedmond Rivers, and Bag Harbour, Big Goose Bay, George Bay, Harriet Bay, Lagoon Bay, Oyster Cove, and Pallant Creeks) in Area 2B (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). Average escapements were between 20,000 and 50,000 chums in the Ain River; between 10,000 and 20,000 fish in the Awun, Naden, Deena, and Salmon Rivers, and in Canoe Point, Mercer, George Bay, Lagoon Bay, and Pallant Creeks; between 5,000 and 10,000 in the Sedmond River, the Seal Inlet stream, and in Athlou, Bag Harbour, and Oyster Cove Creeks; and between 2,000 and 5,000 in the Honna River, the Peel Inlet stream, and in Big Goose Bay and Harriet Bay Creeks. During the same period the escapement to the Long Arm River exceeded 100,000 in two years and averaged between 2,000 and 5,000 chums in the other years. Most spawning takes place in October except in Canoe Point Creek and the Seal Inlet stream where the peak spawning period is in September.

Nass River (Area 3)

From 1951 to 1963 the catch in Area 3 averaged about 153,000 chums (Figure 27). Taggings carried out near Tree Point and Cape Fox in southeastern Alaska in 1947 (Fisheries Research Institute, 1959) and in Area 3 in British Columbia in 1957 (Fisheries Re-
search Board, 1957) indicate that some British Columbia-bound chum salmon (probably mainly to Area 3) may be caught in Alaskan waters adjacent to the International Boundary and that some chum salmon bound for streams on the Alaskan side of Portland Canal are intercepted by Canadian fishermen in Portland Inlet. The chum run to Area 3 is composed of several spawning populations which enter the fishing area at different times. Therefore chums are caught in moderate numbers in Area 3 from late June to early September. The peak catch may be made as early as the third week of July or as late as the first week of September.

Significant numbers of chum salmon spawn in two streams in Area 3, the Toon River and Illiance Creek (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). From 1951 to 1962 escapements to these streams averaged between 5,000 and 10,000 chums. Chum salmon are believed to spawn in significant numbers in the main channel of the Nass River below the village of Aiyansh but because silty water will not permit visual observations it has not been possible as yet to estimate the size of this spawning stock. Most of the spawning in the Toon River and Illiance Creek takes place in August.

**Skenea River (Area 4)**

The Skenea area, with an average catch of 44,000 fish in the years 1951 to 1963, is a minor producer of chum salmon (Figure 27). The main catches in the area are usually made in the latter half of August. Significant numbers of chum salmon are known to spawn in the Ectast River (Figure 25 and Appendix Figure A-4; Appendix Table A-IV) where the average escapement from 1951 to 1962 was estimated to be between 5,000 and 10,000 chums. It is believed that significant numbers of chum salmon may spawn in the main channel of the Skenea River. Estimates of the size of this population have not been possible as yet. Most chums in the Ectast River spawn in September.

**Grenville-Prinçipe (Area 5)**

With an average catch of 32,000 chums from 1951 to 1963 (Figure 27), the Grenville-Prinçipe area, like the Skenea area, is a minor producer of chum salmon. The peak chum catch in the Area 5 fishery usually occurred in late August or early September. Chum salmon spawn in many streams in Area 5 but from 1951 to 1962 in significant numbers only in Turn Creek (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). In Turn Creek the escapement averaged between 5,000 and 10,000 chums and most of the spawning occurred in September.

**Butedale (Area 6)**

From 1951 to 1963 the average catch of chum salmon in the Butedale area was about 185,000 fish (Figure 27). Peak catches varied from late July to early September. Chum salmon are reported to spawn in 113 streams but from 1951 to 1962 only seven streams had significant numbers of chum spawners (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). The average escapements were between 10,000 and 20,000 chums in the Musel and Kitimat Rivers and Price Creek; between 5,000 and 10,000 in the Kemano River; and between 2,000 and 5,000 in the Kildala, Kiltuish, and Kitlope Rivers. The peak spawning period in these streams was in September.

**Bella Bella (Area 7)**

The Bella Bella area is the largest producer of chum salmon in northern British Columbia with an average catch of 256,000 chums from 1951 to 1963 (Figure 27). The largest catches of chum salmon in Area 7 were made usually in late August or early September. Significant numbers of chums spawned in eight streams in the Bella Bella area in the years 1951 to 1962 (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). The average escapements were between 20,000 and 50,000 chums in the Kainet, Neekis, and Noota Rivers; between 10,000 and 20,000 in Howyct Creek and the Kwakusdis River; between 5,000 and 10,000 in the Gullchuck Head stream and the Clatspe River; and between 2,000 and 5,000 in Salmon Bay Creek. Most spawning takes place in September with the exception of the run to Clatspe River where peak spawning is in October.

**Bella Coola (Area 8)**

The catch of chums in the Bella Coola area, which averaged 259,000 fish in the years 1951 to 1963, was exceeded in northern British Columbia only by the catch in the adjacent Bella Bella area (Figure 27). Chum salmon are caught in Area 8 in significant numbers from mid-July to late September with the peak catches usually in late July or early August. From 1951 to 1962 seven streams supported significant runs of chums (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). The average escapements were between 20,000 and 50,000 fish in the Kimsquit River and the Atmarko-Bella Coola Rivers; between 10,000 and 20,000 in the Cascade Inlet, Dean, and Kwatna Rivers; and between 5,000 and 10,000 in the Koeye River and Elcho Harbour Creek. The peak spawning period is reported to be in August in these streams with the exception of the Atmarko-Bella Coola, Cascade Inlet, and Koeye Rivers where most of the spawning is reported to occur in September.
Rivers, Smith, and Seymour Inlets (Areas 9, 10, and 11)

From 1951 to 1963 the average catches of chum salmon in Rivers, Smith, and Seymour Inlets were 28,000, 19,000, and 5,000 fish, respectively (Figure 27). Chums are present in moderate numbers in the commercial fishery in Rivers Inlet from mid-July to mid-October and in Smith and Seymour Inlets from mid-August to mid-September. Significant numbers of chum salmon spawn in two Rivers Inlet stream systems, the Clyak-Young-Neil Rivers and the Wannock River, and in one Seymour Inlet stream, the Taatlz River (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). From 1951 to 1962 average escapements were between 10,000 and 20,000 chums in the Wannock and Taatlz Rivers and between 5,000 and 10,000 in the Clyak-Young-Neil Rivers. None of the streams in Smith Inlet had significant numbers of chum spawners. Most spawning takes place in August in the Clyak-Young-Neil Rivers, in September in the Taatlz River, and in November in the Wannock River.

Upper Johnstone Strait (Area 12)

The commercial catches in Area 12, which averaged 465,000 chum salmon, were the largest in British Columbia during the period 1951 to 1963 (Figure 27). The catch in Area 12 is composed not only of local chums but also of fish bound for southern streams including the Fraser River (Chatwin, 1953; Manzer, MS 1958). Chum salmon are present in numbers in the Area 12 fishery from late July to late November. The peak catch of chums has occurred as early as late September and as late as the end of October. This difference is probably due in part to the difference in the timing and the relative abundance of the different chum stocks caught in the fishery. In general, chums bound for streams in the inlets adjacent to Johnstone and Georgia Straits pass through Area 12 earlier than do chums bound for the Fraser.

From 1951 to 1962 chum salmon were reported to have spawned in 58 streams in Area 12 but in significant numbers in only 12 of them (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). Escapements averaged between 20,000 and 50,000 chums in the Klinaklini and Viner Sound Rivers; between 10,000 and 20,000 in the Ahmuhati, Kakeweiken, and Kingcome Rivers; between 5,000 and 10,000 in Glendale and Ahta Valley Creeks and in the Qt'aqe', Wakeman, and Waterfall Rivers; and between 2,000 and 5,000 in the Keogh River. The chum escapement to the Nimpkish River exceeded 100,000 chums in one year and averaged between 20,000 and 50,000 fish in the other 11 years. The peak period of spawning was in September in Ahta Valley Creek and in the Ahmuhati, Keogh, and Waterfall Rivers; in October in Glendale Creek and the Kakweiken, Kingcome, Klinaklini, Qt'aqe', Viner Sound, and Wakeman Rivers; and in November in the Nimpkish River.

Lower Johnstone Strait (Area 13)

From 1951 to 1963 the commercial catch of chum salmon in Area 13, which averaged 332,000 chums (Figure 27), was exceeded in British Columbia only by the catch in Area 12. As in Area 12 the Area 13 catch consists of local fish and fish migrating through the area to streams farther south. Chums are caught in significant numbers in Area 13 from late August to December with the peak catches in October. From 1951 to 1962 significant numbers of chum salmon spawned in six streams in Area 13 (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). Average escapements were between 10,000 and 20,000 chums in the Homathko River; between 5,000 and 10,000 in Heydon Creek and in the Orford and Southgate Rivers; and between 2,000 and 5,000 in the Phillips and Salmon Rivers. Peak spawning is in October in these streams with the exception of Heydon Creek and the Homathko River where most of the spawning takes place in November.

Strait of Georgia excluding the Fraser River (Areas 14, 15, 16, 17, 18, 19, and 28)

From 1951 to 1962 the average catches of chum salmon in Areas 14, 15, 16, 17, 18, 19, and 28 were 39,000, 7,000, 66,000, 59,000, 32,000, 500, and 27,000 chums, respectively (Figure 27). The chum salmon fisheries in these areas are late; peak catches are usually in late October. The catches within each of these areas are mixed, probably consisting of fish bound for streams elsewhere along the Strait of Georgia as well as to local streams. Chum salmon bound for streams in these areas are also caught in Johnstone Strait (Chatwin, 1953; Manzer, MS 1958) and may also be taken in small numbers in the Strait of Juan de Fuca.

In these areas from 1951 to 1962 chum salmon were reported to have spawned in 95 streams, in 22 of them in significant numbers (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). Average escapements of chums were between 20,000 and 50,000 in the Qualicum, Little Qualicum, Puntledge, Chemainus, Nanaimo, Sooke, Toba, and Cheakamus Rivers; between 10,000 and 20,000 in the Theodosia, Tzoonie, and Indian Rivers and De Mamiel Creek; between 5,000 and 10,000 in the Englishman, Tsable, Goldstream, and Deserted Rivers and Sliammon and Holland Creeks; and between 2,000 and 5,000 in the Kokisilah River and Bush Creek. Escapements to the Cowichan and Squamish Rivers exceeded 100,000.
chums in one year and averaged between 20,000 and 50,000 fish in the other years. Most spawning occurs in October in Bush and Holland Creeks and the Theodosia, Chemainus, and Nanaimo Rivers; in November in De Mamiel and Sliammon Creeks and the Englishman, Little Qualicum, Puntledge, Tsable, Toba, Deserted, Tzoonie, Goldstream, Sooke, and Indian Rivers; and in December in the Qualicum, Cowichan, Kokishlah, Cheakamus, and Squamish Rivers.

West coast of Vancouver Island (Areas 20 to 27)

From 1951 to 1963 the commercial catch in these areas has averaged 401,000 chum salmon (Figure 27), taken mainly in Areas 23, 25, and 22. The bulk of the catch in these areas probably consisted of local chums since most of the catch was made in inside waters by the net fishery. Large catches were made only in October with the peak catches usually in the third week. From 1951 to 1962 significant numbers of chum salmon spawned in 15 of the 183 west coast streams occupied by chums (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). Average escapements were between 20,000 and 50,000 chums in the Nitinat, Sarita, and Toquart Rivers; between 10,000 and 20,000 in the Inner Basin River and Tranquil Creek; and between 5,000 and 10,000 in the Moira, Moyha, Burman, Tahsis, Zeballos, Clanninick, Malksope, and Tahsish Rivers, and in the left fork of the Toquart River. The Nahmint River had an escapement in excess of 100,000 chums in one year and an average escapement between 20,000 and 50,000 in the other years. Most spawning is reported to take place in October in these streams with the exception of the Malksope, Megin, and Moyha Rivers where the peak spawning is in November.

Fraser River (Area 29)

From 1951 to 1963 the commercial catch of chum salmon in Area 29 averaged 211,000 fish (Figure 27), made mainly in the latter part of October and in November. Fraser River chum salmon are also caught in substantial numbers in Johnstone Strait and the Strait of Georgia and possibly to a minor extent in the Strait of Juan de Fuca. The Fraser River chum salmon run is composed of many subpopulations of which four were of significant size (Figure 25 and Appendix Figure A-4; Appendix Table A-IV). From 1951 to 1962 average escapements were between 20,000 and 50,000 chums in the Chehalis, Chilliwack, and Harrison Rivers. It was estimated that an average of 75,100 chum salmon spawned in the main channel of the Fraser River below Hope in the years 1960 and 1961. Peak spawning occurs in October in the Chehalis River and in December in the Chilliwack and Harrison Rivers and in the Fraser River below Hope.

Coho Salmon

In British Columbia cohos are the most widely dispersed of the five species of Pacific salmon. Production is spread over a large number of moderate-sized systems rather than in a few large ones.

Queen Charlotte Islands (Areas 1 and 2)

From 1951 to 1963 the commercial catch adjacent to the Queen Charlotte Islands averaged 328,000 cohos (Figure 29). Of this catch, about 72% was made in Area 1 and about 95% was made by the troll fishery. Cohos were caught off the Queen Charlotte Islands from late June to late September with peak catches in late July. Tagging (Milne, 1957) indicates that many of the cohos caught in these areas by the troll fishery were probably bound for streams on the mainland.

From 1951 to 1962 cohos were reported to have spawned in 109 streams in the Queen Charlotte Islands, and in significant numbers in nine of them (Figure 28 and Appendix Figure A-5; Appendix Table A-V). Average escapements during this period were between 10,000 and 20,000 cohos in Copper Creek and the Tlelle River; between 5,000 and 10,000 in the Yakoun River; between 2,000 and 5,000 in the Enn, Naden, and Deena Rivers and Mathers and Palant Creeks; and between 1,000 and 2,000 in Lagoon Bay Creek. Peak spawning was reported to be in October in these streams with the exception of the Enn and Naden River systems where most spawning takes place in September.

Nass River (Area 3)

From 1951 to 1963 the average catch in the commercial fishery in the Nass area was 99,000 cohos (Figure 29), about equally divided between the troll and net fisheries. Peak catches were made between mid-August and mid-September. From 1951 to 1962 significant numbers of cohos spawned in two streams (Figure 28 and Appendix Figure A-5; Appendix Table A-V): Illiance Creek (average escapement between 1,000 and 2,000 cohos) and the Tseax River (average escapement between 2,000 and 5,000 cohos). Cohos may also spawn in significant numbers in the main channel of the Nass River but no firm data on numbers are available. Peak spawning in Illiance Creek and the Tseax River is in October.

Skeena River (Area 4)

From 1951 to 1962 the commercial catch of cohos
in the Skeena area averaged 120,000 fish (Figure 29),
again about equally divided between the net and troll
fisheries. Peak catches were made usually in late
July and early August but occurred as early as the
first week of July and as late as the last week of August.
From 1951 to 1962 significant numbers of cohos
spawned in 12 of the 90 streams occupied by cohos in
Area 4 (Figure 28 and Appendix Figure A-5; Ap-
pendix Table A-V). Average escapements were be-
tween 20,000 and 50,000 cohos in the Lakelse River;
between 5,000 and 10,000 in the Gitnadoix, Kispiox,
and Morice Rivers; between 2,000 and 5,000 in the
lower Babine, upper Babine, and upper Bulkley Rivers
and in Diana and Gosnell Creeks; and between 1,000
and 2,000 in the lower Bulkley and Kasiks Rivers and
in the McDonell Lake system. Peak spawning occurs
in September in the Gitnadoix and Kispiox Rivers;
in October in the Babine, Kasiks, and Lakelse Rivers,
in Diana and Gosnell Creeks, and in the McDonell
Lake system; and in November in the Bulkley and
Morice Rivers.

Grenville-Prinicip (Area 5)

From 1951 to 1963 the commercial catch in the
Grenville-Principe area averaged 95,000 cohos (Figure
29); about 57% was taken by net fisheries and 43%
by the troll fishery. Peak catches were made usually
in the latter part of August but were sometimes made
as early as mid-July. Significant numbers of cohos
spawned in nine streams in Area 5 (Figure 28 and
Appendix Figure A-5; Appendix Table A-V): Foote,
Kingkown Inlet, Endhill, Heavenor Inlet, and
Port Stephens Creek, the Pa-aat and Survey Bay
Rivers, and the Lowe Lake and Union Pass Lake
systems, all of which had escapements averaging be-
tween 2,000 and 5,000 cohos with peak spawning in
October.

Butedale (Area 6)

From 1951 to 1963 the average catch in the com-
mmercial fishery in the Butedale area was 103,000 cohos
(Figure 29) with about 81% being made by net
fisheries and 19% by troll. The peak catch of cohos
in Area 6 was made usually in the latter half of August
but occurred occasionally as early as late July. From
1951 to 1962 cohos were reported to have spawned in
112 streams in the Butedale area, in 23 of them in
significant numbers (Figure 28 and Appendix Figure
A-5; Appendix Table A-V). Average escapements were
between 5,000 and 10,000 cohos in the Kitimat
River; between 2,000 and 5,000 in the Dala, Canoona,
Kemano, Kiltuish, Kitkiata, Kitlope, and Quaal
Rivers and in Deer, Eagle, Flux, Gitloyces, Price,
Salmon, Stannard, and Wale Creeks; between 1,000
and 2,000 in the Mussel and Tsayitis Rivers and Doug-
las, Weeteem Bay, and West Creeks; and between
500 and 1,000 in Evelyn Creek and the Kowesas River.
Peak spawning in all of these streams was reported to
be in October.

Bella Bella (Area 7)

From 1951 to 1963 the commercial catch averaged
142,000 cohos in Area 7 (Figure 29), of which about
72% was taken by troll and 28% by the net fisheries.
Probably many of the cohos caught in the troll fishery,
particularly in the offshore areas, were bound for
streams in other areas. Cohos were caught in sub-
stantial numbers in Area 7 from early July to early
September with the peak catches usually in the latter
part of August. From 1951 to 1962 average escape-
ment in Kakushdish Creek, the only stream in Area 7
with significant numbers of coho spawners, was be-
tween 5,000 and 10,000 cohos (Figure 28 and Ap-
pendix Figure A-5; Appendix Table A-V). Most
spawning takes place in October.

Bella Coola (Area 8)

From 1951 to 1963 the average catch in the com-
mmercial fishery in the Bella Coola area was 133,000
cohos (Figure 29), of which about 25% was taken by
troll and 75% by the net fisheries. Substantial num-
bers of cohos were caught from mid-July to mid-
September with the largest catches occurring in the
latter half of August. From 1952 to 1962 significant
numbers of cohos spawned in six streams in Area 8
(Figure 28 and Appendix Figure A-5; Appendix
Table A-V). Average escapements were between
20,000 and 50,000 cohos in the Atarko-Bella Coola
system; between 5,000 and 10,000 in the Dean,
Kimsquit, and Kwatna Rivers; and between 2,000
and 5,000 in the Koeye and Martin Rivers. Peak
spawning in all of these rivers was in October.

Rivers, Smith, and Seymour Inlets (Areas 9, 10, and 11)

These areas are minor producers of coho salmon.
From 1951 to 1963 average commercial catches in
Areas 9, 10, and 11 were 36,000, 16,000, and 11,000
cohos, respectively (Figure 29). About 77% of the
total catch was by net fisheries, the remaining 23% by
troll. Cohos were caught in substantial numbers in
these areas in July, August, and September. From
1951 to 1962 significant numbers of cohos spawned in
two streams, the Wannock and Kilbella Rivers, in
Area 9, and in three streams, the Pack Lake, Seymour,
and Taalit Rivers, in Area 11 (Figure 28 and Ap-
pendix Figure A-5; Appendix Table A-V). No signifi-
cant spawning occurred in Area 10 streams. Average
escapements were between 5,000 and 10,000 cohos in
the Taaltz River; between 2,000 and 5,000 in the Wannock River; and between 1,000 and 2,000 in the Kilbella, Pack Lake, and Seymour Rivers. Peak spawning occurred in September in the Seymour and Pack Lake Rivers, in October in the Wannock and Taaltz Rivers, and in November in the Kilbella River.

Upper Johnstone Strait (Area 12)

From 1951 to 1963 the commercial catch in Area 12 was 362,000 cohos, the largest catch of cohos in any single area in British Columbia (Figure 29). About 58% of the catch was made in the extensive troll fishery which operated mainly at the northern end of Vancouver Island, in Queen Charlotte Strait, and in Blackfish Sound. The remaining 42% of the catch was made by the seine and gillnet fisheries which operated mainly around Malcolm Island, in Johnstone Strait, and in the mainland inlets. Cohos were caught in substantial numbers from mid-June to late September with the peak catches occurring from the third week of June to the third week of September. Cohos tagged off the northeast coast of Vancouver Island in Area 12 have been recovered in Georgia Strait (Milne, 1957), suggesting that they had migrated through Johnstone Strait. Therefore catches in Area 12 and also in Area 13 may contain coho migrating to streams to the south.

From 1951 to 1962 cohos were reported to have spawned in significant numbers in 24 streams in Area 12 (Figure 28 and Appendix Figure A-5; Appendix Table A-V). Average escapements in these years were between 20,000 and 50,000 cohos in the Kingcome River; between 10,000 and 20,000 in the Kakeweiken and Nimpkish Rivers; between 5,000 and 10,000 in the Ahnuxati, Keogh, Klinaklini, Kokish, Quatsat, and Nakamana Rivers; between 2,000 and 5,000 in the Adam, Cluxewe, Embley Lagoon, Kwalate Point, Shushartie, and Viner Sound Rivers and in Ahtna Valley, Bughouse, Glendale, and Thieme Creek; and between 1,000 and 2,000 in the Fulmore, Atlinn Bay, and TsiTuik Rivers and Shooal Harbour and Sim Creeks. Peak spawning occurred in October in the Adam, Ahnuxati, Embley Lagoon, Keogh, Kingcome, Klinaklini, Kwalate Point, Nimpkish, Quatsat, TsiTuik, Viner Sound, and Nakaman Rivers and in Ahtna Valley and Shooal Harbour Creeks. In the remaining streams, the Kluxewe, Fulmore, Kakeweiken, Kokish, and Shushartie Rivers and Bughouse, Glendale, Atlinn Bay, Sim, and Thieme Creeks, peak spawning was reported to have occurred in November.

Lower Johnstone Strait (Area 13)

From 1951 to 1963 the average commercial catch in Area 13 was 116,000 cohos (Figure 29), of which 53% was taken by troll and 47% by the net fisheries. Cohos were caught in Area 13 in substantial numbers from early June to early October. From 1951 to 1962 significant numbers of cohos were reported to have spawned in five streams in Area 13 (Figure 28 and Appendix Figure A-5; Appendix Table A-V). Average escapements were between 5,000 and 10,000 cohos in the Hohmathko and Quinsam Rivers, between 2,000 and 5,000 in the Salmon and Southgate Rivers, and between 1,000 and 2,000 in Village Bay Creek. Peak spawning was in October.

Strait of Georgia excluding the Fraser River (Areas 14, 15, 16, 17, 18, 19, and 28)

From 1951 to 1963 the average catch in the commercial fishery in these areas was 294,000 cohos (Figure 29), about 87% of which was made by troll and about 13% by the net fisheries. Cohos were caught in substantial numbers in the Strait of Georgia from early June to early October with the largest catches in late June and early July. The early catch consists largely of “blueback” or maturing cohos which are resident in the Strait of Georgia throughout the marine phase of their life cycle (Milne, 1957). Substantial numbers of cohos bound for streams adjacent to the Strait of Georgia are caught in the Strait of Juan de Fuca (Milne, 1957; Milne et al., 1959).

From 1951 to 1962 cohos were reported to have spawned in 98 streams in these areas, in 24 of them in significant numbers (Figure 28 and Appendix Figure A-5; Appendix Table A-V). Average escapements were between 20,000 and 50,000 cohos in the Cowichan and Squamish Rivers; between 10,000 and 20,000 in the Oyster and Toba Rivers; between 5,000 and 10,000 in Lang Creek and in the Tsolnum, Nanaimo, and Koksilah Rivers; between 2,000 and 5,000 in the Little Qualicum, Puntledge, Qualicum, Brem, Klite, Theodosia, Tzoonie, Chemainus, Capilano, Cheakamus, and Indian Rivers and in Black, French, and Bonsall Creeks; and between 1,000 and 2,000 in the Deserted and Seymour Rivers. Peak spawning was in September in the Brem and Klite Rivers; in October in Lang Creek and in the Tsolnum, Toba, Tzoonie, Indian, and Seymour Rivers; in November in the Little Qualicum, Oyster, Puntledge, Qualicum, Theodosia, Deserted, Chemainus, Nanaimo, Cowichan, Koksilah, Capilano, Cheakamus, and Squamish Rivers and in Black and French Creeks; and in December in Bonsall Creek.

Strait of Juan de Fuca (Area 20)

From 1951 to 1963 the commercial catch in Area 20 averaged 274,000 cohos (Figure 29) of which 2% were
caught by troll and 98% by seine, gillnet, and trap. The catch consists not only of cohos bound for local streams but also of fish migrating to streams in adjacent areas (Milne, 1957; Milne et al., 1959). Cohos were caught in Area 20 in substantial numbers from late July to late September with peak catches most often in September. From 1951 to 1962 cohos were reported to have spawned in only two streams in Area 20 (Figure 28 and Appendix Figure A-5; Appendix Table A-V). The average escapement was between 10,000 and 20,000 cohos in the San Juan River and between 2,000 and 5,000 in the Gordon River. Peak spawning was in September in the Gordon River and in October in the San Juan River.

West coast of Vancouver Island (Areas 21 to 27)

From 1951 to 1963 the average catch in the commercial fisheries in these areas was 818,000 cohos (Figure 29), about 96% of which was made by troll, and 4% by net fisheries. Cohos were caught in substantial numbers from mid-June to late September. From 1951 to 1962 significant numbers of cohos spawned in 29 of the 168 west coast streams in which cohos were reported to spawn (Figure 28 and Appendix Figure A-5; Appendix Table A-V). Average escapements were between 5,000 and 10,000 cohos in the Toquart and San Josef Rivers; between 2,000 and 5,000 in Tranquil Creek and in the Nitinat, Anderson, Maggie, Clayoquot, Megin, Moyeha, Burman, Tahish, Fisherman, Macjack, Mahatta, and Marble Rivers; between 1,000 and 2,000 in Buck Creek, in the Hesquiat Lake and Jansen Lake systems, and in the Cypre, Conuma, Gold, Artlish, Kaouk, Power, Klashkis, Koprino, and Kwateleo Rivers; and between 500 and 1,000 in Colony Creek. During the same period the escapement to the Somass River exceeded 100,000 cohos in one year and averaged between 20,000 and 50,000 cohos in the other years. The peak of spawning in all these streams is reported to have taken place during October.

Fraser River (Area 29)

From 1951 to 1963 the average commercial catch in Area 29 was 76,000 cohos (Figure 29). Almost the entire catch in this area was taken by gillnets. The largest catches occurred from the first week of September to the fourth week of October. The coho catch in Area 29 is only a part of the total catch of Fraser River cohos, as large numbers of these fish are caught in the Straits of Juan de Fuca and Georgia and in Johnstone Strait (Milne, 1957; Milne et al., 1959).

Coho spawning in the Fraser River and its tributaries has been reported to take place at some 126 locations, none of them upstream from Lillooet. From 1951 to 1962 significant numbers of cohos spawned in 17 locations in the Fraser River drainage (Figure 28 and Appendix Figure A-5; Appendix Table A-V). Average escapements were between 20,000 and 50,000 cohos in the Chilliwack River; between 5,000 and 10,000 in the Chehalis River; between 2,000 and 5,000 in the Birkenhead, Clearwater, Eagle, Lower Shuswap, Salmon (Shuswap Lake), and Upper Pitt Rivers; between 1,000 and 2,000 in the Deadman, Lower Adams, Upper Adams, and Upper Shuswap Rivers and in Leminuc, Weaver, and Louis Creeks; and between 500 and 1,000 in the Salmon River (a tributary of the lower Fraser River). The average escapement in the Nikomekl River, which drains into Boundary Bay, was between 1,000 and 2,000 cohos. The peak spawning period is in October in the Birkenhead, Chilliwack, and Upper Pitt Rivers, in December in the Chehalis River, and in November in the remaining streams.

Chinook Salmon

Chinook spawning takes place in a relatively small number of streams scattered throughout British Columbia with the bulk of the production coming from a few major river systems, the most important of all being the Fraser River.

Queen Charlotte Islands (Areas 1 and 2)

From 1951 to 1963 the commercial catch around the Queen Charlotte Islands averaged 39,000 chinooks (Figure 34), almost all of which was taken by troll. Tagging (Milne, 1957) indicated that many of these were bound for areas south of the Queen Charlotte Islands. Chinooks were caught in substantial numbers from early May to late August with the largest catches usually in June. In the Queen Charlotte Islands, chinooks have been reported to spawn in only one stream, the Yakoun River. From 1951 to 1962 the average escapement there was between 1,000 and 2,000 chinooks (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Peak spawning occurred in September.

Nass River (Area 3)

From 1951 to 1963 the average catch was about 25,000 chinooks in the Nass area (Figure 34). About 60% of the catch was taken by the net fisheries, the remaining 40% by troll. Peak catches in the fishery usually occurred in mid-June. From 1951 to 1962 significant numbers of chinooks were reported to spawn in four streams in Area 3 (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 1,000 and 2,000 chinooks in the Tseax River, between 500 and 1,000 in the Seaskinnish River, and between 300 and 500 in the Kitsault
and Kwinamass Rivers. Moderate numbers of chinook are believed to spawn in the main channel of the Nass River but accurate data on numbers are not available. Recent studies by the Resource Development Service of the Canada Department of Fisheries indicate that significant spawning of chinook may also occur in the Kwinageese, Mezladen, and Bowser systems. Peak spawning occurred in August in the Seaskinnish and Tseax Rivers and in September in the Kitsault and Kwinamass Rivers.

**Skeena River** (Area 4)

From 1951 to 1963 the commercial catch in the Skeena area averaged 38,000 chinooks (Figure 34), of which the troll fishery took slightly more than one-half. Chinooks were taken in substantial numbers from early June to late August with the largest catches usually in mid-July. From 1951 to 1962 significant numbers of chinook were reported to have spawned in eight Area 4 streams (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 10,000 and 20,000 chinooks in the Bear River; between 5,000 and 10,000 in the lower Babine, Kispiox, and Morice Rivers; between 2,000 and 5,000 in the Eclatna River; and between 500 and 1,000 in the upper Bulkley, Cedar, and Cloyah Rivers. Peak spawning occurred in August in the upper Bulkley and Cedar Rivers and in September in the other streams.

**Central British Columbia coast** (Areas 5, 6, 7, 8, 9, 10, and 11)

From 1951 to 1963 the commercial catches in Areas 5, 6, 7, 8, 9, 10, and 11 were 22,000, 13,000, 13,000, 17,000, 6,000, 4,000, and 1,000 chinooks, respectively (Figure 34). Catches in Areas 5, 7, and 11 were made mainly by troll, whereas in Areas 8, 9, and 10 the catches were made mainly by net fisheries. Net and troll fisheries took almost equal amounts of chinook in Area 6. Chinooks were caught along the central British Columbia coast in significant numbers from May through August with the peak catches usually in July. From 1951 to 1962 significant numbers of chinook were spawned in 11 of the 25 streams reported to have been occupied by chinook (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 10,000 and 20,000 chinooks in the Atmarko-Bella Coola Rivers; between 2,000 and 5,000 in the Kitimat and Wannock Rivers; between 1,000 and 2,000 in the Dala, Kemano, Kitlope, Kimsquit, and Docie Rivers; between 500 and 1,000 in the Khutze and Kildala Rivers; and between 300 and 500 in the Dean River. Peak spawning occurred during September in all these streams, with the exception of the Wannock River where most spawning took place in October.

**Johnstone Strait** (Areas 12 and 13)

During the years 1951 to 1963 the commercial catches in Areas 12 and 13 averaged 37,000 and 33,000 chinooks, respectively (Figure 34). Some chinooks tagged off the northeast coast of Vancouver Island were recovered in the Strait of Georgia and in Puget Sound (Milne, 1957) suggesting that the troll fishery at the northern end of Vancouver Island and the net fishery in Johnstone Strait may contain not only chinooks bound for local streams but also fish migrating to southern streams. The troll fishery took about 57% of the chinook in Area 12 and about 80% in Area 13. Chinooks were caught in substantial numbers from May to September with the largest catches usually in mid-July. From 1951 to 1962 significant numbers of chinook spawned in 13 of the 29 Area 12 and 13 streams in which chinooks are reported to spawn (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 10,000 and 20,000 chinooks in the Klinaklini and Nimkish Rivers; between 5,000 and 10,000 in the Homathko River; between 2,000 and 5,000 in the Kingcome, Campbell, and Southgate Rivers; between 1,000 and 2,000 in the Salmon River; between 500 and 1,000 in the Franklin, Wakeman, Orford, and Phillips Rivers and Cumsack Creek; and between 300 and 500 in the Ahnabatki River. Peak spawning was reported to have been in August in the Ahnabatki, Franklin, Kingcome, Klinaklini, and Wake man Rivers; in September in the Campbell, Homathko, Orford, Phillips, Salmon, and Southgate Rivers and in Cumsack Creek; and in October in the Nimkish River.

**Strait of Georgia excluding the Fraser River** (Areas 14, 15, 16, 17, 18, 19, and 28)

From 1951 to 1963 the commercial catch in these areas averaged 93,000 chinooks (Figure 34). The chinook catches in the Strait of Georgia were made mainly by the troll fishery. Substantial catches were made from May through to October with the largest catches in June. From 1951 to 1962 chinook salmon were reported to have spawned in significant numbers in nine streams in these areas (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 10,000 and 20,000 chinooks in the Squamish River; between 5,000 and 10,000 in the Cowichan River; between 2,000 and 5,000 in the Puntledge, Toba, and Naneima Rivers; and between 1,000 and 2,000 in the Little Qualicum, Qualicum and Cheakamus Rivers. Peak spawning was in
September in the Toba, Nanaimo, Chekamans, and Squamish Rivers and in October in the Little Qualicum, Puntledge, Qualicum, and Cowichan Rivers.

**West coast of Vancouver Island (Areas 20 to 27)**

From 1951 to 1963 the average commercial catch along the west coast of Vancouver Island was 390,000 chinooks (Figure 34), made almost entirely by the troll fishery. Chinooks were caught along the west coast from April through to October with the largest catches in July. A large proportion of the chinooks caught along the west coast of Vancouver Island are fish bound for the Columbia and Fraser Rivers (Milne, 1957). From 1951 to 1962 chinooks were reported to have spawned in 74 west coast streams, in significant numbers in 21 of them (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 5,000 and 10,000 chinooks in the Somass River; between 2,000 and 5,000 in the Tahsis and Marble Rivers; between 1,000 and 2,000 in the Nitinat, Nahmint, Megin, Burman, Gold, and Artlish Rivers; between 500 and 1,000 in the Anderson, Bedwell, Lower Kennedy, Moyeha, Tranquille, Conuma, and Kaouk Rivers; and between 300 and 500 in the Gordon, Sarita, Cypre, Tahsis, and Kaouk Rivers. Peak spawning occurred in September in the Gordon, Bedwell, Cypre, Lower Kennedy, Megin, Moyeha, Tranquille, Burman, Conuma, Gold, Kaouk, Tahsis, and Marble Rivers. In the remaining rivers, the Nitinat, Anderson, Nahmint, Sarita, Somass, Tahsis, Artlish, and Kaouk Rivers, peak spawning was reported to have been during October.

**Fraser River (Area 29)**

From 1951 to 1963 the average catch in the commercial fishery in Area 29 was 139,000 chinooks (Figure 34), made almost entirely by gillnets. Chinooks were caught in Area 29 in substantial numbers from May to October with the largest catches in September. Fraser River chinooks are also caught in other parts of the Strait of Georgia, in the Strait of Juan de Fuca, and along the outer coasts of British Columbia and southeast Alaska (Milne, 1957; Parker and Kirke, 1956). Chinook spawning is widespread in the Fraser River drainage, ranging from the Pitt River a few miles above tide water to the spawning grounds in the Fraser River at Tête Jaune Cache, a distance of some 600 miles along the river from the sea. From 1951 to 1962 significant numbers of chinooks spawned at 29 of the 71 locations which chinooks occupy in the Fraser River system (Figure 33 and Appendix Figure A-6; Appendix Table A-VI). Average escapements were between 10,000 and 20,000 chinooks in the Harrison River; between 5,000 and 10,000 in the Nicola River; between 2,000 and 5,000 in the Fraser River at Tête Jaune Cache and in the Clearwater, Lower Adams, Lower Shuswap, and South Thompson Rivers; between 1,000 and 2,000 in Finn Creek and in the Birkenhead, Eagle, North Thompson, Thompson, and Upper Shuswap Rivers; between 500 and 1,000 in the Louie Creek and in the Bowron, Chilcotin, Chilkon, Chililwack, Coldwater, Deadman, McGregor, Nechako, Quesnel, Raft, and Upper Pitt Rivers; between 300 and 500 in Spus Creek and in the Stuart and Taseko Rivers; and between 100 and 300 in the Chehalis River. Peak spawning was reported to have been in July in the Chilliwack River and in August in the Birkenhead, Bowron, Chehalis, Chilcotin, Chilkon, McGregor, Taseko, and Upper Pitt Rivers and in Finn Creek. In the Fraser River at Tête Jaune Cache, in Louie and Spus Creeks, and in the Clearwater, Coldwater, Deadman, Eagle, Nechako, Nicola, North Thompson, Quesnel, Raft, Stuart, and Thompson Rivers, the peak spawning period was in September. In the Lower Adams, Lower Shuswap, Upper Shuswap, and South Thompson Rivers, peak spawning was late, occurring in October. The run to the Harrison River was the last to spawn in the Fraser River system with the peak spawning period reported to have occurred in November.
Appendix Figure A-1. British Columbia streams which support "major" stocks of sockeye salmon. See Appendix Table A-VII for stream names associated with map index numbers.
Appendix Figure A-2. British Columbia streams which support "major" stocks of pink salmon in odd-numbered years. See Appendix Table A-VII for stream names associated with map index numbers.
Appendix Figure A-3. British Columbia streams which support "major" stocks of pink salmon in even-numbered years. See Appendix Table A-VII for stream names associated with map index numbers.
APPENDIX FIGURE A-4. British Columbia streams which support "major" stocks of chum salmon. See Appendix Table A-VII for stream names associated with map index numbers.
APPENDIX FIGURE A-5. British Columbia streams which support "major" stocks of coho salmon. See Appendix Table A-VII for stream names associated with map index numbers.
Appendix Figure A-6. British Columbia streams which support "major" stocks of chinook salmon. See Appendix Table A-VII for stream names associated with map index numbers.
### Table A-1

<table>
<thead>
<tr>
<th>Statistical area</th>
<th>Stream</th>
<th>Map index number (App. Fig. A-1)</th>
<th>Average escapement (thousands)</th>
<th>Spawning times</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Naden River and Lake</td>
<td>5</td>
<td>5-10</td>
<td>July Aug. Sept.</td>
</tr>
<tr>
<td></td>
<td>Yakoum River and Lake</td>
<td>6</td>
<td>5-10</td>
<td>July Aug. Sept.</td>
</tr>
<tr>
<td></td>
<td>Gintik Creek</td>
<td>38A</td>
<td>60.0(b)</td>
<td>Aug. Sept. (stream)</td>
</tr>
<tr>
<td></td>
<td>Pierre Creek</td>
<td>73</td>
<td>23.7</td>
<td>July Sept. Sept.</td>
</tr>
<tr>
<td></td>
<td>South-end Creek</td>
<td>75</td>
<td>10-20</td>
<td>Aug. Sept. Sept.</td>
</tr>
<tr>
<td></td>
<td>Twin Creek</td>
<td>78</td>
<td>7.9</td>
<td>July Aug. Sept.</td>
</tr>
<tr>
<td>5</td>
<td>Kingkown Inlet Creek</td>
<td>81</td>
<td>2-5</td>
<td>July Aug. Sept.</td>
</tr>
<tr>
<td></td>
<td>Curtis Inlet Creek</td>
<td>82</td>
<td>5-10</td>
<td>July Aug. Sept.</td>
</tr>
<tr>
<td>8</td>
<td>Atmanko and Bella Coola Rivers</td>
<td>132</td>
<td>1 yr &gt;100 11 yr 50-100</td>
<td>Aug. Sept. Oct.</td>
</tr>
</tbody>
</table>

*Continued...*
### SPawning Populations—Pacific Salmon in Canada

**Appendix Table A-1.** (Continued)

<table>
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<th>Statistical area</th>
<th>Stream</th>
<th>Map index number (App. Fig. A-1)</th>
<th>Average escapement (thousands)</th>
<th>Spawning times</th>
</tr>
</thead>
</table>

* Surveys carried out by the Resource Development Service of the Department of Fisheries have indicated that a "major" run of sockeye spawns in Bowser Lake.

* These estimates are based on surveys carried out by the Resource Development Service of the Department of Fisheries in 1956, 1957, and 1958.
### SALMON OF THE NORTH PACIFIC OCEAN—PART IV

**APPENDIX TABLE A-II.** Estimated average escapement of sockeye in the four cycle years to tributaries of the Fraser River which supported "major" stocks of sockeye salmon, 1951 to 1962 (see text, p. 274).

<table>
<thead>
<tr>
<th>Cycle years</th>
<th>1901</th>
<th>1902</th>
<th>1903</th>
<th>1904</th>
<th>Peak time of spawning</th>
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</thead>
<tbody>
<tr>
<td>Stream</td>
<td>Map index number (App. Fig. A-1)</td>
<td>'53 '57 '61</td>
<td>'54 '58 '62</td>
<td>'51 '55 '59</td>
<td>'52 '56 '60</td>
</tr>
<tr>
<td><strong>Lower Fraser</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultus Lake</td>
<td>294</td>
<td>15,100</td>
<td>27,000</td>
<td>28,800</td>
<td>16,400</td>
</tr>
<tr>
<td>Upper Pitt River</td>
<td>342</td>
<td>14,400</td>
<td>14,900</td>
<td>23,700</td>
<td>33,200</td>
</tr>
<tr>
<td><strong>Harrison</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Silver Creek</td>
<td>284</td>
<td>400</td>
<td>300</td>
<td>100</td>
<td>5,600</td>
</tr>
<tr>
<td>Harrison River</td>
<td>305</td>
<td>22,500</td>
<td>17,200</td>
<td>17,100</td>
<td>13,400</td>
</tr>
<tr>
<td>Weaver Creek</td>
<td>344</td>
<td>11,200</td>
<td>26,800</td>
<td>14,200</td>
<td>16,400</td>
</tr>
<tr>
<td><strong>Lillooet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birkenhead River</td>
<td>285</td>
<td>28,900</td>
<td>20,200</td>
<td>27,700</td>
<td>47,000</td>
</tr>
<tr>
<td><strong>South Thompson</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seymour River</td>
<td>332</td>
<td>6,700</td>
<td>54,100</td>
<td>28,700</td>
<td>3,900</td>
</tr>
<tr>
<td>Lower Adams River</td>
<td>314</td>
<td>2,300</td>
<td>1,411,800</td>
<td>100,400</td>
<td>5,000</td>
</tr>
<tr>
<td>Little River</td>
<td>312</td>
<td>300</td>
<td>316,200</td>
<td>13,000</td>
<td>500</td>
</tr>
<tr>
<td>South Thompson River</td>
<td>333</td>
<td>200</td>
<td>76,700</td>
<td>300</td>
<td>&lt;100</td>
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<tr>
<td>Lower Shuswap River</td>
<td>310</td>
<td>19,500</td>
<td>9,300</td>
<td>0</td>
<td>late Oct.</td>
</tr>
<tr>
<td><strong>North Thompson</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Raft River</td>
<td>326</td>
<td>7,600</td>
<td>9,500</td>
<td>8,000</td>
<td>10,300</td>
</tr>
<tr>
<td><strong>Chilcotin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilko River</td>
<td>290</td>
<td>124,900</td>
<td>77,500</td>
<td>226,800</td>
<td>518,100</td>
</tr>
<tr>
<td>Taseko River</td>
<td>339</td>
<td>2,700</td>
<td>3,900</td>
<td>7,100</td>
<td>2,700</td>
</tr>
<tr>
<td><strong>Qu'equet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horsefly River</td>
<td>306</td>
<td>209,100</td>
<td>1,000</td>
<td>&lt;100</td>
<td>200</td>
</tr>
<tr>
<td><strong>Nechako</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Nadina River</td>
<td>318</td>
<td>44,600</td>
<td>1,700</td>
<td>600</td>
<td>1,300</td>
</tr>
<tr>
<td>Stellako River</td>
<td>335</td>
<td>43,100</td>
<td>126,400</td>
<td>75,800</td>
<td>39,200</td>
</tr>
<tr>
<td><strong>Stuart—early</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankwil Creek</td>
<td>283</td>
<td>10,900</td>
<td>300</td>
<td>&lt;100</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Bivouac Creek</td>
<td>286</td>
<td>6,500</td>
<td>100</td>
<td>&lt;100</td>
<td>&lt;100</td>
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<tr>
<td>Driftwood River</td>
<td>296</td>
<td>45,300</td>
<td>900</td>
<td>&lt;100</td>
<td>&lt;100</td>
</tr>
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<td>Dust Creek</td>
<td>297</td>
<td>14,200</td>
<td>1,700</td>
<td>100</td>
<td>100</td>
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<td>Forsfar Creek</td>
<td>303</td>
<td>16,500</td>
<td>6,300</td>
<td>4,600</td>
<td>4,600</td>
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<tr>
<td>Forsythe Creek</td>
<td>300</td>
<td>5,600</td>
<td>&lt;100</td>
<td>&lt;100</td>
<td>&lt;100</td>
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<td>304</td>
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<tr>
<td>Kynoch Creek</td>
<td>309</td>
<td>15,400</td>
<td>11,100</td>
<td>11,600</td>
<td>8,900</td>
</tr>
<tr>
<td>Leo Creek</td>
<td>311</td>
<td>6,200</td>
<td>100</td>
<td>early Aug.</td>
<td></td>
</tr>
<tr>
<td>Narrows Creek</td>
<td>319</td>
<td>14,900</td>
<td>1,700</td>
<td>200</td>
<td>700</td>
</tr>
<tr>
<td>Rosette Creek</td>
<td>327</td>
<td>6,100</td>
<td>4,200</td>
<td>3,600</td>
<td>3,900</td>
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<tr>
<td>Sakeniche Creek</td>
<td>328</td>
<td>5,600</td>
<td>200</td>
<td>&lt;100</td>
<td>early Aug.</td>
</tr>
<tr>
<td><strong>Stuart—late</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kazchek Creek</td>
<td>307</td>
<td>14,400</td>
<td>200</td>
<td>100</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Kuzkwa Creek</td>
<td>308</td>
<td>31,000</td>
<td>1,200</td>
<td>mid Sept.</td>
<td></td>
</tr>
<tr>
<td>Middle River</td>
<td>317</td>
<td>248,300</td>
<td>7,800</td>
<td>1,800</td>
<td>400</td>
</tr>
<tr>
<td>Tachie River</td>
<td>338</td>
<td>134,200</td>
<td>7,300</td>
<td>2,200</td>
<td>1,800</td>
</tr>
<tr>
<td><strong>Bowron</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bowron River</td>
<td>287</td>
<td>10,900</td>
<td>10,500</td>
<td>20,100</td>
<td>11,100</td>
</tr>
</tbody>
</table>

* Does not include 1,066,177 sockeye which were diverted in 1958.
### Appendix Table A-III.

Estimated average escapements of pink salmon in the odd- and even-numbered years to British Columbia streams which supported "major" stocks of pink salmon, 1951 to 1962 (see text, p. 274).

<table>
<thead>
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* Observations made by the Department of Fisheries suggest that in some years large numbers of pink salmon enter the Nass River. The size of the spawning population and the spawning areas are not known.

* Based on Fisheries Research Board counts at the Babine River counting weir, 1946 to 1962.

* Based on Fisheries Research Board weir counts and stream surveys, 1955 to 1962.

### APPENDIX TABLE A-IV

Estimated average escapements of chum salmon to British Columbia streams which supported "major" stocks of chum salmon, 1951 to 1962 (see text, p. 274).

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<td>8 yr 2-5</td>
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<td>Skeena River (main channel)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>74</td>
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<td>5</td>
<td>Turn Creek</td>
<td>91</td>
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<td>Sept. Sept. Oct.</td>
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### SPAWNING POPULATIONS—PACIFIC SALMON IN CANADA

#### APPENDIX TABLE A-IV. (Continued)

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<td></td>
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### APPENDIX TABLE A-IV. (Continued)

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<td>75, 1</td>
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<sup>a</sup> Chum salmon are believed to spawn in the main channel of the Nass and Skeena Rivers. No estimates of abundance have been made.

<sup>b</sup> Includes the Vedder River and Sweltzer Creek.
### Table A-V

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<td>Naden River and Lake</td>
<td>5</td>
<td>2-5</td>
<td>Sept.</td>
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<tr>
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<td>Yakoun River and Lake</td>
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<td>60</td>
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<td>Sept. Oct.</td>
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<td>64</td>
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<td>Aug. Sept.</td>
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### APPENDIX TABLE A-V. (Continued)

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<th>Average escapement (thousands)</th>
<th>Spawning times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lang Creek</td>
<td>218</td>
<td>5-10</td>
<td>Sept.  Dec.</td>
</tr>
<tr>
<td></td>
<td>Tzoonie River</td>
<td>221</td>
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<td>Aug.  Nov.</td>
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<td>Nanaimo River</td>
<td>226</td>
<td>5-10</td>
<td>Sept.  Nov.</td>
</tr>
<tr>
<td></td>
<td>Toquart River</td>
<td>241</td>
<td>5-10</td>
<td>Oct.  Nov.</td>
</tr>
<tr>
<td></td>
<td>Colony Creek</td>
<td>269</td>
<td>0.5-1</td>
<td>Sept.  Oct.</td>
</tr>
<tr>
<td></td>
<td>Chehalis River</td>
<td>288</td>
<td>5-10</td>
<td>Sept.  Dec.</td>
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<td>313</td>
<td>1-2</td>
<td>Oct.  Nov.</td>
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Continued...
### Appendix Table A-V. (Continued)

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<td>Oct. Nov. Dec.</td>
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</table>

*Coho salmon may spawn in the main channel of the Nass River but no firm data on numbers are available.*
### Spawning Populations—Pacific Salmon in Canada

**Appendix Table A-VI.** Estimated average escapements of chinook salmon to British Columbia streams which supported "major" stocks of chinook salmon, 1951 to 1962 (see text, p. 274).

<table>
<thead>
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<th>Average escapement (thousands)</th>
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<td>Nass River*</td>
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<td>Kwinamass River</td>
<td>41</td>
<td>0.3-0.5</td>
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<td>Seiskinnish River</td>
<td>42</td>
<td>0.5-1</td>
<td>Aug. Aug. Sept.</td>
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<tr>
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<td>Bulkley River (upper)</td>
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<td>Cedar River</td>
<td>52</td>
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<td>Aug. Aug. Sept.</td>
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<tr>
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<td>Cloyah River</td>
<td>53</td>
<td>0.5-1</td>
<td>Aug. Sept. Sept.</td>
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<tr>
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<td>104</td>
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<td>Aug. Sept. Sept.</td>
</tr>
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<td>Atmanka and Bella Coola Rivers</td>
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<td>July Sept. Sept.</td>
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<td>July Aug. Sept.</td>
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<td>July Aug. Sept.</td>
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<td>Aug. Sept. Sept.</td>
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<td>Sept. Sept. Nov.</td>
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### Appendix Table A-VI. (Continued)

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<td>232</td>
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<td>Burman River</td>
<td>234</td>
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<td>Sept.</td>
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<td>Deadman River</td>
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<td>Eagle River</td>
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<td>Aug.</td>
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<td>Fraser River at Tête Jaune Cache</td>
<td>301</td>
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<td>Aug.</td>
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<td>Oct.</td>
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<td>Aug.</td>
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<td>Upper Shuswap River</td>
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<td>Aug.</td>
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</table>

* Chinook salmon are believed to spawn in the main channel of the Nass River. No estimates of abundance have been made.
### APPENDIX TABLE A-VII. List of “major” salmon streams in British Columbia. The “major” stocks present in each stream are indicated (see text, p. 274).

<table>
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<th>Statistical area</th>
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<th>Pink Odd years</th>
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Continued...
### APPENDIX TABLE A-VII. (Continued)

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### APPENDIX TABLE A-VIII. Counts of large and jack sockeye at the Babine River counting weir.

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</tr>
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<td>261,460</td>
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<tr>
<td>1948*</td>
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<td>1949</td>
<td>461,139</td>
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<td>1950</td>
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<tr>
<td>1951</td>
<td>141,415</td>
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<tr>
<td>1952</td>
<td>349,011</td>
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<td>1953</td>
<td>686,386</td>
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<tr>
<td>1954</td>
<td>493,677</td>
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<tr>
<td>1955</td>
<td>71,352</td>
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<tr>
<td>1956</td>
<td>355,345</td>
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<td>1957</td>
<td>433,149</td>
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<td>1958</td>
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<td>1959</td>
<td>782,866</td>
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<tr>
<td>1960</td>
<td>262,719</td>
</tr>
<tr>
<td>1961</td>
<td>941,711</td>
</tr>
<tr>
<td>1962</td>
<td>548,000</td>
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* Total sockeye estimated from comparison with stream surveys and fence counts of other years.
### APPENDIX TABLE A-IX

Escapements of pink salmon in the odd- and even-numbered years to the most important pink salmon spawning areas in the Skeena River watershed. From annual reports of the Skeena Salmon Management Committee.

<table>
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<th>Kitwanga* River</th>
<th>Lakelse* River</th>
<th>Main stem Skeena* River</th>
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<tr>
<td>1947</td>
<td>55,421</td>
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<tr>
<td>1949</td>
<td>13,663</td>
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<td>1953</td>
<td>1,108</td>
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<tr>
<td>1955</td>
<td>2,151</td>
<td>540,000</td>
<td>125,000</td>
<td>175,000</td>
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<td>1957</td>
<td>25,865</td>
<td>360,000</td>
<td>160,000</td>
<td>140,000</td>
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<td>1959</td>
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<td>250,000</td>
<td>185,000</td>
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<td>1961</td>
<td>70,044</td>
<td>280,000</td>
<td>100,000</td>
<td>325,000</td>
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<tr>
<td>Average</td>
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<td>457,500</td>
<td>158,750</td>
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#### Odd-Numbered Years

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<th>Lakelse* River</th>
<th>Main stem Skeena* River</th>
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</thead>
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<td>1946</td>
<td>28,161</td>
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<td>1950</td>
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<td>1952</td>
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<td>1954</td>
<td>4,604</td>
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<td>2,691</td>
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<td>6,600</td>
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<td>27,000</td>
<td>122,000</td>
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<tr>
<td>1962</td>
<td>37,500</td>
<td>50,000</td>
<td>65,000</td>
<td>635,000</td>
<td>37,000</td>
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<tr>
<td>Average</td>
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<td>59,000</td>
<td>77,250</td>
<td>273,500</td>
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#### Even-Numbered Years

* Estimates made by Fisheries Research Board personnel only since 1955.

### APPENDIX TABLE A-X


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<th>United States</th>
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<td>2,885,514</td>
<td>7,971,798</td>
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<td>1953</td>
<td>4,951,429</td>
<td>4,142,117</td>
<td>9,093,546</td>
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<td>1955</td>
<td>4,685,984</td>
<td>4,129,063</td>
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<td>1957</td>
<td>2,777,366</td>
<td>2,634,720</td>
<td>5,412,086</td>
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<td>1959</td>
<td>2,427,535</td>
<td>2,312,906</td>
<td>4,740,441</td>
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<tr>
<td>1961</td>
<td>508,544</td>
<td>545,128</td>
<td>1,053,672</td>
</tr>
<tr>
<td>Average</td>
<td>3,406,190</td>
<td>2,774,968</td>
<td>6,181,108</td>
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APPENDIX B. THE SPAWNING STOCKS OF SALMON IN THE CANADIAN SECTIONS OF RIVERS WHICH DRAIN FROM CANADA INTO THE SEA THROUGH THE UNITED STATES

CONTENTS

<table>
<thead>
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<th>River</th>
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<td>Alsek River</td>
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<tr>
<td>Chilkat River</td>
<td>324</td>
</tr>
<tr>
<td>Taku River</td>
<td>324</td>
</tr>
<tr>
<td>Stikine River</td>
<td>324</td>
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<tr>
<td>Unuk River</td>
<td>325</td>
</tr>
<tr>
<td>Okanagan River</td>
<td>325</td>
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</table>

Pacific salmon spawn within Canadian territory in several rivers which flow from Canada to the sea through the United States. In the north these include the Yukon, Alsek, Chilkat, Taku, Stikine, and Unuk Rivers which originate in the Yukon Territory and northern British Columbia, flowing through Alaska to empty into the Pacific Ocean. In the south the Okanagan River flows from southern British Columbia into the State of Washington where it joins the Columbia River. The salmon runs to these rivers are exploited by United States commercial fisheries operating at the river mouths and in the case of the Yukon River in Alaska by native food fisheries which operate inland. In Canada these spawning runs are utilized by limited native food fisheries in the Yukon, Alsek, Taku, Stikine, and Okanagan drainages and by a small commercial fishery along the Yukon River within the Yukon Territory. Precise information on the abundance and distribution of spawners in the northern rivers is lacking because of the difficulty of making estimates in turbid glacial streams and because of the remoteness of the region. The information which follows has been obtained from annual reports and salmon catch statistics of the Alaska Department of Fish and Game (formerly the Alaska Department of Fisheries) and from unpublished material from the Canada Department of Fisheries.

Yukon River

The Yukon River, which is the fifth largest river on the North American continent, originates in northwestern British Columbia and in the Yukon Territory, flowing northwestward through the Yukon Territory and Alaska to empty into the Bering Sea (Figure 1). From its farthest headwaters to its mouth the Yukon is about 2,000 miles long and has a drainage basin of about 320,000 square miles, of which 127,000 are in Canada.

A commercial salmon fishery has operated intermittently in Alaska at the mouth of and along the Yukon River since about 1903 (Pennoyer et al., 1965). Until 1961 this fishery was limited in various ways in order to preserve the runs for the use of the local native and white populations. Because of the various restrictions the size of the catches does not reflect the true size of the runs. Between 1918 and 1960 the commercial catch in the Yukon District of Alaska varied between 4,739 and 104,822 chinooks, between 8,000 and 327,898 chums, and between 1,000 and 37,070 cohos. In 1961 the commercial catch totalled 120,260 chinooks, 42,461 chums, and 2,853 cohos.

Substantial subsistence fisheries have operated along the Alaskan portion of the Yukon River. It is reported (Pennoyer et al., 1965) that in earlier years as many as 26,700 chinooks and 1,400,000 other salmon (mainly chums) were taken annually by these subsistence fisheries. In 1961 the subsistence fishery catch along the Yukon River below the International Boundary was 20,831 chinooks and 391,970 chums.

For the part of the Yukon River system above the International Boundary little information is available on the size of the catch and escapement of salmon prior to 1959 (Summers, 1966). During the years 1959 to 1963, along the Canadian section of the Yukon River the catches in the commercial fishery averaged about 3,300 chinooks and 2,600 chums and in the native subsistence fishery about 8,000 chinooks and 10,400 chums (Appendix Table B-I). Chinooks are widely distributed throughout the Canadian part of the Yukon system, spawning in the Little Salmon, Big Salmon, Teslin, Nisultin, Ross, Pelly, Stewart, Swift,

APPENDIX TABLE B-I. The catches of chinook and chum salmon in the Canadian portion of the Yukon River system, 1959 to 1963 (Summers, 1966).

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial catches</th>
<th>Subsistence catches</th>
<th>Commercial catches</th>
<th>Subsistence catches</th>
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<td>1,098</td>
<td>2,000*</td>
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<td>1960</td>
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<td>5,493</td>
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<tr>
<td>1961</td>
<td>3,446</td>
<td>9,800</td>
<td>3,278</td>
<td>5,800</td>
</tr>
<tr>
<td>1962</td>
<td>4,037</td>
<td>9,900</td>
<td>936</td>
<td>23,500</td>
</tr>
<tr>
<td>1963</td>
<td>2,283</td>
<td>7,886</td>
<td>2,192</td>
<td>8,500</td>
</tr>
<tr>
<td>Average</td>
<td>3,300</td>
<td>8,000</td>
<td>2,660</td>
<td>10,400</td>
</tr>
</tbody>
</table>

* Incomplete
Kluane, Takhine, Klondike, Tatchun, and M'Clintock Rivers (Appendix Figure B-1), with the Teslin and Pelly Rivers accommodating the largest number of spawners (Canada Dept. Fish., 1963a). It was estimated that in 1961, the escapement of chinooks to these streams was in excess of 28,100 fish. Chum salmon spawning in the Yukon Territory is limited mainly to the main stem of the Yukon River, to the mouth of the Teslin River and up the Teslin to Teslin Crossing (Matson, 1962). Chum salmon have also been reported up the White River to the Donjek River and in the lower Donjek River. Cohos are reported to spawn in the Canadian section of the Porcupine River, a northern tributary of the Yukon River. Accurate estimates of the number of chum and coho salmon which spawn in the Yukon River system above the International Boundary are not available.

Alsek River

The Alsek River originates in the southwestern part of the Yukon Territory and flows southwestward through British Columbia and southeast Alaska to empty into Dry Bay on the Pacific Ocean (Appendix Figure B-2). Most of the Alsek River drainage is located within Canada.

All five species of Pacific salmon are indigenous to the Tatshenshini River, the tributary of the Alsek River to which salmon spawning is restricted. In the years 1951 to 1954, a commercial fishery, which utilizes set nets at the outlet of the Alsek River in Dry Bay, caught an average of 27,825 sockeye, 102 pinks, 1,042 chums, 12,894 cohos, and 1,347 chinooks. A native food fishery, which operates within the Yukon Territory on the Klukshu River, a tributary of the Tatshenshini, takes an average of about 2,000 sockeye, 100 chinooks, and 100 cohos annually. An estimated 2,000 sockeye spawn annually in the Klukshu River system. The size of the sockeye escapement to Village Creek, another spawning area, and the size of the escapement of the other species to the Tatshenshini River are not known. Chinook salmon enter the Alsek River from April through June; the sockeye migration occurs during July and August; coho salmon are present from late July to early October.

Chilkat River

The Chilkat River is located mainly in Alaska and only a small portion of six tributaries originate in British Columbia (Appendix Figure B-2). The major part of the production of salmon within the Chilkat River drainage arises from the Alaskan segment of the system. Spawning in the Canadian portion of the system is restricted to small populations of sockeye, chums, and cohos.

Taku River

The Taku River originates in northwestern British Columbia and, except for that portion of the drainage associated with a 12-mile section of the river located between the head of Taku Inlet and the International Boundary, the entire drainage area is located within British Columbia (Appendix Figure B-2). All five species of Pacific salmon spawn in the Taku River system. In the years 1951 to 1963 a commercial fishery operated by United States fishermen in Taku Inlet at the river mouth caught an average of 39,590 sockeye, 41,990 pinks, 34,060 chums, 27,310 cohos, and 12,800 chinooks (Simpson, 1960; Alaska Department of Fish and Game, unpublished salmon catch statistics for 1960 to 1963). No regular native food fishery operates on the Taku River although natives from Atlin fish occasionally at Tulsequah, five miles above the International Boundary. For chinooks, the main spawning areas in the Taku River system are located in the Nakina and Nahlin Rivers and smaller populations are found in several of the minor tributaries. River spawning sockeye have been observed in the Nakina River and lake spawning sockeye have been reported from both Silver Salmon Lake and from Tatsamnic Lake. Cohos have been reported from all major tributaries although the Nahlin River appears to be the major producer of this species. The only known important spawning ground for pink salmon is the Nakina River. Only minor spawning concentrations of chum salmon have been reported but observations have been hampered by glacial water conditions. Estimates made by the Alaska Department of Fisheries indicated that in 1951, 1952, and 1953 the chinook escapement to the Taku River was 7,860, 13,490, and 12,310, respectively, between a third and a half of the run (Alaska Department of Fisheries, Annual Report for 1953). Little information is available on the size of the escapements of the other species to the Canadian portion of the Taku River system. Chinook salmon enter the river from late April to the end of June. Sockeye appear early in June and the migration continues until mid-July. Pink salmon enter from the first of July to mid-August. Coho and chum salmon are present from mid-July to early October.

Stikine River

The Stikine River which originates in northern British Columbia flows southwest to empty into the sea near Wrangell, Alaska (Appendix Figure B-2). It is a large river draining about 19,400 square miles, 90% of which is located within British Columbia. All five species of Pacific salmon spawn in the Stikine River. During the period 1951 to 1963 the average
catches in the commercial fishery off the mouth of the Stikine River were 20,030 sockeye, 21,250 pinks, 19,390 chums, 45,750 cohos, and 18,200 chinooks. Part of this catch probably included small numbers of fish bound for other streams close to the outlet of the Stikine River. In recent years a small native food fishery operating near Telegraph Creek has taken annually about 4,000 to 7,000 salmon, most of them sockeye.

Escapement figures are not available from the Stikine with the exception of the sockeye run to Tahl- tan Lake. This run, which has been counted at a weir operated at the lake outlet, ranged in the years 1959 to 1964 between 1,700 and 18,352 sockeye with an average of 10,495 annually. It has been estimated (Alaska Department of Fish and Game, Annual Report for 1958) that Tahl tan Lake possesses over 75% of the known sockeye spawning area of the Stikine system. Sockeye spawning has also been observed in the Iskut and Tuya River systems. The major spawning area of chinook salmon in the Stikine River system is located in the Tahl tan River, although fair numbers of chinook salmon occur in the Iskut and Tuya Rivers; small spawning populations have been reported in several other tributaries. Cohos have been reported throughout the accessible portions of the Stikine River system with the Iskut River the major producer. Chum and pink salmon have been reported to occur in tributaries of the lower Stikine and Iskut Rivers. The main commercial production of chums and pinks probably originates from stocks native to United States tributaries of the Stikine.

Chinook salmon enter the Stikine River during June and the peak of migration occurs during late June and early July. Sockeye appear early in June and the migration continues throughout July. The main migration of cohos occurs in September. Pink and chum salmon are caught in the commercial fishery throughout July and August with the largest catches occurring in late July.

Unuk River

The Unuk River originates in northern British Columbia, flowing southwestward through southeast Alaska to enter Burroughs Bay at the head of Behm Canal (Appendix Figure B-2). The glacial nature of the river has prevented an accurate assessment of the magnitude and distribution of the escapement. The only information available is from a survey conducted in 1961 by the Alaska Department of Fish and Game. In this survey approximately 4,300 chums, 3,500 pinks, 700 chinooks, and 875 sockeye were counted in the Unuk River system. The only spawners seen in the Canadian portion of the Unuk River were noted immediately upstream from the International Boundary in Border Lake where a “few hundred” sockeyes and two chinooks were observed.

Okanagan River

The Okanagan River which originates from Okana- gan Lake in southern British Columbia flows southward into the State of Washington where it joins the Columbia River which in turn flows first south and then west to empty into the Pacific Ocean (Figure 1). One of the Columbia River sockeye runs spawns within Canadian territory in the Okanagan River between Osoyoos and Vaseux Lakes. In the years 1951 to 1963 the number of sockeye which spawned in the Okanagan River averaged between 20,000 and 50,000 annually (Figure 8). A small native food fishery takes place on the Okanagan River. In the years 1947 to 1952 the Okanagan sockeye run was estimated to have formed 45% of the total number of sockeye which reached the Columbia River spawning grounds. Spawning in the Okanagan River takes place between September and November with the peak in October.
Appendix Figure B-1. Yukon River watershed in Canada.
APPENDIX Figure B-2. Watersheds of salmon-producing rivers which drain from Canada into southeast Alaska.