
**Report of the
Fraser River Panel
to the
Pacific Salmon Commission
on the
1988 Fraser River
Sockeye Salmon Fishing Season**



Prepared by

**Pacific Salmon Commission
May, 1989**

**REPORT OF THE
FRASER RIVER PANEL
TO THE PACIFIC SALMON COMMISSION
ON THE 1988 FRASER RIVER SOCKEYE
SALMON FISHING SEASON**

1988 PANEL MEMBERS AND ALTERNATES

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M. Forrest
M. Hunter
R. Kendall
J. Sam
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E. Birch
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UNITED STATES

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Prepared by

**PACIFIC SALMON COMMISSION
May, 1989**

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I. EXECUTIVE SUMMARY

1. The 1988 fishing season for Fraser River sockeye salmon was the fourth year (1985-1988) of management under the Pacific Salmon Treaty. While the 1988 season produced only moderate sockeye catches, a summation of the four years provides an overview of management performance. Cumulative escapements in the 1985 to 1988 period were 9,002,000 adult sockeye and 9,685,000 pink salmon, compared with Canadian goals which summed to 9,566,000 sockeye and 11,000,000 pink salmon. Catches by United States and Canadian fishermen provide another measure of management success. From 1985 to 1988, United States catches of sockeye totalled 8,284,000 fish, compared to the cumulative allocation of 8,372,000 fish. Canadian commercial catches in the four years reached 21,572,000 sockeye. The current estimates leave the United States 88,000 sockeye short of their allocation. Fraser River pink salmon catches in United States waters during the period totalled 5,138,000 fish, which was 103,000 short of the United States allocation of this species. Canadian commercial catches totalled 10,934,000 Fraser River pink salmon.
2. In May, the Panel developed a management plan for 1988 Fraser River sockeye fisheries that was designed to achieve the escapement goals and catch allocation objectives provided by the Parties. The Commission adopted the fishing regime and management plan and submitted these to the Parties.
3. In-season regulation of the Panel Area commercial fisheries for sockeye salmon focused on the conflicting requirements of conservation of Chilko River sockeye and the harvest of Stellako, Birkenhead and Weaver sockeye stocks. The Panel met 30 times during the season to adjust fishing schedules to meet these objectives.
4. Fraser River sockeye returns totalled 3,762,000 fish, of which 2,344,000 were harvested and 1,418,000 reached spawning grounds in the watershed. Canadian and United States commercial catches were 1,176,000 and 679,000 sockeye, respectively. Canadian Indian food fisheries harvested 423,000 sockeye and Canadian sport fisheries landed 16,000 fish. Test fisheries in Canada and the United States caught 50,000 sockeye.
5. Information from test fishing played an important role in managing the sockeye fisheries in 1988. Restricted fishing time during the peak of the Chilko River sockeye migration limited the data available from commercial fishery catches. Estimates of late-run sockeye escapement to the Strait of Georgia, based on test fishing results, were vital in the management of the fishery.
6. Estimates of stock composition from racial analyses revealed the weak return of Chilko River sockeye and provided information necessary for the Panel to take regulatory action to protect this stock. Current estimates place the Chilko River return at 579,000 fish compared with the pre-season forecast of 850,000. In contrast, the Stellako River produced 743,000 fish (350,000 forecast), the Birkenhead River returned 527,000 (235,000 forecast) and Weaver Creek returns were 685,000 (450,000 forecast).
7. Spawning escapements of Fraser River sockeye were estimated by Canada Department of Fisheries and Oceans at 1,418,000 fish. Of the total, 1,370,000 were adult and 48,000 were jack sockeye. Escapement below the pre-season goal was recorded at Chilko River but escapement goals were exceeded at Stellako and Birkenhead Rivers.
8. The total allowable catch in 1988 was estimated at 2,018,000 sockeye. The United States share was 718,000, including a payback of 68,000 sockeye (5% of Canada's share of the TAC) derived from prior-year catch shortfalls. The actual United States catch was 679,000 sockeye, leaving a shortfall in 1988 of 39,000 sockeye. This shortfall, in addition to the carry-over shortfall of 49,000 sockeye from previous years, resulted in a cumulative shortfall of 88,000 Fraser River sockeye in United States catches.

II. FRASER RIVER PANEL

Fraser River sockeye and pink salmon encounter a gauntlet of commercial fisheries while migrating southwards along the coast of British Columbia and through the passages towards the Fraser River. The fishing capacity of each fleet along the gauntlet is sufficiently great that intense in-season management is needed in order to prevent overfishing and to achieve the goals of the Treaty and the Parties. Such management necessarily involves many individuals, including the appointed Panel members, Canadian and United States agency staffs and the Commission staff. Panel members are appointed to serve in the interests of the long-term health of the stocks and to ensure the agreed international division of catch. They also provide access to the Panel by resource users. The current (May, 1989) membership of the Panel is as follows:

UNITED STATES

Members:

Mr. R. Turner, Chair
Assistant Director
Washington Department of Fisheries

Ms. L. Loomis
Treaty Indian tribes

Mr. R. Schmitten
Director, Northwest Region
National Marine Fisheries Service

Mr. R. Zuanich
Commercial salmon fishing industry

Alternates:

Mr. R. Allen
Treaty Indian tribes

Dr. T. Kruse
Deputy Director, Northwest Region
National Marine Fisheries Service

Mr. L. Phinney
Deputy Assistant Director
Washington Department of Fisheries

Mr. R. Suggs
Commercial salmon fishing industry

CANADA

Members:

Mr. F. Fraser, Vice Chair
Area Manager, Fraser River, N.B.C.
and Yukon Division
Department of Fisheries and Oceans

Mr. M. Forrest
Gillnet fishermen

Mr. M. Hunter
Salmon processing industry

Ms. R. Kendall
Freshwater sport fishermen

Mr. J. Sam
Fraser River Indian food fishermen

Mr. L. Wick
Purse seine fishermen

Alternates:

Mr. E. Birch
Gillnet fishermen

Mr. M. Griswold
Gulf troll fishermen

Mr. J. Hill
Salmon processing industry

Mr. H. Matsuzaki
Fishing equipment suppliers

Mr. A. Roberts
Purse seine fishermen

Ms. M. Williams
Outside troll fishermen

Under the Pacific Salmon Treaty the Commission has the overall responsibility for allocating the catch of Fraser River sockeye and pink salmon. The Treaty delegates the responsibility for in-season management of these stocks within a defined Area to the Fraser River Panel. Discharge of this responsibility requires that Canada provide the Panel each year with stock size forecasts and escapement goals. Both Parties provide their domestic allocation objectives for the season. The Panel utilizes these data, the Treaty, Commission policy and the input of user groups in each country to design fisheries which, in the pre-season planning stage, incorporate escapement goals and domestic allocation objectives into a balanced schedule of fishing. There is a

need to adjust the planned fisheries in-season as run sizes, timing and migration routes deviate from pre-season forecasts and expectations. Also, adjustments are needed to compensate for the variable effects of seaward fisheries on the abundance of fish arriving in each fishing area along the gauntlet through which the sockeye and pink salmon pass. Management by the Panel of annual sockeye runs and the odd-year returns of pink salmon to the Fraser River affects most fisheries in southern British Columbia and northern Washington State from late June to early October each year.

The Panel views its mandate as a series of descending priorities. The order is as follows:

1. Conservation of the resource — Attain the annual escapement goals for Fraser River sockeye and odd-year pink salmon by stock or stock-grouping. These goals are established by Canada.
2. International allocation of the total allowable catch (TAC) — Provide opportunities for fishermen of the two countries to catch the international share as specified in the Treaty and as agreed to by the Commission. Incorporated in this is the allocation of the TAC by major stock grouping (i.e. summer-run and late-run sockeye).
3. Domestic allocation determined by treaties, court rulings and the governments — Design United States fisheries to permit Treaty Indian and Non-Indian fishermen to achieve the sharing of the catch specified by the Federal court. Allow adequate fishing time for each gear type in Canada to obtain the catch shares established by the Minister of Fisheries from recommendations provided by industry advisory groups.

The Treaty also specifies that the Panel consider the management requirements of other stocks in the Area. The Panel must provide adequate protection from excess harvest for other salmon and steelhead stocks harvested incidentally in the directed fisheries for Fraser River sockeye and pink salmon.

These objectives form the "ground rules" for managing the directed commercial fisheries within the Panel Area in which Fraser River sockeye or pink salmon are the target species.

III. INTRODUCTION

The competing priorities of the Panel mandate were often in conflict as the 1988 fishing season was one of the more difficult for the Panel to manage. A forecast of low sockeye salmon run size and the need to protect the traditionally most productive stock on the cycle, Chilko River sockeye, presented a difficult management situation in the pre-season period. When the fish arrived in coastal areas, actual returns were larger than the individual forecasts for all stocks except those returning to the Chilko River watershed. Also, stock timing was unusual; severe overlaps in timing occurred between Chilko River sockeye and the abundant stocks arriving prior to and immediately following the peak of this run. The conflicting demands to conserve the Chilko River sockeye versus the adequate harvest of other stocks could not, in the end, be totally reconciled. Low escapement of the Chilko River stock and escapement exceeding the pre-season goals for other stocks, most notably Stellako River and Birkenhead River sockeye, were events recognized during the season but were unavoidable.

A degree of differential exploitation of the stocks was achieved, however, particularly for those late-run sockeye which delayed in the Strait of Georgia for several weeks prior to river entry. Successful harvests of delaying sockeye by Canadian purse seine and troll fishermen in this area allowed the goals of international catch sharing and domestic allocation within Canada to be approached.

The 1988 sockeye fishing season was the fourth year of management under the Pacific Salmon Treaty. Although only the latter three years were under Fraser Panel management, this is an opportune time to review the management performance of the Panel relative to the objectives and goals of the Treaty signed in March, 1985. The broad goals of the Parties include the international management of Fraser River sockeye and pink salmon within the Panel Area to achieve catch goals, and coordination of management actions outside the Area between the Government of Canada (through the Department of Fisheries and Oceans) and the Panel.

Annex IV, Chapter 4 of the Treaty contains estimates of annual Fraser River sockeye and pink salmon TACs for the years 1985 to 1988. Background documentation to the Treaty identified the escapement levels used for computation of these TACs. Canada subsequently modified these levels and allocated the escapement goals to the individual stocks to fit the needs of the stocks and to promote stock and total resource growth. The achievement of these annual escapement goals is the highest priority for the Panel. Comparing the goals for sockeye and pink salmon escapement during 1985-88 to the numbers estimated to have reached spawning grounds in the Fraser River watershed (Table 1), show that total sockeye escapement goals were not met in two of the four years and were exceeded in two years. The cumulative escapements were 9,002,000 sockeye compared to goals totalling 9,566,000. This shortfall in escapement (564,000) is traced primarily to the shortage of Adams River sockeye spawners in 1986. Pink salmon escapement was below the goal in 1987 due to a lower-than-forecasted run. Escapements in 1985 and 1987 totalled 9,685,000 pink salmon versus the target of 11,000,000 spawners.

TABLE 1. Comparison of 1985-1988 adult sockeye and pink salmon escapements versus goals and United States and Canadian commercial fishery catches versus allocation estimates.

<u>Escapement:</u>		
Sockeye:	<u>Goals¹</u>	<u>Actual</u>
1985	2,300,000	2,078,000
1986	4,350,000	3,658,000
1987	1,792,000	1,896,000
1988	1,124,000	1,370,000
Totals	9,566,000	9,002,000
Pink:		
1985	5,000,000	6,461,000
1987	6,000,000	3,224,000
Totals	11,000,000	9,685,000
<u>Commercial Catch:</u>		
<u>United States:</u>		
Sockeye:	<u>Allocations²</u>	<u>Actual</u>
1985	3,013,000	2,925,000
1986	2,797,000	2,748,000
1987	1,912,000	1,932,000
1988	650,000	679,000
Totals	8,372,000	8,284,000
Pink:		
1985	4,087,000	3,811,000
1987	1,154,000	1,327,000
Totals	5,241,000	5,138,000
<u>Canada:</u>		
Sockeye:	<u>Allocations³</u>	<u>Actual</u>
1985	8,242,000	8,330,000
1986	8,750,000	8,799,000
1987	3,287,000	3,267,000
1988	1,205,000	1,176,000
Totals	21,484,000	21,572,000
Pink:		
1985	8,258,000	8,534,000
1987	2,573,000	2,400,000
Totals	10,831,000	10,934,000

¹ Goals adjusted for in-season management decisions and shortfalls in Fraser River Indian food fishery catches.

² United States allocations do not include paybacks.

³ Canadian allocations for commercial catch do not include payback adjustments.

International sharing of sockeye and pink salmon catches in the 1985-1988 period has been marked by chronic shortfalls in United States catch. These shortfalls have occurred mainly due to 1) underestimation of Canadian catch during the season and 2) late-season increases in run-size estimates which led to large Canadian catches of late-run sockeye in the Strait of Georgia. Both situations caused the estimated TAC to rise after most sockeye had passed through United States waters. The Commission in 1987 approved a policy for regulating payback of catch shortfalls. Each season the prior years' shortfalls are carried into the catch allocation computation. These paybacks, up to 5% of a paying country's share of the annual TAC of that species, have reduced the cumulative United States shortfall of sockeye catch to 88,000 fish on an allocation of 8,372,000 fish (Table 1). The current estimate of pink salmon shortfall in United States waters is 103,000 fish on their 5,241,000 allocation. Commercial catches in Canada totalled 21,572,000 Fraser River sockeye and 10,934,000 pink salmon during this period.

IV. MANAGEMENT ACTIONS

A. Pre-season Regulations

Canada Department of Fisheries and Oceans (DFO) provided the Commission with pre-season forecasts of 1988 stock abundances of Fraser River sockeye salmon and a spawning escapement goal for each (Appendix A). The forecast return was 2,900,000 sockeye salmon, including 2,840,000 adults and 60,000 jacks. The historically predominant stocks on this cycle are the Chilko River, Stellako River, Birkenhead River and Weaver Creek sockeye. The Panel viewed the escapement of Chilko River sockeye as a major conservation concern, because of the low forecast of its abundance. The peak of the Chilko River run was to be protected from the commercial fishery. The Early Stuart stock was forecast to be below a harvestable level and to require conservation efforts. Late-run stocks which co-migrate with Weaver Creek sockeye were also expected in low numbers and were targeted for protection.

The pre-season gross escapement goal was 1,540,000 sockeye salmon. This goal included 1,000,000 adult and 40,000 jack sockeye for spawning escapement (Appendix A), and 500,000 fish for the Fraser River Indian food fishery [the 400,000 sockeye exemption provided in the Treaty (Annex IV, Chapter 4), plus an additional 100,000 sockeye from Canada's share of the TAC].

The pre-season estimate of the TAC of Fraser River sockeye salmon was 1,430,000 fish, including allocations of 791,000 fish for Canada's commercial fishermen, and 509,000 for United States fishermen. The United States share of the TAC included a payback of 48,000 fish owed by Canada from prior years.

The goals for Canadian allocation of Fraser River sockeye in all fisheries, as determined by the Minister of Fisheries, were:

outside troll	4.8%,
inside troll	4.0%,
purse seine	52.8%, and
gillnet	38.4%.

The inside (Strait of Georgia) troll fishery was to be allocated additional late-run sockeye if escapements to the Strait of Georgia were in excess of spawning requirements.

Domestic allocation goals in the United States were for Treaty Indian and Non-Indian fishermen to share the catch equally, except for a payback of 46,000 fish from Non-Indian to Treaty Indian fishermen for the 1987 shortfall in Treaty Indian catch of Fraser River sockeye.

With the establishment of objectives and goals of the Parties, fishing schedules were simulated using a mathematical fishery model. The Fraser River Panel evaluated the results and established a pre-season plan which, in the model, best met the requirements for escapement and catch allocation.

The original intent of the pre-season management plan was to severely restrict the harvest of Chilko River sockeye, and to concentrate the fisheries on stocks that arrive immediately before and after the peak of this stock. In particular, fisheries were to concentrate on the Stellako, Birkenhead and Weaver sockeye stocks, which historically arrive later. Taking into account DFO's

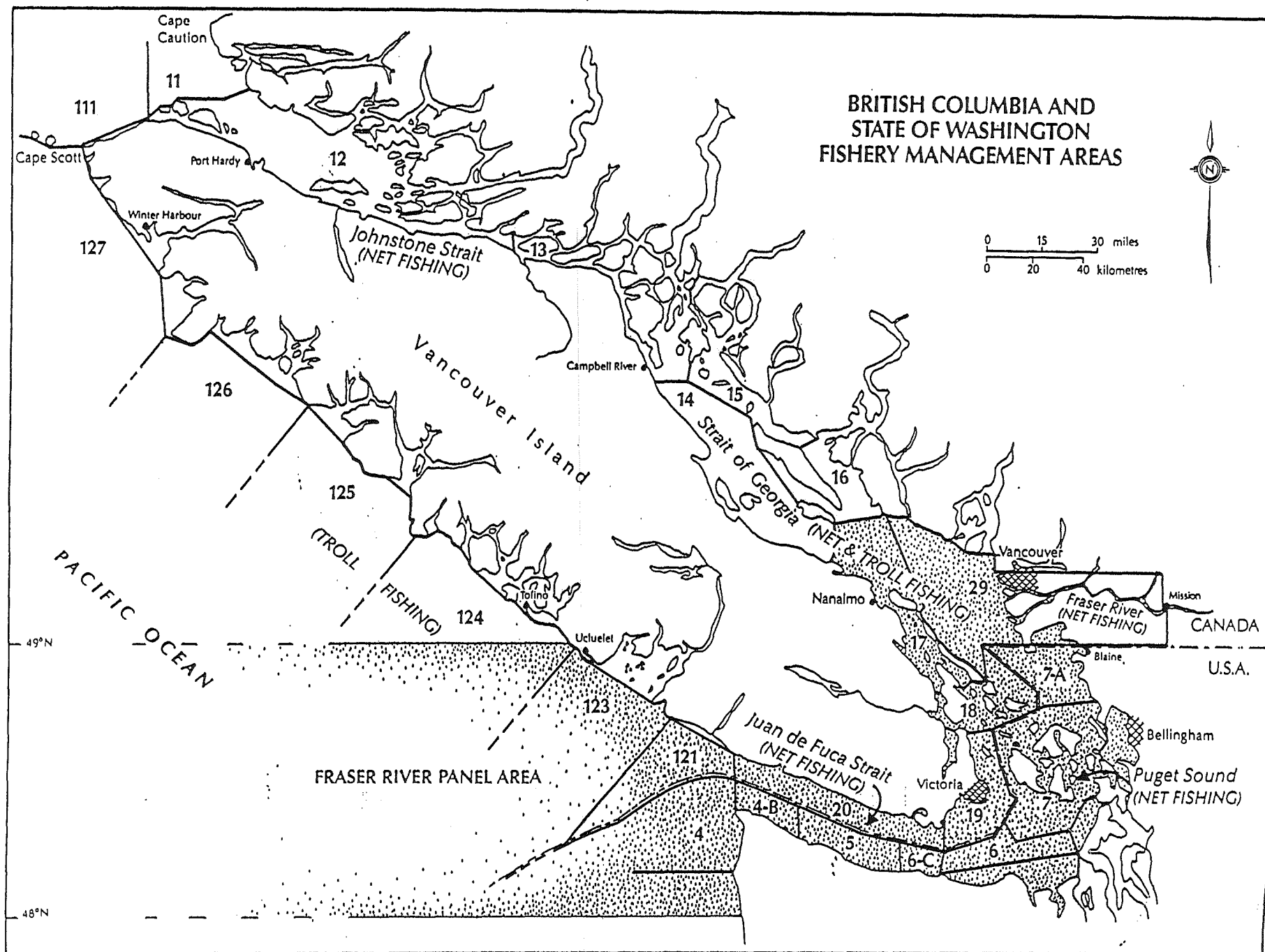


FIGURE 1. Fishery management areas in the Fraser River Panel Area, along Canada's south coast and in United States waters. The type of fishery (net or troll) that operates in each area is also indicated.

pre-season forecast, a complete closure during the passage of Early Stuart sockeye was planned to allow a high proportion of this stock to reach the spawning grounds.

The Fraser River Panel adopted fishery management plans for the Panel Area in May, 1988. The Commission accepted the fishing regime and management plan and submitted these to the Parties for approval. Panel Area waters were to be "CLOSED UNLESS OPENED". Thus, Panel Area fisheries were closed by the pre-season Regulations of the Commission (Appendix B) and only opened by in-season Orders of the Fraser River Panel.

The pre-season Management Plan proposed opening dates and fishing times for the various fisheries. The plan called for closures in all areas prior to July 24 (July 19 in United States Areas 4B, 5 and 6C; Figure 1) for protection of Early Stuart sockeye. Closures in marine areas the week of July 31 to August 6 and in the Fraser River the week of August 7 to 13 were planned to protect the expected peak migration of Chilko River sockeye. Little fishing time was expected, because a low exploitation rate would be sufficient to harvest the surplus sockeye (Tables 2 and 3).

TABLE 2. Proposed versus actual fishing times (days) in major United States net fisheries in the Fraser River Panel Area.

Week	TREATY INDIAN				ALL-CITIZEN	
	AREAS 4B, 5 & 6C		AREAS 6, 7 & 7A		AREAS 4B, 5, 6, 6C, 7, 7A	
	Proposed	Actual	Proposed	Actual	Proposed	Actual
6/19 - 7/9	Closed	Closed	Closed	Closed	Closed	Closed
7/10 - 7/16	Closed	4	Closed	2	Closed	1
7/17 - 7/23	5	5	Closed	Closed	Closed	Closed
7/24 - 7/30	7	5	2	2	1	1
7/31 - 8/6	Closed	Closed	Closed	Closed	Closed	Closed
8/7 - 8/13	6	4	2	1	1	1
8/14 - 8/20	6	6	4	4	2	4
8/21 - 8/27	5	5	4	2	2	2
8/28 - 9/3	Closed	3	Closed	2	Closed	2
9/4 - 9/10	Relinq.	Closed	Closed	Closed	Closed	Closed
9/11 - 9/17			Relinq.	Relinq.	Relinq.	Relinq.
TOTALS	29	32	12	13	6	11

TABLE 3. Proposed versus actual fishing times (days) in major Canadian net fisheries in the Fraser River Panel Area.

Week	AREA 20		AREA 29	
	Proposed	Actual	Proposed	Actual
6/19 - 7/23	Closed	Closed	Closed	Closed
7/24 - 7/30	1	Closed	1	1
7/31 - 8/6	Closed	Closed	1	1
8/7 - 8/13	2	3	Closed	1
8/14 - 8/20	2	3**	1	Closed
8/21 - 8/27	2	1***	1	Closed
8/28 - 9/3	Closed	Closed	Closed*	Closed
9/4 - 9/10	Relinq.	Relinq.	Closed*	Closed
9/11 - 9/17			Closed*	1 PS
9/18 - 9/24			Closed*	1 + 1 PS
9/25 - 10/1			Closed*	Closed
10/2 - 10/8			Closed*	1
10/9 - 10/15			Closed*	Relinq. (10/11)
10/16 - 10/22			Relinq.	
TOTALS	7	7	4	5 + 2 PS

* Area 29 fishing in September-October dependent on conservation and allocation decisions.

** Restricted on 3rd day to Area 20-3 and 4 only by Canada Department of Fisheries and Oceans.

*** Panel allocation of 2 days reduced by Canada Department of Fisheries and Oceans to 1 day.

B. In-season Regulations

To achieve the goals for Fraser River sockeye salmon spawning escapement and catch allocation between Canada and the United States and within the countries, fishing schedules were adjusted numerous times throughout the season. The Fraser River Panel conferred, in-person or by telephone conference calls, 30 times between July 5 and October 11 to consider and enact regulations. The resulting schedule of fishing is summarized in the Orders of the Fraser River Panel (Appendix C).

The season opened earlier than expected. United States Panel Area waters were opened during the week of July 10-16 (Table 2) to allow United States fishermen to harvest their share of the Early Stuart sockeye run, which was then estimated to be 220,000 sockeye, about 85,000 fish larger than forecast. Canada opted to allow its share of the TAC of these early-run fish to escape upriver to spawn, and to receive the benefits from these "escapement add-ons" in later years when the progeny from this brood return.

The first net fishery opening in Canadian Panel Area waters was on July 25 for gillnet fishermen in Area 29 (Figure 1; Table 3) to harvest early-summer stocks such as the Bowron, Fennell, Nadina, Gates, Pitt and Chilko Lake sockeye stocks. The Area 20 opening planned for that week did not proceed because of a request by Canada. United States fishermen were permitted fishing time during that week and landed an unexpectedly large catch of 362,000 sockeye. This catch achieved the United States share of the estimated TAC of summer-run sockeye.

By July 29, it was apparent that the total return of Chilko River sockeye, which has been the mainstay of the 1988 cycle, was only about 50% of the already low pre-season forecast. In response, the Panel closed the United States Treaty Indian fishery in Areas 4B, 5 and 6C earlier than planned, to minimize the catch of Chilko River fish. The extreme conservation concerns for the Chilko River sockeye stock resulted in extended closures of marine fishing areas until the week of August 7. Fishing in Canadian Area 20 was delayed until August 10; United States Areas 6, 7 and 7A remained closed until August 12.

Meanwhile, escapement goals for early summer-run stocks had not yet been met because these fish held off the mouth of the Fraser River, instead of migrating up-river in their usual pattern. However, larger daily escapements during late July and early August allowed openings in Area 29 on August 2 and 9 as these stocks moved into the Fraser River. Fortunately, the Chilko River sockeye also delayed in the Strait of Georgia, thereby permitting fisheries on the early summer-run stocks in the Fraser River, without severely affecting the Chilko River sockeye escapement.

Near the end of July, Weaver Creek sockeye began entering Area 20 in significant numbers. Because the Chilko River run was so weak and the Weaver Creek run arrived early, it was difficult to target fisheries exclusively on Weaver sockeye. However, an opportunity to harvest Weaver sockeye without reducing the escapement of Chilko River fish occurred during the week of August 7 to 13 when most Chilko River sockeye were in or near the mouth of the Fraser River. Area 29 was closed to protect the Chilko River sockeye, while Area 20 was opened for net fishing, Areas 18-1 and 18-11 were opened for trolling, and the United States Panel Areas were opened for net fishing to harvest Weaver sockeye. The sockeye run size estimate was increased by the Panel on August 15 to 3.2 million fish and on August 26 to 3.54 million, based on the best indices of abundance. The Weaver Creek run was estimated to be nearly double the pre-season forecast.

Fisheries in Area 20 during the weeks of August 14-20 and August 21-27, however, resulted in significant by-catches of juvenile chinook salmon while sockeye catches were low (Appendix Table 1). The Department of Fisheries and Oceans unilaterally closed the western portion of Area 20 (Area 20-1) on August 19 and reduced the number of days fishing in Area 20 during the week of August 21 in an attempt to reduce these by-catches. In addition, the Panel limited the opening on August 19 and during the week of August 21 to purse seines only, because Canadian gillnets had achieved their allocation goal. These actions lowered the Canadian Area 20 catches of sockeye somewhat and permitted approximately 40,000 to 50,000 more of the late-run fish to escape into the Strait of Georgia. In total, some 600,000 late-run fish entered the Strait of Georgia as a result of Panel action to conserve Chilko River sockeye in all marine areas and of DFO action to protect juvenile chinook salmon in Area 20. In contrast, the pre-season expectation was for 180,000 late-run fish to enter the Strait of Georgia.

Forecast weakness in the returns of late-run sockeye which arrive with Weaver Creek sockeye prompted the Parties to agree that the gross escapement goal of all late-run sockeye including Weaver Creek but excluding Birkenhead River, would be increased to 145,000 fish from the pre-season goal of 100,000. This was expected to yield modest increases in escapement of several late-run stocks which had existed at depressed levels in recent cycle years.

A highly unusual opening for purse seines on September 14 in the Strait of Georgia (Areas 29-3 and 29-4) was directed at harvesting late-run Weaver Creek and Birkenhead River sockeye and to balance domestic allocation objectives for the Canadian catch. As a result of this fishery, the run size estimate was increased to 3.7 million fish, which also raised the TAC and the Canadian and United States shares. However, virtually all sockeye had passed through United States waters and the stocks delaying in the Strait of Georgia were unavailable to United States fishermen. The Panel allowed Canadian fishermen to harvest these fish since they were surplus to the escapement goals. The Strait of Georgia portion of Area 29 was opened a second time for purse seines, and for troll and gillnet fishing, as well, during the week of September 18 to take the available surplus of these stocks. Additional troll harvest was permitted during the week of September 25.

As a result of the TAC increases, Canada was required to reallocate the available harvest among the users in late September. Ten-thousand sockeye from the outside troll allocation were transferred to inside trollers because the late-season increases in estimated run size generated a larger TAC at a time when the migrating fish had already passed through the outside troll areas. The remaining portion of the United States allocation was recognized too late in the season for additional United States catches. These fish were transferred to Canada and allocated to purse seine, gillnet and inside troll fishermen in proportion to their adjusted seasonal allocations. An additional 15,000 late-run sockeye were subsequently reallocated from gillnet to inside troll fishermen in late September, when it appeared unlikely that gillnets could harvest these fish due to constraints imposed by the presence of significant numbers of other species of salmon.

The last fishery that targeted on Fraser River sockeye was a gillnet opening on October 5 in Area 29 to harvest Weaver Creek sockeye. Relatively low gillnet catches and a concern for other species of salmon limited the flexibility of the Panel to harvest additional late-timed sockeye believed to be available in Area 29. As a result of low sockeye abundance, the Panel relinquished control of the last of the Panel Areas (Area 29) on October 11, 1988. Actual escapements of late-run sockeye were much smaller than projected during upstream passage and the apparent inability to harvest these stocks was based on incorrect information.

V. CATCH SUMMARY

The 1988 run of Fraser River sockeye salmon was slightly larger than the average of the last six cycle years. The total return was 3,762,000 fish, which was 30% larger than the pre-season forecast of 2,900,000 fish. However, the total was only 64% the size of the brood year (1984) run (Figure 2). This latter decline was due to low production of Chilko River sockeye (579,000 in 1988 vs. 3,800,000 in 1984), associated with the effects of flooding and a landslide into Chilko Lake in early October, 1984. Production of all other stocks combined was the largest recorded on the cycle.

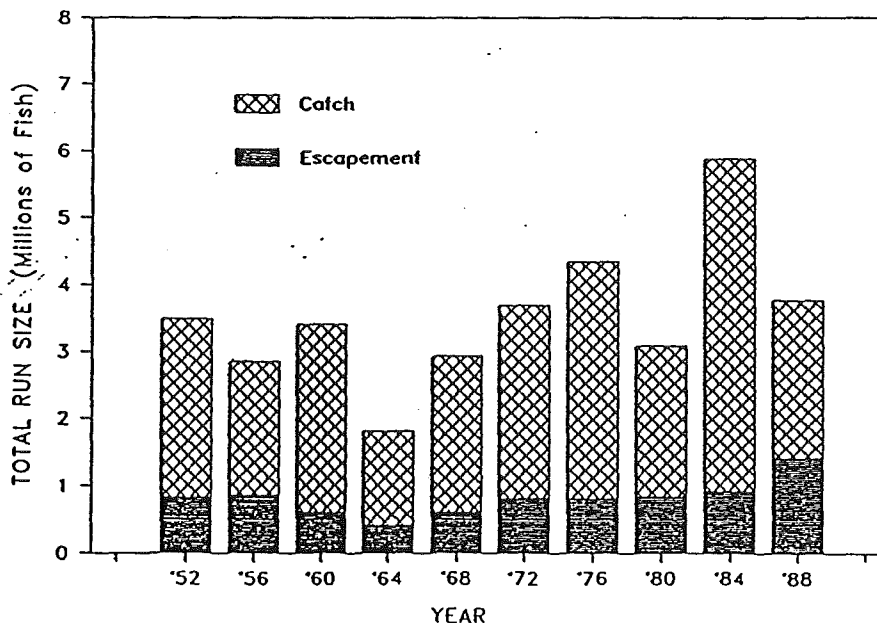


FIGURE 2. Catch, escapement and total run sizes for the 1988 cycle of Fraser River sockeye salmon for cycle years 1952-1988.

The total catch of Fraser River sockeye salmon was 2,344,000 fish: 1,855,000 in commercial fisheries; 423,000 in Canadian Indian food fisheries; 16,000 in Canadian recreational fisheries; and 50,000 in test fisheries (Table 4). The commercial catch was 43% larger than forecast, due to larger-than-forecast returns of most stocks with the exception of the Chilko area stocks.

TABLE 4. Preliminary estimates for total fishery catches of Fraser River sockeye salmon during the 1988 fishing season, by country and area.

COMMERCIAL CATCH:	Number of Fish	% of Run
<u>CANADA</u>		
Fraser River Panel Area:		
Areas 121-124 Troll	16,000	0.43
Area 20 Net	219,000	5.82
Areas 17-18 and 29 Troll	77,000	2.04
Area 29 Net	682,000	18.13
Subtotal	994,000	26.42
Non-Panel Area:		
Areas 1-10 Troll and Net	2,000	0.05
Areas 11-12, 124-127 Troll	32,000	0.85
Areas 11-16 Net	144,000	3.83
Areas 13-16 Troll	4,000	0.11
Subtotal	182,000	4.84
CANADA TOTAL	1,176,000	31.26
<u>UNITED STATES</u>		
Fraser River Panel Area:		
Areas 4B, 5 and 6C Net	56,000	1.49
Areas 6, 7 and 7B Net	437,000	11.62
Area 7A Net	186,000	4.94
Subtotal	679,000	18.05
Non-Panel Area:		
Alaska Net	Nil	Nil
UNITED STATES TOTAL	679,000	18.05
COMMERCIAL TOTAL	1,855,000	49.31
NON-COMMERCIAL CATCH:		
<u>CANADA</u>		
Areas 12-13, 18, 20, 123-124 Indian F.F.	7,000	0.19
Area 12 Test Fishing	1,000	0.03
Fraser River Indian Food Fishery	416,000	11.06
Recreational Fishery	16,000	0.42
Subtotal	440,000	11.70
<u>UNITED STATES</u>		
Area 5 Test Fishing	Nil	Nil
<u>COMMISSION</u>		
Areas 123-124,, 20, 29 Test Fishing	38,000	1.01
Areas 7, 7A Test Fishing	11,000	0.29
Subtotal	49,000	1.30
NON-COMMERCIAL CATCH	489,000	13.00
TOTAL CATCH	2,344,000	62.31
ESCAPEMENT:	1,418,000	37.69
TOTAL RUN	3,762,000	100.00

The spawning escapement totalled 1,418,000 fish, including 1,370,000 adult and 48,000 jack sockeye. In spite of extensive closures to maximize Chilko River sockeye escapement, the spawning escapement of this stock was only 68% of the pre-season goal. The efforts to provide escapement to the Chilko River led to escapements of other co-migrating stocks that exceeded pre-season goals, notably to the Stellako and Birkenhead Rivers. The spawning escapement total was the largest on the cycle for all years on record.

Fish size in 1988 was above normal for the cycle due to the relatively high proportion of heavier late-run sockeye; the average weight of 4-year-old sockeye was 6.2 lbs (2.8 kg). Fishery catches averaged 6.3 lbs (2.9 kg), due to a 17% contribution of larger age S_2 fish.

A. Canada

The Fraser River Panel and the Canada Department of Fisheries and Oceans managed the harvest of Fraser River sockeye salmon in Canada to achieve the allocation to the respective gear that was set by the Minister of Fisheries. By agreement, the Panel's responsibility was confined to management of net fisheries within Panel Area waters and the Areas 18 and 29 troll fishery. Canada Department of Fisheries and Oceans regulated the coastal troll fishery, including that portion within the Panel Area, and net fisheries outside the Area (Figure 1).

The commercial catch in Canada totalled 1,176,000 sockeye, 994,000 (84.5%) of which were caught in the Panel Area and 182,000 (15.5%) in non-Panel Areas (Table 4, Appendix Tables 1 to 4). Fishermen in Area 29 harvested the largest portion of the catch (65%), followed by net fishermen in Area 20 (19%) and Areas 11 to 16 (12%). The proportion taken in Area 29 was high because substantial portions of the gillnet, purse seine and troll catches were taken here primarily as a result of: 1) a low diversion rate of sockeye salmon through Johnstone Strait (15% of the run) and 2) closures in marine migratory areas to apply differential harvest rates to Chilko River versus late-run stocks.

The original allocation goals established by the Minister of Fisheries were achieved within 2.9% for each user group. Late-season revisions to the allocation goals for all gear types were implemented to harvest the available surpluses. Actual catches were closer, of course, to the revised allocation goals. The outside troll, inside troll, purse seine and gillnet catches were, respectively, 4.2%, 6.9%, 53.0% and 35.9% (Table 5).

TABLE 5. Preliminary estimates for Canadian catches¹ of Fraser River sockeye salmon by gear type and area during the 1988 fishing season.

Areas	Troll		Purse Seine		Gillnet		Total	
	Catch	%	Catch	%	Catch	%	Catch	%
1-10	1,000	0.08	1,000	0.08	0	0.0	2,000	0.16
11-16*	3,000	0.26	99,000	8.42	45,000	3.82	147,000	12.50
13-16**	4,000	0.34	—	—	—	—	4,000	0.34
121-127	45,000	3.83	0	0.00	0	0.00	45,000	3.83
20	0	0.00	184,000	15.65	35,000	2.98	219,000	18.63
17, 18, 29	77,000	6.54	339,000	28.83	343,000	29.17	759,000	64.54
TOTALS	130,000	11.05	623,000	52.98	423,000	35.97	1,176,000	100.00

* Troll catch includes Areas 111, 11 and 12 only (outside troll).

** Includes Areas 13-16 troll only (inside troll).

¹ Preliminary catch data from Canada Department of Fisheries and Oceans' fish sales slips plus estimates of unreported catches by the Fisheries Management Division of the Pacific Salmon Commission.

The peak catches in Area 20 and Areas 12 to 16 occurred the week of August 7-13 (Appendix Tables 1 and 4). These catches were primarily of late-run sockeye entering after the peak of the Chilko River run had passed through these areas. Area 29 gillnet catches peaked the week of July 31-August 6 (Appendix Table 3) and were dominated by early summer-run stocks that entered prior to the peak of the Chilko River run. The catch of 204,000 late-run sockeye on September 14 by purse seines in Area 29 was the largest daily catch in Canada. Outside troll catches were taken in the period July 10 to 21 and consisted mainly of early summer-run sockeye.

The cumulative duration of fishery openings in each Panel Area were similar to pre-season expectations, but the weekly patterns of fishing differed substantially (Table 3).

In the Fraser River Indian food fishery the catch of sockeye salmon reached 416,000 fish, 83% of which were caught in the mainstem of the Fraser, and 17% in tributary systems (Appendix Table 6). The largest catches (183,000 sockeye) were made in the section of the river between Mission and North Bend. The Indian food fishery in the mainstem was closed by Canada during the three weeks of peak passage of Early Stuart sockeye for conservation of this stock. Extended fishing opportunities were provided by the Department of Fisheries and Oceans on those stocks entering prior to the Chilko River run. Normal fishing times prevailed during the passage of Chilko River and Stellako River sockeye.

B. United States

Commercial catches of Fraser River sockeye in the United States totalled 679,000 fish, all of which were caught by net fishermen in the Panel Area (Table 4, Appendix Table 5). This was the smallest catch on the cycle since 1980 when a high diversion of sockeye via Johnstone Strait resulted in a very small catch in United States waters. In 1988, fishermen in Areas 6 and 7 harvested the largest portion of the catch (437,000 fish), while fishermen in Area 7A caught 186,000 and fishermen in Areas 4B, 5 and 6C landed 56,000 Fraser River sockeye. In addition to the catch of Fraser River sockeye, United States fishermen landed 3,500 non-Fraser sockeye. These were primarily fish destined for Lake Washington.

The actual United States catch of Fraser River sockeye was 39,000 less than their share of the TAC, as estimated at the end of the season. However, during the period that sockeye were still available in United States waters, the balance was more even. Late in-season increases in run size estimates resulted in a larger TAC and, consequently, a larger United States share, but this developed after most sockeye had cleared United States waters.

Within the United States fishery, Treaty Indian fishermen harvested 377,000 (56%) and Non-Indian fishermen harvested 302,000 (44%) of the commercial catch of 679,000 Fraser River sockeye salmon (Table 6). This allocation difference of 75,000 fish was greater than the pre-season goal for a 46,000 sockeye payback to Treaty Indian fishermen. The imbalance resulted primarily from large Treaty Indian catches in late July. Subsequent Treaty Indian and Non-Indian fisheries in August were of equal duration, which resulted in larger catches in the Non-Indian sector, but these catches were not sufficiently large to counter-balance the earlier, large Treaty Indian catches.

TABLE 6. Preliminary estimates for United States catches of Fraser River sockeye salmon by user group, gear type and area during the 1988 fishing season.

TREATY INDIAN								
Areas	Gillnet		Purse Seine		Reef Net		Total	
	Catch	%	Catch	%	Catch	%	Catch	%
4B, 5, 6C	53,000	14.06	0	0.00	0	0.00	53,000	14.06
6, 7, 7B	186,000	49.34	59,000	15.65	0	0.00	245,000	64.99
7A	63,000	16.71	16,000	4.24	0	0.00	79,000	20.95
TOTALS	302,000	80.11	75,000	19.89	0	0.00	377,000	100.00
NON-INDIAN								
Areas	Gillnet		Purse Seine		Reef Net		Total	
	Catch	%	Catch	%	Catch	%	Catch	%
4B, 5, 6C	3,000	0.99	0	0.00	0	0.00	3,000	0.99
6, 7, 7B	141,000	46.69	38,000	12.58	13,000	4.31	192,000	63.58
7A	52,000	17.22	55,000	18.21	0	0.00	107,000	35.43
TOTALS	196,000	64.90	93,000	30.79	13,000	4.31	302,000	100.00
GRAND TOTAL	498,000	73.34	168,000	24.74	13,000	1.92	679,000	100.00
UNITED STATES TEST FISHING (Treaty Indian Catch):	Nil							
ALASKA (DISTRICT 104) CATCH:	Nil							
UNITED STATES TOTAL CATCH:	679,000							

Catch by gear in United States waters was predominantly by gillnets (498,000; 73.3%) and purse seines (168,000; 24.7%) (Table 6). Reef nets harvested 13,000 (1.9%) sockeye. Both Treaty Indian and Non-Indian catches were dominated by gillnets. Treaty Indian gillnets harvested 302,000 sockeye, which was 80.1% of the total catch by Treaty fishermen. In the Non-Indian fleet, gillnets caught 196,000 sockeye (64.9%), purse seines 93,000 (30.8%) and reef nets 13,000 (4.3%). The proportion taken by gillnets in 1988 was the highest of any year on record. This resulted because summer-run sockeye, which are most available to gillnets, predominated in the United States catch. Also, the pre-season forecasts of low run size and small catch in the United States influenced many Non-Indian purse seines to remain in other fishing areas. The maximum number of Non-Indian purse seines fishing during the season was 93 boats, one of the smallest fleet sizes on record.

The peak catch of Fraser River sockeye in United States waters was taken during the week of July 24 to 30 (Appendix Table 5). This fishery targeted on the peaks of the runs that entered just prior to the Chilko River sockeye. An unusually large abundance of these fish was in United States waters on July 26 to 28 and resulted in a much larger-than-expected catch of 362,000 sockeye, over one-half of the total season catch. This catch exceeded the United States allocation of summer-run sockeye and placed their total catch ahead of target levels for the date. As a result, United States fishermen did not fish again until August 12, after the bulk of Chilko River sockeye had passed through United States waters. Subsequent United States fisheries for late-run sockeye were less successful than expected. The low catches occurred because a large fraction of the migration passed quickly through Haro Strait on the west side of San Juan Island and into the Strait of Georgia, where they were unavailable to United States fishermen. Fishing in Canadian Area 20 also affected the availability of sockeye to United States fishermen.

Fishing times were close to pre-season expectations for both Treaty Indian and Non-Indian fishermen (Table 2).

VI. STOCK MONITORING

During each fishing season, the pre-season forecasts of abundance, run timing and migration route are modified using data gathered through a stock-monitoring program. The objective of the program is to determine the actual abundance and timing of Fraser River sockeye and pink salmon in the principal marine and river areas where commercial fisheries occur. These estimates of abundance and timing are made from analyses of catch data from commercial and test fisheries. In addition, estimates of gross escapement are determined through an echo sounding program on the Fraser River at Mission and by visual monitoring at Hells Gate.

Test fishing operations in 1988 were conducted by the Commission in the following areas:

Canadian Panel Areas

Area 123	Troll	July 23 - August 17
Area 20	Gillnet	June 22 - August 28
Area 29-13	Gillnet	July 13 - October 15
Area 29-16	Gillnet	June 23 - October 4
Area 29-1 to 6	Gillnet	August 23 - October 6
Area 29-1 to 6	Purse Seine	August 21 - September 28
Area 29-1 to 6	Troll	July 28 - October 5

United States Panel Areas

Area 7	Gillnet	July 18 - August 22
Area 7A	Purse Seine	August 21 - September 15

In addition, Canada Department of Fisheries and Oceans operated a gillnet test fishing program in Area 12 between July 19 and August 18 at the request of the Panel, and reported the results to the Commission staff.

Test fishing catch per unit of effort (CPUE) is used in run-size and timing analyses. Fish caught in the test fisheries also provide scales and biological data for racial analyses of the catches. Test fishery catch and racial analysis information was used extensively to estimate run size by stock during the 1988 season.

The emphasis of the stock-monitoring program in 1988 differed from recent years because of prolonged fishery closures during the peak of the Chilko River sockeye migration. The data for evaluation of migration parameters were derived mainly from test fishing. In-season estimates of run size and timing were made by comparing cumulative estimates of abundance from test fishing CPUE with cumulative normal distributions of variable timing and spread.

Stock-monitoring programs commenced on the Early Stuart sockeye run in late June. Assessment of run size and timing of this stock was based on data from Area 20 test fishing and fine-tuned with estimates of gross escapement from echo sounding at Mission. Management of the run was complicated by the co-migration of Lake Washington sockeye in Area 20. Initially, the strength of the Early Stuart run was estimated to be near the pre-season forecast. A second peak of the Early Stuart run occurred and the run size estimate was subsequently revised upwards to 220,000 sockeye. Timing appeared to be slightly later than normal, the peak of the run occurring in the lower Fraser River on July 8-9.

After completion of the Early Stuart run in mid-July, stock monitoring focused on early summer-run sockeye. Additional information was available from Area 123 troll, Area 12 gillnet and Area 7 gillnet test fishing operations. During the last week of July, test fishing in the Fraser River indicated fewer fish entering the river than expected. Delay of these fish in the Strait of Georgia was confirmed by troll test fishing. The estimation of timing and run-size was complicated by the delay of these stocks, since river escapement information at Mission could not be matched with test fishing catch information from the migratory areas. Consequently, Area 20 test fishing CPUE data alone were used for much of the assessment. Early in the migration, the run size of the early summer-run stocks was estimated at 1.0 to 1.25 million. By early August, the estimate was reduced to 900,000. Only about 10% of these fish migrated via Johnstone Strait, foreshadowing the low diversion rate for the summer-run and late-run sockeye stocks arriving later.

As Chilko River sockeye began to appear in late July, it became clear that managing the Chilko River stock would be more difficult than the simulation model had indicated prior to the season. The early summer-run sockeye stocks were approximately 150,000 fish larger than forecast and peaked in Area 20 on July 24, a few days later than normal. The run size of Chilko

River sockeye appeared to be less than the pre-season forecast, and was subsequently estimated at between 500,000 and 600,000 fish. The peak of the run in Area 20 occurred on August 4, 5 days later than normal. The Stellako River and Weaver Creek runs were substantially larger and earlier than forecast.

Reduced exploitation rates in the migratory areas were required for conservation of Chilko River sockeye and, necessarily, applied to other similarly timed stocks such as Stellako, Birkenhead and Weaver sockeye. The abundances of these three stocks were much larger than forecast, totalling 1,938,000 million sockeye compared to the pre-season estimate of 1,035,000 million. The total run size of all stocks was increased to 3.2 million total sockeye on August 15 and to 3.54 million on August 26. After most Chilko River sockeye had cleared Area 20, attempts to harvest late-run sockeye were not successful as fisheries were restricted for the conservation of juvenile chinook salmon. Approximately 600,000 late-run sockeye escaped to the Strait of Georgia as a result of actions taken to conserve Chilko River sockeye and to protect juvenile chinook salmon. Only 150,000 of these fish were required to achieve escapement goals. Troll and purse seine test fishing efforts in the Strait of Georgia were directed at determining the location and availability of these fish for harvest and to estimate the potential by-catch of other species. The sockeye first became available to the purse seine test fishery on September 12 and a commercial purse seine catch of 204,000 was taken in less than 3 hours on September 14. Analysis of this catch led to an increase in the estimated total Fraser River sockeye run to 3.7 million fish on September 16.

Echo sounding at Mission from June 23 to August 30 provided daily estimates of sockeye gross escapements past the upstream commercial fishery boundary in the River. The cumulative escapement of all stocks migrating in that period was estimated at 1,436,000 adult sockeye. Upstream migration of late-run sockeye was monitored by test fishing until October 15 and brought the estimated gross escapement to 1,727,000 adult sockeye. Peak escapement occurred between July 29 and August 20 (Figure 3) as the majority of the early summer-run sockeye, Chilko River and Stellako River sockeye, moved upstream. Much of the Birkenhead River escapement occurred during this period, as well.

Escapement of Early Stuart sockeye past Mission was estimated in-season at 192,000 fish compared to a post-season estimate of 208,000 from Indian food fishery catches and spawning escapement (Table 7). Summer-run sockeye gross escapements were estimated in-season at 1,142,000 adult sockeye compared to the post-season estimate of 1,326,000 fish. Late-run sockeye, including the Birkenhead River fish, were estimated in-season at 393,000 compared with 252,000 in the post-season accounting. The total catch and spawning escapements upstream of Mission was 1,786,000, or 59,000 larger than estimated in-season.

TABLE 7. Comparison of 1988 pre-season escapement goals and in-season and post-season estimates of gross escapement (adults only).

	Pre-Season Goals	In-Season Estimates	Post-Season Estimates ¹
Early Stuart	185,000*	192,000	208,000
Summer-run Stocks:			
Seymour/Brown/Group	127,000	278,000	140,000
Gates/Nadina Group	135,000	128,000	130,000
Early Chilko Lake Group	203,000	108,000	154,000
Chilko Group	575,000	335,000	366,000
Stellako Group	125,000	293,000	536,000
Subtotals	1,165,000	1,142,000	1,326,000
Late-run Stocks			
Birkenhead Group	100,000	200,000	185,000
Weaver & Misc.	145,000**	193,000	67,000
Subtotals	245,000	393,000	252,000
TOTALS	1,595,000	1,727,000	1,786,000

* As adjusted by Canada in early July.

** As adjusted by Panel agreement on August 22.

¹ Includes 36,000 sockeye caught in Indian food fisheries below Mission, B.C.

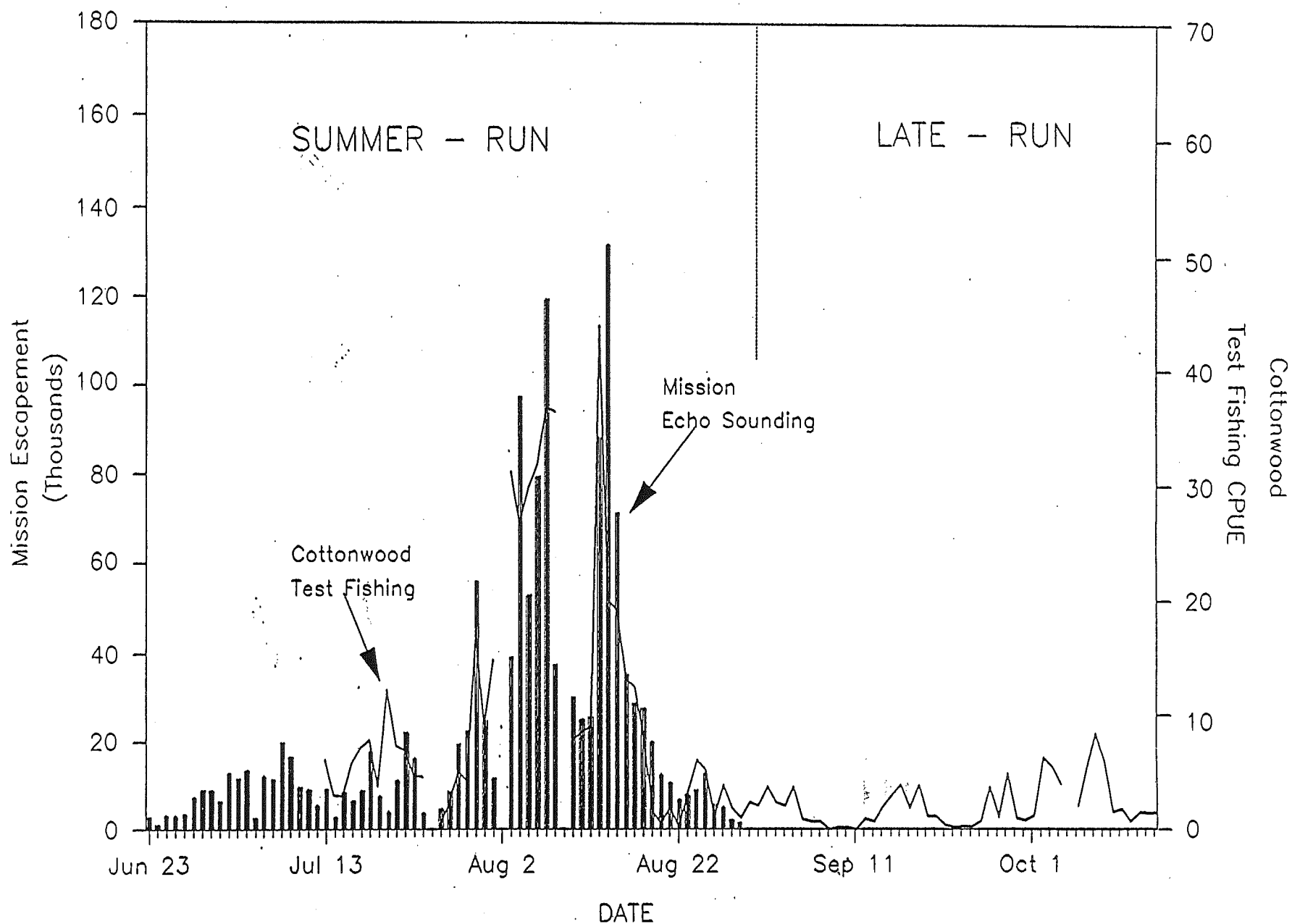


FIGURE 3. Daily escapements of sockeye salmon estimated at Mission, B.C. by echo sounding compared with prior-day test fishing CPUE at Cottonwood during 1988.

VII. RACIAL IDENTIFICATION

Under the Pacific Salmon Treaty, catches of Fraser River sockeye and pink salmon must be ascertained wherever they occur. To achieve this, the Commission staff conducts programs to identify the Fraser stock component in catches of sockeye and pink salmon taken in coastal waters from Oregon to southeastern Alaska. In-season management of sockeye salmon also requires knowledge of stock-specific abundance, timing and migratory behavior. Racial analyses of scales and biological data collected from commercial and test fishing catches enable the staff to identify individual stocks of Fraser River sockeye. Thus, not only are catches of Fraser sockeye salmon enumerated, but stock groupings, unique in their timing and behavioral traits, are monitored throughout the fishing season. This in-season information about the stocks is central to the development of management strategies and fishing plans designed to optimize stock-specific harvest and escapement objectives.

Fish scales and sex and length data were collected in 1988 from sockeye salmon caught in Canadian and United States fisheries in Panel and non-Panel Area waters (Table 8). Discriminant analysis of scale pattern features is the primary method used to identify stocks of Fraser sockeye salmon. Juvenile growth differences, such as circuli counts and spacing in the freshwater zone of the scale (Figure 4), allow individual stocks to be distinguished. Associated biological data including age composition, length and sex information and historical timing data are used to augment the racial identification. Analyses conducted by the Commission staff in 1988 focused on 20 Fraser River sockeye salmon stocks expected to return in numbers significant enough to warrant their inclusion in stock-identification models.

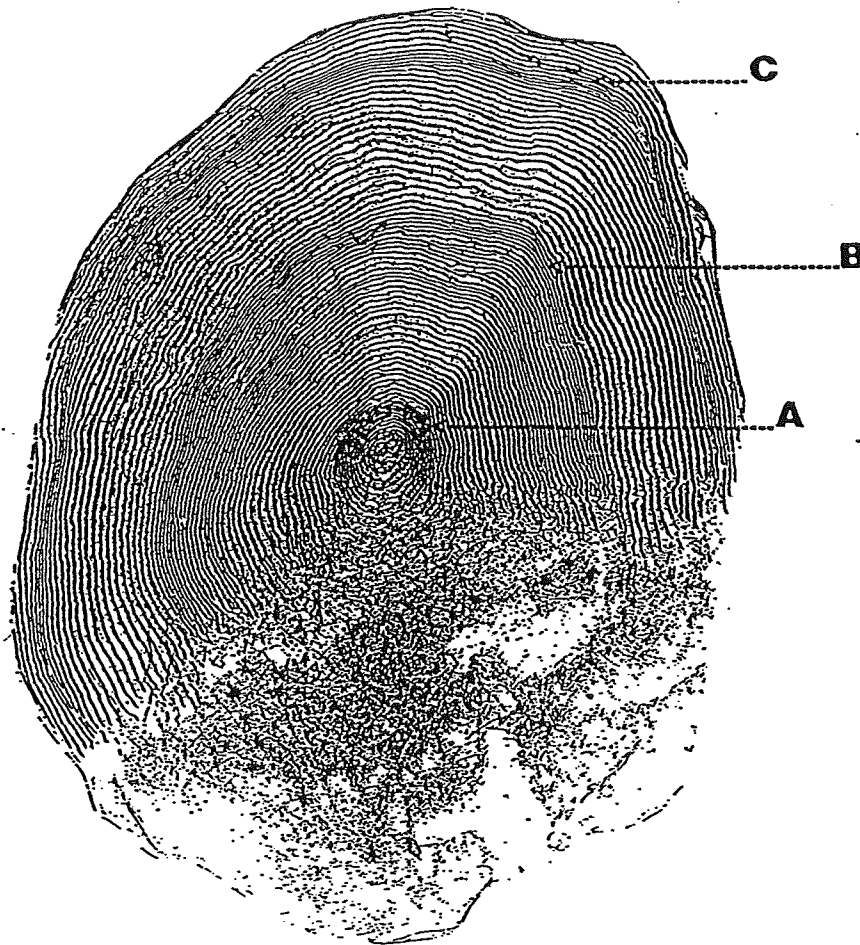


FIGURE 4. Scale of age 4₂ Fraser River sockeye salmon showing freshwater and marine annuli (A=freshwater annulus, B=first marine annulus, C=second marine annulus).

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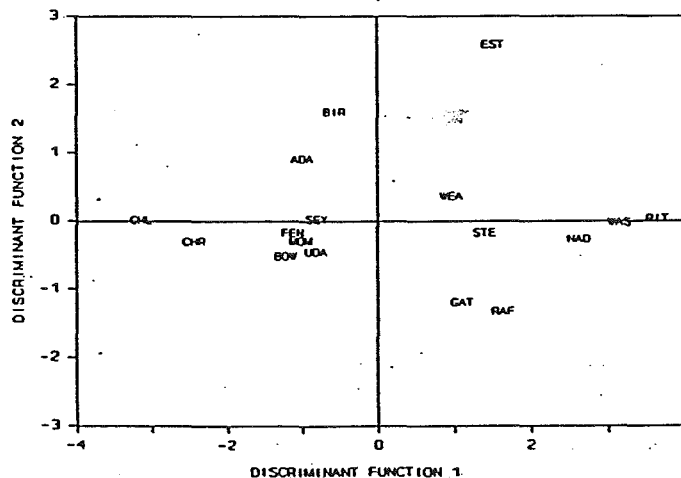
TOTAL ALL AREAS

In-season stock separation using discriminant analysis is a multi-step process. The main analyses are done for 4-year-old sockeye, because they comprise the largest age group. To "learn" the scale characteristics for age-4 fish for an individual stock for a particular cycle, samples from the same brood are obtained from 3-year-old jack spawners from the previous year. If these data are insufficient, scale characteristics from 4-year-old spawners from previous years but the same cycle, especially the parents of the returning brood, can be used. For example, scale characteristics for age-4 Early Stuart sockeye returning in 1988 could be obtained from Early Stuart jack spawners in 1987, and from age-4 spawners from 1984, 1980, 1976, etc.

The criteria for separating the stocks (the "discriminant functions") are calculated based on the variables measured for each stock. Classification matrices are then produced which tabulate the number of fish from each known stock that are both correctly and incorrectly classified by the rules. These matrices are used to generate procedures that correct the initial racial estimates from commercial fishery samples.

For the 1988 return, three scale features were used to separate the stocks; circuli counts to the first freshwater annulus, circuli counts in the freshwater plus-growth zone, and distances from the scale center to the first freshwater annulus (Figure 4). The discriminant analyses were age-group specific for the dominant ages. For the in-season analyses, learning standards for each stock were constructed from spawning ground data collected from jacks in 1987 and adults from prior years. A post-season re-analysis of all samples was conducted using learning standards constructed from 1988 spawning ground returns of 4- and 5-year-old spawners. This re-analysis corrects for biases introduced by using data from other ages and years for the in-season estimates.

Stock groupings were formed by comparing scale characteristics for each stock, and pooling stocks with similar characteristics. The relationships between the stocks used for in-season classification of 1988 fishery samples are shown in Figure 5. Those stocks which give similar discriminant scores are often grouped in the analysis due to the inability of the analysis to adequately distinguish between some stocks.



$$\text{FUNCTION 1} = 0.32(\text{COUNT}) - 0.01(\text{PLUS}) + 0.74(\text{DISTANCE}) \quad R^2 = 0.88$$

$$\text{FUNCTION 2} = 0.23(\text{COUNT}) + 1.08(\text{PLUS}) + 0.18(\text{DISTANCE}) \quad R^2 = 0.66$$

STOCK KEY

ADA - LOWER ADAMS RIVER	MAD - MADINA RIVER
BIR - BIRKENHEAD RIVER	PIT - PITT RIVER
BOU - BOURN RIVER	RAF - RAFT RIVER
CHL - CHILKO LAKE	SEY - SEYHOUS RIVER
CHR - CHILKO RIVER	STE - STELLAKO RIVER
EST - STUART LAKE SYSTEM	UDA - UPPER ADAMS RIVER
FEN - FENWELL CREEK	WAS - LAKE WASHINGTON
CAT - CATES CREEK	WEA - WEAVER CREEK
NON - NONICH RIVER	

FIGURE 5. Spatial distribution of mean discriminant scores for age 4₂ Fraser River sockeye salmon used as in-season standards for 1988. The three discriminating variables used to separate the stocks were 1) circuli count to the first freshwater annulus, 2) circuli count in the spring plus-growth zone and 3) distance to the first freshwater annulus.

The analysis of sockeye salmon scales yielded estimates of stock composition for each fishery. These results were applied to the area-specific catch data to estimate Fraser River sockeye catch by stock by area. Racial analysis of test fishery catches was vital to the management of the commercial fisheries in 1988. Area 20 test fishery scales provided the data needed for stock-size estimates and escapements of late-run sockeye to the Strait of Georgia. In addition, stock composition estimates obtained from Area 29 (Fraser River) test fishery catches were applied to daily total sockeye escapement estimates from the Mission echo sounding program to estimate the daily upstream escapement by stock.

Post-season racial analysis of samples from commercial fisheries, Fraser River Indian food fisheries (IFF) and the spawning grounds show that total returns of most major Fraser River sockeye salmon stocks were higher than forecast. The total return was 3,762,000 fish, of which 72 % were 4-year-old sockeye from the 1984 spawning, 26 % were 5-year-old adults of the 1983 spawning and 2 % were 3-year-old jacks of the 1985 spawning. Returns (including jacks) for individual stocks were: Chilko River-579,000, Stellako-743,000, Birkenhead-527,000, Weaver-685,000, Early Stuart-221,000, and there were 892,000 early summer-run fish from fourteen stocks. Five-year-old fish were significant in several stocks: Chilko River (51%), Birkenhead (53 %), Stellako (18%) and Upper Pitt (74%).

The Early Stuart run was protected from intense fishing in 1988. Consequently, total outside commercial and non-commercial catches for this stock were only 13,000 fish and Fraser River Indian food fishing catches were 28,000 fish (Table 9).

TABLE 9. 1988 Fraser River adult sockeye stocks: catch, escapement, and exploitation rate.

Stock Grouping	Outside* Catch	Fraser IFF Catch	Net Escapement (Adults)	Total** Run	Exploitation Rate	
					Outside Catch	All Catch
Early Stuart	13,000	28,000	180,000	221,000	5.9%	18.6%
Early Summer-Run Stocks	436,000	97,000	326,000	859,000	50.8%	62.0%
Chilko River	212,000	111,000	255,000	578,000	36.7%	55.9%
Stellako Group	207,000	154,000	382,000	743,000	27.9%	48.6%
Birkenhead Group	331,000	18,000	167,000	516,000	64.1%	67.5%
Weaver & Misc.						
Late Run Stocks	729,000	8,000	60,000	797,000	91.6%	92.5%
TOTALS	1,928,000	416,000	1,370,000	3,714,000	51.9%	63.1%

* Includes test fishing catches and other miscellaneous catches.

** Not included is the escapement of 48,000 jack sockeye.

The complex of early summer-run stocks yielded an outside catch of approximately 436,000 fish, plus 97,000 were taken in the Indian food fishery. The outside exploitation rate on these stocks was 51 % (Table 9). The Chilko River stock, in contrast to the majority of sockeye stocks, experienced production levels below pre-season expectations. The outside catch of Chilko River sockeye salmon was 212,000 fish, a 37% exploitation rate. Because the timing of the Stellako River stock grouping (including Late Stuart and Horsefly stocks) was similar to that of the Chilko River stock, the protection of the Chilko run resulted in low exploitation rates on these stocks as well. The outside catch of this group was estimated at 207,000 fish, a 28 percent exploitation rate (Table 9).

The outside catch of Birkenhead sockeye was 331,000 fish, a 64 percent exploitation rate (Table 9). The exploitation rates on late-run stocks were higher than those for summer-run stocks, primarily because of fisheries directed toward Weaver sockeye in the Strait of Georgia during September. The catch of Weaver and miscellaneous late-run sockeye salmon was 729,000 fish, a 92 % exploitation rate.

VIII. ESCAPEMENT

(Provided by Canada Department of Fisheries and Oceans)

Escapements to sockeye salmon spawning grounds in the Fraser River watershed (Table 10) were enumerated by Canada Department of Fisheries and Oceans. These estimates were provided to the Panel to assess how well the in-season management of Panel Area fisheries achieved the objectives for spawning escapements to the watershed as a whole, and to the individual tributaries. Evaluation of management actions designed to achieve the escapement goals provides information that can lead to improved management in the future.

TABLE 10. Adult sockeye salmon net (spawning) escapement goals and estimated actual escapements.

Stock	Pre-season Goal	Revised In-Season	Actual Escapement	Deviation (%)
Early Stuart	110,000	150,000	179,800	+ 20%
Early summer-run stocks				
Bowron River	20,000		12,800	
Fennell Creek	20,000		26,900	
Pitt River	30,000		37,700	
Gates Creek	30,000		44,900	
Nadina River	10,000		9,300	
Chilko Lake	100,000		108,700	
Upper Adams River	10,000		7,200	
Momich River	10,000		5,900	
Seymour River	15,000		16,800	
Raft River	10,000		19,900	
Late Stuart	5,000		7,100	
Misc. Summer-run	7,000		43,200	
Subtotals	267,000	267,000	340,400	+ 28%
Chilko River	375,000	Revised to achieve maximum number of Chilko R. sockeye	254,700	- 32%
Stellako River	80,000		367,700	+360%
Birkenhead River	80,000		166,600	+108%
Late-run stocks				
Adams River	7,000	130,000	4,800	
Weaver Creek	70,000		49,300	
Harrison River	5,000		1,500	
Cultus Lake	1,000		900	
Portage Creek	2,000		1,100	
Misc. Late-run	3,000		3,500	
Subtotals	88,000	130,000	61,100	- 53%
TOTALS	1,000,000	1,082,000	1,370,300	+ 27%

Total sockeye escapements to spawning areas in the Fraser River watershed were estimated at 1,370,000 adult (4- and 5-year-old) and 48,000 jack (3-year-old) sockeye (Appendix Table 7). The adult escapement was the largest recorded on the cycle and was 27% above the revised escapement goal (Table 10). Escapements to individual spawning streams deviated significantly from the goals, principally for Chilko River, Stellako River and Birkenhead River stocks (Table 10). Much of the larger-than-forecast escapements of co-migrating stocks related to the efforts to obtain sufficient numbers of Chilko River sockeye spawners from the poorest return for this stock on the cycle.

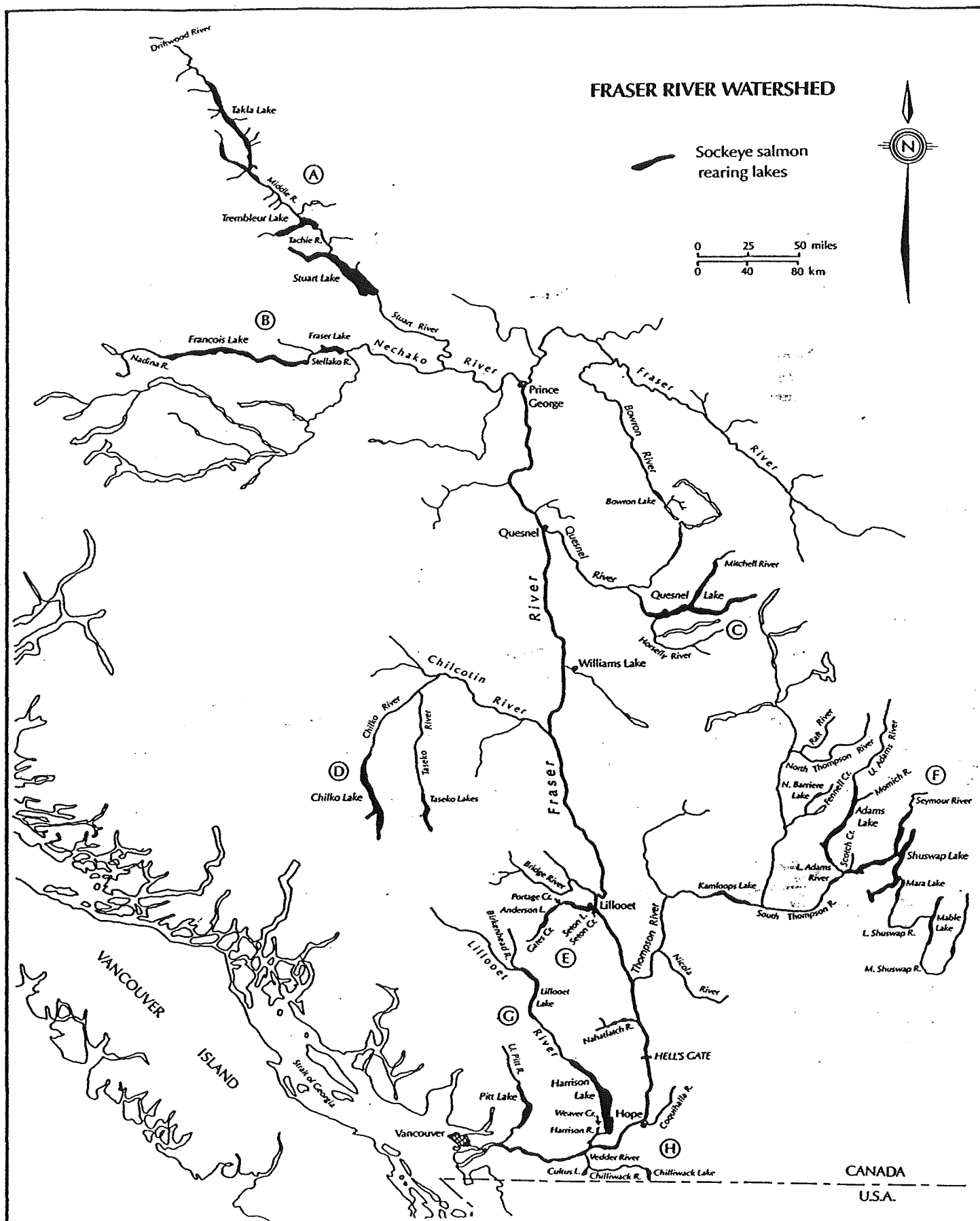


FIGURE 6. Sockeye salmon spawning grounds in the Fraser River watershed.

The earliest migrating sockeye, the Early Stuart stock (A; Figure 6), returned in numbers larger than forecast. Canada increased the net escapement goal to 150,000 fish, 40,000 of which were contributed from Canada's share as escapement add-ons. The final estimate of actual escapement was 180,000 adult sockeye. This was the largest recorded on the cycle and the sixth largest of any year since 1938. The majority of fish (114,000) spawned in Middle River tributary streams. Escapements to Takla Lake tributaries reached 23,000 adult sockeye, while Trembleur Lake tributary streams had 42,000 sockeye.

Late Stuart escapements included many jack sockeye from the dominant 1985 cycle run. The escapements of 7,100 adults and 4,300 jacks were increases from the brood-year levels. The majority of these fish spawned in Tachie River and Kuzkwa Creek.

Stocks in the Nechako River watershed (B; Figure 6) provided a significant portion of the sockeye escapement in 1988. Nadina River sockeye escapements were similar to the brood year (1984). The early run accounted for 600 spawners (800 in 1984) while the late Nadina population increased slightly to 8,800 from 7,100 four years prior. The most dramatic increase in spawning population in the entire Fraser system occurred at Stellako River. A record escapement of 368,000 adult sockeye arrived on the spawning grounds. This number exceeded the previous high escapement (1979) by nearly 100,000 fish. More surprising was the increase compared to the brood year (1984) when only 61,000 fish spawned. The 1988 cycle has been an "off" year for Stellako sockeye, but the 1976 cycle-year escapement of 151,000 sockeye was an abundant spawning population, as well. Management measures to reduce the rate of commercial harvest of Chilko River sockeye in 1988 resulted in the unavoidably large Stellako escapement. Approximately 18% of Stellako River sockeye in 1988 were 5-year-old spawners from the successful 1983 brood, which also produced abundant 4-year-old fish in 1987.

Escapement to the Horsefly River and other Quesnel watershed stocks (C; Figure 6) on this cycle have predominantly been jack sockeye, which are 3-year-old precocious males that return in the year preceding the main brood-year return. Jack sockeye abundance totalled 20,000 fish in 1988, 18,000 to the Horsefly system and 2,400 to Mitchell River. These were the largest numbers which have been observed in this area; however, reduced harvests in commercial fisheries allowed a high proportion of the jacks to escape. The adult escapement was 6,800 fish, substantially higher than the 900 adults recorded in 1984. Many (57%) adults were 5-year-old spawners from the 1983 brood.

The Bowron River escapement reached 12,800 fish, the largest number since 1979. This population has had relatively even escapements since 1983, in contrast to the cyclic dominance pattern exhibited for many years.

Chilko River sockeye returns were forecast to be depressed in 1988 but the actual run size was lower than expected. In spite of severe restrictions on the commercial harvest that resulted in a low exploitation rate, only 255,000 adult spawners arrived at the Chilko River spawning grounds (D; Figure 6). This was the smallest dominant-cycle escapement since 1964. For many years on this cycle, the fisheries have depended on the Chilko River sockeye and, as such, the low escapement in 1988 is a serious concern. Significantly, the escapement was comprised of 51% 5-year-old adults from the 1983 brood, accentuating the poor survival of the 1984 brood-year spawning. Approximately 4,700 sockeye were airlifted into the newly completed Chilko River spawning channel because the wild fish did not voluntarily enter. Spawning was successful in the river, but 30% of the females in the channel died unspawned.

The early sockeye that spawn along beaches in the southern portion of Chilko Lake returned in good numbers with a spawning population estimated at 109,000 fish. This escapement was slightly below the 1984 level (128,000), but was the second consecutive year in which the number of spawners exceeded 100,000 fish.

Gates Creek and the adjacent spawning channel (E; Figure 6) has supported a sizable spawning population on the 1988 cycle. The total in 1988 reached a modern-day high escapement of 45,000 adults. Of this total, 27,400 entered the spawning channel, the largest number in its 21-year history. The Creek escapement of 17,500 was the largest since 1964, which was prior to the construction of the spawning channel. Portage Creek, a short stream between Anderson and Seton Lakes, has had small spawning populations on the cycle and, again in 1988, only 1,100 adult sockeye spawned there. These late-run sockeye sustained a high harvest rate in the Strait of Georgia in September during fisheries directed toward Weaver Creek sockeye.

Sockeye stocks in the North Thompson area (F; Figure 6) include the Fennell Creek and Raft River stocks. Large escapements were recorded at both locations in 1988. Fennell Creek had 27,000 adult spawners, the largest population on record, and nearly two and one-half times the brood year (1984) population of 11,000. The Raft River also had a record escapement of 19,900 adults, which was slightly above the 1984 level of 19,100 adults.

Sockeye stocks in the South Thompson River drainage have not been abundant on the 1988 cycle. However, 1988 escapements of early stocks were above previous recorded levels in most locations. These stocks benefitted from the reduced fishing intensity that was implemented to protect the Chilko River sockeye. The Upper Adams River sockeye population has been increasing on this cycle; it was the subject of stock rebuilding efforts in 1980 and 1984. The 1988 population was estimated at 7,200 adult sockeye, double the 1984 escapement. Momich River/Cayenne Creek is the site of a similarly timed stock which has been an egg source for repopulating the Upper Adams River. The Momich escapement was estimated at 5,900 sockeye, slightly above the brood-year population of 5,800 spawners.

Other early sockeye in the South Thompson River watershed include Seymour River sockeye which, in 1988, had the second largest escapement on the cycle, 16,800 adults. Scotch Creek had 1,100 adult and 1,000 jack sockeye. Late-run sockeye populations also include the off-year runs to the Adams River (4,600 adults) and Lower Shuswap River (200 adults); these escapements were similar to brood-year levels.

Sockeye spawning populations in the Harrison-Lillooet system (G; Figure 6) were larger in 1988 than in prior cycle years. Birkenhead River had an escapement of 167,000 adult and 11,000 jack sockeye. This was the third successive year of at least 160,000 adults, and was four times the 1984 level of 40,000 spawners. Birkenhead sockeye were also affected by the measures taken to maximize the Chilko River sockeye escapement. Over one-half of the Birkenhead return in 1988 were 5-year-old fish from the successful 1983 brood.

Harrison River had a small escapement of 1,500 sockeye in 1988. Weaver Creek sockeye supported an intense, mid-September fishery in the Strait of Georgia. The escapement to Weaver Creek and Weaver spawning channel totalled 49,000 adult sockeye, with 25,000 of these fish entering the spawning channel. The total escapement was somewhat below the 1984 level of 60,000 adults.

Sockeye stocks in Lower Fraser River tributaries (H; Figure 6) had mixed escapement success in 1988. The early stock at Upper Pitt River had an escapement of 37,700 spawners, over double the 1984 escapement of 16,000 and the largest of any year since 1975. The Nahatlatch River watershed populations totalled 16,400 adults, the largest on record. Lake spawning areas and short, interconnecting streams between lakes in this system provide spawning for some of these sockeye, but most normally spawn in the Upper Nahatlatch River. Late-run Cultus Lake sockeye have been in low abundance on the 1988 cycle. This year, the spawning escapement was only 900 fish, the lowest on record for the cycle.

Conditions for spawning were generally favorable in the Fraser River watershed in 1988. High-water events occurred during and immediately after spawning in several areas. Water temperatures, however, were favorable throughout the spawning period in each area. Pre-spawning mortality losses were at average or below average levels in most populations.

IX. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage fisheries in the Fraser River Panel Area to achieve the annual goals for Fraser River sockeye and pink salmon escapement and catch allocation established in the Treaty or modified by approval of both Parties. Panel management strategies are assessed after each season to determine if the goals were met, to estimate catch deficiencies which require future attention, and to improve management techniques and data collection programs.

A. Escapement

The primary goal of the Fraser River Panel is to ensure that escapement requirements are met. In 1988, Canada set a spawning escapement goal of 1,082,000 adult sockeye allocated across a wide range of stocks. These are summarized together with the achieved escapements in Table 10. The deviations between goals and the realized escapements for the individual stocks were due largely to low abundance of Chilko sockeye and to the severe overlap in the timing of Chilko, Stellako and Birkenhead sockeye migrations through the fishing areas. The size of the Chilko River run was much less than expected, and in fact, was less than the gross escapement goal for this stock. A portion (84,000 fish) of the overage in total escapement to the watershed was due to a shortfall in the Fraser River Indian food fishery catch. These fish, along with 40,000 Early Stuart sockeye, were absorbed by Canada as escapement add-ons for which Canada will receive future benefits.

B. International Allocation

The Panel also focused on the catch-allocation requirements of the Treaty throughout the fishing season. The total allowable catch (TAC) was to be shared across the stock groupings according to the Treaty-defined sharing arrangements for 1988. Post-season analysis gave a TAC estimate of 2,018,000 sockeye and a United States share of 718,000, which includes a partial payback of past-year catch shortfalls (Table 11). The total United States catch was 679,000 sockeye, 39,000 short of the allocation for 1988. Combined with a prior-year shortfall carry-over of 49,000 fish, this produced a cumulative shortfall of 88,000 sockeye. The United States share of the TAC of summer-run sockeye (including Early Stuart) was 350,000 compared to the actual catch of 412,000. The United States share of the TAC of late-run sockeye was 368,000 compared to the actual catch of 267,000.

TABLE 11. Preliminary calculations of the total allowable catch (TAC) and United States allocation of Fraser River sockeye in 1988.

	SOCKEYE	
TOTAL RUN	3,762,000	
DEDUCT:		
Treaty-Designed Escapement	1,000,000	
Jack Escapement	48,000	
Inadvertent Escapement ¹	246,000	
Fraser River Indian Food Fishery Exemption	400,000	
Panel-Approved Test Fishing	50,000	
Total Deductions:	1,744,000	
TOTAL ALLOWABLE CATCH	2,018,000	
UNITED STATES ALLOCATION		
Sockeye: $(1.16/3.60 \times 2,018,000)$	650,000	
Payback	68,000	
	718,000	(35.6%)
CANADA ALLOCATION	1,300,000	(64.4%)
CURRENT STATUS:		
1988 United States Allocation	718,000	
1988 Estimated Catch	679,000	
Difference ²	(39,000)	
Payback Carry-Over	(49,000)	
UNITED STATES ALLOCATION STATUS	(88,000)	

¹ Panel agreement of January 23, 1989.

² () indicates a negative number or shortfall.

The post-season evaluation of the allocation status differed from in-season estimates. Run size and TAC were adjusted upwards in September, after all opportunities had passed for harvesting additional sockeye in United States waters. This increased the United States catch shortfall.

C. Domestic Allocation

In percentage terms, the final Canadian user-group catches closely approximated the allocations as adjusted during the season. However, the actual percentage catches of sockeye by gear type diverged from the pre-season allocations by up to 2.9%. Numerical deviations were as high as 34,000 fish. Outside (west coast of Vancouver Island and north coast) troll catches of 49,000 Fraser River sockeye were 7,000 less than the percentage allocation would have permitted. This shortfall in outside troll catch was due to increases in run-size estimates that occurred in September, after the sockeye had migrated through those fishing areas. These fish were subsequently reallocated to the inside trollers. Purse seines harvested 623,000 Fraser River sockeye or 2,000 over the allocation based on pre-season percentages. The gillnet catch was 423,000, which was 29,000 less than allocation for this gear type. The inside troll catch was 81,000, or 34,000 greater than the pre-season allocation formula would have allowed.

United States Treaty Indian fishermen caught 377,000 sockeye while Non-Indian fishermen caught 302,000. Because Treaty Indian fishermen were due a payback of 46,000 sockeye for prior-year shortfalls, the actual difference between allocation catches was 29,000 sockeye.

D. Conservation of Other Stocks

The Panel is principally concerned with the escapement and harvest requirements of Fraser River sockeye and pink salmon in the Panel Area from late June to early October. However, the Panel must also consider the management requirements of other co-migrating salmon species and stocks. Panel control in 1988 was limited to the net fisheries within the Panel Area and to the troll fisheries in Canadian Area 18-1 and 11 and Area 29. Total reported catches of other species and non-Fraser stocks of sockeye during Panel control are summarized in Table 12.

TABLE 12. Catches of non-Fraser sockeye and other salmon species in commercial fisheries regulated by the Fraser River Panel in 1988. Figures are preliminary estimates by Washington Department of Fisheries and Canada Department of Fisheries and Oceans.

Area	Non-Fraser Sockeye	Chinook	Coho	Chum
United States				
Areas 4B, 5, 6C Net	1,500	5,816	10,483	346
Areas 6, 7, 7A Net	1,000	36,071	36,016	766
Subtotals	2,500	41,887	46,499	1,112
Canada				
Area 20 Net	0	11,452	53,449	1,537
Area 29 Net	0	13,549	19,480	37,285
Areas 18-1 and 11, 29 Troll	0	72	1,349	211
Subtotals	0	25,073	74,278	39,033
TOTALS	2,500	66,960	120,777	40,145

A significant bycatch of juvenile chinook salmon occurred in Canadian Area 20 during the latter half of August, when sockeye catches were low. Canada Department of Fisheries and Oceans first identified the problem on August 12 and took action to close Area 20-1 on August 19 and to prevent the August 23 opening scheduled by the Panel from proceeding. These restrictions reduced sockeye catches, but lowered the incidental catch of juvenile chinook in this area.

Purse seine fisheries in Area 29 in mid-September caught few salmon of other species. Small catches of chinook (1,300), coho (3,000) and chum salmon (3,200) were made during these fisheries, in which 363,000 sockeye were harvested.

X. ALLOCATION STATUS

The Canada-United States allocation status of Fraser River sockeye and pink salmon is periodically revised as catch estimates are derived from final sales-slip and landing-slip data and from final racial composition estimates. The shortfalls in catches in any year are carried over to subsequent years, in accordance with the policy for paybacks that was ratified by the Pacific Salmon Commission in February, 1988. This policy specifies that catch shortfalls and overages be compensated during the following year for sockeye or two years hence for pink salmon, up to a maximum of 5% of the paying Party's share of the TAC of that species.

The current status of sockeye catches shows a United States shortfall of 88,000 fish, the result of a 39,000 catch shortfall in 1988, and a 49,000 catch shortfall from previous years (Table 13).

Re-evaluation of 1985 and 1987 Fraser River pink salmon catches was completed in April, 1989. Catches of Fraser River pink salmon by Canadian fishermen in northern British Columbia and United States fishermen in southeastern Alaska in 1985 were estimated using recoveries of tags applied in the International North Coast Salmon Tagging Program that year. In 1987, tissue samples were collected and used in protein electrophoretic analyses for genetic stock identification (GSI) of mixed-stock catches. These results provided data that were used to estimate interceptions of Fraser River pink salmon by Canadian and United States fishermen. The current allocation status shows a United States cumulative shortfall of 103,000 Fraser River pink salmon (Table 13).

Based on the Commission policy for payback of prior year catch shortfalls, the United States will be compensated for both sockeye and pink salmon in 1989.

TABLE 13. Allocation status of Fraser River sockeye and pink salmon for 1985-1988.¹

	SOCKEYE				PINK	
	1985	1986	1987	1988	1985	1987
TOTAL RUN:	13,879,000	15,904,000	7,694,000	3,762,000	19,038,000	7,136,000
ESCAPEMENT & OTHER DEDUCTIONS:	2,522,000	4,042,000	2,103,000	1,744,000	6,479,000	3,251,000
TOTAL ALLOWABLE CATCH	11,357,000	11,862,000	5,591,000	2,018,000	12,559,000	3,885,000
UNITED STATES:						
ALLOCATION	3,013,000 ⁴	2,797,000 ⁵	1,912,000 ⁶	650,000 ⁷	4,110,000 ⁸	1,166,000 ⁹
ACTUAL CATCH	2,925,000	2,748,000	1,932,000	679,000	3,834,000	1,339,000
ANNUAL ALLOCATION STATUS ²	(88,000)	(49,000)	20,000	29,000	(276,000)	173,000
CUMULATIVE ALLOCATION STATUS ²	(88,000)	(137,000)	(117,000)	(88,000)	(276,000)	(103,000)
CANADA:						
ALLOCATION	8,344,000	9,065,000	3,679,000	1,368,000	8,449,000	2,719,000
ACTUAL CATCH/ESCAPEMENT ³	8,432,000	9,114,000	3,659,000	1,339,000	8,725,000	2,546,000
ANNUAL ALLOCATION STATUS ²	88,000	49,000	(20,000)	(29,000)	276,000	(173,000)
CUMULATIVE ALLOCATION STATUS ²	88,000	137,000	117,000	88,000	276,000	103,000

¹ - Based on Commission interpretations and Panel agreements in February, 1989.

² - () indicate a negative number or shortfall.

³ - Includes escapement add-ons requested or approved by Canada which will generate future benefits.

⁴ - (1.78/6.60 million x 11,357,000) - 50,000

⁵ - (3.0/12.5 million x 11,862,000) - 50,000

⁶ - (1.06/3.1 million x 5,591,000)

⁷ - (1.16/3.6 million x 2,018,000)

⁸ - (3.6/11.0 million x 12,559,000)

⁹ - (3.6/12.0 million x 3,885,000)

XI. APPENDICES

APPENDIX A: FRASER RIVER SOCKEYE - 1988 FORECAST AND NET ESCAPEMENT BY STOCK. (Provided to the Panel by Canada Department of Fisheries and Oceans).

<u>Stock</u>	<u>Total Adults</u>	<u>Net Escapement Goal</u>
Early Stuart	135,000	110,000
Bowron	50,000	20,000
Fennell	55,000	20,000
Pitt	60,000	30,000
Gates	90,000	30,000
Late Nadina	30,000	10,000
Chilko Lake	300,000	100,000
Momich	30,000	10,000
Upper Adams	25,000	10,000
Seymour	35,000	15,000
Raft	35,000	10,000
Late Stuart	15,000	5,000
Chilko	850,000	375,000
Stellako	350,000	80,000
Birkenhead	235,000	80,000
Adams	35,000	7,000
Weaver	450,000	70,000
Harrison	15,000	5,000
Cultus	5,000	1,000
Portage	5,000	2,000
Miscellaneous	35,000	10,000
SUB-TOTAL	2,840,000	1,000,000
OTHER AGES	60,000	40,000
GRAND TOTAL	2,900,000	1,040,000

APPENDIX B: 1988 REGULATIONS

The Fraser River Panel approved regulations for the management of the Fraser River sockeye and pink salmon fishery in Panel Area Waters at a meeting held May 4, 1988 and submitted these to the Pacific Salmon Commission. The Commission approved the Fishery Regime and Regulations and submitted these to the respective national governments for approval on May 24, 1988. The United States Government informed the Commission of its approval on July 6, 1988. The recommendations for Canadian waters were implemented under the Fisheries Act, Pacific Commercial Salmon Fishery Regulations.

Canadian Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends to Canada the adoption of the following Fishing Regime developed by the Fraser River Panel as per Annex IV, Chapter 4 (I) (d) of the Treaty, namely:

1. a) No person shall fish for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 with nets from the 19th day of June, 1988 to the 3rd day of September, 1988, both dates inclusive.
b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 from the 24th day of July, 1988 to the 3rd day of September, 1988, both dates inclusive.
2. a) No person shall fish for sockeye or pink salmon in Pacific Fishery Management Areas 17 and 18 with nets from the 19th day of June, 1988 to the 1st day of October, 1988, both dates inclusive.
b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1 and II from the 24th day of July, 1988 to the 1st day of October, 1988, both dates inclusive.
3. a) No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29 from the 19th day of June, 1988 to the 15th day of October, 1988, both dates inclusive.
b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 24th day of July, 1988 to the 15th day of October, 1988, both dates inclusive.
4. The following Fraser River Panel Area waters are excluded:
 - a) High Seas westerly of the Bonilla Point-Tatoosh Island Lighthouse Line.
 - b) Pacific Fishery Management Area 19, Area 20-2 and 5 to 7 and Area 29-8.
 - c) Commercial troll fishing in Pacific Fishery Management Area 17, Area 18-2 to 10 and Area 29-5; and in Pacific Fishery Management Area 18-1 and II, Area 20-1, 3 and 4 and Area 29-1 to 4 and 6, prior to July 24th, 1988, provided that regulations formulated by the Canada Department of Fisheries and Oceans require the release of sockeye taken by commercial troll gear during the period June 19 to July 23, 1988, inclusive.

During the 1988 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the 1988 Management Plan (attached). This Plan has been designed to achieve Treaty-mandated international allocations of the catch and domestic goals of the Parties.

United States Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends to the United States Government the adoption of the following Fishing Regime developed by the Fraser River Panel as per Annex IV, Chapter 4 (I) (d) of the Treaty, namely:

Treaty Indian Fisheries:

1. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C with drift gillnets or purse seines from the 19th day of June, 1988 to the 3rd day of September, 1988, both dates inclusive.
2. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Area 6A with nets from the 19th day of June, 1988 to the 3rd day of September, 1988, both dates inclusive.
3. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 7 and 7A with nets from the 19th day of June, 1988 to the 10th day of September, 1988, both dates inclusive.
4. No Treaty Indian shall commercially fish for sockeye or pink salmon with nets in that portion of the Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 11th day of September, 1988 to the 24th day of September, 1988, both dates inclusive.

All-Citizen Fishery:

1. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, 6, 6A and 6C with nets from the 19th day of June, 1988 to the 3rd day of September, 1988, both dates inclusive.
2. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 7 and 7A with nets from the 19th day of June, 1988 to the 10th day of September, 1988, both dates inclusive.
3. No person shall fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 11th day of September, 1988 to the 24th day of September, 1988, both dates inclusive.

Treaty Indian and All-Citizen Fisheries:

The following Fraser River Panel Area waters are excluded:

1. High Seas westerly of the Bonilla Point-Tatoosh Island Lighthouse Line.
2. Puget Sound Salmon Management and Catch Reporting Areas 6B, 6D, 7C, 7D and 7E.
3. Puget Sound Salmon Management and Catch Reporting Area 7B, provided that regulations formulated by the Washington Director of Fisheries and Tribal authorities minimize the incidental catch of sockeye by requiring 7-inch minimum mesh for gillnets and by requiring the release of sockeye taken by other gear during the period, June 21 to July 25, 1988, inclusive.

During the 1988 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the 1988 Management Plan (attached). This Plan has been designed to achieve Treaty-mandated international allocations of the catch and domestic goals of the Parties.

APPENDIX C: 1988 FRASER RIVER PANEL IN-SEASON ORDERS

In order to provide for adequate escapement of the various stocks of Fraser River sockeye and for the prescribed allocation of catch (a) internationally, to the fishermen of the United States and Canada and (b) domestically, to the commercial user groups in Canada and the United States, the Fraser Panel promulgated Orders for the regulation of Panel Area fisheries as follows:

July 11, 1988

For the harvest of Early Stuart and early summer-run sockeye stocks, the Panel approved the following regulations: 1) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnet fishing commencing 12:00 p.m. (noon) July 12 for 4 days of fishing; 2) United States Areas 6, 7 and 7A open to Treaty Indian net fishing July 13 for 2 days of fishing; and 3) United States Areas 4B, 5, 6, 6C, 7 and 7A open for All-Citizen net fishing July 13 for 1 day.

July 15, 1988

For the harvest of early summer-run stocks of sockeye, the Panel approved opening United States Areas 4B, 5 and 6C for Treaty Indian drift gillnet fishing commencing 12:00 p.m. (noon) July 19 for 12 days of fishing.

July 22, 1988

For the harvest of early summer-run sockeye, the Panel approved the following regulations for the week commencing July 24: 1) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets July 25 for 1 day of fishing; 2) United States Areas 6, 7 and 7A open to Treaty Indian nets July 26 for 2 days of fishing; and 3) United States Areas 4B, 5, 6, 6C, 7 and 7A open for All-Citizen net fishing July 27 for 1 day.

July 29, 1988

For the conservation of Chilko River sockeye, the Panel approved closing United States Areas 4B, 5 and 6C to Treaty Indian drift gillnet fishing July 29 at 6:00 p.m.

August 1, 1988

For the harvest of early summer-run sockeye, the Panel approved regulations opening Canadian Area 29-1 to 7 and 9 to 17 to gillnets on August 2 for 1 day of fishing.

August 7, 1988

In order to harvest Weaver Creek and other late-run sockeye in Area 20 and early summer-run sockeye in the Fraser River, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open to nets August 10 for 2 days of fishing; and 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets August 9 for 1 day.

August 10, 1988

To provide for harvest of late-run sockeye, the Panel approved the following regulations: 1) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnets 4:00 p.m. August 10 for 5 days of fishing; 2) United States Areas 6, 7 and 7A open for Treaty Indian nets August 12 for 1 day of fishing; and 3) United States Areas 4B, 5, 6, 6C, 7 and 7A open to All-Citizen net fishing August 12 for 1 day.

August 11, 1988

In order to harvest Weaver Creek sockeye the Panel approved extension of fishing in Canadian Area 20-1, 3 and 4 by one day making 3 days in the current period.

August 12, 1988

In order to meet international and domestic sockeye catch allocation objectives, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open for nets August 17 for 2 days of fishing; 2) Canadian Area 18-1 and 11 open to trolling August 17 until further notice; 3) Extension of United States Treaty Indian drift gillnet fishing in Areas 4B, 5 and 6C by 1 day; 4) United States Areas 6, 7 and 7A open to Treaty Indian nets August 16 for 2 days of fishing; and 5) United States Areas 4B, 5, 6, 6C, 7 and 7A open to All-Citizen net fishing August 16 for 2 days.

August 15, 1988

For additional harvest of late-run sockeye, the Panel approved the following regulations: 1) Extension of United States Treaty Indian drift gillnets in Areas 4B, 5 and 6C by 2 days making a total of 8 days of fishing for the current period; 2) Re-opening of United States Areas 4B, 5 and 6C to Treaty Indian drift gillnets at 12:00 p.m. (noon) August 19 for 4 days of fishing; and 3) Effective August 16, United States Panel Area waters north of the Iwersen's Dock Line were closed until further notice to protect delaying Chilko River sockeye.

August 17, 1988

In order to harvest Weaver Creek sockeye and for domestic allocation, the Panel approved the following regulations: 1) Extension of purse seine fishing in Canadian Area 20-1, 3 and 4 by 1 day making a total of 3 days in the current period; 2) Extension of United States Treaty Indian net fishing in Areas 6, 7 and 7A by 1 day making a total of 3 days for the current period; and 3) Extension of United States All-Citizen net fishing in Areas 4B, 5, 6, 6C, 7 and 7A by 1 day.

August 19, 1988

For the harvest of Weaver Creek sockeye, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open to purse seines August 22 for 2 days of fishing; 2) United States Areas 6, 7 and 7A open for Treaty Indian nets August 20 for 1 day of fishing; and 3) United States Areas 4B, 5, 6, 6C, 7 and 7A open for All-Citizen nets August 20 for 1 day of fishing.

August 22, 1988

In order to harvest additional late-run sockeye, the Panel approved the following regulations: 1) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnets commencing 12:00 p.m. (noon) August 25 for 3 days of fishing; 2) United States Areas 6, 7 and 7A open for Treaty Indian nets August 23 for 2 days of fishing; and 3) United States Area 7 and 7A open for All-Citizen nets August 23 for 2 days of fishing.

August 23, 1988

At the request of the United States Section of the Fraser Panel, the Panel approved opening United States Area 6 for All-Citizen nets August 23 for 2 days of fishing.

August 26, 1988

In order to meet in the United States catch allocation and for harvest of late-run sockeye, the Panel approved the following regulations: 1) Extension of United States Treaty Indian drift gillnets in Areas 4B, 5, 6C by 2 days making a total of 5 days for the current fishing period; 2) United States Areas 6, 7 and 7A open for Treaty Indian net fishing August 29 for 2 days; and 3) United States Areas 6, 7 and 7A open for All-Citizen net fishing August 29 for 2 days.

September 12, 1988

In the interest of harvest of Weaver Creek sockeye and for international and domestic allocation of catch, the Panel approved the opening of Canadian Area 29-3 and 4 for purse seines September 14 by announcement by Canada Department of Fisheries and Oceans.

September 16, 1988

In the interest of Weaver Creek sockeye harvest and for domestic allocation, the Panel approved opening Canadian Area 29-3, 4 and 6: a) for trollers at 8:00 a.m. September 18 for 8 hours of fishing or until 20,000 sockeye are caught, b) purse seines at or after 10:00 a.m. September 19 for 6 hours or until 185,000 sockeye are caught and c) gillnets on September 20 for 1 day of fishing.

September 23, 1988

In the interest of harvest of late-run sockeye and for domestic allocation, the Panel approved opening Canadian Area 29-3, 4 and 6 for trollers September 26 for 1 day of fishing.

September 26, 1988

In order to harvest additional sockeye and for domestic allocation, the Panel approved the extension of Canadian Area 29-3, 4 and 6 for trollers by 1 day making a total of 2 days of fishing for the current period.

October 4, 1988

In the interest of domestic allocation, the Panel approved opening Canadian Area 29-1 to 7 and 9 to 17 for gillnets October 5 for 1 day of fishing.

The Fraser River Panel relinquished regulatory control of remaining Panel Area waters effective October 12, thus completing the Panel's regulatory responsibility in Area waters for the 1988 season.

APPENDIX D:

APPENDIX TABLE 1. Commercial net catches of Fraser River sockeye salmon in Canadian Area 20 (Juan de Fuca Strait) by week-ending period for cycle years 1976-1988.

Week-ending Date	1976	1980	1984	1988
July 9	0	0	0	0
16	0	0	0	0
23	0	0	0	0
30	188,000	15,000	0	0
Aug. 6	212,000	29,000	94,000	0
13	179,000	60,000	68,000	140,000
20	48,000	0	168,000	58,000
27	12,000	2,000	204,000	21,000
Sep. 3	2,000	0	5,000	0
10	1,000	0	0	0
17	0	0	0	0
24	0	0	0	0
Oct. 1	0	0	0	0
8	0	0	0	0
TOTALS	642,000	106,000	539,000	219,000

APPENDIX TABLE 2. Commercial net and troll catches of Fraser River sockeye salmon in Canadian Areas 17,18 and 29 (Strait of Georgia and lower Fraser River) by week-ending period for cycle years 1976-1988.

Week-ending Date	1976	1980	1984	1988
July 9	0	0	0	0
16	0	0	0	1,000
23	27,000	4,000	0	0
30	96,000	0	89,000	51,000
Aug. 6	220,000	20,000	103,000	148,000
13	3,000	102,000	439,000	143,000
20	55,000	54,000	155,000	28,000
27	92,000	74,000	129,000	2,000
Sep. 3	91,000	22,000	22,000	0
10	64,000	17,000	22,000	0
17	3,000	7,000	13,000	204,000
24	2,000	7,000	4,000	152,000
Oct. 1	3,000	0	7,000	19,000
8	0	6,000	0	8,000
15	0	0	0	2,000
TOTALS	656,000	313,000	983,000	758,000

APPENDIX TABLE 3. Commercial troll landings of Fraser River sockeye salmon in Canadian Areas 121 to 127 (west coast of Vancouver Island) by week-ending period for cycle years 1976-1988.

Week-ending Date	1976	1980	1984	1988
July 9	12,000	1,000	0	0
16	34,000	1,000	0	5,000
23	16,000	1,000	0	32,000
30	40,000	3,000	1,000	5,000
Aug. 6	20,000	5,000	3,000	1,000
13	18,000	3,000	10,000	0
20	3,000	1,000	10,000	1,000
27	1,000	1,000	4,000	0
Sep. 3	0	0	1,000	0
10	0	0	0	0
17	0	0	0	0
24	2,000	0	0	0
Oct. 1	0	0	0	0
8	0	0	0	0
TOTALS	146,000	16,000	29,000	44,000

APPENDIX TABLE 4. Commercial net and troll catches of Fraser River sockeye salmon in Canadian Areas 11 to 16 (Johnstone Strait and northern Strait of Georgia) by week-ending period for cycle years 1976-1988.

Week-ending Date	1976	1980	1984	1988
July 9	6,000	6,000	0	0
16	28,000	9,000	0	1,000
23	53,000	30,000	14,000	2,000
30	145,000	58,000	86,000	8,000
Aug. 6	132,000	229,000	229,000	6,000
13	60,000	548,000	342,000	70,000
20	26,000	141,000	264,000	45,000
27	25,000	29,000	195,000	17,000
Sep. 3	11,000	7,000	73,000	0
10	5,000	1,000	0	0
17	0	0	1,000	5,000
24	0	0	3,000	0
Oct. 1	0	1,000	0	0
8	0	0	0	0
TOTALS	491,000	1,059,000	1,207,000	154,000

APPENDIX TABLE 5. Commercial net catches of Fraser River sockeye salmon in United States Areas 4B, 5, 6, 6C, 7, 7A and 7B (Juan de Fuca Strait and northern Puget Sound) by week-ending period for cycle years 1976-1988.

Week-ending Date	1976	1980	1984	1988
June 25	0	0	0	0
July 2	0	0	0	0
9	0	0	0	0
16	1,000	0	0	31,000
23	141,000	29,000	6,000	15,000
30	228,000	15,000	164,000	362,000
Aug. 6	313,000	111,000	268,000	0
13	624,000	185,000	739,000	93,000
20	4,000	111,000	331,000	106,000
27	0	0	116,000	53,000
Sep. 3	0	5,000	12,000	16,000
10	1,000	1,000	0	0
17	0	0	0	0
24	0	0	0	0
Oct. 1	0	3,000	0	0
8	0	1,000	0	3,000
TOTALS	1,312,000	461,000	1,636,000	679,000

APPENDIX TABLE 6. Catches of Fraser River sockeye salmon in the Canadian Fraser River Indian food fishery by area (Fraser River mainstem or tributary areas) for cycle years 1980-1988.

	1980	1984	1988
FRASER RIVER MAINSTEM:			
Steveston	3,983	14,277	25,387
Deas to Mission	3,870	4,019	11,073
Mission to Hope	45,507	76,787	86,392
Hope to North Bend	20,855	110,412	96,328
North Bend to Churn Creek	61,255	45,093	111,589
Churn Creek to Hixon	2,182	16,350	14,605
Above Hixon	1,000	3,019	1,290
Subtotals	138,652	269,957	346,664
TRIBUTARIES:			
Harrison/Lillooet System	11,850	10,136	8,974
Thompson System	1,000	0	174
Chilcotin System	17,022	56,874	32,279
Nechako System	13,589	15,276	16,926
Stuart System	3,853	5,286	11,005
Subtotals	47,314	87,572	69,358
TOTALS	185,966	357,529	416,022

APPENDIX TABLE 7. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1976 to 1988¹.

DISTRICT Stream/Lake	1988 Period of Peak Spawning	Estimated Number of Adult Sockeye				1988 Jacks
		1976	1980	1984	1988	
NORTHEAST						
Upper Bowron River	Sept. 2 - 6	2,250	2,894	10,461	12,780	0
STUART						
<u>Early Runs</u>						
Forfar Creek	Aug. 4 - 8	1,222	2,317	6,848	24,500	140
Gluske Creek	July 30 - Aug. 6	896	1,039	6,928	17,642	58
Kynoch Creek	Aug. 3 - 7	6,468	10,624	16,928	53,275	172
Rossette Creek	July 31 - Aug. 3	1,825	2,034	8,126	18,799	78
Takla Lake Streams	July 29 - Aug. 11	1,129	676	4,337	23,453	1,418
Trembleur Lake Streams	July 30 - Aug. 9	221	249	2,034	42,138	456
Early Stuart Totals		(11,761)	(16,939)	(45,201)	(179,807)	(2,322)
<u>Late Runs</u>						
Middle River	Sept. 22 - 26	320	165	184	1,203	602
Tachie River	Sept. 22 - 26	2,554	756	810	3,137	2,267
Late Stuart Totals*		(2,898)	(946)	(1,228)	(7,117)	(4,342)
NECHAKO						
Nadina River (Late)	Sept. 17 - 20	271	57	659	794	0
Nadina Channel (Late)	Sept. 17 - 20	1,354	3,268	6,411	7,950	0
Stellako River	Sept. 24 - 29	150,734	72,050	60,957	367,702	49
QUESNEL						
Horsefly River (Area)	Aug. 30 - Sept. 15	296	308	894	5,876	17,780
Mitchell River	Sept. 13 - 18	7	0	20	954	2,417
CHILCOTIN						
Chilko River	Sept. 30 - Oct. 7	361,752	467,812	452,618	249,989	506
Chilko Channel	Sept. 29 - Oct. 5	—	—	—	4,679	8
Chilko Lake-South End	Late Sept.	22,638	29,947	127,561	108,721	1,887
Taseko Lake	Sept. 8 - 12	630	679	2,771	11,138	0
SETON-ANDERSON						
Gates Creek	Aug. 31 - Sept. 3	2,789	4,289	2,646	17,512	1,745
Gates Channel	Aug. 31 - Sept. 3	14,344	20,799	26,253	27,401	3,699
Portage Creek	Nov. 8 - 12	1,042	1,800	1,710	1,068	368
SOUTH THOMPSON						
<u>Summer Runs</u>						
Seymour River	Aug. 30 - Sept. 3	8,306	8,309	17,172	16,781	233
Scotch Creek	Sept. 1 - 5	34	107	409	1,060	1,033
Upper Adams River	Aug. 30 - Sept. 4	40	560	3,502	7,169	0
Momich/Cayenne Creek	Aug. 24 - 29	1,998	3,345	5,854	5,912	0
<u>Late Runs</u>						
Lower Adams River	Oct. 18 - 23	4,590	2,464	4,183	4,578	52
Lower Shuswap River	Oct. 18 - 20	30	18	75	194	0
NORTH THOMPSON						
Raft River	Aug. 30 - Sept. 5	8,665	5,418	19,086	19,851	6
Fennell Creek	Aug. 24 - 29	4,090	8,437	11,021	26,927	5
HARRISON-LILLOOET						
Birkenhead River	Sept. 21 - 26	77,305	78,613	40,245	166,591	10,736
Harrison River	Nov. 12 - 15	5,130	5,092	1,267	1,544	0
Weaver Creek	Oct. 18 - 24	22,534	32,668	14,171	23,958	214
Weaver Channel	Oct. 19 - 24	27,398	41,162	45,431	25,299	135
LOWER FRASER						
Nahatlatch River	Sept. 8 - 13	1,737	1,323	1,513	16,446	160
Cultus Lake	Late Nov.	4,435	1,657	994	861	103
Upper Pitt River	Sept. 11 - 16	36,525	17,101	15,797	37,747	22
ADULTS *		781,040	829,754	922,059	1,370,339	47,960
JACKS *		42,413	18,566	9,612	47,960	
TOTALS *		823,453	848,320	931,671	1,418,299	

¹ - 1976, 1980 and 1984 data from Pacific Salmon Commission data. Estimates for 1988 are from Canada Department of Fisheries and Oceans.

* - Totals include small numbers of fish in tributaries not listed in table.