1989

Report of the Fraser River Panel to the Pacific Salmon Commission on the 1989 Fraser River Sockeye and Pink Salmon Fishing Season

Prepared by

Pacific Salmon Commission

May, 1990

REPORT OF THE
FRASER RIVER PANEL
TO THE PACIFIC SALMON COMMISSION
ON THE 1989 FRASER RIVER SOCKEYE
AND PINK SALMON FISHING SEASON

1989 PANEL MEMBERS AND ALTERNATES

UNITED STATES	CANADA
R. Turner, Chair	F. Fraser, Vice-Chair
L. Loomis	M. Forrest
R. Schmitten	M. Hunter
R. Zuanich	R. Kendall
R. Allen	J. Sam
T. Kruse	L. Wick
L. Phinney	E. Birch
R. Suggs	M. Griswold
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PACIFIC SALMON COMMISSION

MAY, 1990

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I. EXECUTIVE SUMMARY

1. The 1989 fishing season for sockeye and pink salmon was the first year of the second four-year cycle (1989-92) covered by the Treaty. The United States selected a target harvest level of 2,150,000 Fraser River sockeye salmon in 1989, out of its cumulative allocation of 7,000,000 sockeye for the 1989-92 period. In addition, a payback of 88,000 sockeye was due to United States fishermen for catch shortfalls in previous years. Pink salmon were to be shared according to the Treaty formula, with the United States share equal to a proportion of the Total Allowable Catch (3.6/14.0 x TAC). A payback of 103,000 pink salmon to the United States was planned in 1989 for a catch shortfall in 1987. Canadian commercial harvests were expected to reach 7,071,000 sockeye and 7,879,000 pink salmon.

2. Based on pre-season forecasts of 13,000,000 sockeye and 17,000,000 pink salmon, gross escapement goals for sockeye (3,511,000) and pink (6,100,000) salmon established by Canada, and on the international and domestic catch allocation goals, the Panel established a fishing regime and management plan. In this process, the Panel used the fishery simulation model to examine fishing schedule options.

3. Major alterations to historical United States fishing patterns were planned prior to the season to accommodate weekly fishing and separation of Treaty Indian and Non-Indian fisheries and Non-Indian gear types. The Panel agreed to restrict fishing time in Canadian Area 20 if chinook by-catch became severe and to limit the by-catch of Lake Washington sockeye in United States Areas 4B, 5 and 6C in response to requests from the Parties.

4. The Panel met 37 times during the season to review the progress of the runs and to adjust fishing times as needed to obtain escapements and harvest the stocks. Many of the adjustments were needed to meet the domestic allocation objectives of the Parties.

5. The total return of Fraser River sockeye amounted to 18,336,000 fish, the second largest since 1913. Catches in all areas exceeded 15,000,000 sockeye, the largest catch since 1913. Canadian commercial harvests totalled 12,152,000 sockeye while United States fleets took 2,381,000. Non-commercial harvests were 696,000 sockeye, principally in the Fraser River Indian food fishery.

6. Fraser River pink salmon returned in numbers slightly below the forecast with 15,569,000 total fish, the third largest run on record. Commercial catches amounted to 8,172,000 fish, 6,165,000 in Canada and 2,007,000 in United States waters.

7. Monitoring of the run provided data which were used to update the estimated run sizes during the season. Several adjustments occurred in the estimates for both species and allowed the Panel to modify fishing plans to achieve harvest objectives in the Panel Area. The timing of peak summer-run sockeye arrival was approximately three weeks later than normal, which created difficulties in estimating stock abundances and timing. The arrival of pink salmon was also later than normal, thereby minimizing the overlap between the sockeye and pink salmon runs and alleviating potential problems in managing the harvest of these species.

8. Racial analyses of sockeye salmon using scale data correctly identified the major stocks, but low relative abundance and confounded scale data created difficulties in identifying minor stocks during the passage of Quesnel and Late Stuart sockeye. The Quesnel Lake area stocks produced approximately 11,694,000 sockeye, the largest on record and probably comparable to the early 1900's dominant year returns. Late Stuart sockeye production was 3,203,000 fish, also the largest on record for this group and 62% above the previously largest return in 1985.

9. The stock composition of pink salmon catches were determined in 1989 by use of genetic stock identification (GSI) data. Identification of Fraser River pink salmon

catches in mixed-stock fisheries in southern areas (Washington and southern British Columbia) and in northern fisheries (central and northern British Columbia and southeastern Alaska) was successful due to the reconstructed baseline. Development of bias correction techniques is anticipated to improve racial catch estimates for pink salmon.

10. Spawning escapement goals for Early Stuart sockeye were exceeded, while early summer-run, summer-run and late-run stock escapements were less than desired. Escapements totalled 3,060,000 adult sockeye versus a goal of 3,300,000 (7% deviation). Pink salmon escapements reached 7,189,000, well over the goal of 6,000,000 (20% deviation).

11. International and domestic catch allocations of sockeye salmon were near the objectives established by the Parties. The United States catch was 144,000 larger than the goal set prior to the season, primarily as a result of an unexpected catch of 133,000 Fraser River sockeye in Alaska District 104 (estimate subject to review). The pink salmon catch in United States waters was short of the allocation by 241,000 fish, which will be compensated for in future years.

12. With the 1989 catch, United States catches in the 1990-92 period shall not exceed 4,706,000 sockeye and 5,296,000 pink salmon.

II. FRASER RIVER PANEL

Under the terms of the Pacific Salmon Treaty, the responsibility of the Fraser River Panel is to manage the fisheries that target on Fraser River sockeye and pink salmon within the Panel Area (Figure 1). The annual process begins with the Panel recommending a pre-season fishing regime and a management plan for Panel Area waters to the Pacific Salmon Commission. The management plan is based on abundance forecasts and escapement goals for Fraser River sockeye and pink salmon stocks provided by Canada Department of Fisheries and Oceans (DFO), international allocation goals set out in the Treaty, domestic allocation goals set by each country and management concerns for other stocks and species also identified by each country.

In-season management of Panel Area fisheries is under the direct control of the Panel. To achieve the Parties' objectives, the Panel uses commercial and test fishing data and various analyses from the Commission staff to modify the fishing times set out in the management plan. In 1989, the Panel exercised its in-season regulatory mandate in the Panel Area only for the net fisheries, the Canadian inside (Strait of Georgia) troll fishery and the Washington Non-Indian coastal troll fishery, as recommended by the Parties.

During the brief, four-year history of the Panel, achievement of the domestic allocation goals of Canada and the United States has been a major focus of in-season management. Generally, the Panel has successfully implemented the national directives for domestic allocation of the allowable catch while achieving the goals for resource conservation (escapement) and international allocation. When trade-offs among these three objectives are necessary, however, resource conservation and international allocation goals take precedence over domestic allocation objectives.

The Panel is modifying its approach to the management of Panel Area fisheries in response to increasing complexities due to more elaborate domestic allocation schemes and greater consideration of species other than sockeye and pink salmon. Important in this process is the Fraser River

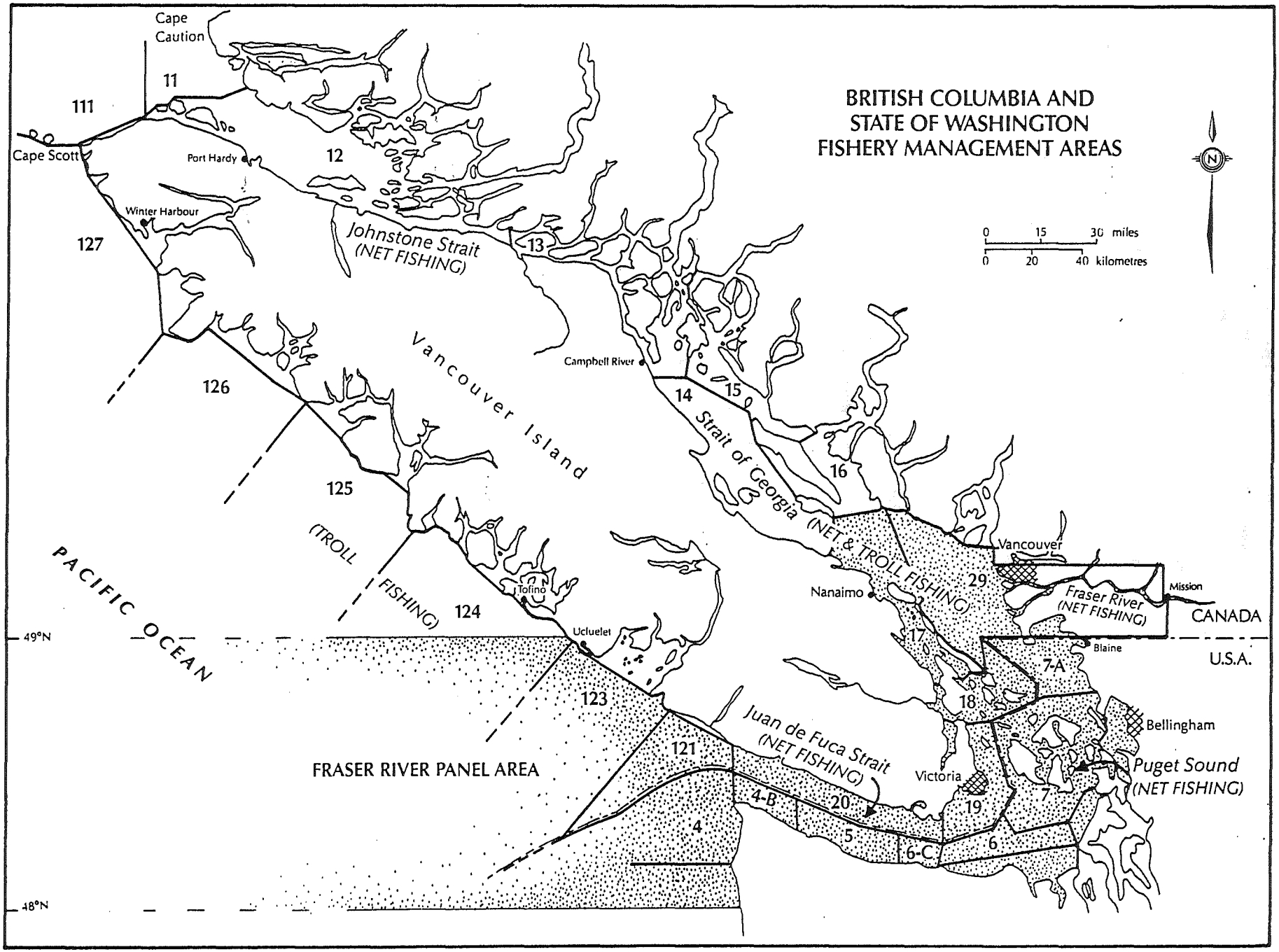

FIGURE 1. Fishery management areas in the Fraser River Panel Area, along Canada's south coast and in United States waters. The type of fishery (net or troll) that operates in each area is also indicated.

Panel Technical Committee, which provides the Panel with data and advice concerning incidentally harvested species and stocks. Developing internationally agreed-upon management plans for other species intercepted in south coast regions is the responsibility of the Southern Panel and Commission, with the actual management being the responsibility of the countries.

Prior to the 1989 fishing season, the Panel asked the national agencies responsible for managing species and stocks of salmon that occur in Panel Areas to identify their management concerns. Responses from Canadian and United States agencies resulted in Commission participation in programs to monitor the by-catch of chinook salmon in Canadian Area 20 and Lake Washington sockeye salmon in United States Areas 4B, 5 and 6C.

Input to the decision-making process has been primarily through the national sections of the Panel where most user groups are represented. The Panel membership during the 1989 season is shown on the front cover of this report. Membership for the upcoming 1990 season, as of May, 1990, is:

CANADA

Members:

Mr. F. Fraser, 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

Ms. M. Williams
Outside troll fishermen

UNITED STATES

Members:

Mr. R. Zuanich, Vice-Chair
Commercial salmon fishing industry

Mr. D. Austin
Chief, Harvest Management
Washington Department of Fisheries

Ms. L. Loomis
Treaty Indian tribes

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

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

III. INTRODUCTION

Management goals for Panel Area fisheries differed in 1989 from those in the previous four years (1985-1988), because 1989 initiated the second four-year cycle (1989-1992) covered in the Treaty, where a new allocation scheme would be in effect. Catches during the first cycle were allocated to fishermen of Canada and the United States according to a formula described in Annex IV, Chapter 4 of the Treaty. In this formula, the national allocations were calculated as a proportion of the TAC and, therefore, they changed as the TAC increased or decreased in response to run-size updates throughout the season. However, during the second four-year cycle, the cumulative catch of Fraser River sockeye and pink salmon by United States fishermen is not to exceed 7.0 million sockeye and 7.2 million pink salmon. The United States determines its catch goal each year, with the constraints that the total catch during 1989-1992 does not exceed the above limits and that the United States catch in any one season does not exceed a specified percentage of the TAC.

The pre-season forecasts of run size for Fraser River sockeye and pink salmon were 13,000,000 and 17,000,000 fish, respectively. These forecasts were among the factors used by the Panel to determine the commercial catch allocations for Canadian and United States fishermen.

To help stabilize annual catches during the 1989-1992 period, the United States set its sockeye catch goal for 1989 at 2,150,000 fish. This was fewer fish than they could have declared based on the pre-season estimate of TAC. Pink salmon were to be shared according to the proportional allocation formula in the Treaty (i.e., 3.6/14.0 x TAC), because the run-size forecast was below that which would have numerically limited the United States catch. Paybacks to the United States for catch shortfalls of both sockeye and pink salmon in prior years added to the United States allocations. Adjusted pre-season goals were for catches of 2,238,000 sockeye and 2,926,000 Fraser River pink salmon in United States waters. Canadian commercial fishery allocations were estimated at 7,071,000 sockeye and 7,879,000 pink salmon.

Fraser River sockeye were more abundant than forecast, totalling 18,336,000 fish compared to the forecast 13,000,000 fish. The United States catch (2,382,000) was larger than the pre-season goal, due to unexpected catches of Fraser River sockeye in southeastern Alaska, which count against the United States share. Canadian commercial catches of Fraser sockeye reached 12,152,000 fish, the largest in Canada since 1901. Fraser River pink salmon harvests in United States (2,007,000) and Canadian (6,165,000) waters were lower than the pre-season expectations due to a smaller-than-forecast run: 15,569,000 fish instead of the 17,000,000 fish forecast.

The 1989 Fraser River sockeye salmon run was a large return of fish that were smaller in body size (5.5 lb) and later in migration timing than normal. This run also had a high rate of diversion via Johnstone Strait (Figure 2), related to the run reaching continental waters (i.e., "landfall") farther north than usual. These characteristics were also evident in the brood-year return of these stocks in 1985. Oceanographic conditions along the coast of British Columbia and Washington most likely affected the landfall and timing of migration.

Canadian domestic allocation objectives for the catch of Fraser River sockeye and southerly migrating pink salmon by user group and gear type were provided to the Panel before the season opened. Catches of these fish were to be counted wherever they occurred in British Columbia waters. United States catches of Fraser sockeye and pink salmon were to be divided between Treaty Indian and Non-Indian fishermen in Washington State waters according to a formula that included paybacks for prior-year shortfalls. United States Non-Indian sockeye catches were to be allocated by gear type, while Treaty Indian catches were to allocated by area.

Successful allocation of the sockeye catches in 1989 was accomplished through intense management of the fisheries in Panel Area waters. The Panel regulation of Canadian fisheries was limited to net fisheries in the Panel Area and the inside troll fishery in the southern Strait of

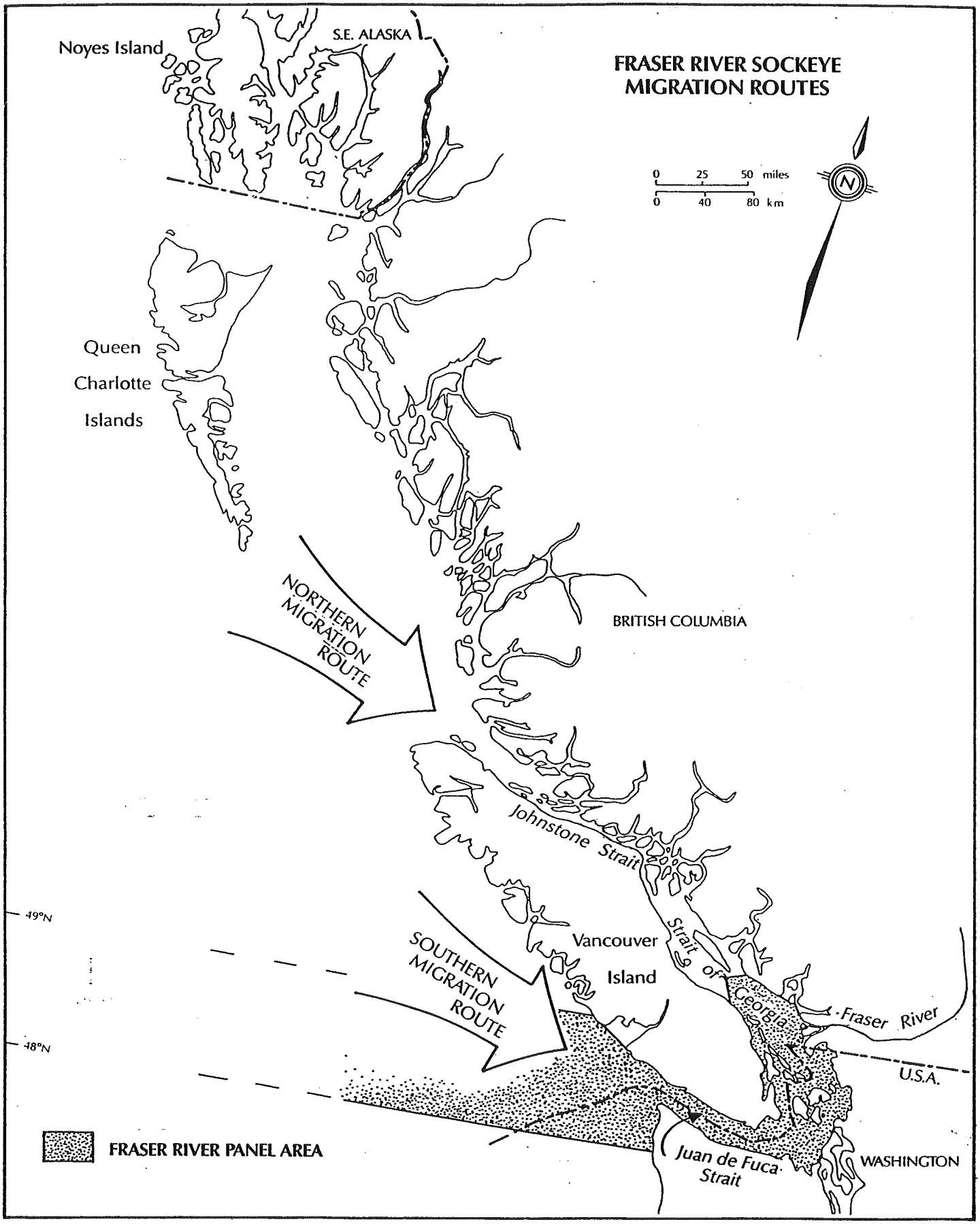

FIGURE 2. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migrating to the Fraser River.

Georgia. Much of the Canadian catch of Fraser River sockeye and pink salmon occurs outside the Panel Area or in Panel areas that Canada chose to regulate (including the outside troll fishery in all coastal areas).

In the four years of Fraser River Panel regulatory responsibility (1986-89), domestic allocation objectives have been a focus of in-season management. Coordination of management actions inside the Panel Area by the Panel and outside the Area by Canada has produced generally well-balanced annual catches in Canadian fisheries (Table 1).

TABLE 1a. Canadian catches of Fraser River sockeye salmon by gear, compared with domestic allocation goals for 1986-1989.

		Allocation		Actual		Deviation	
Year	Gear Type	Number of Fish	%	Number of Fish	%	Number of Fish	%
1986	Inside Troll	301,000	3.4%	279,000	3.2%	(22,000)	-0.2%
	Outside Troll	1,797,000	20.5%	1,831,000	20.9%	34,000	0.4%
	Purse Seine	4,100,000	46.8%	4,037,000	46.0%	(63,000)	-0.8%
	Gillnet	2,566,000	29.3%	2,617,000	29.9%	51,000	0.6%
	Total	8,764,000	100.0%	8,764,000	100.0%	0	0.0%
1987	Inside Troll	81,000	2.5% *	95,000	2.9%	14,000	0.4%
	Outside Troll	355,000	11.0% *	555,000	17.2%	200,000	6.2%
	Purse Seine	1,668,000	51.8% *	1,544,000	48.0%	(124,000)	-3.8%
	Gillnet	1,120,000	34.8% *	1,030,000	31.9%	(90,000)	-2.8%
	Total	3,224,000	100.0%	3,224,000	100.0%	0	0.0%
1988	Inside Troll	47,000	4.0%	81,000	6.9%	34,000	2.9%
	Outside Troll	56,000	4.8%	49,000	4.2%	(7,000)	-0.6%
	Purse Seine	621,000	52.8%	623,000	52.9%	2,000	0.1%
	Gillnet	452,000	38.4%	423,000	36.0%	(29,000)	-2.4%
	Total	1,176,000	100.0%	1,176,000	100.0%	0	0.0%
1989	Inside Troll	243,000	2.0%	257,000	2.1%	14,000	0.1%
	Outside Troll	1,215,000	10.0%	1,417,000	11.7%	202,000	1.7%
	Purse Seine	6,684,000	55.0%	6,480,000	53.3%	(204,000)	-1.7%
	Gillnet	4,010,000	33.0%	3,998,000	32.9%	(12,000)	-0.1%
	Total	12,152,000	100.0%	12,152,000	100.0%	0	0.0%

* Approximate mid-points of the 1987 sockeye salmon allocations, which were the following ranges of percentages:

Inside Troll:	1.5% - 3.5%
Outside Troll:	10.5% - 11.5%
Purse Seine:	51.5% - 52.0%
Gillnet:	34.5% - 35.0%

TABLE 1b. Canadian catches of southerly migrating pink salmon by gear, compared with domestic allocation goals for 1987 and 1989.

		Allocation		Actual		Deviation	
Year	Gear Type	Number of Fish	%	Number of Fish	%	Number of Fish	%
1987	Inside Troll	153,000	4.0%	143,000	3.7%	(10,000)	-0.3%
	Outside Troll	1,112,000	29.0%	1,318,000	34.4%	206,000	5.4%
	Purse Seine	2,223,000	58.0%	2,013,000	52.5%	(210,000)	-5.5%
	Gillnet	345,000	9.0%	359,000	9.4%	14,000	0.4%
	Total	3,833,000	100.0%	3,833,000	100.0%	0	0.0%
1989	Inside Troll	369,000	4.0%	396,000	4.3%	27,000	0.3%
	Outside Troll	2,679,000	29.0%	2,589,000	28.0%	(90,000)	-1.0%
	Purse Seine	5,358,000	58.0%	5,656,000	61.2%	298,000	3.2%
	Gillnet	831,000	9.0%	596,000	6.5%	(235,000)	-2.5%
	Total	9,237,000	100.0%	9,237,000	100.0%	0	0.0%

NOTE: ( ) indicate a negative number or a catch shortfall.

Panel regulated fisheries in United States waters also have had well balanced domestic allocations of the two species between Treaty Indian and Non-Indian fishermen in Washington State waters (Table 2). Shortfalls in the allocation of catch between Treaty Indian and Non-Indian fishermen are compensated for in succeeding years. Catch allocation of sockeye salmon by gear type for Non-Indian fishermen in Washington waters was added to the Panel's responsibilities in 1989. Although the balance was imperfect in 1989, a payback provision exists for this allocation scheme, as well.

TABLE 2. United States Treaty Indian and Non-Indian allocations and catches* of Fraser River sockeye and pink salmon in Washington State waters for 1986-1989.

		Sockeye Salmon Catch					
		Allocation		Actual		Deviation	
Year	User Group	Number of Fish	%	Number of Fish	%	Number of Fish	%
1986	Treaty Indian	1,367,000	50.0%	1,351,000	49.4%	(16,000)	-0.6%
	Non-Indian	1,367,000	50.0%	1,383,000	50.6%	16,000	0.6%
	Total	2,734,000	100.0%	2,734,000	100.0%	0	0.0%
1987	Treaty Indian	963,500	50.0%	962,000	49.9%	(1,500)	-0.1%
	Non-Indian	963,500	50.0%	965,000	50.1%	1,500	0.1%
	Total	1,927,000	100.0%	1,927,000	100.0%	0	0.0%
1988	Treaty Indian	339,500	50.0%	377,000	55.5%	37,500	5.5%
	Non-Indian	339,500	50.0%	302,000	44.5%	(37,500)	-5.5%
	Total	679,000	100.0%	679,000	100.0%	0	0.0%
1989	Treaty Indian	1,124,500	50.0%	1,123,000	49.9%	(1,500)	-0.1%
	Non-Indian	1,124,500	50.0%	1,126,000	50.1%	1,500	0.1%
	Total	2,249,000	100.0%	2,249,000	100.0%	0	0.0%
1986-1989	Treaty Indian	3,794,500	50.0%	3,813,000	50.2%	18,500	0.2%
	Non-Indian	3,794,500	50.0%	3,776,000	49.8%	(18,500)	-0.2%
	Total	7,589,000	100.0%	7,589,000	100.0%	0	0.0%

		Pink Salmon Catch					
		Allocation		Actual		Deviation	
Year	User Group	Number of Fish	%	Number of Fish	%	Number of Fish	%
1987	Treaty Indian	669,000	50.0%	617,000	46.1%	(52,000)	-3.9%
	Non-Indian	669,000	50.0%	721,000	53.9%	52,000	3.9%
	Total	1,338,000	100.0%	1,338,000	100.0%	0	0.0%
1989	Treaty Indian	1,003,500	50.0%	1,059,000	52.8%	55,500	2.8%
	Non-Indian	1,003,500	50.0%	948,000	47.2%	(55,500)	-2.8%
	Total	2,007,000	100.0%	2,007,000	100.0%	0	0.0%
1987-1989	Treaty Indian	1,672,500	50.0%	1,676,000	50.1%	3,500	0.1%
	Non-Indian	1,672,500	50.0%	1,669,000	49.9%	(3,500)	-0.1%
	Total	3,345,000	100.0%	3,345,000	100.0%	0	0.0%

* Catches of Fraser River sockeye and pink salmon in fisheries in Alaska District 104 are not included.

IV. MANAGEMENT ACTIONS

A. Pre-season TAC and Goals

Canada Department of Fisheries and Oceans (DFO) provided the Commission with pre-season forecasts of abundance and goals for spawning escapement for stocks of Fraser River sockeye and pink salmon (Appendix A). Based on the pre-season forecast of a total run of 13,000,000 sockeye, the gross escapement goal was set at 3,511,000 fish, which included

500,000 fish for the Fraser River Indian food fishery and 3,011,000 sockeye on the spawning grounds. Similarly, the forecast run of 17,000,000 pink salmon included a gross escapement goal of 6,100,000 pinks: 100,000 fish for the Indian food fishery and a spawning escapement of 6,000,000 fish.

The pre-season estimate of TAC for Fraser River sockeye salmon was 9,711,000 fish (Table 3). The United States elected to harvest 2,150,000 of their total allocation of 7,000,000 sockeye for the years 1989-92, plus a payback of 88,000 fish for a total of 2,238,000 sockeye. This catch goal was not to be adjusted unless the total run size was less than 11,900,000 sockeye. The Canadian share of the total run was 7,722,000 sockeye, including 249,000 sockeye that were a benefit for allowing 78,000 sockeye from its TAC in 1985 to spawn. From this share, Canada allocated 511,000 fish for extra spawning escapement and 140,000 fish to augment the catch in Indian food fisheries, leaving 7,071,000 sockeye salmon to be caught in commercial fisheries.

TABLE 3. Pre-season estimates of the total allowable catch (TAC) and United States and Canadian allocations of Fraser River sockeye and pink salmon in 1989.

	Sockeye	Pink
TOTAL ALLOWABLE CATCH		
Total Run Size	13,000,000	17,000,000
Canadian Add-on Benefit	249,000	0
Total Available to Share:	12,751,000	17,000,000
Deductions		
Treaty Escapement	2,500,000	6,000,000
Jack Escapement	75,000	–
Inadvertant Escapement	–	–
Fraser River Indian Food Fishery	400,000	–
Test Fishing	65,000	20,000
Total Deductions	3,040,000	6,020,000
Total Allowable Catch:	9,711,000	10,980,000
UNITED STATES		
Initial Allocation	2,150,000 *	2,823,000 **
Payback	88,000	103,000
United States Share:	2,238,000	2,926,000
CANADA		
TAC - United States Share	7,473,000	8,054,000
Escapement Add-on Benefit	249,000	0
Canadian Share:	7,722,000	8,054,000

* Sockeye allocation in 1989 was the amount requested by the United States as part of its 1989–1992 cumulative total, which may not exceed 7,000,000 fish.

** Pink allocation in 1989 was calculated by the formula (TAC x 3.6/14.0).

The TAC of Fraser River pink salmon was forecast to be approximately 10,980,000 fish: 8,054,000 pink salmon for the Canadian allocation and 2,926,000 fish for the United States. The United States share included a payback of 103,000 pink salmon. Canadian commercial catches were expected to total 7,879,000 pink salmon while Fraser River Indian food fishery and sport catches were projected to reach 100,000 and 75,000 fish, respectively.

The domestic allocation goals in Canada for Fraser River sockeye and for southerly migrating pink salmon (including Fraser River, Johnstone Strait, Strait of Georgia and United States (Puget Sound) stocks), as established by the Minister of Fisheries, were:

	Sockeye Salmon	Pink Salmon
inside troll	2%	4%,
outside troll	10%	29%,
purse seine	55%	58%,
and gillnet	33%	9%.

Domestic allocation goals in the United States were for Treaty Indian and Non-Indian fishermen to share the catch of Fraser River salmon equally, except for a payback of sockeye salmon to Non-Indian fishermen for their 1988 catch shortfall and a payback of pink salmon to Treaty Indian fishermen for a catch shortfall in 1987. The sockeye salmon catch by Non-Indian fishermen was to be allocated as follows:

	Sockeye Salmon
purse seine	54%,
gillnet	41%,
and reef net	5%.

The Treaty Indian catch of Fraser River sockeye salmon was to be allocated by area: 80,000 sockeye in Areas 4B, 5 and 6C, and 1,025,000 sockeye in Areas 6, 7 and 7A. No allocation goals were set for catches of pink salmon within the Treaty Indian and Non-Indian shares, except for a harvest guideline of 145,000 fish for the Non-Indian troll fishery in Areas 3 and 4.

B. Pre-season Regulations

Using the stated goals and objectives of the Parties and the forecasts of run size and migration timing, a mathematical model that simulates the gauntlet fisheries in south coast areas was used to evaluate different fishing schedules. In establishing a pre-season fishing plan, the Fraser River Panel considered the simulated fishing schedules that best achieved the escapement and allocation goals. At the time these simulations were done, the expectations for the 1989 runs of Fraser River sockeye and pink salmon were for large run sizes, relatively early arrival time in coastal areas and low rates of diversion through Johnstone Strait.

The primary targets for the sockeye fishery in 1989 were the Early Stuart, Quesnel Lake (Horsefly River) and Late Stuart stock groups that were forecast to return in abundances of 1,100,000, 9,100,000 and 1,300,000 sockeye, respectively. The sockeye fishery was to focus initially on the Early Stuart group, which was forecast to peak in Area 20 during the first week of July. Later, the fishery was to target on the very large mid-summer run, consisting primarily of Quesnel and Late Stuart sockeye. These latter stocks were expected to peak in Area 20 in late July and, therefore, would constitute most of the sockeye expected in Panel Areas during late July through mid August. The abundance of late-run sockeye stocks was expected to be too low to support directed fisheries, although they would be harvested incidentally in fisheries directed at pink salmon.

The peak in pink salmon abundance in Juan de Fuca Strait was expected to occur during mid to late August, approximately one week earlier than normal, resulting in a separation between the peak abundances of sockeye and pink salmon of 2 to 4 weeks in this area.

The fishing regime for the Panel Area was adopted by the Fraser River Panel on May 4, 1989. The Commission accepted this plan and submitted it to the Parties for approval. Panel Areas were to be "CLOSED UNLESS OPENED": closed by the pre-season Regulations of the Commission (Appendix B) and opened only by in-season Orders of the Fraser River Panel (Appendix C).

In the pre-season management plan, adopted on June 14, the proposed fishing times by week (Tables 4 and 5) for Panel controlled fisheries called for closures of all areas prior to June 25 in

TABLE 4. Proposed versus actual fishing times by gear type (days) in major Canadian net fisheries in the Fraser River Panel Area.

	Area 20			Area 29	
Date	PS, GN* Proposed	PS Actual	GN Actual	GN Proposed	GN Actual
June 18–24	Closed	Closed	Closed	Closed	Closed
June 25–July 1	Closed	Closed	Closed	Closed	Closed
July 2–8	Closed	Closed	Closed	2	1
July 9–15	Closed	Closed	Closed	2	2
July 16–22	2	1	1	2	1
July 23–29	2	Closed	Closed	2	Closed
July 30–Aug. 5	3	3	3	2	2
Aug. 6–12	2	2	2	2	2
Aug. 13–19	2	4	4	2	2
Aug. 20–26	2	3	4	1	2
Aug. 27–Sept. 2	2	3	4	Closed	3
Sept. 3–9	1	1	3	Closed	Closed
Sept. 10–16	Closed	1	2	Closed	Closed
Sept. 17–23	Relinq.	Relinq.	Relinq.	Closed	Closed
Sept. 24–30				Closed	2
Oct. 1–7				Closed	Closed
Oct. 8–14				Closed	Closed
Oct. 15–21				Relinq.	Relinq.
Total	16	18	23	15	17

* PS – purse seine, GN – gillnet.

TABLE 5. Proposed versus actual fishing times by area [periods (hours)] in major United States net fisheries in the Fraser River Panel Area.

	Treaty Indian				Non-Indian *	
	Areas 4B, 5 and 6C		Areas 6, 7 and 7A		Areas 6, 7, 7A	
Date	Proposed	Actual	Proposed	Actual	Proposed	Actual
June 18–24	Closed	Closed	Closed	Closed	Closed	Closed
June 25–July 1	4 (96)	2 (48)	Closed	Closed	Closed	Closed
July 2–8	6 (144)	1 (16)	1 (16)	1 (16)	1 (14)	1 (14)
July 9–15	6 (144)	Closed	1 (16)	Closed	1 (14)	1 (8)
July 16–22	6 (144)	2 (59)	1 (16)	1 (16)	1 (14)	1 (14)
July 23–29	6 (144)	Closed	1 (16)	Closed	1 (14)	Closed
July 30–Aug. 5	6 (144)	3 (72)	1 (16)	1 (19)	1 (14)	1 (24)
Aug. 6–12	6 (144)	1 (12)	1 (16)	2 (40)	1 (14)	1 (33)
Aug. 13–19	6 (144)	1 (9)	1 (16)	1 (9)	1 (14)	1 (15)
Aug. 20–26	7 (156)	1 (12)	2 (51)	1 (12)	1 (28)	1 (8)
Aug. 27–Sept. 2	7 (168)	4 (114)	4 (88)	1 (30)	1 (27)	Closed
Sept. 3–9	7 (168)	6 (156)	3 (75)	2 (51)	1 (28)	1 (28)
Sept. 10–16	Closed	5 (128)	Closed	2 (34)	Closed	2 (54)
Sept. 17–23	Relinq.	Relinq.	Closed	1 (29)	Closed	1 (28)
Sept. 24–30			Closed	Closed	Closed	1 (27)
Oct. 1–7			Relinq.	Relinq.	Relinq.	Relinq.
Total	67 (1,596)	26 (626)	16 (326)	13 (256)	10 (181)	12 (253)

* Periods and hours are the sum for purse seine and gillnet gear in the area.

United States waters, and July 2 in Canadian waters. The proposed fishing times per week during the sockeye and pink salmon fishing seasons were fairly constant in most areas. United States Treaty Indian fisheries for pink salmon were planned to be more extensive to ensure that catch goals would be reached.

The Panel's management of Canadian fisheries differed from previous years in several ways. First, DFO requested that the Panel manage the purse seine fisheries for sockeye and pink salmon in Canadian Area 20 such that the by-catch of chinook salmon was controlled. Second, Canada provided the Panel with the option of varying the number of gillnet fishing days in Area 20 to better achieve domestic allocation goals. Gillnet catches of pink salmon were expected to be limited by Canada's desire to minimize fishing in Area 29 during September to accommodate the management needs of other species of salmon, particularly Harrison River chinook, which occur as by-catch in late-season Area 29 sockeye and pink salmon fisheries. Also, Commission staff were to participate in meetings of the Inside Troll Committee and recommend the weekly fishing schedules to the Panel for inside troll fisheries in Panel Areas.

The United States fishing pattern during the sockeye fishery changed dramatically compared to previous years: 1) the duration of fishing periods was shortened, 2) fishing periods for Treaty Indian and Non-Indian fishermen were separated, and 3) fishing periods for Non-Indian purse seines, gillnets and reef nets were separated, with gillnets fishing during daylight hours. The United States implemented these changes in 1989 in response to the management requirements of the four-year catch ceiling. The objectives were to reduce weekly exploitation rates on sockeye, spread the catch over the entire period of sockeye migration and to provide weekly openings on separate days for both Treaty Indian and Non-Indian fishermen. This was the first major revamping of this fishery since the implementation of United States versus Washington (equal division of the catch between Treaty Indian and Non-Indian fleets). In addition, the Panel regulated the Non-Indian coastal troll fishery for pink salmon to ensure that troll fishermen shared in the harvest of Fraser River pink salmon.

United States Non-Indian fishermen were to be restricted from fishing in Areas 4B, 5 and 6C in early July to reduce the interception of Lake Washington sockeye, which were identified as a conservation concern. Treaty Indian fishermen whose "usual and accustomed" fishing areas included Areas 4B, 5 and 6C were permitted to fish in those areas. The Panel agreed to monitor the catches of Lake Washington sockeye and to limit the by-catch to 2,600 fish.

C. In-season Regulations

To achieve the goals for spawning escapement of Fraser River sockeye and pink salmon, and for international and domestic catch allocation, fishing plans were adjusted each week throughout the season. The Fraser River Panel conferred, in-person and by telephone conference calls, 37 times between June 23 and October 6 to consider and enact regulations. The resulting schedule of fishing is summarized in the Orders of the Fraser River Panel (Appendix C).

To begin harvesting the Early Stuart run, the season opened with a Treaty Indian fishery in United States Areas 4B, 5 and 6C on June 29. Gillnet fishing in Canadian Area 29 and United States Non-Indian reef net fishing in Areas 7 and 7A was opened on July 3. On July 5, United States Areas 6, 7 and 7A were opened to Treaty Indian fishing. Areas 7 and 7A were opened to Non-Indian gillnet and purse seine fishermen on July 6.

Due to modest catches between July 3 to 6, the run-size estimate for Early Stuart sockeye was reduced to 900,000 (200,000 less than the pre-season forecast) on July 7. Because United States fishermen had already caught their share of this smaller abundance, the United States Panel Area was initially closed for the week of July 9. However, a very large catch in Canadian Area 29 on July 10-11 prompted the Panel to increase the run-size estimate for Early Stuart sockeye to 1,200,000 fish on July 12. United States Non-Indian fisheries were opened on July 13 to harvest the small remaining allocation generated by the run-size update.

During the week of July 23, the apparent late arrival (7-10 days) of the Quesnel Lake group and United States concerns about coho salmon by-catch led to the closure of Canadian Area 20. Area 29 and United States waters were closed because of concerns about the escapement of Early Stuart sockeye. During this period Quesnel sockeye should have been arriving in large numbers. The lack of fish caused the Panel to be concerned that the total abundance of summer-run sockeye stocks was possibly lower than expected. However, to harvest the Late Stuart sockeye that appeared to be returning in the forecast abundance, the Panel opened all net fishing areas the following week (July 30).

By August 4, the abundances of Quesnel and Late Stuart sockeye salmon were increasing in Panel waters. However, these stocks appeared to be either very late in arriving or less abundant than predicted. A high initial diversion rate (50%) of these stocks through Johnstone Strait meant that availability of fish to United States fishermen was low. To achieve the international allocation in these circumstances, it was necessary to increase fishing time in United States waters (Areas 6, 7 and 7A) during the week of August 6. The United States catch was 57% complete at the end of this week.

Based on the magnitudes of commercial catches in net and troll fisheries, the Panel concluded on August 11 that the return of the major summer-run sockeye stocks, although very late, would at least equal the pre-season forecast of 11,000,000 fish. Also, the diversion of sockeye through Johnstone Strait was decreasing, thereby increasing the availability of the abundant Quesnel Lake sockeye to United States fishermen. As a consequence of these factors, fisheries in net fishing areas were opened to both Canadian and United States fishermen during the week of August 13.

Record-level purse seine catches of Fraser River sockeye salmon occurred in Canadian Area 20 and Areas 12 and 13 during the week of August 13. These catches, in addition to the continued strength in troll test fishing catches and a substantial gross escapement past Mission, convinced the Panel to upgrade the run-size estimate of Fraser River sockeye to 20,000,000 fish on August 18. This update increased the Canadian allocation to 13,700,000 sockeye, and resulted in Canada increasing the gross escapement goal to 3,800,000 sockeye to ensure adequate spawning escapement to the Horsefly River.

Canadian Area 29 was scheduled to open on Saturday, August 19, to harvest additional summer-run fish. The opening, however, was cancelled due to a contaminant spill into the lower Fraser River on August 18. Based on water-quality tests by DFO, the fishery was cleared to proceed on August 20. United States areas were opened, except to Non-Indian purse seine and reef net fishermen, who had nearly achieved their sockeye allocations the previous week.

On August 22 the Panel reduced the run-size estimate of Fraser River sockeye salmon to 19,000,000 fish, after learning that catches in the Area 20 purse seine fishery on August 17 had been overestimated. However, fishing was scheduled for the week of August 27 to achieve international and domestic catch objectives. Pink salmon catches were increasing in Area 20 and Johnstone Strait by this time, but were not expected to peak in Area 20 until after September 5, 8 to 10 days later than normal.

Due to a more rapid decline than expected in sockeye catches in Juan de Fuca and Johnstone Straits during the week of August 27, the Panel further reduced the estimate of sockeye run size to 18,000,000 fish on September 1. Concern was expressed that the gross escapement goal of 3,800,000 fish would not be achieved. The Panel subsequently adjusted the run-size estimate of Fraser River sockeye salmon to 17,800,000 on September 8. No further fisheries were targeted on sockeye salmon after this date because of weak returns of late-run sockeye stocks.

Moderate catches and low CPUE's of Fraser River pink salmon during the week of August 27 caused the Panel to reduce the estimated run size to 13,000,000 fish, 4,000,000 less than the pre-season forecast. This reduction resulted in a TAC of about 7,000,000 pink salmon. Fisheries occurred during the week of September 3 to fulfil objectives for international and domestic allocation.

Catches of Fraser River pink salmon were better than expected during the week of September 3, leading the Panel to revise the run-size estimate to 15,000,000 salmon. The timing of the pink salmon run appeared to be approaching the latest on record. Troll fishing was permitted in Canadian Area 20 when the run-size upgrade generated a larger allocation for outside trollers. However, both the effort and success of this fishery were low.

A rapid decline in pink salmon abundance in Juan de Fuca Strait resulted in the Panel reducing the estimated run size to 14,000,000 Fraser River pinks on September 15. The Panel relinquished control of Canadian Area 20 and United States Areas 4B, 5, 6A and 6C on September 17.

The continued presence of pink salmon in United States waters allowed fishing through to September 26. However, United States allocation goals were not achieved because of a more rapid-than-expected decline in pink salmon abundances and catches. Gillnet fisheries in Canadian Area 29 on September 25 and 27 failed to achieve harvest objectives, leading to a cessation of fishing. On September 29, the Panel adjusted the run-size estimate to 14,500,000 Fraser River pink salmon, although there were few pink salmon available to harvest by this time. The estimate of Fraser River sockeye run size was revised to 18,000,000. The Panel relinquished regulatory control of all remaining areas on October 1, except for Canadian Area 29 and the area northwest of the Iwersen's Dock Line in United States waters. Final relinquishment of regulatory control of Area 29 took place on October 16 as scheduled.

V. CATCH SUMMARY

A. Sockeye Salmon

The 1989 run of Fraser River sockeye salmon was the largest since 1958 and the second largest since 1913. The total return of 18,336,000 fish was 41% larger than the pre-season forecast of 13,000,000 fish. This cycle has increased dramatically in abundance since 1981 (Figure 3).

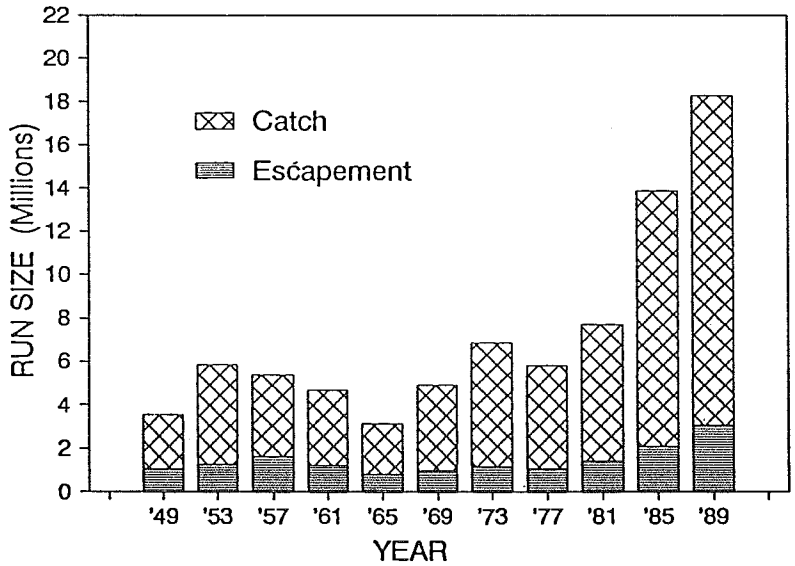

FIGURE 3. Catch, escapement and total run sizes for the 1989 cycle of Fraser River sockeye salmon for cycle years 1949-1989.

This unexpectedly large return was reflected mostly in the catch taken - 15,229,000 fish (Table 6) compared to the pre-season forecast of 9,914,000. Spawning escapement (3,107,000), in contrast, was only 21,000 fish larger than the pre-season goal of 3,086,000 sockeye salmon

(including jack sockeye). The catch of Fraser River sockeye was 14,533,000 fish in commercial fisheries and 696,000 fish in non-commercial fisheries. The total catch was the largest since 1913, and had a landed value of approximately $160 million (Canadian dollars).

Fish size was smaller than normal for the cycle with a mean weight of 5.5 lb (2.5 kg) per fish. Fish of several stocks, including Late Stuart and Horsefly River sockeye, were the smallest on record.

TABLE 6. Preliminary estimates for total fishery catches of Fraser River sockeye salmon during the 1989 fishing season, by country and area.

	Number of Fish	% of Run
COMMERCIAL CATCH		
CANADA		
Fraser River Panel Area		
Areas 121-124 Troll	463,000	
Area 20 Net	3,286,000	
Areas 17-18 and 29 Troll	65,000	
Area 29 Net	2,420,000	
Total	6,234,000	34.0%
Non-Panel Areas		
Areas 1-10 Troll and Net	350,000	
Areas 11-16 Troll and Net	4,984,000	
Areas 124-127 Troll	584,000	
Total	5,918,000	32.3%
CANADA TOTAL	12,152,000	66.3%
UNITED STATES		
Fraser River Panel Area		
Areas 4B, 5 and 6C Net	78,000	
Areas 6, 7 and 7B Net	1,343,000	
Area 7A Net	827,000	
Total	2,248,000	12.3%
Non-Panel Areas		
Alaska Net	133,000	0.7%
UNITED STATES TOTAL	2,381,000	13.0%
COMMERCIAL TOTAL	14,533,000	79.3%
NON-COMMERCIAL CATCH		
CANADA		
Areas 12-13, 18, 20, 123-124 Indian Food Fishery	39,000	
Area 12 Test Fishing	4,000	
Other Catches (Charters, etc.)	4,000	
Fraser River Indian Food Fishery	572,000	
Recreational Fishery	13,000	
Total	632,000	3.4%
UNITED STATES		
Ceremonial and Test Fishing	1,000	0.0%
COMMISSION		
Areas 123-127, 20 and 29 Test Fishing	50,000	
Area 7 Test Fishing	13,000	
Total	63,000	0.3%
NON-COMMERCIAL TOTAL	696,000	3.8%
TOTAL CATCH	15,229,000	83.1%
SPAWNING ESCAPEMENT	3,107,000	16.9%
TOTAL RUN	18,336,000	100.0%

i. Canada

Total commercial catch in Canada was 12,152,000 Fraser River sockeye salmon, 6,234,000 of which were caught in Panel Area waters and 5,918,000 in non-Panel areas (Table 6). This is the largest Canadian catch since 1901, when approximately 12,000,000 Fraser River sockeye salmon were harvested. Net fishermen in Johnstone Strait (Areas 11 to 16) harvested the largest portion of the catch, followed by net fishermen in Area 20 and Area 29. The catch in Johnstone Strait was high because about 45% of Fraser River sockeye migrated through Johnstone Strait during the migration of the Quesnel Lake stock, the dominant stock on the 1989 cycle. The large troll catch of 262,000 sockeye off the Queen Charlotte Islands (Areas 1 and 2W) is indicative of the northerly coastal landfall. A breakdown of Canadian catches by area and gear are shown in Table 7.

TABLE 7. Preliminary estimates for Canadian catches* of Fraser River sockeye salmon by gear type and area during the 1989 fishing season.

Areas	Inside Troll	Outside Troll	Purse Seine	Gillnet	Total
1-10	0	262,000	86,000	2,000	350,000
11-16	192,000	108,000	3,633,000	1,051,000	4,984,000
121-127	0	1,047,000	0	0	1,047,000
20	0	0	2,761,000	525,000	3,286,000
17, 18, 29	65,000	0	0	2,420,000	2,485,000
TOTAL	257,000	1,417,000	6,480,000	3,998,000	12,152,000
% of Catch	2.1%	11.7%	53.3%	32.9%	100.0%

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

The peak catches in Area 20 and Areas 11 to 16 occurred during the week of August 13-19 (Appendix Tables 1 and 2). A record one-day catch (763,000 sockeye) for Area 20 was harvested on August 17 by 158 purse seines and 200 gillnets. Area 29 catches peaked the week of August 20-26 (Appendix Table 3). The outside troll catch was largest during the week of July 28-August 5, after which closures for domestic allocation were imposed by Canada (Appendix Table 4). These catches were primarily of the Quesnel Lake stocks. Intense exploitation by gillnets in Area 29 between August 13 and September 2 was required, because of the very large sockeye abundance and because the United States had already harvested most of their allocation by that time. A modern-day record for gillnet fleet size occurred with 1,577 boats fishing on August 27.

The cumulative duration of fishery openings in Area 20 was higher than the pre-season plan (Table 4). Fisheries were extended in late August to harvest the Canadian allocation of the much larger- and later-than-forecast sockeye run. Both the weekly and cumulative durations in Area 29 were fairly close to the pre-season plan, although fisheries later in the season were extended slightly.

The catch of sockeye salmon in the Indian food fishery in the Fraser River was 572,000 (Table 6). This was the largest catch on record for this fishery. The majority of these fish were caught in the mainstem of the Fraser River downstream of North Bend (Appendix Table 5). An additional 39,000 Fraser sockeye were harvested in Indian food fisheries in Johnstone Strait, Juan de Fuca Strait and the west coast of Vancouver Island.

ii. United States

The commercial catch of Fraser River sockeye salmon by United States fishermen was 2,381,000 fish (Table 6), 2,248,000 by net fishermen in Panel Area waters and 133,000 fish in Alaskan waters (estimate subject to review). Approximately 1,000 more fish were taken in Treaty

Indian ceremonial and test fisheries. Because the large run of Fraser River sockeye coincided with an unusually northerly landfall, the Alaskan catch was the largest ever recorded. This high Alaskan catch contributed most of the United States overage in catches of Fraser River sockeye.

Most of the United States commercial catch occurred in the Areas 6 and 7 fishery, followed by the Area 7A and Areas 4B, 5 and 6C fisheries. All of the catch in Areas 4B, 5 and 6C was by Treaty Indian fishermen, because Washington Department of Fisheries requested that these areas remain closed to Non-Indian fishermen to minimize the harvest of Lake Washington sockeye and, later, coho salmon.

The Washington State harvest of Fraser River sockeye by Treaty Indian and Non-Indian fishermen, respectively, was 1,123,000 and 1,126,000 fish (Table 8). The largest catch by gear in Washington State waters was by gillnets, followed by purse seines and reef nets. Treaty Indian fishermen in Areas 4B, 5 and 6C caught 78,000 sockeye while the catch in Areas 6, 7 and 7A was 1,044,000 fish, 660,000 by gillnets and 384,000 by purse seines. Among the Non-Indian fishermen, the purse seines, gillnets and reef nets caught 605,000, 423,000 and 98,000 fish, respectively.

TABLE 8. Preliminary estimates for United States catches* of Fraser River sockeye salmon by user group, gear type and area during the 1989 fishing season.

	Treaty Indian				
Areas	Test and Ceremonial	Purse Seine	Gillnet	Reefnet	Total
4B, 5 and 6C	1,000	0	78,000	0	79,000
6 and 7	0	266,000	417,000	0	683,000
7A	0	118,000	243,000	0	361,000
Total	1,000	384,000	738,000	0	1,123,000
% of Catch	0.1%	34.2%	65.7%	0.0%	100.0%
	Non-Indian				
Areas	Test and Ceremonial	Purse Seine	Gillnet	Reefnet	Total
4B, 5 and 6C	0	0	0	0	0
6, 7 and 7B	0	299,000	266,000	95,000	660,000
7A	0	306,000	157,000	3,000	466,000
Total	0	605,000	423,000	98,000	1,126,000
% of Catch	0.0%	53.7%	37.6%	8.7%	100.0%
Panel Area Total	1,000	989,000	1,161,000	98,000	2,249,000
Alaska (District 104) Catch					133,000
UNITED STATES TOTAL CATCH					2,382,000

* Preliminary Washington catch data from Washington Department of Fisheries "soft system" totals, plus estimates of unreported catches by the Fisheries Management Division of the Pacific Salmon Commission.

The peak catch-by-week occurred during the week of August 6-12 in United States Panel Area waters (Appendix Table 6). Although sockeye abundance was actually higher during the following week (August 13-19), the catch was smaller because the proximity of United States fishermen to their allocation necessitated less fishing time.

Fishing times were fairly close to the pre-season plan for Non-Indian fisheries (Table 5), except from mid to late September when fisheries were extended to harvest the later-than-normal run of Fraser River pink salmon. The number of Treaty Indian openings, especially in Areas 4B, 5 and 6C, was much fewer than anticipated. In spite of this, they had no difficulty in approaching their allocation.

B. Pink Salmon

The 1989 run of pink salmon to the Fraser River was 15,569,000 fish (Table 9). This abundance is the third largest return since 1957 and is slightly above the average for the last 5 cycle

TABLE 9. Preliminary estimates for total fishery catches of Fraser River pink salmon during the 1989 fishing season, by country and area.

	Number of Fish	% of Run
COMMERCIAL CATCH		
CANADA		
Fraser River Panel Area		
Areas 121–124 Troll	468,000	
Area 20 Net	1,214,000	
Areas 17–18 and 29 Troll	86,000	
Area 29 Net	191,000	
Total	1,959,000	12.6%
Non-Panel Areas		
Areas 1–10 Troll and Net	257,000	
Areas 11–16 Troll and Net	3,320,000	
Areas 124–127 Troll	629,000	
Total	4,206,000	27.0%
CANADA TOTAL	6,165,000	39.6%
UNITED STATES		
Fraser River Panel Area		
Areas 4B, 5 and 6C Net	35,000	
Areas 6 and 7 Net	1,312,000	
Area 7A Net	634,000	
Areas 3, 4, 4B, 5 and 6C Troll	25,000	
Total	2,006,000	12.9%
Non-Panel Areas		
California/Oregon/Washington Troll	1,000	
Alaska Net	0	
Total	1,000	0.0%
UNITED STATES TOTAL	2,007,000	12.9%
COMMERCIAL TOTAL	8,172,000	52.5%
NON-COMMERCIAL CATCH		
CANADA		
Areas 12–13, 18, 20, 123–124 Indian Food Fishery	0	
Area 12 Test Fishing	0	
Other Catches (Charters, etc.)	0	
Fraser River Indian Food Fishery	72,000	
Recreational Fishery	96,000	
Total	168,000	1.1%
UNITED STATES		
Ceremonial and Test Fishing	0	0.0%
COMMISSION		
Areas 123–124, 20 and 29 Test Fishing	35,000	
Areas 7 and 7A Test Fishing	5,000	
Total	40,000	0.3%
NON-COMMERCIAL TOTAL	208,000	1.3%
TOTAL CATCH	8,380,000	53.8%
SPAWNING ESCAPEMENT	7,189,000	46.2%
TOTAL RUN	15,569,000	100.0%

years (14,870,000 for 1979-87), but more than 1,000,000 fish less than the pre-season forecast of 17,000,000 Fraser River pink salmon (Appendix A). The abundance of Fraser pinks has shown a large increase since 1977 (Figure 4) that is related to increased escapement levels. The marine survival of pink salmon returning as adults in 1989 was above average at 3.8%. Production statistics for Fraser River pink salmon are in Appendix Table 7.

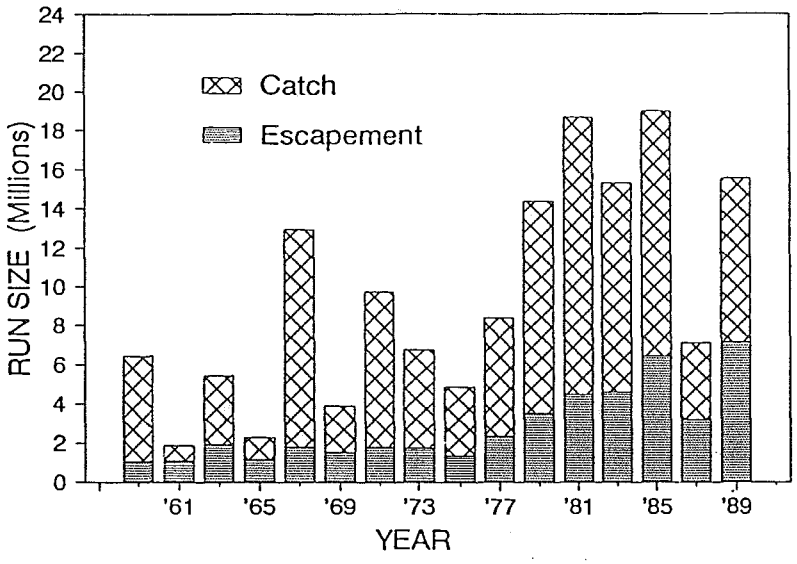

FIGURE 4. Catch, escapement and total run sizes for the odd-year cycle of Fraser River pink salmon for years 1959-1989.

The total catch of Fraser River pink salmon was 8,380,000 fish, while the spawning escapement of 7,189,000 fish was more than 1,000,000 over the goal of 6,000,000 fish. Commercial catches of Fraser River pink salmon totalled 8,172,000. (The development of bias correction procedures is expected to result in slightly larger catch estimates).

Fraser River pink salmon returned at a very small average body size (4.5 lb or 2.0 kg) for the second cycle year in a row. These runs have tended to return at high abundances and small body sizes since 1977.

i. Canada

The total commercial catch of Fraser River pink salmon by Canadian fishermen was 6,165,000 salmon, most of which were caught in non-Panel areas (Table 9). The majority of the catch was taken by net fishermen in Areas 11 to 16 and Area 20, and by outside troll fishermen off the west coast of Vancouver Island. Catches in the Fraser River Indian food fishery totalled 72,000 fish and 96,000 fish were taken by sport fishermen, primarily in the Sooke area (Area 19). Commercial catches by gear type are 3,659,000 for purse seines, 1,854,000 for outside trollers, 429,000 for gillnets and 223,000 for inside trollers (Table 10).

TABLE 10. Preliminary estimates for Canadian catches* of Fraser River pink salmon by gear type and area during the 1989 fishing season.

Areas	Inside Troll	Outside Troll	Purse Seine	Gillnet	Total
1-10	0	237,000	20,000	0	257,000
11-16	137,000	520,000	2,491,000	172,000	3,320,000
121-127	0	1,097,000	0	0	1,097,000
20	0	0	1,148,000	66,000	1,214,000
17, 18, 29	86,000	0	0	191,000	277,000
TOTAL	223,000	1,854,000	3,659,000	429,000	6,165,000
% of Catch	3.6%	30.1%	59.4%	7.0%	100.0%

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

ii. United States

Commercial fishermen in United States waters caught 2,007,000 Fraser River pink salmon (Table 9): 2,006,000 in Panel areas and 1,000 in troll fisheries in non-Panel areas. Most pink salmon were caught in net fisheries in Areas 6, 7 and 7A.

The Treaty Indian catch was 1,059,000 Fraser River pink salmon, mostly caught by purse seines in Areas 6 and 7 (Table 11). The largest gillnet catch was in the same areas. Non-Indian fishermen harvested 948,000 Fraser River pink salmon, primarily by purse seines in Areas 7 and 7A.

TABLE 11. Preliminary estimates for United States catches* of Fraser River pink salmon by user group, gear type and area during the 1989 fishing season.

	Treaty Indian				
Areas	Troll	Purse Seine	Gillnet	Reefnet	Total
4B, 5 and 6C	0	0	35,000	0	35,000
6 and 7	0	593,000	154,000	0	747,000
7A	0	162,000	112,000	0	274,000
Calif/Ore/Wash	3,000	0	0	0	3,000
Total	3,000	755,000	301,000	0	1,059,000
% of Catch	0.3%	71.3%	28.4%	0.0%	100.0%

	Non-Indian				
Areas	Troll	Purse Seine	Gillnet	Reefnet	Total
4B, 5 and 6C	0	0	0	0	0
6, 7 and 7B	0	425,000	91,000	49,000	565,000
7A	0	303,000	57,000	0	360,000
Calif/Ore/Wash	23,000	0	0	0	23,000
Total	23,000	728,000	148,000	49,000	948,000
% of Catch	2.4%	76.8%	15.6%	5.2%	100.0%
TOTAL CATCH	26,000	1,483,000	449,000	49,000	2,007,000

* Preliminary Washington catch data from Washington Department of Fisheries "soft system" totals, plus estimates of unreported catches by the Fisheries Management Division of the Pacific Salmon Commission.

VI. STOCK MONITORING

Stock monitoring activities are directed towards estimating the stock size, daily abundance and timing of Fraser River sockeye and pink salmon stocks at different points along their migration route during the fishing season. These data are integral to the development of fishing plans designed to meet annual escapement and allocation objectives. Test fishing and echo sounding programs provide much of the data that are used to make the estimates. Increasingly complex international and domestic allocation requirements in recent years have strained this process and necessitated the refinement of the estimation procedures to ensure that the accuracy and timeliness of the estimates are improved.

The data used in estimating the run sizes of salmon stocks and stock groups are the historic and current information on commercial catches, effort, exploitation rates, test fishing catch-per-unit of effort (CPUE), daily escapements and racial composition. These data are analyzed using two principal methodologies. One technique involves regression analyses of run size verses catch or CPUE data from commercial and test fisheries. The second technique uses commercial catches, test fishing CPUE's, gross escapements and historical exploitation rates to "reconstruct" daily abundances of the run entering migratory areas. The cumulative daily abundance is then calculated and, using regression procedures, compared to mathematically-generated cumulative normal distributions that vary in the starting date and duration of the run. Run size and migration timing are estimated from the model of best fit.

These analyses provide several estimates of run size which must be reviewed before a "best estimate" is determined. This review involves ranking the estimates based on whether the various assumptions are adequately met in the analyses. For example, estimates made from catch and CPUE data will not change once the maximum catch in a fishery for the season has been made. However, if it appears that the maximum catch did not coincide with actual peak abundance of the run, then this estimate may be discounted. Also, results from the cumulative reconstruction technique tend to be very unstable early in the run, but improve as more fish enter Panel fishing areas. If several methods and indicators point to a particular run size, the decision can be made to change the run-size estimate. Run-size updates tend to be conservative early in the season when uncertainty about run characteristics is greatest. However, later in the season, run-size updates are made regularly to estimate the TAC and permit "fine-tuning" of the management actions needed to achieve escapement, international and domestic allocation goals.

Flexibility is essential in run-size estimation. No one method will always provide the "best" estimate. For example, in years such as 1988 when extensive conservation measures were required, the data for evaluating migration parameters were derived mainly from test fishing CPUE data because of restrictions in commercial fisheries. In contrast, commercial catch data was used for important run-size updates in 1989. Other data that are considered, depending on the circumstances, are estimates of gross escapement from the Mission echo-sounding program (summer-run sockeye stocks) and escapement to the Strait of Georgia (late-run sockeye and pink salmon).

Finally, the date when accurate in-season run-size estimates can be made depends on the timing of the run. For example, the timing of the Quesnel and Late Stuart sockeye runs in 1989 was about three weeks later than normal. Correspondingly, reliable estimates of run size could not be made until late in the season. In 1989, the run-size update that followed the peak abundance in Area 20 occurred on August 22, much later than in previous cycle years.

Every year, the Commission conducts test fishing and echo-sounding studies as part of an overall stock monitoring program designed to assess run size, daily abundance and timing of Fraser River sockeye and pink salmon stocks. These assessments have proved valuable in the management of commercial fisheries and in the achievement of escapement goals for Fraser River stocks. Test fishing operations in 1989 were conducted by the Commission in the following areas:

Canadian Panel Areas

Area 123	Troll	July 15 - August 18
Area 20	Gillnet	June 15 - September 10
Area 20	Purse Seine	August 25 - September 15
Area 29-13	Gillnet	June 26 - October 11
Area 29-16	Gillnet	June 19 - September 3
Area 29-1 to 6	Gillnet	September 21 - 29
Area 29-1 to 6	Troll	September 11 - October 4

Canadian Non-Panel Areas

Area 125-127	Troll	July 15 - August 18

United States Panel Areas

Area 7	Gillnet	June 27 - September 10
Area 7	Purse Seine	September 9

The test fishing operation in Areas 125 to 127 was done with the approval of the Canadian government. At the request of the Commission, DFO operated a test fishing program in Area 12 between June 20 and August 25 by gillnet and between August 24 and September 16 by purse seine.

In addition to test fishing, the stock monitoring program undertakes echo-sounding at Mission and observations at Hells Gate. To monitor the upstream passage of sockeye and pink salmon, echo-sounding at Mission was carried out between June 21 and October 11, and observations were made at Hells Gate between June 30 and October 9.

Test fishing and echo-sounding programs were initiated earlier in 1989 than in the previous three years because an earlier-than-normal timing of the Early Stuart sockeye run was expected.

A. Sockeye Salmon

The assessment of run size and timing of Early Stuart sockeye was based initially on Area 20 test fishing CPUE data and subsequently updated using estimates of commercial catches in various areas and gross escapement past Mission. Normally, Area 20 test fishing boats are very effective on Early Stuart sockeye. However, in 1989 the efficiency was quite low. This may have been due to a shift in the migration of Early Stuart sockeye through the southern portion of Juan de Fuca Strait, where United States Treaty Indian gillnet fishermen in Areas 4B, 5 and 6C recorded good catches during this time. Initially, the Early Stuart run was estimated to be slightly less than forecast and on July 7 was downgraded from the pre-season estimate of 1,100,000 to 900,000 fish. However, by July 12, continued strength of the migration prompted the Panel to approve a run-size upgrade to 1,200,000 sockeye.

Following the Early Stuart run, stock monitoring focused on summer-run sockeye. As with the Early Stuart run, temperature information from the central Gulf of Alaska indicated that the Quesnel and Late Stuart sockeye populations would have earlier-than-normal timing, possibly peaking as early as July 21 in Area 20. However, by mid July it was clear that, instead, the Quesnel run would probably be later than normal. By the end of July the Quesnel run appeared to be either much smaller than forecast or extremely late, although the arrival of the Late Stuart run was proceeding as forecast. Mission echo-sounding data indicated that escapements of summer-run stocks were ahead of target, probably due to restrictions on fishing time.

In early August, the diversion of Fraser sockeye through Johnstone Strait was approximately 50%, substantially higher than the pre-season forecast of about 20%. Good troll and net catches of sockeye off the Queen Charlotte Islands (Canadian Areas 1 and 2W) indicated a more northerly than normal landfall of the sockeye migration. However, on August 9 troll test fishing catches off Ucluelet (Area 123) started to climb to a record single-day catch on August 16. The strength of the catch in the troll test fishery indicated that the Johnstone Strait diversion had moderated and that good catches could be expected in southern-approach net fishery areas.

By August 11, the strength of the Quesnel run had increased and the total Fraser River run appeared to be at least equal to the pre-season forecast of 13,000,000 fish. The peak of the run in Area 20 occurred on August 17, the final day of a 4-day commercial fishery in that area. The run peaked in Area 12 on August 14 to 16. Based on very large catches during this week, the run size was upgraded to 20,000,000 sockeye on August 18. However, a subsequent reduction of the Area 20 catch estimate lead to the run size being revised downward to 19,000,000 fish on August 22. The run size was further reduced to 18,000,000 fish on September 1, because the abundance of sockeye declined more rapidly than expected. Of the total run approaching the south coast, about 41% migrated via Johnstone Strait.

Daily gross escapements of sockeye salmon were monitored using test fishing at Cottonwood and by echo-sounding at Mission (Figure 5). The total escapement of Early Stuart sockeye past Mission was estimated at 465,000 fish compared to a post-season estimate of 559,000 from Indian food fishery catches and spawning escapements (Table 12). Gross escapements of summer-run

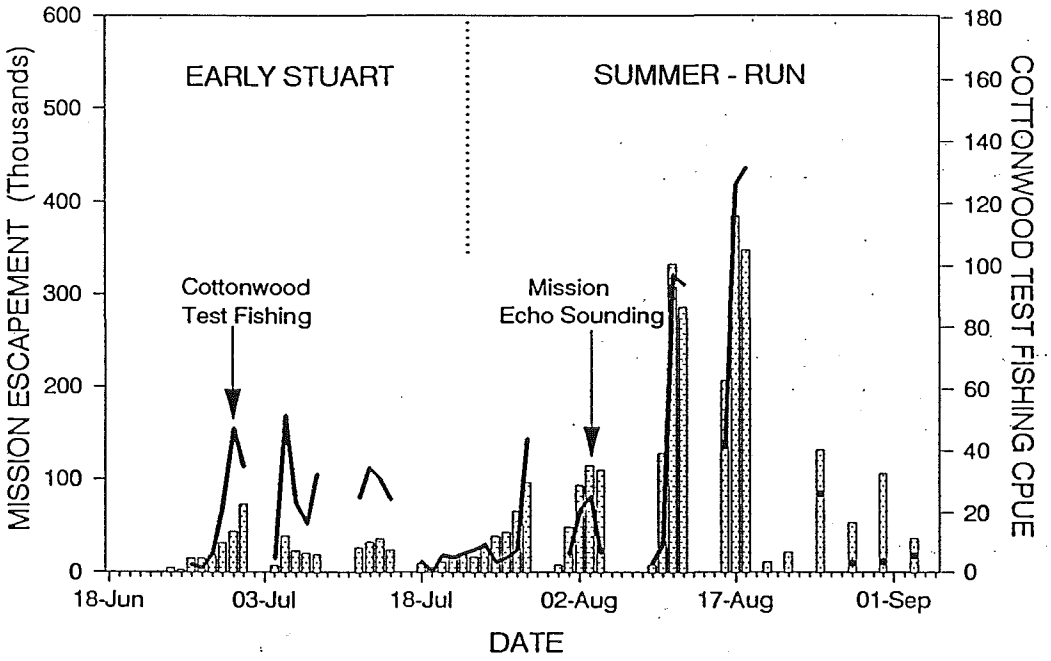

FIGURE 5. Daily escapements of sockeye salmon estimated at Mission, B.C. by echo-sounding compared with prior-day test fishing CPUE at Cottonwood during 1989.

TABLE 12. Comparison of 1989 in-season goals and in-season and post-season estimates of the gross escapement (adults only) of Fraser River sockeye salmon stocks.

Sockeye Salmon Stock	In-season Goals *	In-season Estimates	Post-season Estimates**
Early Stuart	475,000	465,000	559,000
Early Summer-run Stocks	98,000	189,000	116,000
Summer-Run Stocks	3,076,000	2,842,000	2,893,000
Late-run Stocks	151,000	222,000	64,000
TOTAL	3,800,000	3,718,000	3,632,000

* As adjusted by Canada on August 18.
** Includes 35,500 sockeye salmon caught in Fraser River Indian food fisheries below Mission, B.C.

sockeye were estimated at 3,031,000 in-season, compared to a post-season estimate of 3,009,000 fish. Late-run sockeye gross escapements were estimated in-season at 222,000 fish compared to a post-season estimate of 64,000. The total Fraser River Indian food fishery catches and spawning escapements of adult sockeye salmon was 3,632,000 fish, 86,000 (2.3%) less than the in-season estimate. The largest single-day escapement at Mission occurred on August 17 when 385,000 sockeye migrated past the echo-sounding site.

Observations at Hells Gate showed that the passage of sockeye salmon proceeded smoothly, with large abundances of fish observed during the first three weeks of August. No delays in the migration were noted.

B. Pink Salmon

The migration of Fraser River pink salmon was also timed later than normal in 1989, with the resulting temporal separation between major sockeye and pink salmon runs easing the difficulty of managing the fisheries on these species. Assessment of the pink salmon run began during the last week in August with purse seine test fishing in Areas 12 and 20. The estimation of run size was based primarily on commercial catch and effort data. Estimates of escapement to the Strait of Georgia were derived from catch and effort data and exploitation rates. The Fraser River pink salmon component in these escapements was initially estimated using pre-season forecasts of racial abundance, because the results from genetic stock identification (GSI) analyses were not available for at least a week after each fishery. Estimates were updated with GSI data as results became available.

On September 1, the run-size estimate was reduced from the pre-season estimate of 17,000,000 to 13,000,000 pink salmon because of low CPUE's in that week. Subsequently, peak catches per set by the purse seine test fishing boat in Area 20 were attained on September 2 and 8, indicating several "waves" of fish moving along the coast. A peak catch per set in the Area 12 test fishery was made on September 9, although this peak did not result in a large commercial catch on September 11. Catch data from September 3-5 fisheries led the Panel on September 8 to increase the estimate of run size to 15,000,000 Fraser River pinks. When catches dropped sharply, the Panel approved a reduction of the run-size estimate to 14,000,000 on September 11. On September 18 the run size was revised to 14,600,000. Gross escapement to the Strait of Georgia, excluding the inside troll and gillnet catch, was estimated at 6,200,000 fish. Approximately 36% of the run migrated through Johnstone Strait.

Two experimental stock monitoring programs were conducted in 1989. First, a troll test fishery on pink salmon in the Strait of Georgia was initiated to develop a data base that in future years will help to assess escapement to the Strait. The area was divided into northern, central and southern sectors. The sampling strategy required each of the two vessels to fish one sector each day until the entire study area was covered. This was repeated each week during the presence of pink salmon. Peak troll test fishing catches were made in the week of September 10-16, near the time of maximum abundance in the Strait.

The second study was a two-part echo-sounding study of pink salmon migration in the Fraser River. The tendency of adult pink salmon to stay close to shore during their upstream migration has, in the past, interfered with attempts to enumerate this species using hydroacoustic techniques. To address this problem, the echo-sounding vessel was moved to a new site near the Pattullo Bridge at New Westminster, an area of the Fraser River where the near-shore migration of pink salmon is reduced. In the second part of the study, a submerged array of streamers was placed in the Fraser River at Mission. This array successfully diverted pink salmon from the shallow near-shore area to deeper waters where they could be monitored with echo-sounding equipment. Although both programs were operationally successful, the in-season estimates of pink salmon gross escapement were lower than accounted for in upstream catch and escapement. The estimates of 4,400,000 and 4,200,000 pink salmon escapements for the Pattullo Bridge and Mission programs, respectively, were 61% and 58% of the estimate of 7,261,000 from Indian food fishery and spawning ground data. Daily migration estimates were consistent at the two sites, while test fishing at Cottonwood showed much greater day-to-day variation (Figure 6).

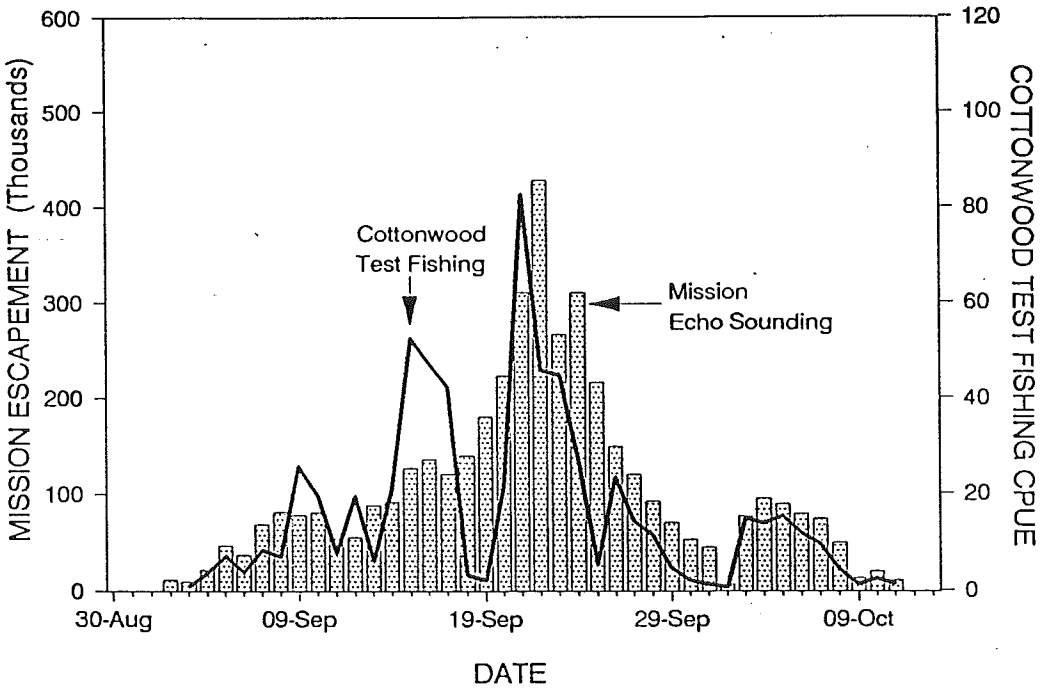

FIGURE 6. Daily escapements of pink salmon in 1989, estimated at Mission, B.C. by echo-sounding compared with test fishing CPUE at Cottonwood two days prior.

The shortfall in the hydroacoustic estimate of pink salmon escapement was due, in part, to the method used to enumerate the pink salmon component of the species-complex migrating upstream. Echo-sounding estimates of the combined escapement of all species of salmon from September 1 to October 13 were 6,500,000 and 6,100,000 fish at the Pattullo Bridge and Mission, respectively. Of these, 2,000,000 fish were estimated in-season to be species other than pink salmon, based on species composition estimates from gillnet test fishing. This compares to a post-season estimate of 650,000 fish from a review of spawning escapements of the other species. Using these latter data, the estimates of pink salmon escapement are closer to the final escapement estimate of 7,261,000, with estimates of 5,850,000 and 5,450,000 in contrast to the in-season estimates of 4,400,000 and 4,200,000 pink salmon.

Pink salmon migrated upstream past Hells Gate without accumulation or delay. Improved fish passage facilities at Hells Gate and other points of difficult passage in the Fraser Canyon were completed by DFO in 1989. These facilities were designed to aid pink salmon migration, but may also have assisted sockeye migration.

VII. RACIAL IDENTIFICATION

Programs for identifying racial components in sockeye and pink salmon catches are conducted by the Commission. The data provided by these programs have two main purposes. First, effective in-season management of Fraser River sockeye and pink salmon requires accurate, timely information on the stocks migrating through marine waters and into the Fraser River throughout the management period. This racial information is used in the development of management strategies designed to achieve stock-specific harvest and escapement objectives.

Second, to fulfil the Panel's obligation under the Treaty, the Commission must account for catches of Fraser River sockeye and pink salmon wherever they occur. To this end, the Commis-

sion annually implements programs to identify the Fraser River component of sockeye and pink salmon harvested by Canadian and United States commercial fishermen in coastal waters from Oregon to southeast Alaska.

A. Sockeye Salmon

i. Methodology

Racial identification of sockeye salmon is based primarily on scale pattern analysis, supplemented with information about age composition, fish length and historical patterns of stock-specific timing and behaviour. Scale pattern analyses in 1989 focused on twenty Fraser River sockeye stocks and seven non-Fraser sockeye stocks (Table 13). Primary emphasis was placed on successfully identifying the two major sockeye stocks returning to the Fraser River in 1989, the Quesnel Lake (Horsefly River) and Late Stuart stocks, as well as identifying the contribution of Fraser River stocks to fishery catches in northern areas.

TABLE 13. Stock groupings used in sockeye salmon racial analyses for 1989.

FRASER RIVER STOCKS	NON-FRASER STOCKS
Early Stuart	Lake Washington
	Barclay Sound
Early-Summer Group	Skeena River
Bowron River	Nass River
Fennell Creek	Nimpkish River
Upper Pitt River	Rivers Inlet
Gates Creek	Smith Inlet
Nadina River	
Scotch Creek	
Seymour River	
Early Chilko Lake	
Mid-summer Group	
Quesnel Lake	
Late Stuart	
Chilko River	
Stellako River	
Birkenhead River	
Late-run Group	
Adams/Lower Shuswap Rivers	
Weaver Creek	
Portage Creek	
Harrison River	
Cultus Lake	
Miscellaneous Stocks	

The statistical technique, "linear discriminant function analysis", was used to determine the rules for separating samples into their component stock complexes. The technique is described in the 1988 Report of the Fraser River Panel to the Pacific Salmon Commission. Two scale characteristics were used to separate the stocks: circuli count to the first freshwater annulus and circuli count in the freshwater plus-growth zone. Three general models were developed for separating stock mixtures into their component stocks in 1989, namely, early-summer, mid-summer and late-run models. These in-season classification models were age-class specific and were developed using data (i.e., "learning standards") from spawning ground collections of scales from jack (3-year-old) spawners in 1988 and adult spawners in previous years.

Initial assessment of the variability in scale patterns among the learning standards used for each model revealed that certain stocks were difficult to distinguish. Stock groupings were formed

by comparing scale characteristics for each stock, and pooling stocks that exhibited similar scale characters.

The landfall of Fraser River sockeye farther north than usual, perhaps influenced by coastal oceanographic conditions in 1989, resulted in significant catches of Fraser River sockeye in Alaska District 104, in the Canadian Area 1 net fishery and Areas 101 and 142 (Area 2W) troll fisheries. To identify the Fraser River component of the catch, age- and sex-specific scale samples from selected northern area fisheries were subjected to a three-variable discriminant analysis that included length data. The inclusion of length data by sex with two scale variables improved the classification accuracy of the models used for the northern area analyses.

In-season scale analysis in 1989 was initiated in mid June and continued through early October. Scale samples were collected coast-wide from both test and commercial fisheries. Estimates of stock composition by week and area were multiplied by estimates of catch in each fishery to arrive at catch by stock grouping. Racial estimates from Fraser River test fishing samples were applied to Mission echo-sounding data to estimate daily gross escapement by stock grouping.

Expanded scale collections from Fraser River Indian food fisheries were provided by DFO at the request of the Commission. These collections allowed in-river catches by stock to be estimated in 1989, a process that will occur each year in the future.

ii. Results

Scale pattern analysis performed adequately in separating early summer-run sockeye stocks in 1989. Problems were encountered, however, in distinguishing the minor mid-summer and late-run stocks from the larger Quesnel - Late Stuart assemblage throughout August and into mid September. Consequently, estimates of Stellako, Chilko, Birkenhead and Weaver Creek sockeye were obtained by subtraction from the Quesnel - Late Stuart estimates using ratios based upon expected abundances. Post-season revisions to these analyses will be conducted using 1989 spawning ground samples provided by DFO.

The total Fraser River sockeye return by stock was estimated by combining catch and racial data from commercial, test and Fraser River Indian food fisheries (IFF) with net escapement estimates from the spawning grounds. In 1989 the total return was 18,336,000 fish, of which 95% were age 4_2, 3% were age 5_2, 1% were age 5_3 and 1% were age 3_2. Catch and escapement data by stock grouping are listed in Table 14.

TABLE 14. Catch, escapement and exploitation rates for Fraser River adult sockeye salmon by stock group.

Stock Group	River & Ocean Catch*	Fraser IFF** Catch	Net Escapement (Adults)	Total*** Run	Exploitation Rate River & Ocean	Exploitation Rate All Areas
Early Stuart	643,000	174,000	385,000	1,202,000	53%	68%
Early Summer-run Stocks	278,000	43,000	73,000	394,000	71%	81%
Late Stuart	2,552,000	75,000	576,000	3,203,000	80%	82%
Quesnel	9,583,000	240,000	1,871,000	11,694,000	82%	84%
Chilko	523,000	19,000	53,000	595,000	88%	91%
Stellako	367,000	16,000	43,000	426,000	86%	90%
Birkenhead	384,000	3,000	30,000	417,000	92%	93%
Misc. Late-run Stocks	234,000	2,000	29,000	265,000	88%	89%
TOTAL	14,564,000	572,000	3,060,000	18,196,000	80%	83%

* Includes ocean and river catches in commercial, test and other fisheries, excluding the Fraser River Indian food fishery.
** IFF = Indian food fishery.
*** Not included is the total return of 140,000 jack sockeye.

The dominant stock in 1989 was the Horsefly River stock, which was part of the Quesnel stock-group. Total production for this stock-group reached 11,694,000 fish in 1989, the largest return since 1913. Rebuilding of Quesnel area stocks has been progressing rapidly since 1977. The Late Stuart stocks were strong again in 1989, producing a record 3,203,000 sockeye. The 1989 return was the largest recorded and was 62% above the previous record in 1985. Early Stuart returns reached 1,202,000, the largest return since 1977.

Catches in all fisheries were dominated by Quesnel sockeye which yielded a total harvest of 9.823,000 fish. Late Stuart sockeye contributed 2,627,000 fish to the commercial and Fraser River Indian food fish catch. Fraser River Indian food fishermen caught 174,000 Early Stuart sockeye, their largest catch of this stock on record.

B. Pink Salmon

i. Methodology

Genetic differences that exist between pink salmon stocks can be measured using genetic stock identification (GSI) methods. These methods involve applying starch-gel electrophoresis to tissue samples (muscle, heart, liver and eye) taken from individual salmon. Electrophoresis is the separation and identification of electrically charged enzyme molecules (gene loci) in an electric field. Each genetic characteristic produces specific patterns on the starch gel. The accumulated differences, by stock, of genotypes observed at several loci are used to predict the probable stock composition of pink salmon collections taken from commercial fisheries. The results of the electrophoretic analyses are analyzed using "maximum likelihood" models to predict the contribution of Fraser River pink salmon to mixed-stock fisheries.

Canadian Department of Fisheries and Oceans (DFO) personnel first identified the potential for using GSI techniques to distinguish south coast pink salmon stocks. Beginning in 1987, Commission staff, in cooperation with Washington Department of Fisheries and DFO, implemented odd-year pink salmon GSI programs that involved the following steps: (1) development of spawning ground standards by electrophoretic analyses of tissues collected from all major Fraser River pink salmon stocks and other non-Fraser pink salmon stocks likely to occur together in mixed-stock fisheries; (2) in-season electrophoretic analyses of muscle tissues collected from all major commercial catches of pink salmon where Fraser River stocks may occur; and (3) estimation of stock-specific contributions to major fisheries using maximum likelihood analyses.

The Commission's "baseline" for pink salmon GSI includes data on stocks from southern Puget Sound to northern British Columbia. In this context, the "baseline" is a reference database where the genetic characteristics for each stock are kept, thereby allowing the characteristics of selected stocks or groups of stocks to be compared. The characteristics of these stocks or groups of stocks is used later to estimate the stock composition in mixed-stock fisheries. There are approximately 40 stocks in the complete baseline, from four major stock groups: (1) Fraser River; (2) Puget Sound; (3) Canadian south coast stocks; and (4) Canadian central and north coast stocks.

Two separate baselines are used by the Commission for pink salmon racial analyses. One baseline includes all major stock groups and is employed for mixed-stock fisheries occurring north of Cape Caution. The second baseline, in which stocks that spawn in central and northern British Columbia are excluded, is used for fisheries south of Cape Caution. This is done because pink salmon from central and northern British Columbia stocks are normally not taken in southern fisheries. The accuracy of separation can be increased by eliminating stocks from the baseline that are unlikely to occur in a particular mixed-stock fishery.

In-season electrophoretic analyses of pink salmon tissue samples was done by three independent laboratories. This enabled Commission staff to test for consistency among labs and allowed

for a shorter processing time so racial estimates would be available more quickly for in-season fisheries management.

To improve the accuracy and precision of the estimates, updated baseline data were collected in the fall of 1989 from a number of key spawning stocks. These data will be used to re-assess the in-season estimates.

ii. Results

Northern catches of Fraser River pink salmon began in early July and continued through the beginning of September. There was no clear peak in the catch of Fraser River pink salmon in northern fisheries, either numerically or in percentage terms. The contribution of Fraser pinks in northern fisheries in 1989 ranged from 0% to 58%.

Analysis of pink salmon tissue samples from Alaska District 104 showed little evidence that Fraser River pink salmon were harvested in Alaskan waters. The largest catches of Fraser pinks in the north occurred in the Canadian troll fishery in Area 142 (2W). The largest weekly contribution of the Fraser stock group in northern area catches occurred in Area 142 during the week ending August 26, when Fraser pinks comprised an estimated 53% of the catch.

The majority of the Fraser River pink salmon catch occurred in waters south of Cape Caution. The major catch areas in 1989 were: Canadian Areas 121 to 127 troll fishery, Areas 11 to 16 net fishery and Area 20 net fishery; and United States Areas 7 and 7A net fisheries. In these fisheries, the Fraser pink salmon component followed a broad trend of increasing from approximately 40% in mid-August to over 80% by mid-September. The catch of Fraser River pink salmon in these areas peaked in late August and early September.

iii. Future Work

Two of the most pressing challenges in the Commission's GSI program exist in the laboratory and computer analysis phases. Computer simulation studies suggest that even with the recent addition of several new gene loci to the baseline, there remains a degree of genetic similarity between a number of stock groups within the baseline. The largest source of misclassification of pink salmon stocks occurs between Fraser River and Puget Sound stock groups. This problem is likely related to the geographic proximity and the corresponding similarity in genetic profiles of stocks comprising these different stock groups. To refine the estimates of genotype frequencies for loci now used to identify stocks and, therefore, to improve the accuracy and precision of the estimates of stock composition, a major effort to upgrade the baseline is currently under way. This effort involves collecting additional data from key spawning areas for all pink salmon stock groups.

The other problem currently affecting the accuracy of GSI analyses involving Fraser River pink salmon lies within the maximum likelihood model, which is used to produce racial estimates. The model tends to incorrectly estimate stock contributions when stock groups are present in very low or very high proportions in fishery samples. Commission staff are working with scientists from other agencies to develop a bias correction procedure for the maximum likelihood model to improve the accuracy of pink salmon racial analyses.

VIII. ESCAPEMENT

Canada Department of Fisheries and Oceans estimates the annual escapements to sockeye and pink salmon spawning grounds in the Fraser River watershed. These data along with biological samples from the spawners are provided to the Panel so that Commission staff can (a) revise in-season racial analyses, (b) estimate total production for each stock and (c) assess Commission programs for stock monitoring.

A. Sockeye Salmon

Sockeye salmon escapements to the Fraser River spawning grounds totalled 3,107,000 fish, including 3,060,000 adult (4- and 5-year-old) and 47,000 jack (3-year-old) spawners (Appendix Table 8). This escapement was near the pre-season goal, but 7% below the revised in-season goal of 3,300,000 adult spawners. The escapement is the largest spawning population on the cycle since 1909, which was the last large escapement prior to the Hells Gate disaster in 1913, that decimated this cycle. The distribution of spawners was close to the goals established by Canada to continue rebuilding Quesnel Lake stocks and to provide adequate escapements to other stocks on the cycle.

Two of the major stocks in 1989 were the Early Stuart and the Late Stuart sockeye. Both stocks spawn in the Stuart River watershed where three large lakes (Stuart, Trembleur and Takla) are used by the juveniles for rearing. Early Stuart sockeye spawn in tributaries to Takla and Trembleur Lakes (A; Figure 7). The escapement estimated in 1989 was 385,000 spawners, the largest since 1949. Fish were well distributed throughout the system with 250,000 in the Driftwood River system at the head of Takla Lake. These latter spawners have the longest migration for sockeye in the Fraser watershed, some 1,200 kilometers (740 miles) from the river mouth.

Late Stuart sockeye produced the largest return and escapement in recent years with 576,000 adults reaching the spawning grounds. The escapement was nearly equally divided between the two major spawning areas, Middle and Tachie Rivers. These two streams drain the large lakes in the watershed and, being lake-fed, provide stable incubation areas. Success of spawning was excellent in both populations.

Stocks from the Nechako River watershed (B; Figure 7) showed generally low to moderate escapements. The Nadina River sockeye escapement declined drastically (down 64%) from the brood year (1985) with few, if any, Early Nadina spawners and 4,900 Late Nadina adult sockeye. Of the latter fish, 4,400 entered the spawning channel. Stellako River sockeye produced 43,000 spawners, similar to the brood year. A high proportion of these spawners (65%) were 5-year-old fish from the 1984 brood which gave a record number of spawners (368,000) in 1988. Without these 5-year-old spawners, the Stellako River population would have been very poor as was the Nadina River escapement.

A modern-day escapement record of 1,871,000 spawners arrived at the spawning areas of the Quesnel Lake watershed (C; Figure 7) in 1989, a 39% increase from the brood year. These fish were part of the 11,694,000 total return of adult sockeye produced from the system and was the largest escapement since 1909. The primary spawning areas are the Horsefly River (1,614,000) and Mitchell River (241,000). Within the Horsefly River, the Upper Horsefly River spawning grounds were occupied by 658,000 fish, McKinley Creek by 118,000 fish, and the lower Horsefly River by 815,000 spawners. In addition, 23,300 lower river spawners were allowed into the newly constructed spawning channel near the town of Horsefly. The lower river, thus, accounted for 52% of the spawning, by far the highest proportion in recent years. These spawning grounds were home to many of the sockeye in the very large escapements in the pre-1913 period. Rebuilding this segment of the Horsefly River population has been a priority of management for many years. Mitchell River sockeye escapements appear to have stabilized with the 1989 population being similar to 1985 (207,000). Pre-spawning mortality rates were low again in 1989 in the Quesnel Lake system with 98% of female spawners successfully depositing eggs.

Chilcotin district (D; Figure 7) stocks have been at low levels on the 1989 cycle for many years. The adult escapement for Chilko River in 1989 (53,000) was 25% lower than in 1985 (71,000). However, the Chilko Lake population showed a sharp increase from 500 in 1985 to 10,000 in 1989. Some Chilko River spawners (1,500) were captured and transported to the spawning channel. In addition, 5,400 jack sockeye were observed on the Chilko River spawning grounds and 10,000 at beach spawning sites at the south end of the lake.

The Seton-Anderson system (E; Figure 7) escapements were well above brood-year levels. Gates Creek sockeye had an excellent escapement of 17,000 adult spawners. This was nearly a 4-fold increase from 1985. Approximately, 14,000 adults entered the spawning channel. This was

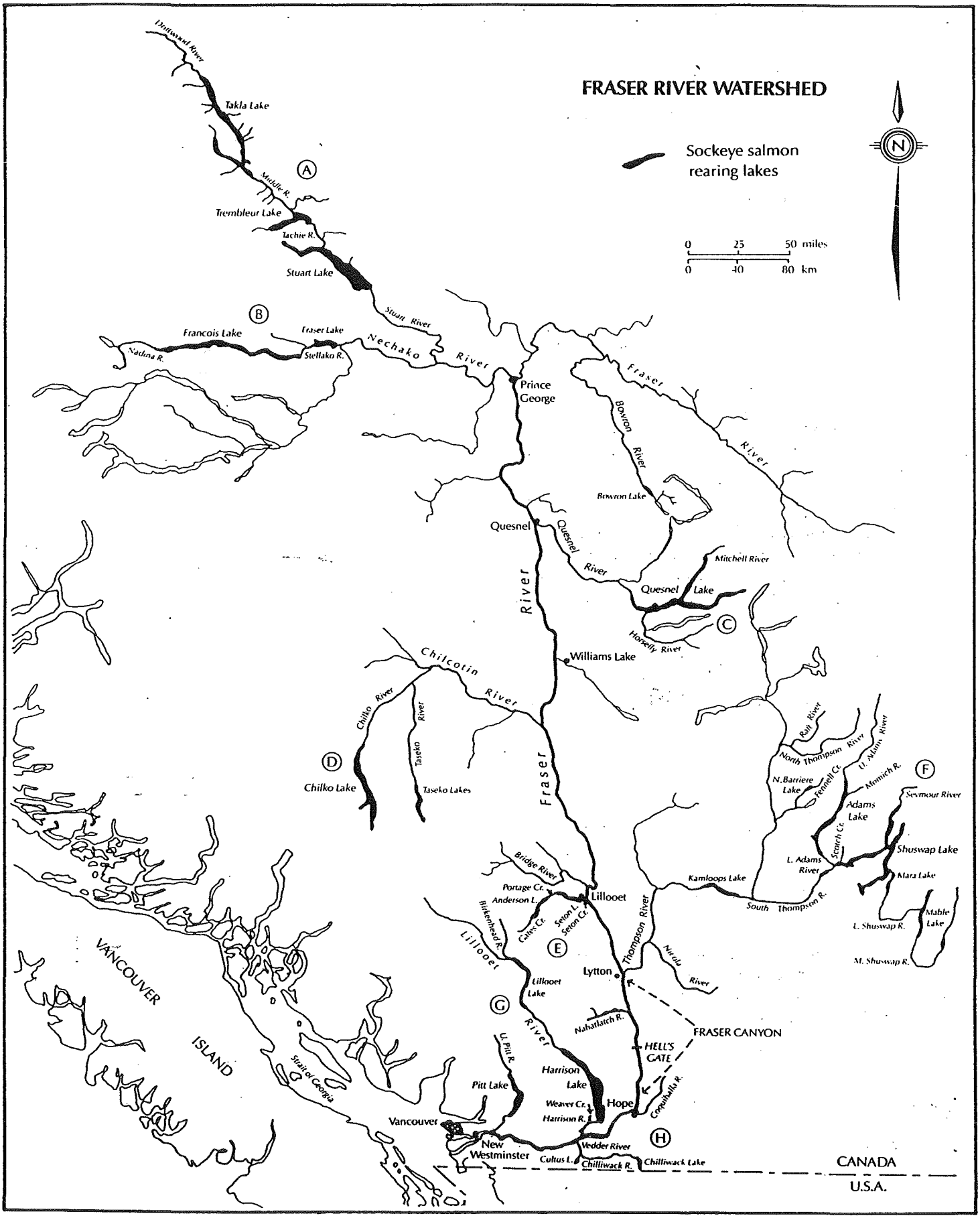

FIGURE 7. Sockeye salmon spawning grounds in the Fraser River watershed.

the first off-cycle escapement on record to reach dominant-year escapement levels since the channel was constructed in 1968. Portage Creek sockeye increased sharply to 8,000 spawners from 1,800 in the brood year.

Historically, few of the sockeye stocks in the Thompson River watershed (F; Figure 7) have produced well on the 1989 cycle. In the North Thompson River system, Fennel Creek had 4,000 spawners, 2.5 times the escapement in 1985. Raft River escapement was 1,600 versus 3,600 in the brood year. South Thompson River sockeye stocks showed an increase at Scotch Creek with 7,200 spawners and no change at Seymour River with 5,500 spawners. Late-run sockeye stocks typically produce primarily jack sockeye on the 1989 cycle prior to the dominant-year returns on the 1990 cycle. The Lower Adams River received an escapement of 7,800 fish, 7,700 of which were jacks. Similarly, the Lower Shuswap River showed a total escapement of 3,000 sockeye with 2,500 of these being jacks. The adult escapements to both Adams and Lower Shuswap Rivers were below the brood year levels.

Sockeye returns to Harrison-Lillooet stocks (G; Figure 7) were lower than expected. The Birkenhead River sockeye escapement was estimated at 29,000 adults, 2.5 times the brood-year level. The majority of these were 5-year-old fish from the 1984 brood. Jack sockeye were abundant with 17,000 escaping to the spawning grounds. Weaver Creek sockeye were much less abundant in 1989 than in the brood year with 17,000 adults versus 37,000 in 1985. This was the smallest total escapement recorded since 1971, and the spawning channel escapement of 12,000 adult salmon was the lowest since 1972. An escapement of 2,900 adult sockeye arrived at the Harrison River spawning grounds. All these stocks migrate late in the season and were exploited in the intense fishery directed at Quesnel Lake stocks.

Sockeye salmon from lower Fraser River tributaries (H; Figure 7) showed mixed escapements in 1989. The Upper Pitt River had a moderate escapement of 16,000 spawners, over 4 times the 1985 level. Approximately 90% of Upper Pitt sockeye were 5-year-old spawners. The Nahatlatch River watershed populations totalled 3,600 spawners, three times as many as in the brood year. The escapement of late-run Cultus Lake sockeye (400) was the same as the brood-year escapement.

Low water levels and moderate temperatures were common conditions at many of the sockeye spawning areas in 1989. Success of spawning at 98% was the highest measured for the cycle. A total of 1,604,000 female spawners deposited eggs in 1989, a 48% increase from 1985 and the largest yet recorded on the cycle.

B. Pink Salmon

Canada Department of Fisheries and Oceans set a goal of 6,000,000 pink salmon spawners in 1989. In-season estimates of escapement to the Strait of Georgia were approximately 6,200,000 fish. However, the final spawning escapement estimate obtained from an extensive tagging program carried out by DFO gave a total population of 7,189,000 spawners (Appendix Table 9). The discrepancy between in-season and spawning ground estimates was not detected during upstream migration.

The majority of pink salmon spawned in the Fraser River between Chilliwack and Hope, where the population was estimated at 4,781,000 fish, or 67% of the watershed total. While this is a very large number, the 1985 escapement was larger (5,249,000 fish) and comprised a higher fraction of the total escapement (81%) in that year. The 1989 escapement was nearly 4.5 times the brood year level (1,066,000).

Two of the major pink salmon spawning areas in the upper Fraser River system are in the Seton Creek area and in the Thompson River below Kamloops Lake (Figure 7). Escapements to these areas totalled 1,341,000, compared to 996,000 in 1987. The majority of upper Fraser pink salmon (1,059,000) spawned in the Seton Creek/Bridge River area. Bridge River pink salmon numbered 104,000 fish, the largest population on record. Seton Creek and the two spawning

channels were used by 934,000 pink salmon, also the largest number on record. The escapement to the Thompson River, however, was only 282,000, just slightly above the 1987 level.

In the lower Fraser area, the Harrison River pink salmon population declined to 682,000 spawners from 1,029,000 in 1987. However, the Chilliwack-Vedder River population tripled in 1989 to 328,000 fish from 106,000 in 1987.

Spawning conditions were excellent in all areas with low, stable stream flows at spawning. Flooding in lower Fraser River areas in November may adversely affect fry production, particularly from the Chilliwack-Vedder system.

IX. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage fisheries in the Panel Area to achieve the annual goals for Fraser River sockeye and pink salmon escapement, for allocation of the catch between the countries and for domestic allocation of the catch within each country's share. 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 objective of the Fraser River Panel is to ensure that escapement goals are achieved. In 1989, Canada set an initial gross escapement goal of 3,511,000 adult sockeye, including 500,000 fish for the Fraser River Indian food fishery and 3,011,000 for spawning escapement. The gross escapement goal was revised in August to 3,800,000 sockeye (Table 12). The purpose of the adjustment was to achieve a Quesnel area escapement nearer to the pre-season objective of 2,000,000 adult spawners, while recognizing that the Late Stuart stock would receive escapement above the goal.

The actual gross escapement in 1989 was 3,632,000 adults, of which 3,060,000 reached the spawning grounds. The net (spawning) escapement goal for Early Stuart sockeye was exceeded by 52,000 fish (Table 15). For post-season accounting purposes, these extra fish are preliminarily classified as inadvertent escapements that occurred as the result of management imprecision. The pre-season summer-run sockeye escapement goal was met, however, the in-season adjusted goal was not achieved resulting in a shortfall in the Quesnel area escapement. The goals for the early summer-run and late-run stock-groups were also not achieved due to low production and to the high exploitation necessary to harvest the very large Quesnel sockeye return.

TABLE 15. Net (spawning) escapement goals and estimated actual escapements of adult Fraser River sockeye salmon by stock group in 1989.

Stock	Pre-season goal	Revised In-season	Actual Escapement	Deviation
Early Stuart	333,000	333,000	385,000	52,000
Early Summer-run Stocks	83,000	83,000	73,000	(10,000)
Summer-run Stocks	2,464,000	2,753,000	2,543,000	(210,000)
Late-run Stocks	131,000	131,000	59,000	(72,000)
TOTAL	3,011,000	3,300,000	3,060,000	(240,000)

The spawning escapement goal for 1989 as defined in background documents to the Treaty was 2,500,000 adult sockeye. The actual net escapement of 3,060,000 sockeye included the Treaty-defined goal of 2,500,000 fish, with 508,000 sockeye designated as escapement add-ons and 52,000 Early Stuart sockeye as inadvertent escapements. These estimates of escapement add-ons and inadvertent escapements are preliminary because the question of how to classify escapements that exceed the goals is currently under discussion by the Panel.

The total pink salmon escapement was 7,189,000 compared to the pre-season escapement goal of 6,000,000. The difference between the goal and the realized escapement was due to underestimation of the escapement of pink salmon to the Strait of Georgia. In calculating the TAC, the overage in escapement is treated as inadvertent escapement that resulted from management imprecision and is shared by the countries. Benefits from inadvertent escapements in the form of added production in 1991 will be similarly shared by the countries.

B. International Allocation

Satisfying the catch-allocation requirement of the Treaty is the second most important goal of the Fraser River Panel during the fishing season. The 1989 season was the first year of the second four-year term of the Treaty, during which the United States catch shall not exceed 7,000,000 sockeye. A Commission agreement (June, 1987) provides the United States the opportunity to schedule its catch, providing the annual goals do not exceed a stipulated percentage of the TAC. For 1989, the United States stated their intention to limit their catch to 2,150,000 sockeye plus the

TABLE 16. Preliminary calculations of the international allocations of Fraser River sockeye and pink salmon between Canada and the United States in 1989.

	Sockeye	Pink
TOTAL ALLOWABLE CATCH		
Total Run Size	18,336,000	15,569,000
Canadian Add-on Benefit	366,000	0
Total Available to Share:	17,970,000	15,569,000
Deductions		
Treaty Escapement	2,500,000	6,000,000
Jack Escapement	47,000	0
Inadvertant Escapement	52,000 *	1,189,000
Fraser River Indian Food Fishery	400,000	0
Test Fishing	67,000	40,000
Total Deductions	3,066,000	7,229,000
Total Allowable Catch:	14,904,000	8,340,000
UNITED STATES		
Initial Allocation	2,150,000 **	2,145,000 ***
Payback	88,000	103,000
Calculated Share:	2,238,000	2,248,000
Actual Catch:	2,382,000	2,007,000
Deviation:	144,000	(241,000)
CANADA		
TAC - United States Share	12,666,000	6,092,000
Escapement Add-on Benefit	366,000	0
Calculated Share:	13,032,000	6,092,000
Actual Catch + Escapement Add-on:	12,888,000	6,333,000
Deviation:	(144,000)	241,000

* Preliminary assessment of overage in the spawning escapement of Early Stuart sockeye salmon.

** Sockeye allocation in 1989 was an amount requested by the United States as part of their 1989-1992 cumulative total of 7,000,000 fish.

*** Pink allocation in 1989 was calculated by the formula (TAC x 3.6/14.0).

payback of 88,000 for shortfalls in past years (Table 16). United States fishermen caught 2,382,000 sockeye, 144,000 greater than the pre-season goal. This overage is approximately equal to the Alaska District 104 catch of Fraser sockeye in 1989 and will be carried over in the calculation of the United States TAC in the remainder of the four-year term. This overage did not cause the United States catch to exceed the maximum available as a percentage of the TAC.

In 1987, the small run of Fraser River pink salmon created management difficulties which interfered with the Panel's ability to achieve the allocation goals. However, in 1989 the total Fraser River pink salmon run was large enough to afford the Panel more flexibility in management. During the season, the United States catch of Fraser pink salmon appeared to be close to the allocation goal. However, preliminary post-season accounting indicates that United States catches had been overestimated and Canadian troll catches had been underestimated in-season, with the result that the United States catch was again below their allocation goal. United States fishermen caught 2,007,000 Fraser pink salmon compared to the allocation of 2,248,000 salmon (Table 16). This leaves a cumulative catch shortfall of 241,000 pink salmon, which will be compensated for in future years.

C. Domestic Allocation

The Panel manages only those United States and Canadian fisheries that occur within the Panel Area. In 1989, this included the Canadian Areas 20 and 29 net fisheries, the Areas 18 and 29 troll fisheries and all Washington State fisheries directed at Fraser River sockeye and pink salmon. The Canadian outside troll fisheries, including the fisheries within the Panel Area (Areas 121-124), were regulated by Canada. DFO regulates Non-Panel areas to ensure that the combined fisheries achieve the Canadian domestic allocation goals.

Canadian catches of Fraser River sockeye by gear type were close to the goals set by the Minister of Fisheries. The largest discrepancies were in the outside troll fishery which caught 1,417,000 sockeye, or 202,000 over their allocation of 1,215,000 (Table 1a), and in the purse seine fishery that caught 204,000 fewer fish than their allocation of 6,684,000. The inside troll catch was 14,000 above their allocation of 243,000 and gillnet fishermen caught 12,000 fewer fish than the goal (4,010,000).

Pink salmon allocation in Canada was for all "southerly migrating pink salmon stocks", including Fraser River, southern British Columbia and Washington State stocks. Canadian catches of pink salmon diverged somewhat from the goals set by Canada (Table 1b). The largest discrepancy was in the purse seine fishery which exceeded its allocation by 298,000 fish. On the other hand, the gillnet fishery was 235,000 fish short of its allocation. This discrepancy was partly due to the inability of gillnet fishermen to catch their allocation in the migratory areas although additional fishing time was provided. Directed gillnet fisheries on Fraser River pink salmon in Area 29 were restricted because of conservation concerns for other species and because in-season estimates of abundance were below the actual levels. Outside troll fishermen caught 90,000 fish fewer than their allocation of 2,679,000, while inside trollers were over their allocation by 27,000.

The catch of sockeye in United States Panel Areas was nearly evenly divided between Treaty Indian and Non-Indian fishermen (Table 8), although the latter group was due a payback because of 1988 catch shortfalls. An additional catch of approximately 133,000 sockeye was taken in Alaska District 104: the status of this catch must be resolved to allow appropriate allocation to occur. Other domestic sockeye allocations were established for the first time in 1989. Treaty Indian fishermen in Areas 4B, 5 and 6C caught 78,000 of an allocated 80,000 sockeye, but significant disruption of this fishery occurred as catch rates were much higher than normal on this cycle, resulting in severe restrictions in fishing times. Allocation of the Non-Indian catch of sockeye was requested by the United States in 1989. The largest discrepancy occurred with the reef net fishermen who exceeded their allocation by 42,000 fish. Purse seine fishermen were 3,000 fish below their allocation of 608,000 sockeye. Gillnet fishermen caught 39,000 fish less than their goal of 462,000 fish.

Including a domestic add-on of 104,000 fish, the Treaty Indian allocation was 1,055,500 Fraser River pink salmon. Their actual catch was 4,000 above their allocation. Non-Indian fishermen were 4,000 below their allocation of 951,500 Fraser River pink salmon. The catch guideline of 145,000 pink salmon in the Areas 3 and 4 Non-Indian troll fishery was not met due to higher than anticipated catches of coho salmon which forced the closure of these areas when the coho quota was reached.

D. Conservation of Other Stocks

Part of the mandate of the Fraser River Panel is to accommodate the conservation and management needs of other salmon species and stocks during the management of Fraser River sockeye and pink salmon in Panel Areas. Panel control was limited to the net fisheries within the Panel Area, troll fisheries in Canadian Areas 18-1, 18-11 and 29 and Non-Indian troll fisheries in United States Areas 3 and 4. Total catches of other species and non-Fraser stocks of sockeye and pink salmon during Panel control are summarized in Table 17.

To address the concerns for other species, in 1989 the Commission embarked on a joint program with DFO to monitor by-catch of chinook salmon in Area 20 purse seine fisheries. This catch monitoring program provided daily estimates of purse seine catch per set for all five species of salmon and for steelhead. The Panel agreed before the season to restrict the Area 20 fishery if serious chinook by-catches occurred. The Panel used the sockeye and pink salmon catch information from this program for managing fisheries targeting on these species, but no problems with chinook by-catch surfaced that required Panel action. However, a large by-catch of coho salmon early in the season led to management concerns about this species (Table 17).

TABLE 17. Preliminary estimates of catches of non-Fraser sockeye and pink salmon and of other salmon species in commercial fisheries regulated by the Fraser River Panel in 1989.*

	Non-Fraser				
Area	Sockeye	Pink	Chinook	Coho	Chum
United States					
Areas 3 and 4 Troll	0	17,144	265	41,337	0
Areas 4B, 5 and 6C Net	2,577	17,904	6,807	44,099	531
Areas 6, 7 and 7A Net	0	460,791	16,036	92,364	19,231
Total	2,577	495,839	23,108	177,800	19,762
Canada					
Area 20 Net	0	498,687	32,228	311,996	7,904
Area 29 Net	0	0	22,059	7,403	13,999
Area 29 Troll	0	0	728	725	1
Total	0	498,687	55,015	320,124	21,904
TOTAL	2,577	994,526	78,123	497,924	41,666

* Estimates are provided by the Washington Department of Fisheries and Canada Department of Fisheries and Oceans.

Conservation concerns about the Lake Washington sockeye catch in United States Areas 4B, 5 and 6C led to monitoring of by-catch in these areas. United States Non-Indian fisheries were not permitted in Areas 4B, 5 and 6C early in the season because of Lake Washington sockeye, and they remained closed for the remainder of the season due to coho by-catch concerns. The catch of Lake Washington sockeye was about 2,600 fish, which was equal to the pre-season by-catch guideline.

Fisheries for sockeye in Area 29 started on July 3 and continued on a regular basis until the end of August, resulting in a larger catch of chinook salmon than in recent years. However, Canada requested that fishing in Area 29 be restricted in the latter part of the season to protect late-run chinook and other species. As a result of Panel action to limit fishing time in September to two days, only modest catches of coho and chum salmon occurred.

X. ALLOCATION STATUS

The international allocation status of Fraser River sockeye and pink salmon as of April, 1990, is summarized in Table 18. The accounting of catch by country, in relation to annual catch allocations agreed to under the Treaty, is a measure of the management precision achieved in a given year. Preliminary allocation figures are generated at the end of each fishing season. These estimates are periodically revised as catch estimates are updated with final sales-slip and landing-slip data, and as final racial composition estimates become available. The shortfalls in catches in one 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.

TABLE 18. Allocation status of Fraser River sockeye and pink salmon for 1985-1989.*

	Sockeye Salmon					Pink Salmon		
	1985	1986	1987	1988	1989	1985	1987	1989
TOTAL RUN	13,879,000	15,904,000	7,694,000	3,762,000	18,336,000	19,038,000	7,136,000	15,569,000
Escapement and Other Deductions	2,522,000	4,042,000	2,103,000	1,744,000	3,432,000	6,479,000	3,251,000	7,229,000
Total Allowable Catch (TAC)	11,357,000	11,862,000	5,591,000	2,018,000	14,904,000	12,559,000	3,885,000	8,340,000
UNITED STATES								
Allocation **	3,013,000	2,797,000	1,912,000	650,000	2,150,000	4,110,000	1,166,000	2,145,000
Catch	2,925,000	2,748,000	1,932,000	679,000	2,382,000	3,834,000	1,339,000	2,007,000
Annual Allocation Status	(88,000)	(49,000)	20,000	29,000	232,000	(276,000)	173,000	(138,000)
Cumulative Allocation Status	(88,000)	(137,000)	(117,000)	(88,000)	144,000	(276,000)	(103,000)	(241,000)
CANADA								
Allocation + Add-on Benefits	8,344,000	9,065,000	3,679,000	1,368,000	13,120,000	8,449,000	2,719,000	6,195,000
Catch + Escapement Add-ons ***	8,432,000	9,114,000	3,659,000	1,339,000	12,888,000	8,725,000	2,546,000	6,333,000
Annual Allocation Status	88,000	49,000	(20,000)	(29,000)	(232,000)	276,000	(173,000)	138,000
Cumulative Allocation Status	88,000	137,000	117,000	88,000	(144,000)	276,000	103,000	241,000

NOTE: ( ) indicate a negative number or shortfall.

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

** Allocation calculations:

Sockeye: 1985: (TAC x 1.78/6.60) - 50,000
1986: (TAC x 3.0/12.5) - 50,000
1987: (TAC x 1.06/3.1)
1988: (TAC x 1.16/3.6)
1989: Portion of 7,000,000 United States share for the 1989-1992 period.

Pink: 1985: (TAC x 3.6/11.0)
1987: (TAC x 3.6/12.0)
1989: (TAC x 3.6/14.0)

*** Includes escapement add-ons requested or approved by Canada that will generate future benefits.

Sockeye catches in United States waters exceeded the 1989 allocation goal by 144,000 fish. Therefore, the current cumulative allocation status shows a United States overage of 144,000 Fraser River sockeye salmon. However, because the United States catch of Fraser River sockeye was less than their permissable maximum catch of 7,000,000 fish for the 1989-92 period, and also less than their permissable portion of the 1989 TAC, there was no actual overage. Instead, the remaining sockeye allocation for United States fishermen is simply reduced to 4,706,000 fish for the 1990-92 period.

The United States elected to harvest the maximum permissable share of the TAC of Fraser River pink salmon (TAC x 3.6/14.0), because the run was small relative to the United States allocation. The 1989 Fraser River pink salmon catch by United States fishermen was 2,007,000. This catch fell short of the annual allocation goal by 138,000 fish. When combined with the payback of 103,000 fish owed from 1987, the current allocation status shows a United States cumulative shortfall of 241,000 Fraser River pink salmon.

Based on the Commission policy for payback of catch shortfalls and overages, adjustments will be made to United States allocations in future years to compensate for these differences between cumulative allocation goals and actual catches of Fraser River sockeye and pink salmon.

XI. APPENDICES

APPENDIX A: FRASER RIVER SOCKEYE AND PINK SALMON - 1989 PRODUCTION FORECAST AND ESCAPEMENT GOALS. (Provided to the Panel by Canada Department of Fisheries and Oceans).

A. Sockeye Salmon:

Stock Grouping	Forecast Total Adults	Net Escapement Goal *	Net Escapement Goal	Gross Escapement Goal
Early Stuart	1,110,000	276,000	333,000	475,000
Early Summer	303,000	69,000	83,000	98,000
Summer	10,955,000	2,046,000	2,464,000	2,787,000
Late	432,000	109,000	131,000	151,000
Total Adults	12,800,000	2,500,000	3,011,000	3,511,000
Jacks	200,000			
Total Return	13,000,000			

* Derived from Treaty background documents

B. Pink Salmon:

Stock Grouping				
Early & Late Timing Groups Combined	17,000,000	6,000,000	6,000,000	6,100,000

APPENDIX B: 1989 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, 1989 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 6, 1989. The United States Government informed the Commission of its approval on June 6, 1989. 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 (1) (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 18th day of June, 1989 to the 16th day of September, 1989, 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 18th day of June, 1989 to the 16th day of September, 1989, 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 18th day of June, 1989 to the 30th day of September, 1989, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1 and 11 from the 16th day of July, 1989 to the 30th day of September, 1989, both dates inclusive.

3. a) No person shall fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29 from the 18th day of June, 1989 to the 14th day of October, 1989, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 18th day of June, 1989 to the 14th day of October, 1989, 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.

During the 1989 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 1989 Management Plan (to be adopted on or about May 26, 1989). This Plan will be 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 (1) (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 18th day of June, 1989 to the 16th day of September, 1989, 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 18th day of June, 1989 to the 16th day of September, 1989, 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 18th day of June, 1989 to the 23rd day of September, 1989, 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 24th day of September, 1989 to the 30th day of September, 1989, both dates inclusive.

All-Citizen Fisheries:

1. No person shall troll commercially for sockeye or pink salmon in Coastal Salmon Management and Catch Reporting Area 4 and that part of Area 3 north of 48°N. latitude (Carroll Island) from the 16th day of July, 1989 to the 31st day of August, 1989, both dates inclusive.

2. 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 18th day of June, 1989 to the 16th day of September, 1989, both dates inclusive.

3. 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 18th day of June, 1989 to the 23rd day of September, 1989, both dates inclusive.

4. 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 24th day of September, 1989 to the 30th day of September, 1989, both dates inclusive.

The following Fraser River Panel Area waters and fisheries are excluded:

Treaty Indian Troll Fishery:

1. Coastal Salmon Management and Catch Reporting Area 4 and that part of Area 3 north of 48°N. latitude (Carroll Island).

Treaty Indian and All-Citizen Fisheries:

1. Puget Sound Salmon Management and Catch Reporting Areas 6B, 6D, 7B, 7C, 7D and 7E.

During the 1989 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 1989 Management Plan (to be adopted on or about May 26, 1989). This Plan will be designed to achieve Treaty-mandated international allocations of the catch and domestic goals of the Parties.

APPENDIX C: 1989 FRASER RIVER PANEL IN-SEASON ORDERS

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

June 29, 1989

For the harvest of Early Stuart sockeye, the Panel approved opening United States Areas 4B, 5 and 6C for Treaty Indian drift gillnet fishing commencing 12:00 noon June 29 for 3 days of fishing.

June 30, 1989

For the harvest of Early Stuart sockeye and allocation of the catch, the Panel approved the following regulations: 1) United States Areas 4B, 5 and 6C close to Treaty Indian drift gillnet fishing at 12:00 noon July 1 and reopen July 5 for 1 day of fishing; 2) United States Areas 6, 7 and 7A open to Treaty Indian nets July 5 for 1 day of fishing; 3) United States Areas 7 and 7A open to All-Citizen[1] purse seine and gillnet fishing July 6 for 1 day; and 4) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets July 3 for 1 day of fishing.

July 7, 1989

For the harvest of Early Stuart sockeye, the Panel approved opening Canadian Area 29-1 to 7 and 9 to 17 to gillnets July 10 for 2 days of fishing.

July 12, 1989

For the harvest of Early Stuart sockeye, the Panel approved opening United States Areas 7 and 7A for All-Citizen purse seines and gillnets July 13 for 1 day of fishing.

July 14, 1989

For harvest of Early Stuart and early summer-run sockeye, the Panel approved the following regulations for the week commencing July 16: 1) Canadian Area 20-1, 3 and 4 open to nets July 17 for 1 day of fishing; 2) Canadian Area 18-1 and 11 and Area 29-1 to 4 and 6 open to trolling July 20 for 1 day; 3) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets July 17 for 1 day of fishing; 4) United States Areas 4B, 5 and 6C open to Treaty Indian drift gillnets July 16 for 2 days of fishing; 5) United States Areas 6, 7 and 7A open to Treaty Indian net fishing July 18 for 1 day; and 6) United States Areas 7 and 7A open to All-Citizen gillnets and purse seines July 19 for 1 day of fishing.

July 17, 1989

In order to harvest early summer-run sockeye stocks, the Panel approved re-opening United States Areas 4B, 5 and 6C for Treaty Indian drift gillnets July 20 for 3 days of fishing.

July 19, 1989

In the interest of domestic allocation, the Panel approved the closure of United States Areas 4B, 5 and 6C to Treaty Indian drift gillnets effective July 20 until further notice.

July 28, 1989

To provide for harvest of Quesnel Lake and Late Stuart sockeye, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open to net fishing July 31 for 3 days of fishing; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets July 30 for 2 days of fishing; 3) United States Areas 4B, 5 and 6C open to Treaty Indian drift gillnet fishing July 30 for 3 days of fishing; 4) United States Areas 6, 7 and 7A open to Treaty Indian nets July 31 for 1 day of fishing; and 5) United States Areas 6, 7 and 7A open to All-Citizen purse seines August 1 and gillnets August 2 for 1 day of fishing.

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[1] All-Citizen fisheries are referred to as "Non-Indian" fisheries in the text of the 1989 Annual Report.

August 1, 1989

For the harvest of summer-run sockeye and pink salmon, the Panel approved the following regulations: 1) Canadian Area 18-1 and 11 and Area 29-1 to 4 and 6 open to trolling August 3 for 2 days of fishing, and 2) United States Area 4 and Area 3 north of 48°00'15" open for All-Citizen commercial trolling August 7 for 4 days of fishing.

August 4, 1989

In order to meet international and domestic catch allocation objectives and for harvest of Quesnel sockeye, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open for nets August 8 for 1 day of fishing; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets August 6 for 1 day and reopen August 8 for 1 day of fishing; 3) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnets August 8 for 1 day; 4) United States Areas 6, 7 and 7A open to Treaty Indian net fishing August 8 for 1 day; and 5) United States Areas 6, 7 and 7A open for All-Citizen purse seines on August 6 and gillnets August 7 for 1 day of fishing.

August 8, 1989

In order to harvest Quesnel Lake sockeye, the Panel approved the following regulations: 1) extension of net fishing in Canadian Area 20-1, 3 and 4 by 1 day making a total of 2 days of fishing in the current week; 2) Canadian Area 18-1 and 11 and Area 29-1 to 4 and 6 open for trolling August 10 for 2 days of fishing; and 3) extension of United States Treaty Indian net fishing in Areas 6, 7 and 7A by 1 day.

August 11, 1989

In order to harvest additional sockeye salmon and to meet international and domestic catch allocation objectives, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open to nets August 14 for 2 days of fishing; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnet fishing August 14 for 2 days of fishing; 3) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnets August 16 for 1 day; 4) United States Areas 6, 7 and 7A open for Treaty Indian net fishing August 16 for 1 day; and 5) United States Areas 6, 7 and 7A open for All-Citizen purse seine fishing on August 15 and gillnets on August 17.

August 14, 1989

For the harvest of pink salmon, the Panel approved the opening of United States All-Citizen commercial troll fishing in Area 4 and Area 3 north of 48°00'15" August 16 for 4 days of fishing.

August 15, 1989

In order to harvest additional Quesnel Lake area sockeye, the Panel approved a two-day extension of net fishing in Canadian Area 20-1, 3 and 4 making a total of 4 days of fishing for the current period.

August 18, 1989 (a)

For the harvest of Quesnel Lake area sockeye, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open for nets August 20 for 3 days of fishing; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets on August 19 for 1 day of fishing and on August 22 for 1 additional day of fishing; 3) Canadian Area 18-1 and 11 open to trolling August 20 until further notice; 4) Canadian Area 29-1 to 4 and 6 open to trolling August 23 for 1 day; 5) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnets August 23 for 1 day; 6) United States Areas 6, 7 and 7A open for Treaty Indian nets August 23 for 1 day of fishing, 7) United States Areas 6, 7 and 7A open for All-Citizen gillnets August 24 for 1 day, and 8) United States Area 4 and Area 3 north of 48°00'15" closed to commercial trolling effective midnight August 18.

August 18, 1989 (b)

Due to a chemical spill in the Fraser River on August 18, the Panel approved the cancellation of the opening for gillnets in Canadian Area 29-1 to 7 and 9 to 17 on August 19.

August 19, 1989

Upon confirmation that none of the chemical spilled into the Fraser River on August 18 remained, the Panel approved opening Canadian Area 29-1 to 7 and 9 to 17 to gillnets August 20 for 1 day of fishing.

August 22, 1989

In order to meet domestic allocation objectives for the sockeye catch in Canada, the Panel approved the following regulations: 1) extension of gillnet fishing in Canadian Area 20-1, 3 and 4 by 1 day making a total of 4 days of fishing in the current period; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets August 24 for 1 day of fishing; and 3) extension of troll fishing in Canadian Area 29-1 to 4 and 6 by 2 days.

August 25, 1989

In order to harvest sockeye and pink salmon and to meet international and domestic catch allocation objectives, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open for nets August 27 for 3 days of fishing; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnets on August 27 for 1 day of fishing and reopen on August 30 for 1 additional day; 3) extension of troll fishing in Canadian Area 29-1 to 4 and 6 for 4 days making a total of 7 days of fishing for the current period; 4) United States Areas 4B, 5 and 6C open for Treaty Indian drift gillnets August 27 for 1 day of fishing; and 5) United States Areas 6, 7 and 7A open for Treaty Indian net fishing August 27 for 1 day of fishing.

August 29, 1989

In order to harvest pink salmon and to meet domestic sockeye catch allocation objectives, the Panel approved the following regulations: 1) extension of gillnet fishing in Canadian Area 20-1, 3 and 4 by 2 days making a total of 5 days of fishing in the current period; 2) Canadian Area 29-1 to 7 and 9 to 17 open to gillnet fishing September 2 for 1 day; 3) extension of troll fishing in Canadian Area 29-1 to 4 and 6 by 3 days making a total of 10 days of fishing for the current period; and 4) United States Areas 4B, 5 and 6C open to Treaty Indian drift gillnets August 30 for 3 days of fishing.

September 1, 1989

For the harvest of pink salmon, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open for purse seines September 5 for 1 day of fishing and gillnets for 2 days; 2) extension of trolling in Canadian Area 29-1 to 4 and 6 by 4 days making a total of 14 days of fishing for the current period; 3) extension of United States Treaty Indian drift gillnets in Areas 4B, 5 and 6C by 7 days making a total of 10 days of fishing for the current period; 4) United States Areas 6, 7 and 7A open for Treaty Indian net fishing September 3 for 2 days; and 5) United States Areas 6, 7 and 7A open for All-Citizen nets September 6 for 1 day of fishing.

September 5, 1989

In order to meet Canadian catch allocations, the Panel approved the following regulations: 1) extension of gillnet fishing in Canadian Area 20-1, 3 and 4 by 1 day; and 2) extension of troll fishing in Canadian Area 29-1 to 4 and 6 by 3 days making a total of 17 days of fishing for the current period.

September 8, 1989

For the harvest of pink salmon, the Panel approved the following regulations: 1) Canadian Area 20-1, 3 and 4 open for purse seines September 11 for 1 day of fishing and gillnets for 2 days; 2) Canadian Area 20-1, 3 and 4 open to troll fishing September 13 for 3 days; 3) closure of Canadian Area 18-1 and 11 to troll fishing at midnight September 8; 4) extension of United States Treaty Indian drift gillnets in Areas 4B, 5 and 6C by 7 days; 5) United States Areas 6, 7 and 7A (south of the Iwersen's Dock Line) open for Treaty Indian net fishing September 11 for 1 day; and 6) United States Areas 6, 7 and 7A (south of the Iwersen's Dock Line) open for All-Citizen net fishing September 13 for 1 day.

September 11, 1989

In order to meet international and domestic pink salmon catch allocation objectives, the Panel approved the following regulations: 1) advance the opening for trolling in Canadian Area 20 to September 12 for 4 days of fishing; 2) extension of United States Treaty Indian nets fishing in Areas 6, 7 and 7A (south of the Iwersen's Dock Line) by 6 hours; and 3) extension of United States All-Citizen nets in Areas 6, 7 and 7A (south of the Iwersen's Dock Line) by 1 day.

September 13, 1989

In order to meet international pink salmon catch allocation objectives, the Panel approved the following regulations: 1) closure of Canadian Area 20-1, 3 and 4 to trolling at 7:00 p.m. September 13; and 2) closure of United States Areas 4B, 5 and 6C to Treaty Indian drift gillnets at 8:00 a.m. September 15.

September 15, 1989

In order to continue to manage Fraser River pink salmon the Panel approved extension of regulatory control of United States Area 6 for All-Citizen fishing until further notice.

September 18, 1989

In order to meet international and domestic allocation objectives for Fraser River pink salmon, the Panel approved opening United States Areas 7 and 7A (south of the Iwersen's Dock Line) for All-Citizen nets September 20 for 1 day of fishing.

September 21, 1989

In order to harvest Fraser River pink salmon and to meet domestic catch allocation objectives, the Panel approved the following regulations: 1) Canadian Area 29-1 to 6 open for gillnets September 25 for 1 day of fishing; 2) extend regulatory control of United States Areas 6, 7 and 7A until further notice; 3) United States Areas 6, 7 and 7A (south of the Iwersen's Dock Line) open for Treaty Indian net fishing September 22 for 2 days; and 4) United States Areas 7 and 7A (south of the Iwersen's Dock Line) open for All-Citizen nets September 26 for 1 day of fishing.

September 26, 1989

In the interest of international and domestic allocation, the Panel approved the following regulations: 1) Canadian Area 29-1 to 6 reopen to gillnets on September 27 for 1 day of fishing; 2) relinquish regulatory control of United States Areas 6, 7 and 7A south of the Iwersen's Dock Line effective Sunday, October 1.

October 6, 1989

Due to reduced numbers of pink salmon, the Panel approved relinquishment of United States waters remaining under Panel control effective Sunday, October 8.

The Fraser River Panel relinquished regulatory control of remaining Panel Area waters, as scheduled, on October 15, thus completing the Panel's regulatory responsibility in Panel waters for the 1989 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 1977-1989.

Week-ending Date*	1977	1981	1985	1989
July 1 **	68,000	0	0	0
8	0	0	0	0
15	0	0	0	0
22	0	0	0	17,000
29	188,000	0	0	0
Aug. 5	163,000	88,000	587,000	266,000
12	132,000	46,000	877,000	570,000
19	35,000	28,000	945,000	1,399,000
26	4,000	37,000	134,000	826,000
Sept. 2	1,000	37,000	56,000	198,000
9	0	13,000	9,000	9,000
16	0	3,000	3,000	1,000
23	0	0	0	0
Total	591,000	252,000	2,611,000	3,286,000

* Week-ending dates for 1989. For other years, data from the nearest week-ending date was used.
** Includes catches up to this date.

APPENDIX TABLE 2. 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 1977-1989.

Week-ending Date*	1977	1981	1985	1989
July 1 **	31,000	8,000	0	0
8	39,000	33,000	0	4,000
15	35,000	43,000	1,000	30,000
22	76,000	29,000	9,000	40,000
29	108,000	183,000	109,000	161,000
Aug. 5	106,000	700,000	451,000	776,000
12	111,000	875,000	445,000	973,000
19	93,000	876,000	1,160,000	2,038,000
26	55,000	371,000	638,000	621,000
Sept. 2	8,000	113,000	261,000	265,000
9	2,000	23,000	54,000	61,000
16	0	14,000	19,000	15,000
23	0	2,000	3,000	0
Total	664,000	3,270,000	3,150,000	4,984,000

* Week-ending dates for 1989. For other years, data from the nearest week-ending date was used.
** Includes catches up to this date.

APPENDIX TABLE 3. 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 1977-1989.

Week-ending Date*	1977	1981	1985	1989
July 1 **	14,000	0	0	0
8	303,000	46,000	0	96,000
15	82,000	42,000	0	267,000
22	122,000	31,000	0	50,000
29	200,000	30,000	53,000	0
Aug. 5	309,000	32,000	204,000	108,000
12	67,000	256,000	334,000	130,000
19	72,000	103,000	171,000	436,000
26	20,000	221,000	313,000	965,000
Sept. 2	6,000	34,000	286,000	416,000
9	38,000	22,000	21,000	12,000
16	52,000	7,000	11,000	2,000
23	10,000	4,000	5,000	0
30	0	0	0	3,000
Oct. 7	7,000	0	0	0
14	0	0	4,000	0
21	0	0	0	0
28	0	0	0	0
Total	1,302,000	828,000	1,402,000	2,485,000

* Week-ending dates for 1989. For other years, data from the nearest week-ending date was used.
** Includes catches up to this date.

APPENDIX TABLE 4. 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 1977-1989.

Week-ending Date**	1977	1981	1985	1989
July 1 ***	3,000	0	0	0
8	3,000	0	0	11,000
15	6,000	1,000	4,000	15,000
22	7,000	1,000	4,000	2,000
29	10,000	1,000	19,000	42,000
Aug. 5	8,000	1,000	164,000	223,000
12	6,000	11,000	407,000	450,000
19	2,000	7,000	249,000	16,000
26	0	11,000	87,000	136,000
Sept. 2	0	4,000	31,000	143,000
9	0	1,000	8,000	9,000
16	0	0	2,000	0
23	0	1,000	2,000	0
Total	45,000	39,000	977,000	1,047,000

* Landings lag behind actual catches by an average of five days.
** Week-ending dates for 1989. For other years, data from the nearest week-ending date was used.
*** Includes catches up to this date.

APPENDIX TABLE 5. 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 1977-1989.*

	1977	1981	1985	1989
FRASER RIVER MAINSTEM				
Steveston	3,256	8,677	19,721	28,497
Deas to Mission	11,343	7,088	6,624	10,371
Mission to Hope	53,605	82,536	74,959	153,240
Hope to North Bend	50,110	58,828	113,605	132,549
North Bend to Churn Creek	74,070	134,455	100,330	146,764
Churn Creek to Hixon	12,589	71,660	55,432	59,514
Above Hixon	150	4,775	6,887	3,178
Total	205,123	368,019	377,558	534,113
TRIBUTARIES				
Harrison/Lillooet System	14,050	5,010	3,024	3,161
Thompson System	560	150	100	485
Chilcotin System	8,465	31,350	8,990	11,300
Nechako System	6,078	16,452	18,402	11,118
Stuart System	10,151	19,683	16,425	11,766
Total	39,304	72,645	46,941	37,830
TOTAL	244,427	440,664	424,499	571,943

* Data supplied by Canada Department of Fisheries and Oceans.

APPENDIX TABLE 6. Commercial net catches of Fraser River sockeye salmon in United States Areas 4B, 4, 6, 6C, 7, 7A and 7B (Juan de Fuca Strait and northern Puget Sound) by week-ending period for cycle years 1977-1989.

Week-ending Date*	1977	1981	1985	1989
July 1 **	249,000	0	0	17,000
8	378,000	4,000	3,000	119,000
15	116,000	181,000	0	26,000
22	9,000	49,000	1,000	49,000
29	438,000	102,000	174,000	0
Aug. 5	257,000	141,000	538,000	205,000
12	196,000	201,000	654,000	872,000
19	83,000	421,000	921,000	598,000
26	24,000	96,000	282,000	128,000
Sept. 2	6,000	69,000	253,000	183,000
9	0	18,000	48,000	41,000
16	1,000	2,000	13,000	10,000
23	0	2,000	1,000	0
Total	1,757,000	1,286,000	2,888,000	2,248,000

* Week-ending dates for 1989. For other years, data from the nearest week-ending date was used.

** Includes catches up to this date.

APPENDIX TABLE 7. Fraser River pink salmon production for odd years 1961-1987.

	1961	1963	1965	1967	1969	1971	1973	1975	1977	1979	1981	1983	1985	1987
Total Spawners (millions)	1.094	1.953	1.191	1.831	1.529	1.804	1.754	1.367	2.388	3.561	4.488	4.632	6.461	3.224
Female Spawners (millions)	0.654	1.216	0.692	0.973	0.957	1.096	1.009	0.791	1.362	2.076	2.560	2.931	3.567	1.856
Potential Egg Deposition (billions)	1.569	2.435	1.488	2.132	2.018	1.923	1.865	1.493	2.960	3.787	4.814	4.702	5.900	3.471
Fry Production (millions)	143.6	284.2	274.0	237.6	195.6	245.4	292.4	279.2	473.3	341.5	590.2	554.8	256.1	406.9
Adult Return Catch + Escapement (millions)	5.477	2.320	12.968	3.928	9.767	6.789	4.894	8.243	14.404	18.685	15.346	18.864	7.136	15.569
Freshwater Survival	9.2%	11.7%	18.4%	11.1%	9.7%	12.8%	15.7%	18.7%	16.0%	9.0%	12.3%	11.8%	4.3%	11.7%
Marine Survival	3.8%	0.8%	4.7%	1.7%	5.0%	2.8%	1.7%	3.0%	3.0%	5.5%	2.6%	3.4%	2.8%	3.8%

APPENDIX TABLE 8. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1977, 1981, 1985 and 1989*.

DISTRICT	1989 Period of	Estimated Number of Adult Sockeye				Jacks
Stream/Lake	Peak Spawning	1977	1981	1985	1989	1989
NORTHEAST						
Upper Bowron River	Sept. 2–8	2,500	1,170	6,419	2,534	0
STUART						
Early Runs						
Driftwood River	Aug. 5–10	54,568	47,298	93,959	250,301	8
Takla Lake Streams	July 25–Aug. 6	43,275	29,588	42,192	54,937	0
Middle River Streams	July 26–Aug. 5	15,970	44,410	72,856	47,876	12
Tremblcur Lake Streams	July 27–Aug. 3	3,632	8,161	25,512	31,685	0
Early Stuart Total		117,445	129,457	234,519	384,799	20
Late Runs						
Kazchek Creek	Late Sept.	720	6,872	1,955	767	0
Kuzkwa Creek	Late Sept.	9,013	20,520	2,624	4,122	0
Middle River	Sept. 20–30	80,381	125,625	114,115	276,131	31
Tachie River	Sept. 20–30	54,172	93,850	155,641	287,290	63
Miscellaneous	Late Sept.	2,173	2,627	286	7,387	0
Late Stuart Total		146,459	249,494	274,621	575,697	94
NECHAKO						
Nadina River (Late)	Mid Sept.	610	1,024	1,516	545	0
Nadina Channel	Mid Sept.	16,248	17,888	12,291	4,395	0
Stellako River	Sept. 27–Oct. 4	23,047	21,826	42,099	43,179	10
QUESNEL						
Upper Horsefly River	Sept. 5–12	390,812	452,909	762,261	658,452	0
Lower Horsefly River	Sept. 8–14	8,130	119,690	274,991	814,818	0
Horsefly Channel	Sept. 8–14	–	–	–	23,300	0
McKinley Creek	Sept. 5–10	74,148	104,761	97,552	117,830	0
Mitchell River	Sept. 13–18	42,396	66,106	207,041	240,521	13
Miscellaneous	Sept. 5–20	–	–	–	15,899	0
Quesnel Total		515,486	743,466	1,341,845	1,870,820	13
CHILCOTIN						
Chilko River	Sept. 19–25	49,539	34,360	71,435	51,580	5,414
Chilko Channel	Sept. 19–24	–	–	–	1,459	66
Chilko Lake–South End	Late Sept.	1,791	180	540	10,229	9,899
SETON–ANDERSON						
Gates Creek	Aug. 28–Sept. 5	1,051	774	662	2,968	359
Gates Channel	Aug. 28–Sept. 5	1,531	3,896	3,916	13,995	2,350
Portage Creek	Oct. 27–Nov. 2	7,610	5,855	1,765	7,900	182
NORTH THOMPSON						
Raft River	Sept. 2–8	617	815	3,638	1,647	0
Fennell Creek	Aug. 27–31	355	2,076	1,598	3,988	49
SOUTH THOMPSON						
Summer Runs						
Seymour River	Aug. 31–Sept. 5	5,709	11,359	5,620	5,507	185
Scotch Creek	Sept. 1–5	13,586	18,952	3,385	7,236	0
Late Runs						
Adams River	Oct. 14–18	5,169	5,242	422	73	7,705
Lower Shuswap River	Oct. 18–23	6,359	4,075	817	488	2,529
HARRISON–LILLOOET						
Birkenhead River	Sept. 22–29	23,845	49,023	11,905	29,334	17,369
Harrison River	Nov. 15–20	2,246	3,193	5,097	2,934	0
Weaver Creek	Oct. 19–25	20,915	23,287	17,009	4,864	9
Weaver Channel	Oct. 19–24	31,712	18,715	20,010	12,303	23
LOWER FRASER						
Nahatlatch River	Sept. 7–14	628	786	1,257	3,628	3
Cultus Lake	Nov. 23–Dec. 5	82	256	424	418	150
Upper Pitt River	Sept. 6–8	13,852	25,327	3,560	16,037	0
MISCELLANEOUS		5,622	11,606	11,316	1,563	908
ADULTS		1,014,014	1,384,102	2,077,686	3,060,120	
JACKS		99,439	58,573	60,914	47,337	
TOTAL		1,113,453	1,442,675	2,138,600	3,107,457	

* 1977, 1981 and 1985 data from the Pacific Salmon Commission. Estimates for 1989 are from Canada Department of Fisheries and Oceans.

APPENDIX TABLE 9. Escapements of pink salmon to Fraser River spawning areas for cycle years 1983, 1985, 1987 and 1989*.

RUN DISTRICT River/Stream	1989 Period of Peak Spawning	Estimated Number of Pink Salmon 1983	 1985	 1987	 1989
EARLY RUNS					
LOWER FRASER					
Main Fraser	Early Oct.	3,307,834	5,248,742	1,065,710	4,780,703
FRASER CANYON					
Coquihalla River	Oct. 1–7	29,190	118,921	6,029	13,559
Jones Creek	Sept. 28–Oct. 3	973	3,095	1,404	4,958
Miscellaneous Tributaries	Oct. 1–16	19,458	47,842	4,625	22,528
SETON–ANDERSON					
Seton Creek	Oct. 18–21	408,628	169,957	627,966	872,460
Upper Seton Channel	Oct. 18–21	9,691	4,485	13,060	21,522
Lower Seton Channel	Oct. 18–21	31,045	33,807	36,696	40,041
Portage Creek	Oct. 20–25	10,202	4,116	21,117	21,096
Bridge River	Oct. 3–6	41,909	61,755	44,200	104,000
Gates Creek	Mid Oct.	0	0	247	372
THOMPSON					
Thompson River and Tributaries	Oct. 12–17	512,398	193,448	253,109	281,640
UPPER FRASER TRIBUTARIES	–	1,721	530	496	6,535
EARLY-RUN TOTAL		4,373,049	5,886,698	2,074,659	6,169,414
LATE RUNS					
LOWER FRASER TRIBUTARIES		100	16,273	1,359	1,056
HARRISON					
Harrison River	Oct. 25–30	146,014	438,022	1,028,892	681,572
Weaver Creek	Oct. 18–22	1,439	3,583	5,212	3,315
Weaver Channel	Oct. 23–28	1,887	4,772	1,168	2,493
CHILLIWACK–VEDDER					
Chilliwack–Vedder Rivers	Oct. 15–20	99,646	95,556	106,410	328,020
Sweltzer Creek	Oct. 18–23	9,134	14,712	5,467	3,290
MISCELLANEOUS	–	452	1,000	354	26
LATE-RUN TOTAL		258,672	573,918	1,148,862	1,019,772
TOTAL		4,631,721	6,460,616	3,223,521	7,189,186

* 1983 and 1985 data from the Pacific Salmon Commission. Estimates for 1987 and 1989 are from Canada Department of Fisheries and Oceans.

APPENDIX E: STAFF OF THE PACIFIC SALMON COMMISSION IN 1989

Mr. I. Todd, Executive Secretary

Mr. W. Johnson, Deputy Executive Secretary

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