Report of the Fraser River Panel to the Pacific Salmon Commission on the 1997 Fraser River Sockeye and Pink Salmon Fishing Season

Prepared by the

Pacific Salmon Commission

March, 1999

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REPORT OF THE

FRASER RIVER PANEL

TO THE PACIFIC SALMON COMMISSION

ON THE 1997 FRASER RIVER SOCKEYE AND PINK

SALMON FISHING SEASON

1997 PANEL MEMBERS AND ALTERNATES

CANADA	UNITED STATES
A. Lill, Chair	D. Austin, Vice-chair
D. Bailey	J. Giard
M. Forrest	L. Loomis
M. Griswold	W. Robinson
W. Otway	R. Charles
L. Wick	B. Sanford
M. Chatwin	R. Suggs
V. Fiamengo	
C. Hunt	
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Prepared by

FISHERIES MANAGEMENT DIVISION

of the

PACIFIC SALMON COMMISSION

March, 1999

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I. EXECUTIVE SUMMARY

1. Canada and the United States did not agree on a catch sharing arrangement for Fraser River sockeye and pink salmon, so each Party managed its own fisheries in the Panel Area in 1997. Consequently, the Fraser River Panel did not establish pre-season regulations and a management plan, did not manage the sockeye and pink salmon fisheries in the Fraser River Panel Area, and was not responsible for achieving catch allocation and escapement goals. The Parties agreed that PSC staff would conduct normal catch assessment, test fishing, racial analysis and hydroacoustic activities. PSC staff reported the results of their assessments to the national sections of the Panel frequently during the season. The two sections developed domestic regulations and exchanged information on fishing plans.

2. Pre-season forecasts provided by Canada were for total runs of 18,230,000 Fraser sockeye and 11,387,000 Fraser pink salmon. Corresponding spawning escapement goals were 4,072,000 adult sockeye and 6,000,000 pink salmon.

3. The 1997 season was marked by unprecedented migration behaviour of all Fraser sockeye runs. A strong El Niño produced record coastal sea surface temperatures and brought sub-tropical fish species such as ocean sunfish, mackerel and pilchards into coastal B.C. waters. The sockeye migration was characterized by an extreme northern landfall, very high Johnstone Strait diversion rates and late and extended timing. The fish themselves were among the smallest on record. Early Stuart sockeye that entered the river in mid-July were blocked in the Fraser Canyon by high river discharges. Many of these fish entered non-natal tributaries from Hope, B.C., to near the spawning grounds. A record en-route mortality of Early Stuart sockeye (680,000) was estimated. The first segment of the Early Summer sockeye run was also subjected to high discharge conditions in the Canyon, and en-route mortality of 48,000 fish was estimated for this stock group. Summer-run and some Late-run sockeye arrived later than normal and in very extended migrations. Fish arriving in the latter part of the migration were already sexually mature in coastal waters. Some of these fish spawned in tributaries to Johnstone Strait, the Strait of Georgia and, to a lesser extent, in streams tributary to the west coast of Vancouver Island. Late-timed Summer-run sockeye also spawned in non-natal streams within the Fraser watershed such as Weaver Creek.

4. Post-season estimates of actual run sizes were 16,414,000 adult sockeye and 8,198,000 pink salmon. This sockeye return was 1,816,000 less than forecast, but was the third largest on the 1997 cycle since 1913. The pink return was 3,189,000 less than forecast and the second smallest since 1977.

5. Catches of Fraser River sockeye salmon totalled 11,425,000 fish in all fisheries. Canadian catches amounted to 9,724,000 fish, of which 8,435,000 were caught in commercial fisheries, 1,196,000 in First Nations fisheries and 93,000 in recreational and charter fisheries. United States fishers caught 1,559,000 Fraser sockeye, 1,337,000 in Washington and 222,000 in Alaska fisheries. Catches in test fisheries authorized by the Fraser River Panel totalled 142,000 sockeye. Catches of Fraser River pink salmon in all fisheries totalled 5,320,000 fish. The Canadian catch of 3,728,000 fish comprised 3,569,000 caught in commercial fisheries and 40,000 and 119,000 caught in First Nations and recreational fisheries, respectively. United States fishers caught 1,560,000 Fraser pink salmon, with 1,546,000 caught in commercial fisheries and 14,000 taken in recreational catches. Test fishing catches of Fraser pink salmon in fisheries approved by the Fraser River Panel totalled 32,000 fish.

6. The Stock Monitoring program provided in-season assessments of abundance, run timing and Johnstone Strait diversion rate of Fraser River sockeye stocks throughout the fishing season. Early Stuart and Summer-run sockeye abundances were initially underestimated, in part due to the extended nature of the runs. In-season overestimation of Late-run sockeye abundance was traced post-season to elevated harvest rates in migratory area fisheries. Arrival timing was one

day later than forecast for Early Stuart, and eight days later than forecast for Summer-run stocks. Johnstone Strait diversion rates for the 1997 season were estimated at 77% for Fraser sockeye and 55% for Fraser pinks.

7. The Racial Analysis program used discriminant function analysis (DFA) of scale patterns to provide estimates of stock proportions in commercial and test fishing catches. A post-season review of the accuracy of DFA models found that in-season models overestimated the proportions of Fennell/Bowron and Birkenhead because of misclassifications from other stock groups. As a result, post-season catch and Mission escapement estimates are substantially lower than in-season estimates for these two stock groups. In contrast, in-season models underestimated the proportions of the Early Stuart and Late Stuart/Stellako stock groups.

8. Genetic stock identification (GSI) techniques were used to identify the proportion of Fraser River pink salmon in mixed-stock fisheries where these fish were believed to be present.

9. Post-season estimates of gross escapements at Mission are 1,259,000 Early Stuart, 138,000 Early Summer, 4,245,000 Summer and 162,000 Late-run sockeye, for a total of 5,804,000 adults. Pink salmon gross escapements totalled 2,907,000.

10. Spawning escapements to streams in the Fraser River watershed totalled 4,252,000 adult sockeye and 2,878,000 pink salmon. Declines from brood year levels were observed for Early Stuart, Summer-run and Late-run sockeye stocks. The decline in Late-run sockeye escapement was associated with the overestimation of run size and with high catch rates on fish that entered the lower Fraser River in August.

II. FRASER RIVER PANEL

Under the Pacific Salmon Treaty, the Fraser River Panel is responsible for in-season management of fisheries that harvest Fraser River sockeye and pink salmon within the Panel Area (Figure 1). Prior to the onset of the fishing season, the Panel recommends a fishing regime and a management plan for Panel Area fisheries to the Pacific Salmon Commission (PSC). The pre-season plan is based on: 1) abundance and timing forecasts and escapement targets for Fraser River sockeye and pink salmon stocks provided by Canada Department of Fisheries and Oceans (DFO), 2) international allocation goals set by the Treaty, 3) domestic allocation goals set by each country, 4) management concerns for other stocks and species identified by each country, and 5) historic migration patterns and fisheries dynamics. The objectives that guide the Panel's decision-making both before and during the fishing season are, in descending priority, to achieve the targets for gross escapement, international allocation and domestic allocation. In accomplishing these objectives the Panel is required to address the Parties' concerns for other species and stocks.

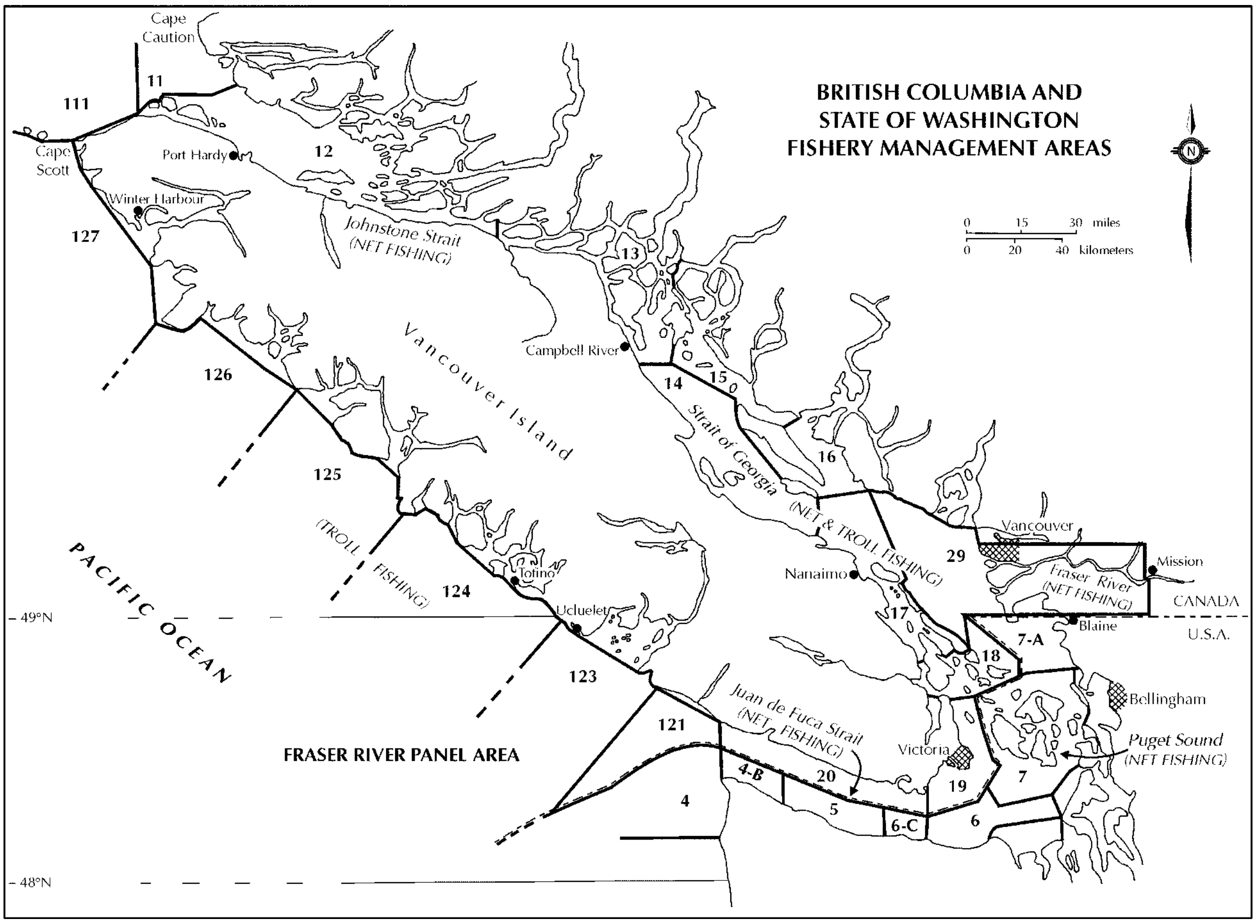

Figure 1. Fishery management areas and commercial gear used in the Fraser River Panel Area and Canadian south coast waters.

In 1997, the Panel did not perform these tasks because the Fraser River sockeye and pink salmon provisions, among others, of Annex IV to the Pacific Salmon Treaty had expired and agreement between Canada and the United States on new arrangements was not reached prior to the season. The Parties agreed that PSC staff would conduct normal catch assessments, test fishing, racial analysis and hydroacoustic activities in 1997. PSC staff reported the results of these assessments to the national sections of the Panel frequently. The two sections independently developed regulations for their fisheries and exchanged information on all fishing plans.

The Panel membership during the 1997 season was:

CANADA	UNITED STATES
Members	
Mr. A. Lill, Chair Fisheries and Oceans Canada	Mr. D. Austin, Vice-Chair Washington Department of Fish & Wildlife
Ms. D. Bailey Fraser River Indian fisher	Mr. J. Giard Commercial salmon fishing industry
Mr. M. Forrest Gillnet fisher	Ms. L. Loomis Treaty Indian tribes
Mr. M. Griswold Troll fisher	Mr. W. Robinson National Marine Fisheries Service
Mr. W. Otway Sport fisher	
Mr. L. Wick Purse seine fisher	
Alternates	
Mr. M. Chatwin Salmon processing industry	Mr. R. Charles Treaty Indian tribes
Mr. V. Fiamengo Purse seine fisher	Mr. B. Sanford Washington Department of Fish & Wildlife
Ms. C. Hunt Johnstone Strait Indian fisher	Mr. R. Suggs Commercial salmon fishing industry
Mr. T. Lubzinski Gillnet fisher	
Mr. M. Medenwaldt Troll fisher	
Mr. W. Saito Fisheries & Oceans Canada	

III. INTRODUCTION

Lack of agreement between Canada and the United States on sharing arrangements (Annex IV, Chapter 4 of the Treaty) for Fraser River sockeye and pink salmon in 1997 resulted in the Canadian and United States national sections of the Fraser River Panel operating independently as fisheries managers. The Commission instructed staff to perform all normal functions pertaining to the management of Fraser sockeye and pink salmon, with the exception that they were not to provide recommendations on the regulation of fisheries. All decisions were to be made by the Parties independently through domestic processes.

Commission staff collected catch information for fisheries in both countries. Test fishing operations were conducted in the Panel Area by the PSC while Canada implemented the Commission's request for test fishing in Canadian non-Panel areas in Johnstone Strait. Escapements of sockeye and pink salmon were estimated at Mission, B.C., via the PSC hydroacoustic program. Racial analyses were conducted on biological samples collected from fish caught in south-eastern Alaska, British Columbia and Washington. Staff analyzed the biological information from all sources and provided the Parties with estimates of run size, timing and diversion rate via Johnstone Strait (Figure 2). Both countries used these data to manage their fisheries.

The 1997 sockeye salmon return was estimated to be approximately 16,414,000 fish, 10% lower than the mid-point of the pre-season probability distribution (18,230,000). The runs were late in arriving and were composed of very small fish. Northerly landfall and high Johnstone Strait diversion of sockeye in 1997 followed the pattern observed in several recent years. The migration of several runs was much more protracted than usual and some Fraser sockeye were identified spawning in streams that flow into Johnstone Strait and the west coast of Vancouver Island. This straying occurred in late September and October, when very late arriving Summer-run sockeye apparently abandoned their migration while still some distance from the Fraser River. At the same time, earlier migrating members of these stocks were actively spawning in their natal streaMs. These and other events were associated with a rapidly developing El Niño event that began in spring and progressed northward along the Pacific coast of North America in late spring and summer. El Niño events are part of the variable environmental landscape that Fraser River sockeye and pink salmon encounter during their freshwater and marine life phases, which shapes the character and behaviour of the runs.

In recent years, the impact of ocean conditions on fish size and behaviour has been very evident. Beginning in 1977, eastern North Pacific Ocean temperatures have been warmer than the long term average in sixteen of twenty-one years. Four of the warmest six years in the 1934-97 period occurred in the most recent twenty-one years, culminating in 1997 when the El Niño event produced the highest sea surface temperatures on record at three coastal British Columbia lighthouse stations (locations shown on Figure 2): Langara Island, Kains Island (Figure 3) and Amphitrite Point. For many years in the 1977-97 period, the size of returning sockeye and pink salmon was below average (Figure 4). Return timing was later than average, possibly due to slower swimming speed of the smaller fish and northerly landfall. Associated with the northerly landfall, Johnstone Strait diversion rates have also been high, with a 1977-97 average of 48% compared to a 1953-76 average of 16%.

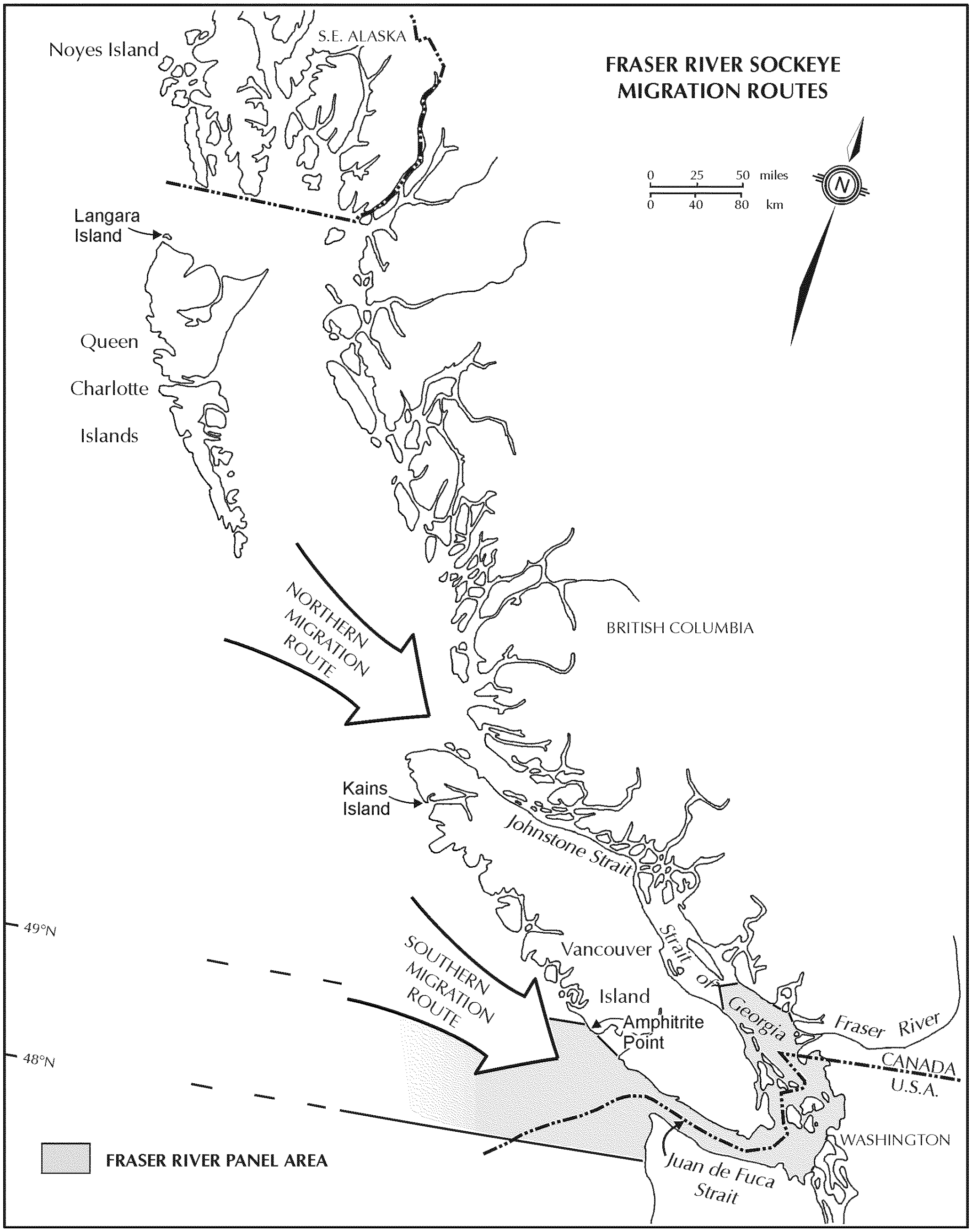

Figure 2. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migrating to the Fraser River.

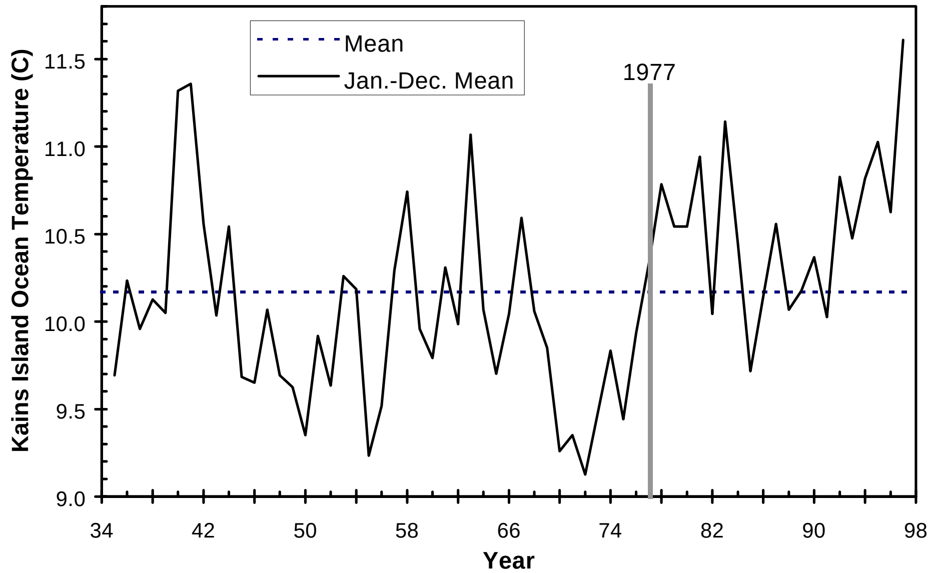

Figure 3. Mean annual ocean temperature (December to January) measured at Kains Island for 1935-1997.

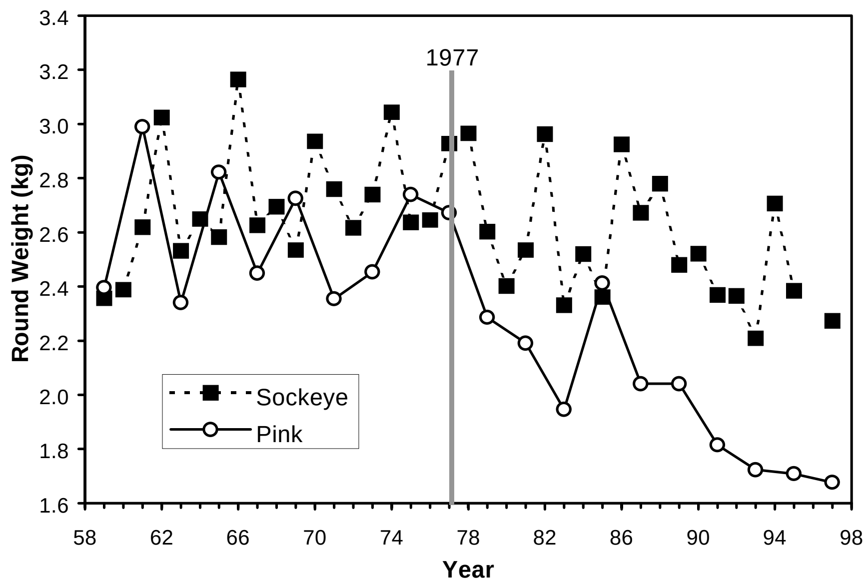

Figure 4. Mean round weight (kg) of Fraser River sockeye and pink salmon for 1959-1997.

Also in 1997 and possibly related to the developing El Niño, heavy rain throughout the Fraser watershed in early to mid July resulted in a rapid rise in river discharge that peaked on July 16-18 (Figure 5). The river discharge level during these dates has been recorded only once before (1964) during this time of year. The high velocities and extreme turbidity of the river, combined with smaller-than-average size and poor condition of the fish resulted in the largest en-route mortality of Fraser sockeye on record. Approximately 680,000 (72%) of the expected Early Stuart net escapement (i.e., gross escapement - in-river catch = 946,000) failed to reach the spawning grounds. Some of these fish entered non-natal streams between Hope and their spawning grounds in the Stuart Lake watershed, presumably because they were too stressed or otherwise unable to complete their migration and simply entered streams along the way. Most of these fish died without spawning, and many exhibited signs of *Chondrococcus columnaris* infection which may have ultimately been the cause of death. Many more sockeye were observed holding near shore in the Fraser Canyon in late July and early August. These fish appear to have eventually weakened and drifted downstream where they were observed as carcasses or caught as moribund fish on the backside (upstream side) of gillnets in the lower river.

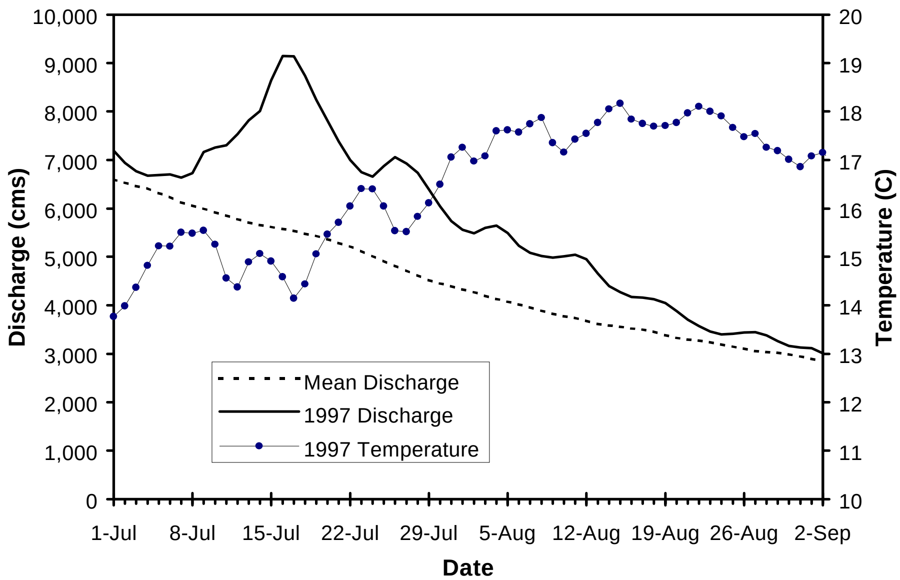

Figure 5. Fraser River discharge levels measured at Hells Gate for June to September, 1997.

Early Summer stocks, which migrate two to three weeks later than the Early Stuart run, also appear to have been affected by the high discharge in the Fraser Canyon in July. An estimate of 48,000 (47%) of the expected net escapement of Upper Fraser Early Summer sockeye (101,000) were not accounted on the spawning grounds. Although the total spawning escapement of all Early Summer sockeye in 1997 (89,000) was similar to 1993 (86,000), 40% of the 1997 total were Upper Pitt River sockeye which migrate only through the lower 30 km of the Fraser River before entering the Pitt River near New Westminster. Since Upper Pitt sockeye do not migrate through the Fraser Canyon, they were not subject to the impacts of high discharge experienced by upriver stocks. Early arriving fish at Scotch Creek weir, the only closely monitored of the Early Summer stocks, were in poor physical condition with multiple injuries, which indicates that they encountered difficult migratory circumstances. Later arriving fish were improved in physical condition.

Summer-run stocks in 1997 were affected more by El Niño-related ocean conditions than passage difficulties in the river. These stocks (Quesnel, Chilko, Late Stuart and Stellako) arrived later than normal along the coast and exhibited very protracted periods of migration. A highly unusual catch of 23,000 Fraser sockeye was taken by southeastern Alaska troll fishers near Sitka using chinook or coho fishing gear between August 20-30, which provided direct evidence that landfall occurred farther north and later in 1997 than previously identified. This late timing was also reflected in Johnstone Strait fisheries, where Summer-run Fraser sockeye were present until September 28 when closures were instituted for other species. In late September-early October, DFO and other sources reported a minimum estimate of between 8,000 and 10,000 spawning sockeye salmon in streams on the west coast of Vancouver Island and in streams tributary to Johnstone Strait and the Strait of Georgia. A mixture of Fraser and local stocks was identified in samples from the west coast of Vancouver Island. The fish collected in Johnstone Strait and Strait of Georgia streams were primarily Summer-run Fraser River sockeye. These sockeye appear to have exhausted their time or energy for migrating to their natal streams and diverted into streams along the migration route. Straying of Fraser River sockeye into non-natal streams along their migration route has not been reported in the past.

Spawning escapements of Late-run sockeye (90,000 fish) were lower than expected, given the in-season estimates of run size based on substantial catches of these stocks in marine fishing areas. Post-season analyses revealed three factors that explain at least part of the difference. First, data from Johnstone Strait test fisheries indicated a higher harvest rate for Weaver sockeye that co-migrated through the area with Summer-run stocks. Second, post-season estimates of Late-run catch in Canadian Area 29 (Fraser River area) were higher than estimated in-season. Third, some Birkenhead sockeye (a Late-run stock) were mixed with Summer-run spawners in Johnstone Strait tributaries. Only small numbers of other Late-run sockeye, however, were found in non-natal streams.

A higher harvest rate in Johnstone Strait for Late-run stocks translates into lower numbers of fish escaping to the Strait of Georgia at a given catch level in Johnstone Strait. Thus, while some Late-run sockeye diverted to non-natal streams or were found in post-season catch estimates, most of the difference between in-season and post-season estimates of Late-run escapement to the Strait of Georgia appears to be associated with a higher-than-expected harvest rate on Late-run sockeye in the Johnstone Strait net and troll fisheries.

Commercial fisheries on Fraser River sockeye have been conducted in both Canada and the United States for over 100 years. The 1997 season will rank as one of the most unusual from the standpoint of fish behaviour. The El Niño event produced record high sea surface temperatures at coastal stations, and was likely the cause of: 1) reduced sockeye marine growth rates, 2) unusual coastal arrival timing and migration routes and 3) straying of Summer-run and Late-run sockeye into non-natal streaMs. The small body size and late arrival, combined with extremely high river discharges during the migration of Early Stuart and Early Summer sockeye caused record en route mortality and highly unusual behaviour such as fish entering, and attempting to spawn, in non-natal streams.

Both the return abundance (8,198,000) and mean weight (1.77 kg, 3.9 lb; Figure 4) of Fraser River pink salmon were low in 1997. The abundance was 27% lower than the pre-season forecast provided by DFO (11,387,000). Low mean weight of Fraser River pink salmon has been noted since 1991, possibly due to density-dependent growth (large returns of small fish) and/or adverse ocean conditions precipitated by El Niño events. Lower-than-expected escapement of pink salmon to the Strait of Georgia occurred in 1997 similar to that observed in Late-run sockeye. Harvest rates in the Johnstone Strait fisheries are believed to have been higher than anticipated, thus causing PSC an overestimate of total abundance. The escapement to the Strait of Georgia consequently was also less than estimated in-season, as that figure is calculated by subtracting the known catch from the total abundance estimate.

IV. MANAGEMENT ACTIONS

A. Forecasts of Returns and Escapement Targets

Canada provided the Panel with run-size forecasts at three different reference probabilities (50%, 75%, and 90%), for Fraser River sockeye and pink salmon stocks on June 27, 1997 (Appendix A, Table 1). The official forecast used for both species was the point estimate (50% reference probability), meaning there were equal probabilities of actual returns being above or below the forecast. The sockeye forecast on this basis totalled 18,230,000 fish, while the forecast pink salmon return was 11,387,000 fish. DFO forecasts for returning sockeye included expectations by stock group as follows: 1,044,000 Early Stuart, 351,000 Early Summer, 15,691,000 Summer and 1,144,000 Late-run sockeye. Spawning escapement targets were established by Canada at 4,072,000 sockeye and 6,000,000 pink salmon at the forecast run sizes. Escapement targets for sockeye by stock group and for pink salmon over a range of returning run sizes were also provided (Appendix A, Table 2). Canada did not provide the Panel with gross escapement targets in 1997.

PSC staff provided the Panel with expected daily abundance curves (Figure 6) for the arrival of Fraser River sockeye and pink salmon in Juan de Fuca Strait. The abundance curves were based on historical timing (1981 to 1993) patterns and the pre-season abundance forecasts.

DFO provided the Panel forecasts of timing for major sockeye stocks and stock groupings, and a forecast of the diversion rate through Johnstone Strait. On June 15, DFO provided an estimate of July 14 as the 50% date for Early Stuart sockeye in the lower Fraser River, equivalent to July 9 in Area 20. On July 23, the Chilko and Quesnel stocks 50% date of August 7 in Area 20 was provided. The forecast of Johnstone Strait diversion rate (78%) was provided on June 27.

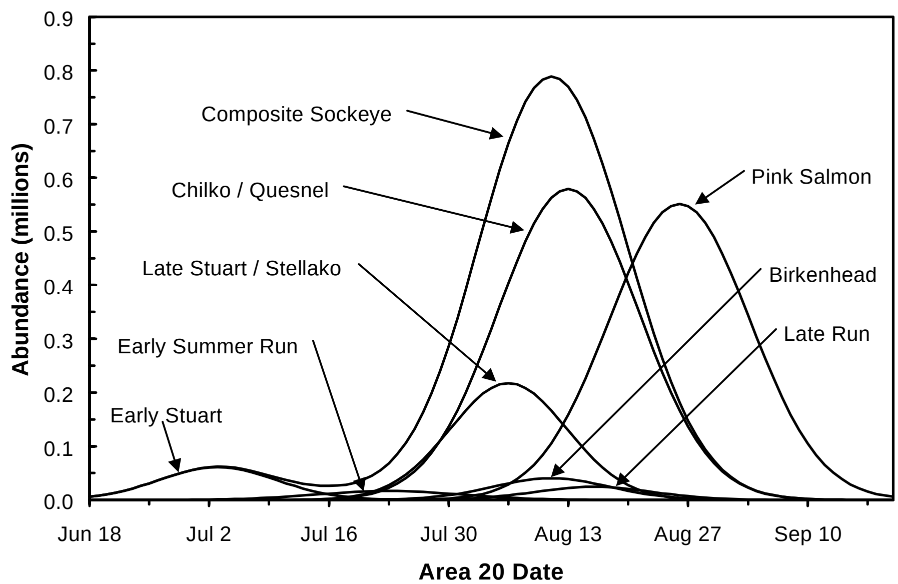

Figure 6. Expected daily abundance curves for migrating Fraser River sockeye and pink salmon in 1997 (Area 20 date), based on forecast abundances and historical timing patterns.

B. Pre-season Regulations

Lack of agreement between the Parties on catch-sharing meant that the Fraser River Panel could not manage fisheries in Panel area waters in 1997. Instead, each Party managed its own fisheries. Consequently, the Panel did not formulate pre-season or in-season regulations and was not responsible for achieving escapement targets, international and domestic catch allocations, or for addressing conservation concerns for other species and stocks. In managing its own fisheries, each Party took into account desired escapement objectives for Fraser sockeye and pink salmon, as well as conservation concerns for other stocks and species.

C. In-season Regulations

Fishing times for the major net fisheries in 1997, as provided by the Parties, are summarized in Appendix B.

V. CATCH SUMMARY

A. Sockeye Salmon

The estimated total return was 16,414,000 Fraser sockeye (Table 1). This was the third largest run on the 1997 cycle and the sixth largest on any cycle since 1913 (Figure 7).

Catches in all fisheries totalled 11,425,000 fish: 9,724,000 fish in Canadian fisheries, 1,559,000 fish in United States fisheries and 142,000 fish in Panel-approved test fisheries. Commercial catches in both countries totalled 9,994,000 Fraser sockeye. Spawning escapements were estimated at 4,261,000 sockeye salmon. An additional 728,000 fish were estimated to have died en-route (see Introduction).

Fraser sockeye in 1997 were smaller than average for this cycle. Weights of age 4_2 fish sampled from commercial purse seine catches in Areas 12 and 20 averaged 2.27 kg (5.01 lb), which is smaller than the 1997 cycle average of 2.40 kg (1981-93) and the second smallest weight on record for any cycle. For sockeye (combined ages) caught in Area 20 commercial seine fisheries the average weight was 2.33 kg (5.14 lb), compared to the cycle average of 2.56 kg (1977-93).

The gross landed value of the commercial catch (24,000,000 kg) was approximately $74,000,000 (Can).

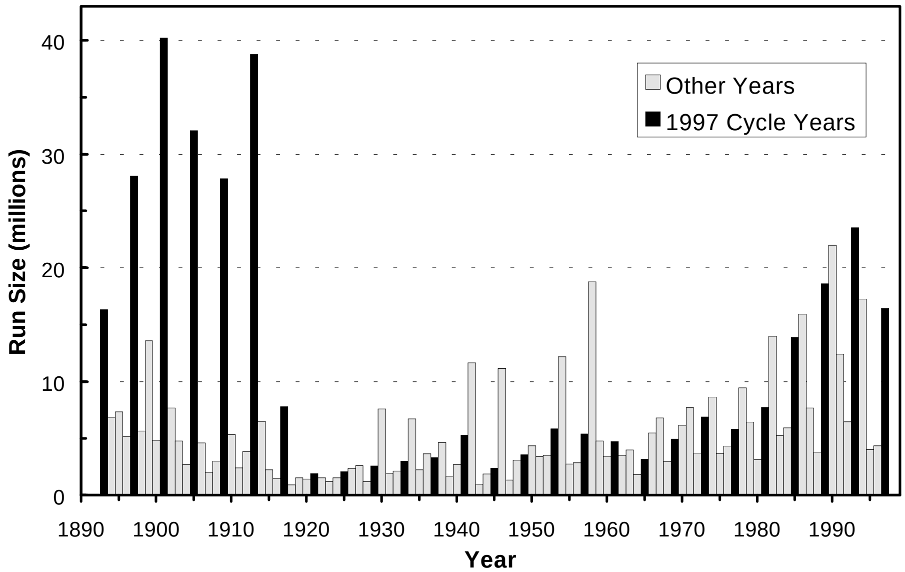

Figure 7. Total run sizes of Fraser River sockeye salmon between 1893-1997. Returns on the 1997 cycle are emphasized.

Table 1. Preliminary estimates of fishery catches, spawning escapement and total run of Fraser River sockeye salmon during the 1997 fishing season, by country and area.

		Number of Fish	% of Run
CANADA			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 121-124 Troll		0	
Area 20 Net		259,000	
Areas 17-18 and 29 Troll		19,000	
Area 29 Net		1,315,000	
	Total	1,593,000	9.7%
Non-Panel Areas			
Areas 1-10 Troll and Net		434,000	
Areas 11-16 Troll and Net		6,408,000	
Areas 124-127 Troll		0	
	Total	6,842,000	41.7%
	Commercial Total	8,435,000	51.4%
FIRST NATIONS CATCH			
Marine Areas			
Areas 12-16, 18, 20, and 123-126		117,000	
Area 29-1 to 7		4,000	
	Total	121,000	0.7%
Fraser River			
Below Sawmill Creek		794,000	
Above Sawmill Creek		281,000	
	Total	1,075,000	6.5%
	First Nations Total	1,196,000	7.3%
NON-COMMERCIAL CATCH			
Charters/Miscellaneous		18,000	
Recreational Fishery In-river		58,000	
Marine		17,000	
	Non-Commercial Total	93,000	0.6%
	CANADIAN TOTAL	9,724,000	59.2%
UNITED STATES			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 4B, 5 and 6C Net		12,000	
Areas 6 and 7 Net		536,000	
Area 7A Net		789,000	
	Total	1,337,000	8.1%
Non-Panel Areas			
Alaska Troll and Net		222,000	1.4%
	UNITED STATES TOTAL	1,559,000	9.5%
TEST FISHING			
COMMISSION			
Areas 123-127, 16, 20 and 29 Test Fishing		77,000	
Areas 7 and 7A Test Fishing		4,000	
	Commission Total	81,000	0.5%
CANADA			
Area 12 and 13 Test Fishing		61,000	0.4%
	TEST FISHING TOTAL	142,000	0.9%
	TOTAL CATCH	11,425,000	69.6%
SPAWNING ESCAPEMENT		4,261,000	26.0%
EN-ROUTE LOSS		728,000	4.4%
	TOTAL RUN	16,414,000	100.0%

i. Canada

Included in Canada's catch of 9,724,000 Fraser sockeye were 8,435,000 in commercial, 1,196,000 in First Nations and 93,000 in non-commercial fisheries (Table 1). Of the commercial catch, 1,593,000 fish were caught in Panel Areas and 6,842,000 in non-Panel Areas. The largest catches occurred in Johnstone Strait net fisheries (Areas 11-16), followed by Fraser River and Strait of Georgia net fisheries (Area 29). Purse seines caught the largest share (49%), followed by gillnets (26%) and trollers (25%) (Table 2). Weekly catches in Canadian Panel Areas are shown in Appendix C, Tables 1-4.

The large majority (1,075,000 fish) of First Nations catches were taken in Fraser River fisheries, 794,000 below Sawmill Creek (located above Yale) and 281,000 fish above (Table 1). First Nations catches in marine areas totalled 121,000 sockeye. Reported Fraser River Indian catches in each in-river area are shown in Appendix C, Table 5. In this regard, it should be noted that catch estimates for Fraser River Indian fisheries in the following areas are not available:

- Lillooet and Seton River systems
- Thompson River from Lytton to Bonaparte River
- Fraser Mainstem from Marguerite Ferry to Naver
- Nechako River above Isle Pierre

Non-commercial catches consisted of a recreational catch of 75,000 sockeye (17,000 marine and 58,000 in-river) and charter catch of 18,000 fish (Table 1). It should be noted that in regard to the in-river recreational catch of sockeye, no estimate of catch for the period after August 31 has been provided.

Table 2. Preliminary estimates of Canadian commercial catches* of Fraser River sockeye salmon by gear type, fishing area and gear license area during the 1997 fishing season.

Canada

	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
1-10	182,000		37,000			215,000			434,000
11-16		3,716,000		834,000	0		1,141,000	717,000	6,408,000
121-127		0		0			0		0
20		248,000			11,000		0		259,000
17, 18, 29		0			1,315,000			19,000	1,334,000
Total Catch	182,000	3,964,000	37,000	834,000	1,326,000	215,000	1,141,000	736,000	8,435,000
% of Catch	2.2%	47.0%	0.4%	9.9%	15.7%	2.5%	13.5%	8.7%	100.0%

*Data from DFO preliminary catch statistics

ii. United States

United States catches totalled 1,559,000 sockeye, including 1,337,000 in the Panel Area (Puget Sound Areas 4B, 5, 6, 6C, 7, and 7A) and 222,000 in Alaska (Table 1).

Treaty Indian catches were 12,000 in Areas 4B, 5 and 6C and 645,000 in Areas 6, 7 and 7A, for a total of 657,000 Fraser sockeye (Table 3). Non-Indian catches were 411,000 by purse seines, 191,000 by gillnets and 78,000 by reefnets, for a total catch of 680,000 fish. Weekly catches of Fraser sockeye in United States Panel Areas are shown in Appendix C, Table 6.

The Alaska catch included a net catch of 199,000 and a troll catch of 23,000 Fraser sockeye (Table 3).

Table 3. Preliminary estimates of United States commercial catches* of Fraser River sockeye salmon by user group, gear type and area during the 1997 fishing season.

Areas	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian				
4B, 5 and 6C	0	12,000	0	12,000
6 and 7	177,000	71,000	0	248,000
7A	178,000	219,000	0	397,000
6, 7 and 7A Total	355,000	290,000	0	645,000
% of Catch	55.0%	45.0%	0.0%	100.0%
Total Catch	355,000	302,000	0	657,000
% of Catch	54.0%	46.0%	0.0%	100.0%
Non-Indian				
7	116,000	94,000	78,000	288,000
7A	295,000	97,000	0	392,000
Total Catch	411,000	191,000	78,000	680,000
% of Catch	60.4%	28.1%	11.5%	100.0%
United States				
Panel Area Total	766,000	493,000	78,000	1,337,000
Alaska Net				199,000
Alaska Troll				23,000
Alaska Total				222,000
Total Catch				1,559,000

* Preliminary Washington catch data from Washington Department of Fish and Wildlife "soft system" totals.

B. Pink Salmon

The estimated return of Fraser River pink salmon totalled 8,198,000 fish (Table 4), the second smallest run since 1977 (Figure 8).

Catches in all fisheries totalled 5,320,000 fish: 3,728,000 in Canadian, 1,560,000 in United States and 32,000 in Panel-approved test fisheries. Commercial catches in both countries totalled 5,115,000 Fraser pinks. Spawning escapements totalled 2,878,000 fish.

Fraser pinks in 1997 were the smallest on record. Weights of fish sampled from commercial purse seine catches in Area 20 averaged 1.68 kg (3.7 lb), compared to a mean of 2.32 kg (5.1 lb) for 1959-95.

The gross landed value of the commercial catch (8,700,000 kg) was approximately $3,500,000 (Can).

Table 4. Preliminary estimates of fishery catches, spawning escapement and total run of Fraser River pink salmon during the 1997 fishing season, by country and area.

		Number of Fish	% of Run
CANADA			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 121-124 Troll	*	7,000	
Area 20 Net		303,000	
Areas 17-18 and 29 Troll		8,000	
Area 29 Net		162,000	
Total		480,000	5.9%
Non-Panel Areas			
Areas 1-10 Troll and Net		76,000	
Areas 11-16 Troll and Net		3,008,000	
Areas 124-127 Troll	*	5,000	
Total		3,089,000	37.7%
Commercial Total		3,569,000	43.5%
FIRST NATIONS CATCH			
Marine Areas			
Areas 12-16, 18, 20, and 123-126		8,000	
Area 29-1 to 7		3,000	
Total		11,000	0.1%
Fraser River			
Below Sawmill Creek		28,000	
Above Sawmill Creek		1,000	
Total		29,000	0.4%
First Nations Total		40,000	0.5%
NON-COMMERCIAL CATCH			
Recreational Fishery In-river		26,000	0.3%
Marine		93,000	1.1%
CANADIAN TOTAL		3,728,000	45.5%
UNITED STATES			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 4B, 5 and 6C Net		2,000	
Areas 6 and 7 Net		582,000	
Area 7A Net		960,000	
Washington Troll		2,000	
Total		1,546,000	18.9%
Non-Panel Areas			
WA, OR and CA Troll		0	
Alaska Troll and Net		0	
Total		0	0.0%
Commercial Total		1,546,000	18.9%
NON-COMMERCIAL CATCH			
Recreational Fishery		14,000	0.2%
UNITED STATES TOTAL		1,560,000	19.0%
TEST FISHING			
COMMISSION			
Areas 123-127, 16, 20 and 29 Test Fishing		26,000	
Areas 7 and 7A Test Fishing		0	
Commission Total		26,000	0.3%
CANADA			
Area 12 and 13 Test Fishing		6,000	0.1%
TEST FISHING TOTAL		32,000	0.4%
TOTAL CATCH		5,320,000	64.9%
SPAWNING ESCAPEMENT		2,878,000	35.1%
TOTAL RUN		8,198,000	100.0%

* Troll catches in Area 124 are divided between Panel and non-Panel Areas.

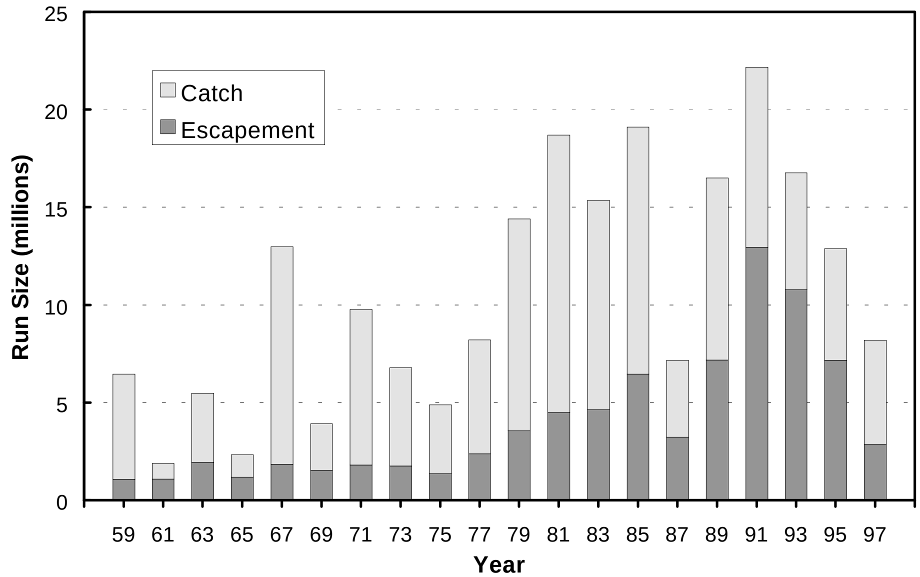

Figure 8. Catch, escapement and total returns of Fraser River pink salmon for odd years between 1959-1997.

i. Canada

Included in Canada's catch of 3,728,000 Fraser pinks were 3,569,000 in commercial, 40,000 in First Nations and 119,000 (93,000 marine and 26,000 in-river) in recreational fisheries (Table 4). Of the commercial catch, 480,000 fish were caught in Panel Areas and 3,569,000 in non-Panel Areas. The largest catch occurred in Johnstone Strait net fisheries (Areas 11-16). Purse seines caught the largest share (75%), followed by trollers (19%) and gillnets (6%) (Table 5). Weekly catches in Canadian Panel Areas are shown in Appendix C, Tables 7-10.

Most (29,000 fish) First Nations catches were taken in Fraser River fisheries, 28,000 below Sawmill Creek and 1,000 fish above (Table 4). First Nations catches in marine areas totalled 11,000 pinks. Reported Fraser River Indian catches in each in-river area are shown in Appendix C, Table 11.

Table 5. Preliminary estimates of Canadian commercial catches* of Fraser River pink salmon by gear type, fishing area and gear license area during the 1997 fishing season.

Canada

	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
1-10	23,000		3,000			50,000			76,000
11-16		2,360,000		52,000	0		382,000	214,000	3,008,000
121-127		0		0			12,000		12,000
20		300,000			3,000		0		303,000
17, 18, 29		0			162,000			8,000	170,000
Total Catch	23,000	2,660,000	3,000	52,000	165,000	50,000	394,000	222,000	3,569,000
% of Catch	0.6%	74.5%	0.1%	1.5%	4.6%	1.4%	11.0%	6.2%	100.0%

*Data from DFO preliminary catch statistics

ii. United States

United States catches totalled 1,560,000 fish, including 1,546,000 in commercial fisheries in the Panel Area and 14,000 in recreational fisheries (Table 6). Most of the catch occurred in Areas 6, 7 and 7A.

Treaty Indian catches were 2,000 in troll fisheries in Areas 3, 4 and 4B, 2,000 in Areas 4B, 5 and 6C and 785,000 in Areas 6, 7 and 7A, for a total of 789,000 Fraser sockeye (Table 7). Non-Indian catches were 672,000 by purse seines, 42,000 by gillnets and 43,000 by reefnets for a total catch of 757,000 fish. Weekly catches of Fraser pink salmon in United States Panel Areas are shown in Appendix C (Table 12).

Table 6. Preliminary estimates of United States commercial catches* of Fraser River pink salmon by user group, gear type and area during the 1997 fishing season.

Areas	Ocean Troll	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian					
3, 4 and 4B	2,000	0	0	0	2,000
4B, 5 and 6C	0	0	2,000	0	2,000
6 and 7	0	295,000	15,000	0	310,000
7A	0	399,000	76,000	0	475,000
6, 7 and 7A Total	0	694,000	91,000	0	785,000
% of Catch	0.0%	88.4%	11.6%	0.0%	100.0%
Total Catch	2,000	694,000	93,000	0	789,000
% of Catch	0.3%	88.0%	11.8%	0.0%	100.0%
Non-Indian					
Wash./Oregon/Calif.	0	0	0	0	0
3, 4 and 4B	0	0	0	0	0
4B, 5 and 6C	0	0	0	0	0
7	0	221,000	8,000	43,000	272,000
7A	0	451,000	34,000	0	485,000
Total Catch	0	672,000	42,000	43,000	757,000
% of Catch	0.0%	88.8%	5.5%	5.7%	100.0%
United States					
Panel Area Total	2,000	1,366,000	135,000	43,000	1,546,000
Non-Panel Area Total	0	0	0	0	0
Alaska					0
Total Catch					1,546,000

* Preliminary Washington catch data from Washington Department of Fish and Wildlife "soft system" totals.

VI. STOCK MONITORING

The goals of the stock monitoring program are to assess run size, daily abundance, migration timing and Johnstone Strait diversion rate of Fraser River sockeye and pink salmon stocks during the fishing season. These data are required to develop fishing plans to attain annual escapement and catch allocation objectives. Commercial fishery catches usually provide much of the data used in the analyses. In addition, test fisheries (Table 7) conducted by the Commission and by DFO at the request of the Commission provide important data before and after the commercial fishing season and between fishing periods. Information about upstream migration in the river is obtained by echosounding at Mission, B.C., visual observations at Hells Gate and analysis of Fraser River First Nations fisheries catches.

Table 7. Test fishing operations that were approved by the Fraser River Panel for the 1997 fishing season.

Area	Gear	Dates	Operated by
Canadian Panel Areas			
20	Purse Seine	July 30 - September 15	PSC
20	Gillnet	June 18 - August 19	PSC
29-13	Gillnet	July 2 - October 3	PSC
29-16	Gillnet	June 20 - October 5	PSC
29-1 to 6	Troll	August 24	PSC
Canadian non-Panel Areas			
12	Gillnet	June 18 - August 8	DFO
12	Purse Seine	July 20 - September 13	DFO
13	Purse Seine	July 20 - September 13	DFO
United States Panel Areas			
7	Reefnet	June 28 - July 29	PSC

The upstream passage of sockeye was monitored by the Mission hydroacoustic program between June 26 and September 9. Estimates of daily gross escapements of sockeye were derived by combining Mission hydroacoustic data with species composition data from gillnet test fishing at Whonnock (Area 29-16). Between September 10 and October 2, daily gross escapement of sockeye was estimated using CPUE models based on data from gillnet test fishing at Cottonwood. The upstream passage of pink salmon was estimated between September 10 and October 2 using Mission hydroacoustic data. The third year of an experimental split-beam hydroacoustic program at Mission was jointly conducted by PSC and DFO.

Daily visual observations at Hells Gate between July 3 and October 8 supplied qualitative information on upstream fish passage.

Run-size estimation for Fraser River sockeye by stock group and for total pink salmon is based primarily on catch and effort of the commercial fishery, racial composition and diversion rate data, which are analyzed using catch, catch-per-unit-effort, cumulative-normal and cumulative-passage-to-date models. Most of these methods are described in the Pacific Salmon Commission's Technical Report No. 6[1] and in the Fraser River Panel's 1995 Annual Report[2].

A. Sockeye Salmon

Each year, the first Fraser River sockeye stock to arrive in coastal waters is the Early Stuart run. In the recorded past, this run has not had a significant migration through Johnstone Strait. In 1997, however, comparisons between gillnet test fishing in Areas 12 and 20 indicated that a substantial portion (55%) of the run migrated via the northern approach (Figure 2). This was a harbinger of very high diversion rates which were observed for all Fraser River sockeye stocks in

[1] Pacific Salmon Commission. 1995. Pacific Salmon Commission run-size estimation procedures: An analysis of the 1994 shortfall in escapement of Late-run Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 6: 179p.

[2] Pacific Salmon Commission. 1998. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1995 Fraser River sockeye and pink salmon fishing season. Vancouver, B.C. 64 pp.

1997. The arrival of the Early Stuart sockeye migration was bimodal with major peaks on July 2-4 and July 11-17, referenced to Area 20 timing (Figure 9). The 50% point in the migration was July 10, approximately one day later than forecast. Analyses early in July indicated the run size was near the pre-season forecast (1,044,000 fish). By July 8, estimates ranged between 800,000 and 1,600,000 fish and the run was considered to be at or above the forecast. By July 16, the estimated run was 1,200,000 fish, although there was concern that estimates of abundance migrating past Mission may have been low due to high river discharge. At the end of the season, Early Stuart estimates included a run size of 1,560,000 and a gross escapement (Mission escapement plus Fraser Indian fishery catch below Mission) of 1,132,000 fish.

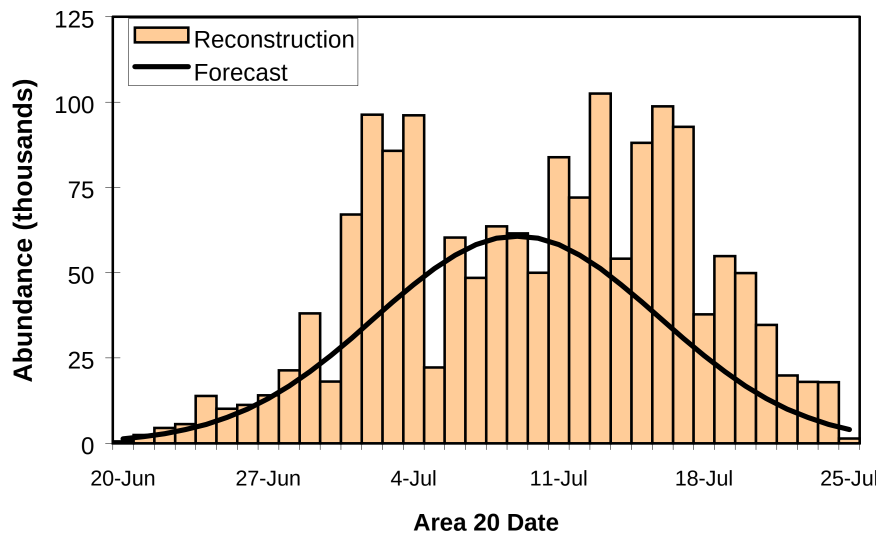

Figure 9. Comparison between pre-season and post-season estimates of timing and abundance for Early Stuart sockeye in 1997.

Later in July and early August, the focus was on Early Summer stocks. In late July, the run size was estimated at approximately 500,000 fish. On August 5, the estimate was revised to 600,000 fish. Final in-season estimates of Early Summer abundance and gross escapement were 630,000 and 363,000 fish, respectively.

Migration timing of Summer-run sockeye has become progressively later over the last twenty years. Prior to 1981, the average 50% migration date (referenced to Area 20 timing) for Quesnel sockeye was July 26. The peak timing reached an extreme late date of August 20 in 1993. In 1997, the peak arrival timing was forecast to be August 7. By August 1, it was clear that the run was arriving later than forecast and assessment of run size would be delayed. On August 14, estimates of Summer-run run size ranged between 12,000,000 and 15,000,000 fish. By August 22, estimates ranged between 10,000,000 and 13,000,000, with a staff estimate of 12,000,000 fish for planning purposes. By the end of the season, estimates were for a run size of 13,700,000 and a gross escapement past Mission of 4,478,000 fish. The 50% arrival date of the migration, referenced to Area 20, was August 15, or about eight days later than forecast (Figure 10).

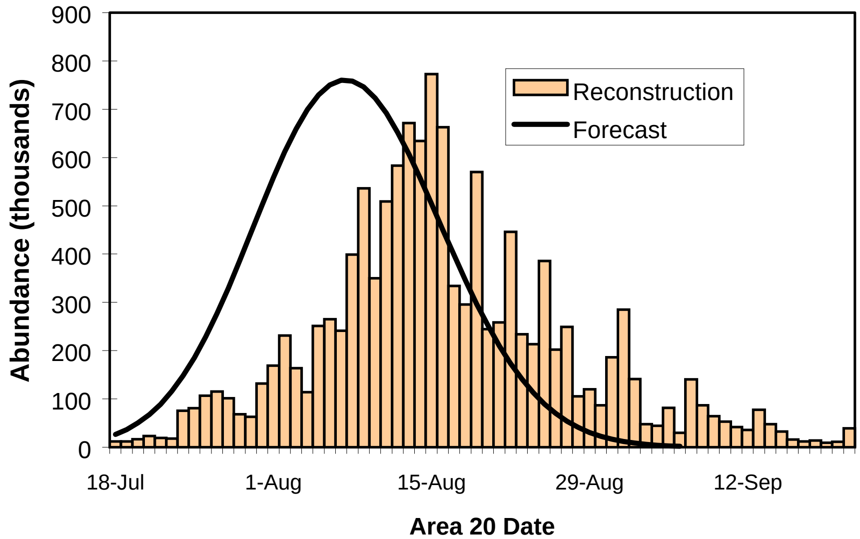

Figure 10. Comparison between pre-season and post-season estimates of timing and abundance for Summer Run sockeye stocks in 1997.

Assessment of Late-run abundance was confounded by the much higher abundance of co-migrating Summer-run sockeye. Late-run abundance was estimated at 900,000-1,000,000 fish in late August, with a potential gross escapement of 250,000 fish. By the end of the season, Late-run abundance was estimated at 1,300,000 with an estimated escapement to the Strait of Georgia of 560,000 fish. The 50% arrival timing of Late-run sockeye, referenced to Area 20, was August 20.

Canadian Johnstone Strait (Areas 11-16) fisheries on Summer-run sockeye were marked by lower than anticipated harvest rates, resulting in a greater-than-expected abundance of sockeye entering the river during the main escapement period each week. Reconstructed point estimates of harvest rates on Late-run sockeye, however, appeared to be considerably greater than those on Summer-run sockeye for most weeks (Figure 11). The application of Summer-run harvest rates in Late-run run-size models appears to have resulted in an overestimation of Late-run abundance and estimated escapement to the Strait of Georgia, compared to the post-season estimate of Area 29 catch and gross escapement (200,000 fish).

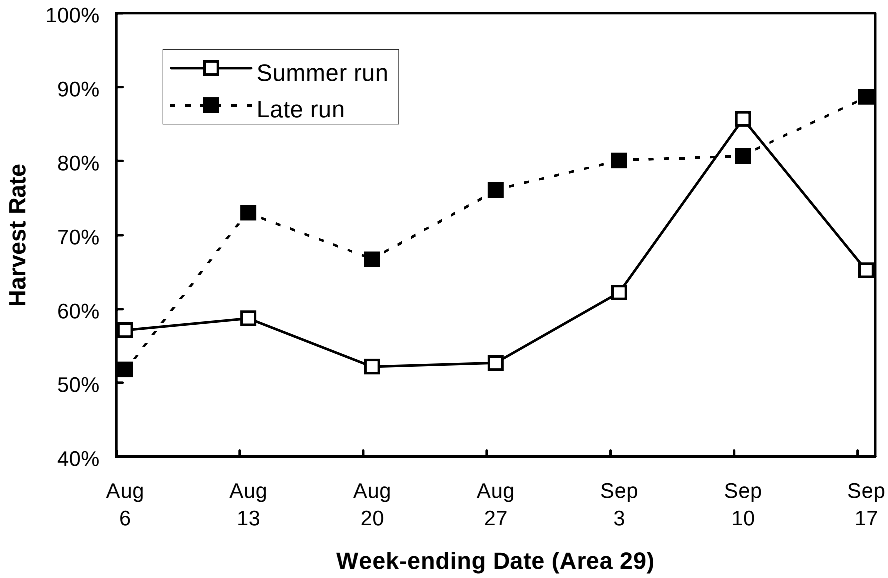

Figure 11. Estimated weekly harvest rates for Summer-run and Late-run sockeye salmon in Johnstone Strait net and troll fisheries combined in 1997.

The high diversion of Fraser sockeye through Johnstone Strait that began with Early Stuart sockeye in July, increased to 80-90% in mid-August and moderated somewhat by the end of August. During September, the diversion rate was just over 50%. The average diversion rate for the season (weighted by run size) was 77%, compared to the recent-year average (1980-96) of 47%.

Cottonwood test fishing CPUE's are compared with daily hydroacoustic estimates of sockeye passage at Mission in Figure 12. Cottonwood data are lagged one to two days, which is the estimated travel time for sockeye between the Cottonwood and Mission sites. The peak Summer-run migration at Mission occurred August 21-25.

Observations at Hells Gate on July 14-20 indicated the passage of sockeye through the Fraser Canyon had slowed drastically as water levels increased. As reported previously, significant en route mortality is estimated for Early Stuart sockeye which were unable to migrate through the Canyon during this extreme high discharge period. The early part of the Early Summer sockeye run was also subjected to delay, and en route mortality on a lower fraction of this run also is estimated to have occurred. Subsequently, the passage of sockeye proceeded normally during August, with no evidence of delay, even though river levels and temperatures remained above normal for the greater part of August.

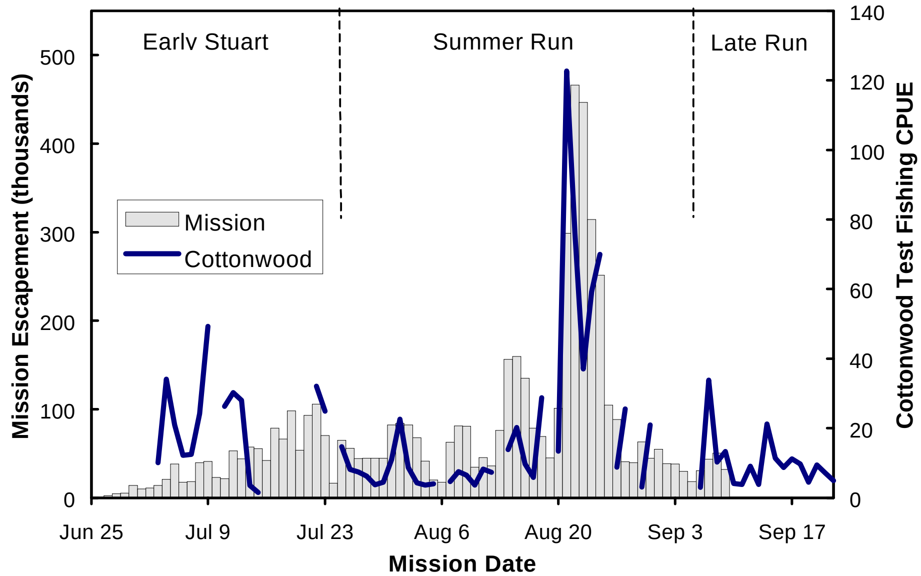

Figure 12. Daily escapements of sockeye salmon estimated at Mission by echosounding compared with test fishing CPUE's at Cottonwood one or two days earlier.

B. Pink Salmon

As with sockeye, assessments of the returning abundance of Fraser River pinks were based on data from commercial and test purse seine fisheries. CPUE and cumulative-normal models, and to a lesser extent biological models based on scale growth data, were used to assess pink salmon abundance. Estimates of escapement to the Strait of Georgia were derived by subtracting catches from estimates of total run. Proportions of Fraser pinks in these catches were initially estimated using pre-season forecasts of racial composition. Approximately one week after each fishery, these proportions were replaced by Genetic Stock Identification (GSI) estimates.

Confidence in run-size estimates for Fraser pinks was of concern in 1997, primarily because of two factors. First, the peak timing of Fraser pinks was forecast to be September 8 (Area 20 date), compared to the long term average of August 27. Second, harvest rates on Summer-run sockeye were lower than expected and the implications for pink salmon harvest rates were uncertain. By the end of August, the run appeared to be late and so analyses of run size were expected to be delayed. On September 2, catch based estimates of run size ranged from 6,250,000-10,000,000 fish, using conservative assumptions about peak timing (August 28 - September 2). On September 9, the estimated run size (assuming September 2 timing) from the cumulative-normal model was 10,500,000 fish, but purse seine catch estimates were relatively unchanged at 6,500,000 fish. Scale growth models were more optimistic, giving an estimate of 17,500,000 fish. On September 16, the estimated run was 11,000,000-13,000,000, depending on the harvest rates applied to marine catch data. At the end of the season, run size was estimated at 13,000,000, with an expected gross escapement to the Strait of Georgia (by subtraction) of 7,800,000 fish.

In 1997, approximately 55% of the Fraser River pink run based on harvest rate estimates migrated through Johnstone Strait, compared to the long-term average of 35% (1959-95). The 50% migration date (Area 20 timing) of September 1 was seven days earlier than forecast.

The pattern of daily pink salmon escapements in the Fraser River, measured by Mission hydroacoustic, Cottonwood test fishing CPUE (lagged two days) and Duncan Bar CPUE data is shown in Figure 13. The hydroacoustic program provided an escapement estimate of 6,135,000 pink salmon. However, in the 1989-95 period, hydroacoustic estimates were less than 50% of spawning ground estimates. As well, the split-beam echosounding study in 1995 indicated that the standard Mission echosounding estimate was underestimated due to the migratory behaviour of pink salmon. Based on this experience, a decision was made to double the daily Mission estimate of abundance. At the time, this was considered to be a conservative adjustment. The final in-season estimate of total gross escapement was 12,000,000 Fraser pink salmon.

Pink salmon migrated upstream past Hells Gate without accumulation or delay. The abundance of pinks above Hells Gate could not be confirmed, however, as spawning ground enumerations at Bridge River, Seton Creek and Thompson River have not been conducted since 1991.

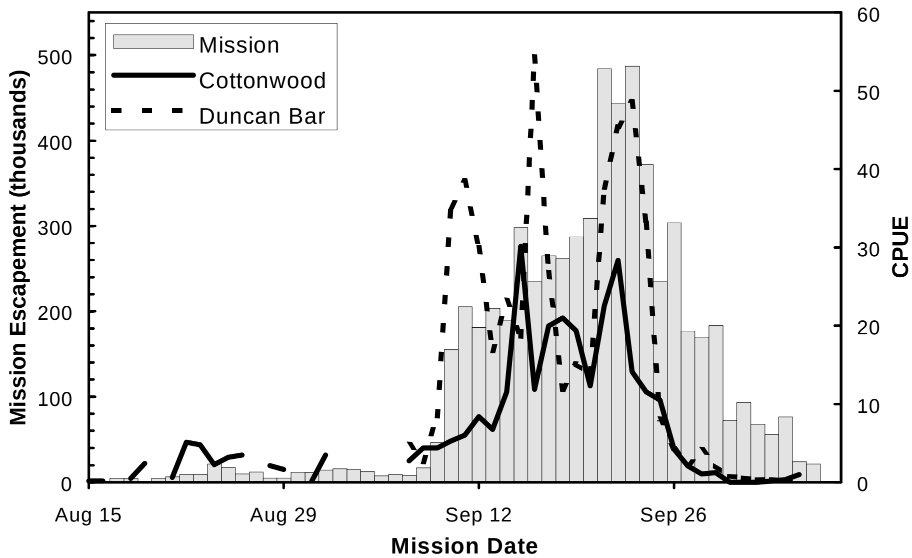

Figure 13. Daily escapements of pink salmon in 1997, estimated at Mission by echosounding compared with test fishing CPUE at Cottonwood two days prior and at Duncan Bar the same day.

C. Standard Hydroacoustic Program at Mission

To improve the data processing and accuracy of Mission hydroacoustic escapement estimates, technical improvements were applied to the standard program[3] in 1997. First echo signals detected by the single-beam sounder were digitized. Second, the digitizer integrated a Differential Global Positioning System (GPS) to record the track of the echosounding vessel during transects. Third, upgraded software allowed us to process the digital echo signals and GPS data. These advances serve the following purposes:

- The data can be analyzed quickly and accurately. Features of the software include automatic target tracking, GPS data decoding, synchronization of sounder data with GPS data, and interactive review of tracked fish data.
- The data can be processed with digital signal processing techniques to extract statistics such as fish duration-in-beam and the distribution of fish both across the river and in the water column (i.e., depth).

[3] Banneheka, S.G., R.D. Routledge, I.C. Guthrie and J.C. Woodey. 1995. Estimation of in-river fish passage using a combination of transect and stationary hydroacoustic sampling. Can. J. Fish. Aquat. Sci. 52: 335-343.

- Mapping the path of the echosounding vessel as it transects the river allows us to assess whether the path is relatively straight and the velocity across the river relatively constant. If both are true then concerns about biases from these sources can be alleviated.
- The data can be compared with other data, such as tidal cycles.

These improvements to data-recording and vessel positioning are planned to be integrated with analytical procedures used to provide daily estimates of abundance in future years. In 1997, however, daily estimates were calculated using traditional analytical procedures.

D. Split-Beam Hydroacoustic Study at Mission

As a result of recommendations by the Mission Hydroacoustic Facility Working Group of the Fraser River Sockeye Public Review Board after the 1994 season, a joint PSC and DFO program that employs a shore-based split-beam echosounder at the Mission hydroacoustic site was conducted in 1995, 1996 and 1997. The results of the 1995 studies are documented in Xie, et al. (1997)[4] and in the 1995[5] and 1996[6] Annual Reports of the Fraser River Panel. The initial objective of the program was to examine assumptions regarding salmon behaviour and distribution that are implicit to the standard (single-beam) echosounding method used to estimate escapement past Mission.

In 1997, the study continued with an upgraded split-beam echosounder system at Mission. Highlights of the 1997 program were:

- Information on fish speed and spatial distribution were obtained.
- The GPS and digital taping system described for the standard program was used in conjunction with data from the split-beam system to investigate the potential of boat avoidance by sockeye, and to compare patterns in fish abundance detected by the two technologies.
- Automated vertical scanning of the water column with a two transducer sampling scheme will allow quantification of vertical fish distributions in the mid-water, surface and bottom of the river.
- A 24-hour data acquisition system was implemented to obtain split-beam data over the entire day as is the practice with the standard echosounding program, which will allow future comparisons of data acquired with the two systems.
- Detection probabilities of the split-beam echosounder were measured as a function of range from the transducer and angle from the beam centre, to get realistic estimates of the number of fish that swim through the insonified volume.
- The upstream pink salmon migration was studied to determine if distribution patterns were similar to those observed in 1995.
- An active split-beam fish tracking sounder (BioSonics Model DT 5000) was used in preliminary trials. The purpose of this study was to explore the possibility of tracking individual fish that are approached by the PSC echosounder vessel.

Although analyses of the 1997 data is far from complete, preliminary findings are similar to those documented for the 1995 and 1996 studies. One exception is that pink salmon distributions were not as compact and near-shore as in 1995, making the tracking of pink salmon easier in 1997. Pinks tended to migrate in clusters of four to five fish, which made the tracking of individual fish difficult. However, the clusters were tracked quite well because the fish within each cluster moved as a cohesive unit, with the same path and speed.

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[4] Xie, Y., G. Cronkite and T.J. Mulligan. 1997. A split-beam echosounder perspective on migratory salmon in the Fraser River: A progress report on the split-beam experiment at Mission, B.C., in 1996. Pacific Salmon Comm. Tech. Rep. No. 9: 31 p.

[5] Pacific Salmon Commission. 1998. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1995 Fraser River sockeye and pink salmon fishing season. Vancouver, B.C.

[6] Pacific Salmon Commission. 1999. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1996 Fraser River sockeye salmon fishing season. Vancouver, B.C.

VII. RACIAL IDENTIFICATION

In 1997, Pacific Salmon Commission staff conducted programs designed to identify the stock proportions of Fraser River sockeye and pink salmon in commercial and test fishing catches. Scale pattern analysis is the primary technique employed to differentiate between stocks and stock groups of Fraser River sockeye. Intensive scale sampling procedures are implemented in all areas where Fraser River sockeye are expected to be present in distinguishable numbers. In addition, in 1997 the PSC conducted an in-season screening program for *Philonema oncorhynchi*, a body cavity parasite that has low prevalence in most Fraser sockeye stocks compared with Southeastern Alaska and northern B.C. stocks. Data obtained from this program, in conjunction with scale-based data, were used to estimate the catch of Fraser River sockeye in Alaska District 104 and in Canadian northern fisheries. Screening was also conducted in south coast fisheries for the brain parasite *Myxobolus* to assist in separating Quesnel from co-migrating Chilko sockeye. In repeated sampling, the parasite has been present in a high proportion of Quesnel sockeye, but absent from Chilko sockeye.

Data collected from the racial identification program provides information on the abundance and timing of these stocks as they migrate to the Fraser River. These data are also used to account for international and domestic catches of Fraser River sockeye salmon in coastal waters, and to apportion the daily Mission sockeye escapement estimates into discrete stock groups.

Identification of Fraser River pink salmon in mixed stock fisheries is conducted using Genetic Stock Identification (GSI) procedures.

The pink salmon stock identification program estimates the contribution rates of Fraser River pink salmon in mixed stock fisheries, but does not separate pink salmon into individual stock groups. Therefore, daily escapements of pink salmon past Mission are only available in a grouped stock format.

A. Sockeye Salmon

Identification of sockeye stocks in mixed-stock fishery samples is conducted using scale pattern analysis. Stock-specific baseline standards are developed for the two dominant adult age-classes in Fraser River sockeye (ages 4_2 and 5_2 for most stocks). In 1997, the age 4_2 baseline standards consisted of seven stock groups. Each stock group is formed by one or more individual stocks exhibiting similar scale traits and migratory timing (Table 8).

Table 8. Individual stocks comprising the stock groups used in 1997.

Run	Stock Group	Component Stocks
Early Stuart	Early Stuart	Early Stuart stocks
Early Summer	Fennell/Bowron	Fennell, Bowron, Raft, Cayenne, Momich, Upper Adams, Chilliwack, Nahatlatch, Scotch, Seymour, misc. early South Thompson stocks
Early Summer	Nadina/Gates/Pitt	Nadina, Gates, Pitt
Summer	Chilko/Quesnel	Chilko River, south and north end Chilko Lake, Taseko, Upper and Lower Horsefly, McKinley, Mitchell, misc. Quesnel Lake tributary stocks and Quesnel Lake spawners
Summer	Late Stuart/Stellako	Tachie, Middle, Stellako
Late	Birkenhead	Birkenhead, Adams, Lower and Middle Shuswap, misc. late Shuswap Lake stocks, Cultus
Late	Weaver	Weaver, Harrison, Portage, Widgeon, Big Silver

Stock-specific baseline standards used for in-season racial analysis models come from two sources. First, standards are constructed from sibling scales collected from the spawning grounds the previous year. Age 4_2 standards are constructed from age 3_2 (jacks) scales and age 5_2 standards from age 4_2 scales. Second, when sibling data from the previous year are unavailable, baseline standards are developed using data for the same age class from previous years. In recent years, low returns of jack sockeye have prevented their use in the development of age 4_2 baseline standards, except for a few stocks. Reliance on age 4_2 standards created from past years' age 4_2 scales reduces the accuracy of in-season baseline standards compared to years where large numbers of prior year age 3_2 scales are available.

Linear discriminant function analysis (DFA) is used to distinguish among baseline standards and to combine individual sockeye stocks into stock groups. Subsequently, the contribution rates of each stock group in mixed-stock fishery samples are determined using linear DFA. Linear DFA is the technique of choice for the following reasons: it has proven to be useful in applications involving scale data; computer programs for linear DFA are readily available; and our scale data generally conform to the assumptions required for linear DFA. In addition, PSC staff assess research findings in the field of stock identification. Such findings may result in future modifications to the PSC's stock identification methodologies.

The differentiation of stock groups in samples of unknown composition was achieved using four scale variables: circuli count to the first freshwater annulus, circuli count in the freshwater spring growth zone, distance from the focus to the fifth circulus, and distance from the focus to the first freshwater annulus. Supplementary data used for stock identification include information on age composition, fish length and historical patterns of stock-specific timing and behaviour (Gable and Cox-Rogers 1993)[7].

Scale analyses of commercial and test fishing catches were conducted daily, beginning in late June and continuing through mid September. Commission staff sampled commercial sockeye landings at sites in Bellingham and Blaine in Washington State, and Vancouver, Steveston, Port Renfrew, Port Hardy and Prince Rupert in British Columbia. Additional scale samples from Johnstone Strait purse seine test fisheries were provided by DFO. Finally, the Alaska Department of

[7] Gable, J.H. and S.F. Cox-Rogers. 1993. Stock identification of Fraser River sockeye salmon: methodology and management application. Pacific Salmon Comm. Tech. Rep. No. 5: 36 p.

Fish and Game (ADF&G) obtained scale samples from the District 104 net fishery at landing sites in Petersburg and Ketchikan and from the southeast Alaska troll fishery at sites in Juneau, Ketchikan, Pelican, Sitka and Yakutat. In total, approximately 50,500 sockeye scales were aged and digitized by PSC staff in 1997.

In addition, DFO in recent years has attempted to obtain weekly scale samples from First Nations fisheries at six fishing areas in the Fraser River: Chilliwack, Yale, Lytton, Bridge River, Williams Lake and below Prince George. The number of scales obtained by individual site in 1997 are: Chilliwack – 460, Yale – 1,694, Lytton – 1,902, Bridge River – 3,378, Sheep Creek (south of Williams Lake) – 1,940 and Prince George – 818. As in past years when scale data from these fisheries were collected, the 1997 data will be used to help assess the reliability of reconstruction based models used to assess catch by stock group in First Nations fisheries. The long term goal is to directly assign First Nations fishery catches into individual stock groups using DFA scale analyses (Gable 1998)[8].

In 1997, the numerically dominant stocks were Early Stuart, Quesnel, Chilko and Late Stuart. These stocks, in combination with other numerically smaller stocks, were pooled to form seven unique stock groups: Early Stuart, Fennell/Bowron, Nadina/Gates/Pitt, Quesnel/Chilko, Late Stuart/Stellako, Birkenhead, and Weaver/Portage. The individual stocks comprising each group are listed in Table 8. For most of the period of active commercial fishing in 1997, the seven stock groups were incorporated into three categories of in-season models: 1) Early Stuart and Early Summer-run, 2) Early Summer and Summer-run, and 3) Summer and Late-run models.

Classification matrices developed from in-season DFA models showed that the dominant early timed stock group, Early Stuart, was confounded with the Fennell/Bowron group. Classification accuracies (estimated rate of correct classification that provides a measure of stock resolution and model performance) for these two stock groups were 58% and 53%, respectively. The Nadina/Gates/Pitt group was relatively well differentiated from Early Stuart and Nadina/Gates/Pitt groups, with a 76% classification accuracy. During the period when the Early Summer and Summer-run model was used, the dominant Summer-run group, Quesnel/Chilko, was accurately distinguished from co-migrating stocks (80% classification accuracy). However, Late Stuart/Stellako (50% classification accuracy) showed relatively high rates of misclassification with both Early Summer groups. During the period when the Summer and Late-run model was used, Quesnel/Chilko and Birkenhead sockeye were well differentiated from other stocks (76% and 84% classification accuracy, respectively), but Late Stuart/Stellako and Weaver groups were expected to have lower classification accuracies (51% and 63%, respectively). To correct for misclassifications among stock groups, bias correction techniques (Cook and Lord 1978)[9] were applied.

The first significant difficulty that was addressed in applying the 1997 DFA models was a high rate of misclassification between Early Stuart and Fennell/Bowron stock groups. Two additional factors further complicated the problem. First, the age 4_2 baseline standard for the Fennell/Bowron stock group was uncertain because it was comprised almost entirely of scales from prior brood years: very few sibling samples (jack scales from the previous year) were available. Second, based on pre-season abundance forecasts and historical timing patterns, the maximum Fennell/Bowron contribution rates were expected to be less than 10% during most of the Early Stuart migration period. High misclassification rates and low expected proportions can result in significant overestimates of stock contributions for less abundant stocks (i.e., Fennell/Bowron) at the expense of dominant stocks (i.e., Early Stuart).

Three strategies were employed to minimize the overestimation bias. First, age 5_2 proportions were expected to increase with the arrival of Early Summer stocks because these stocks were forecast to be 20% age 5_2 fish compared to less than 1% age 5_2's in the Early Stuart forecast. The

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[8] Gable, J.H. 1998. Sockeye stock composition estimates for Fraser River First Nations catches (1989 to 1995): A comparison between run reconstruction models and scale-based discriminant function models. Pacific Salmon Comm. Tech. Rep. No. 9: 94 p.

[9] Cook, R.C. and G.E. Lord. 1978. Identification of stocks of Bristol Bay sockeye salmon (*Oncorhynchus nerka*) by evaluating scale patterns with a polynomial discriminant method. Fish. Bull., U.S. 76: 415-423.

majority of Early Summer 5_2's were in the Nadina/Gates/Pitt group which has a historical timing pattern that is very similar to the Fennell/Bowron group. Thus, increases in age 5_2 proportions in fishery samples were used to signal the earliest appropriate time for inclusion of the Fennell/Bowron group in age 4_2 DFA models. Second, to obtain more accurate estimates of Early Stuart proportions, the pre-season baseline standard was updated using scales obtained from the earliest test fishery samples in the river, which are virtually 100% Early Stuart. The updated standard was used to generate an estimate of Early Stuart stock proportions by pro-rating the proportion of scales in mixtures that had patterns consistent with the core patterns of the Early Stuart standard. The proportion of Early Summers could then be estimated as [1- [Early Stuart proportion]], and the proportion of Fennell/Bowron fish as [Early Summer proportion - Nadina/Gates/Pitt proportion]. This Fennell/Bowron estimator along with the pre-season expected contribution rates was used to verify the DFA model results. Third, other Fennell/Bowron estimators were examined. Individual classifications were used to determine the proportion of fish that had a much higher probability of being Fennell/Bowron than Early Stuart sockeye. Bivariate distributions of length and circuli count were examined for clusters of fish that had length or circuli patterns that were distinct from the Early Stuart standard. If DFA model results were consistent with alternative estimates, then DFA results were used. Otherwise, one method or a combination of methods was used to estimate Fennell/Bowron proportions.

During the period of overlap between the Early Summer and Summer-run migrations, difficulties were encountered in separating Early Summer and Summer-run stock groups. For this reason, and due to the low contribution rates of the Early Summer stocks in mixed stock fisheries during this time period, the proportions of Early Summer stocks were estimated using a combination of methods similar to those described above for the Early Stuart period.

Fortunately, the dominant Summer-run group (Quesnel/Chilko) was fairly accurately distinguished in DFA models. There were significant misclassifications (about 15%), however, between Quesnel/Chilko and Late Stuart/Stellako groups. There was concern about potential overestimation of Late Stuart/Stellako sockeye as this stock group was expected to contribute only about 24% of the total Summer run. There was also uncertainty about the scale standards, especially for the Quesnel stock, for which only 16 prior-year jack scales were available. To avoid overestimation of Late Stuart/Stellako contributions, alternate estimators were compared as described above. The most useful of these for the Late Stuart/Stellako group was derived from length-circuli bivariate distributions. The dominant stock in the group, Late Stuart, is considerably shorter and has a higher mean circular count than the Quesnel/Chilko group. Quesnel and Chilko stocks, which could not be separated using scale characters, were identified using the presence or absence of the brain parasite, *Myxobolus articus*. From past years' samples the Quesnel stock was known to have a high prevalence of *Myxobolus*, while the parasite is largely absent from Chilko and other co-migrating stocks. Data on the incidence of *Myxobolus articus* collected from key test and commercial fishery samples during the season were used to generate separate escapement estimates for Chilko and Quesnel stocks.

During the migration period spanning Summer and Late-run migrations, the most serious stock identification problems concerned misclassifications between Late Stuart/Stellako and Weaver groups. Based on the pre-season forecasts, Weaver sockeye were expected to be a minor contributor during the Summer-run period. Thus, to avoid potential overestimation of Weaver contributions, length-circuli bivariate distributions were used as an alternative estimator (Weaver sockeye are typically longer than Late Stuart sockeye). Individual classifications were also examined to determine whether fish classified as Weaver were large enough to be consistent with Weaver length characteristics. In addition, scale distance measures for about 20% of the Weaver standard were higher than any of the other Summer or Late-run stocks, so a small fraction of the scale patterns in samples could be identified as uniquely Weaver. These data were used to confirm the presence of Weaver. Pre-season expected contributions were also used to check DFA model estimates.

A re-analysis of Fraser River sockeye salmon catches and escapements by stock group was conducted after the season. Revised DFA models were developed using baseline standards derived from the 1997 spawning ground scale samples. The major component stocks in each stock group were the same in the post-season and in-season DFA models (Table 8). A comparison between in-season gross escapement estimates by stock group, and post-season estimates calculated using spawning ground scale standards, is presented in Table 9.

Table 9. Comparison of in-season to post-season estimates of gross escapement (at Mission) by stock group, 1997.

Stock Group	In-Season Estimate	Post-Season Estimate
Early Stuart	1,098,000	1,259,000
Fennell/Bowron/Seymour	168,000	43,000
Nadina/Gates	107,000	95,000
Chilko/Quesnel	3,382,000	3,171,000
Late Stuart/Stellako	830,000	1,074,000
Birkenhead/Adams/Cultus	138,000	83,000
Weaver/Portage/Harr/Widg	81,000	79,000

To investigate the accuracy of the in-season DFA models, we applied these models to the scales collected from each spawning ground in 1997. We first examined the classification accuracy within the Early Stuart/Early Summer-run migration period. We found that the in-season models overestimated the Fennell/Bowron group and underestimated Early Stuart, while the Nadina/Gates/Pitt group was estimated accurately. For the Early Summer and Summer-run period, again the Fennell/Bowron was overestimated, while the Nadina/Gates/Pitt and Late Stuart/Stellako groups were underestimated and the Quesnel/Chilko group was accurately estimated. In the Summer and Late-run migration period, the Quesnel/Chilko, Birkenhead and Weaver groups were overestimated, while the Late Stuart/Stellako group was underestimated. The most significant result of the inaccuracy of the in-season models was that post-season re-analysis of catch and Mission escapement gave substantially lower estimates for the Fennell/Bowron and Birkenhead stock groups than obtained in-season. The principal cause of these biases was that the circuli count of 4-year-old Late Stuart sockeye (Tachie River) returning in 1997 was lower than that for the jacks that were used for the in-season standard. This shift in circuli count (and measurements) between the in-season standard and returning fish caused the in-season model to misclassify many of the Late Stuart sockeye to other stocks resulting in significant overestimates for the relatively less abundant co-migrating stock groups such as Fennell/Bowron and Birkenhead. While this problem is particularly acute on the 1997 cycle, it can be expected to continue in future years until larger, more representative jack samples or a viable alternative to scale pattern analysis are available for improved in-season stock identification.

The brain parasite (*Myxobolus*) was used to separate Quesnel from co-migrating Chilko sockeye. In repeated sampling, Quesnel sockeye have been found to have a very high prevalence of the parasite, while the parasite is absent or in very low prevalence in other major Fraser sockeye stocks. In the 1997 spawning ground samples, the prevalence of *Myxobolus* in Quesnel sockeye was found to be 99%, somewhat higher than assumed for in-season calculations (86%). Thus, in-season calculations slightly overestimated the run strength of Quesnel relative to Chilko sockeye. The 1997 samples confirmed, however, that Quesnel sockeye continue to have substantially higher prevalence rates than co-migrating Summer-run sockeye stocks (Chilko, 0%; Late Stuart, 3%; Stellako, 9%).

Application of post-season standards to current estimates of catch and escapement provides the current best estimates of total returns by stock and stock group. The results of this analysis are presented in Table 10.

The return of Early Stuart adults totalled 1,673,000 (Table 10). Catches of this stock in Canadian and United States commercial fisheries, Canadian First Nations fisheries outside of the Fraser River and non-commercial fisheries totalled 364,000 fish. An estimated 358,000 Early Stuart sockeye were caught in Fraser River Indian fisheries and 5,000 in recreational catches above Mission. The total catch estimated from all sources was 727,000 and spawning escapements totalled 266,000. Based upon the hydroacoustic estimate of gross escapement past Mission, 680,000 Early Stuart sockeye were estimated to have died en route. This figure was derived by subtracting the spawning ground escapement and Indian catch estimates upstream from the gross escapement estimate obtained at Mission. The exploitation rate for all catch areas was 43%.

The estimated return of Early Summer stocks totalled 414,000 adults (Table 10). Preliminary catch estimates for this stock group in commercial, Canadian non-Fraser Indian and non-commercial fisheries totalled 233,000. In addition, there were catches of 42,000 in all Fraser River Indian fisheries and 2,000 in recreational fisheries above Mission for a total catch of 277,000 fish. Estimated spawning escapements and en-route losses were 89,000 and 48,000 fish, respectively. The exploitation rate on Early Summer stocks was 67%.

The Summer-run return was estimated to total 13,406,000 adult sockeye (Table 10). Quesnel/Chilko sockeye dominated the production of Summer-run stocks with a total return of 9,933,000, while the total return of Late Stuart/Stellako was 3,473,000 fish. Commercial, Canadian non-Fraser Indian and non-commercial catches of Summer-run stocks totalled 8,889,000. In addition, 662,000 fish were caught in Fraser River First Nations fisheries and 48,000 in above-Mission recreational fisheries. Catches in all fisheries totalled 9,599,000 fish and spawning escapements totalled 3,807,000 fish. The adult exploitation rate for Summer-run stocks in all fisheries was 72%.

Late-run returns, dominated by Birkenhead and Weaver sockeye, totalled 910,000 adults (Table 10). Production of Birkenhead and Weaver sockeye stock groups were 230,000 and 680,000 fish, respectively. Catches of Late-run stocks included 803,000 in commercial, Canadian non-Fraser Indian and non-commercial fisheries, 14,000 in Fraser River First Nations fisheries, and 3,000 in recreational fisheries above Mission, for a total of 820,000 adults. Spawning escapements totalled 90,000 fish. The exploitation rate for Late-run stocks was 90%.

The total return of Fraser River sockeye in 1997 was 16,403,000 adults. Catches in all fisheries accounted for 70% of the fish, 26% spawned and 4% in the Fraser River died en-route to their spawning grounds (Table 10). Of the 70% harvest component, commercial fisheries harvested 61%, Fraser River First Nations fisheries harvested 7% and other fisheries harvested 2% (Table 1).

Table 10. Catches, escapements and adult exploitation rates for Fraser River sockeye and pink salmon by stock group in 1997.

Stock Group	River & Ocean Catch *	Gross Escapement: Fraser Indian Catch	Gross Escapement: Recreational Catch Above Mission	Gross Escapement: Spawning Escapement	Gross Escapement: En-Route Loss**	Run Size: Adult	Run Size: Jacks	Portion of Run	Adult Exploitation Rate: River & Ocean	Adult Exploitation Rate: All Areas
Sockeye Salmon										
Early Stuart	364,000	358,000	5,000	266,000	680,000	1,673,000	0	10%	22%	43%
Early Summer-run										
Early Miscellaneous	91,000	15,000	1,000	37,000	-7,000	137,000	0	1%	66%	78%
Nadina/Gates/Pitt	142,000	27,000	1,000	52,000	55,000	277,000	1,000	2%	51%	61%
Total	233,000	42,000	2,000	89,000	48,000	414,000	1,000	3%	56%	67%
Summer-run										
Quesnel/Chilko	6,567,000	482,000	40,000	2,844,000	0	9,933,000	11,000	61%	66%	71%
Late Stuart/Stellako	2,322,000	180,000	8,000	963,000	0	3,473,000	0	21%	67%	72%
Total	8,889,000	662,000	48,000	3,807,000	0	13,406,000	11,000	82%	66%	72%
Late-run										
Birkenhead	171,000	5,000	1,000	53,000	0	230,000	2,000	1%	74%	77%
Weaver/Portage/Misc.	632,000	9,000	2,000	37,000	0	680,000	0	4%	93%	95%
Total	803,000	14,000	3,000	90,000	0	910,000	2,000	6%	88%	90%
Total Adults	10,289,000	1,076,000	58,000	4,252,000	728,000	16,403,000	14,000	100%	63%	70%
Total Jacks	5,000	0	0	9,000	0	14,000				
Total	10,294,000	1,076,000	58,000	4,261,000	728,000	16,417,000				
Portion of Total Run	63%	7%	0%	26%	4%	100%				
Pink Salmon										
Total	5,291,000	29,000	0	2,878,000	0	8,198,000	0	100%	65%	65%
Portion of Total Run	65%	0%	0%	35%	0%	100%				

* Includes catches in all fisheries, excluding the Fraser River Indian fishery and recreational fisheries above Mission.
** Mission escapement minus Indian catch and spawning escapement above Mission.
*** Early Chilko included with Chilko (i.e., summer runs).

B. Pink Salmon

Catches of Fraser River pink salmon harvested in mixed stock fisheries have been estimated using GSI (genetic stock identification) techniques since 1987. GSI relies on genetic differences among stocks of pink salmon, expressed as different enzyme phenotypes in body tissues. Pink salmon that spawn in Washington and British Columbia have been sampled and their tissues (generally muscle, heart, liver and eye) electrophoretically analyzed. These electrophoretic data have been compiled into baselines that profile the genetic characteristics of each pink salmon stock. During the fishing season, muscle tissue samples from 150 fish or more were collected from weekly catches where Fraser River pink salmon were expected to be present. After electrophoretic screening of the tissue samples, the results were analyzed using a maximum likelihood estimation (MLE) model. The model compares known genetic standards (from baseline samples) to genetic data from samples of unknown stock composition (from in-season, mixed-stock fishery samples) and generates estimates of the most likely stock composition.

In 1997, in-season sampling of pink salmon extended from early August to mid September. Pink salmon caught in commercial fisheries were sampled at Canadian fish processing plants in Prince Rupert, Port Hardy, Alert Bay, and Vancouver, and at United States processors in Blaine and Bellingham. In total, 6,700 pink salmon were sampled and electrophoretically analyzed.

GSI samples were collected weekly from the Canadian Area 101 troll fishery throughout August. The samples collected in early August showed low proportions (7%) of Fraser pinks with the contribution building to 68% by late August. A sample taken from the Canadian Area 2W purse seine fishery in mid August indicated that Fraser pinks constituted 80% of the catch. Approximately 1.4% (76,000 fish) of the total harvest of Fraser pinks occurred in fisheries north of Cape Caution.

Contributions of Fraser pinks to fisheries in Johnstone Strait (Areas 12 and 13) showed similar trends as previous years. A sample from the Area 12 troll fishery in early August indicated that 66% of the catch were Fraser pinks. Samples collected from Johnstone Strait purse seine fisheries in mid August showed that Fraser pinks comprised about 80% of the catch, and from late August to mid September they represented almost 90% of the catch.

Due to the very low effort and pink salmon catch by commercial trollers off the west coast of Vancouver Island in 1997, tissue samples were not collected from this fishery. Samples were collected from three Canadian Area 20 purse seine fisheries during the last half of August. The proportion of Fraser River pink salmon in these samples averaged 92%.

Pink salmon from United States purse seine fisheries that occurred off Point Roberts (Area 7A) and Salmon Banks (Area 7) were sampled from mid August to mid September. The samples collected in mid August indicated Fraser pink contributions of 81% in these fisheries with the samples in both purse seine fishing areas averaging about 90% Fraser pinks for the balance of the season.

Catches of Fraser River pink salmon totalled 5,320,000 in all fisheries, including 29,000 in Fraser River Indian fisheries (Table 9). DFO's estimate of spawning escapement is 2,878,000 fish. The harvest rate on Fraser pinks was 65%.

VIII. ESCAPEMENT

Canada Department of Fisheries and Oceans estimates the annual escapements of sockeye and pink salmon to spawning grounds in the Fraser River watershed (Figure 12). DFO provided preliminary estimates for this report. Escapement data will be updated in future reports as DFO provides the Panel with finalized estimates. These preliminary data, along with biological samples from the spawners, are provided to Commission staff so they can revise in-season racial analyses, estimate total production for each stock and assess the accuracy of in-season Commission stock monitoring programs.

A. Sockeye Salmon

Preliminary estimates of the 1997 sockeye salmon escapement to streams in the Fraser River watershed total 4,261,000 fish, including 4,252,000 adults (4 and 5-year-old fish) and 9,000 jacks (3-year-old fish) (Appendix C: Table 13). The adult escapement was 1,950,000 lower than in the brood year (6,202,000 in 1993, Table 11), but was the second largest recorded for the cycle.

Table 11. Adult sockeye salmon escapements by run on the 1997 cycle for 1981-1997.

	Spawning Escapement *				
Run	1981	1985	1989	1993	1997
Early Stuart	129,000	235,000	385,000	688,000	266,000
Early Summer	89,000	46,000	63,000	86,000	89,000
Summer	1,054,000	1,738,000	2,553,000	5,072,000	3,807,000
Late	111,000	59,000	59,000	356,000	90,000
Adults	1,383,000	2,078,000	3,060,000	6,202,000	4,252,000

* Early Chilko included with summer runs.

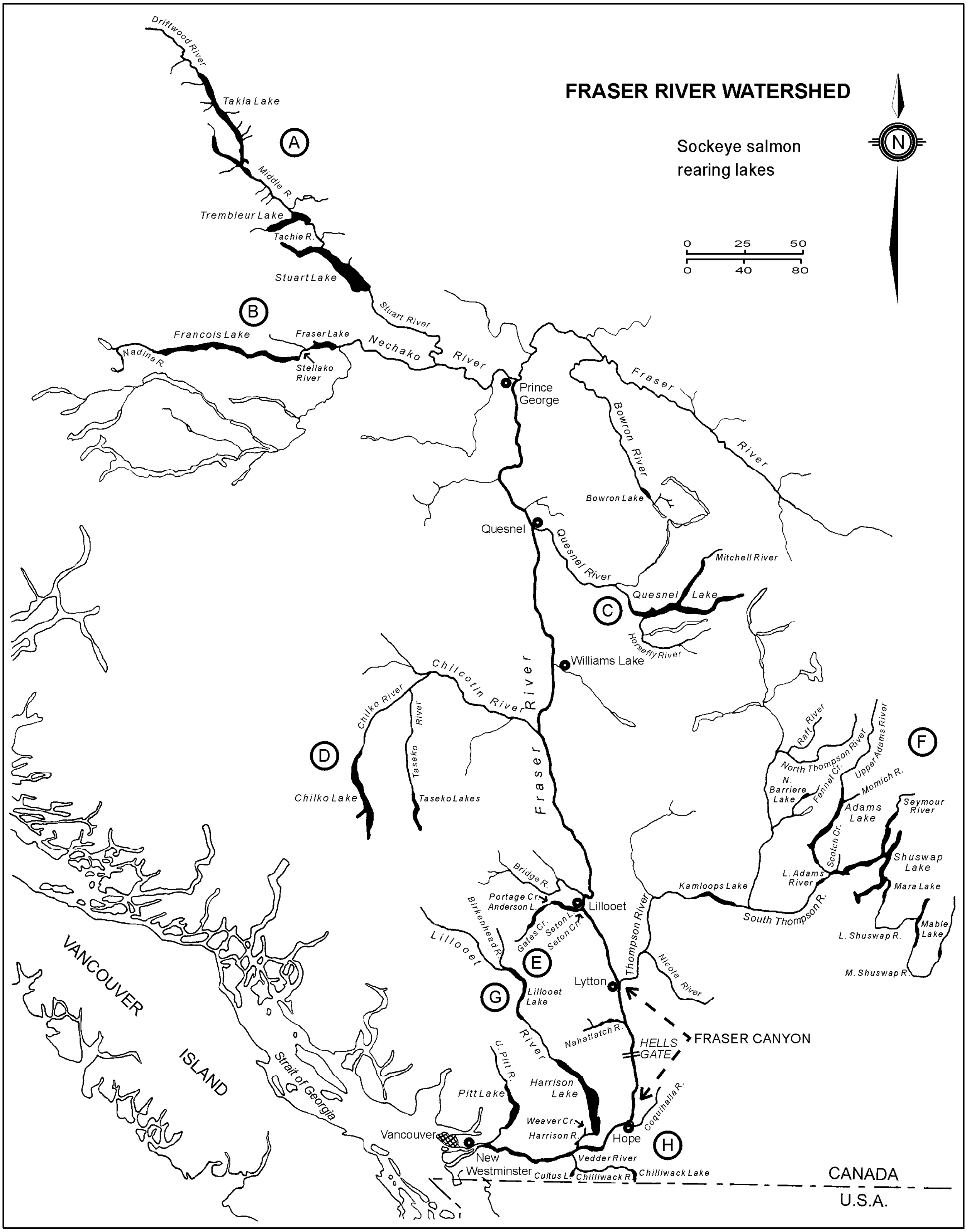

Figure 14. Sockeye salmon spawning grounds in the Fraser River watershed.

The 1997 cycle is the dominant line for Early Stuart sockeye. In past dominant cycle years, the majority of fish have spawned in Driftwood River and tributaries to Takla Lake with smaller numbers in Middle River and Trembleur Lake tributaries (A; Figure 14). In 1997, escapements to Middle River and Takla Lake tributaries were similar to the brood year while the number in Trembleur Lake tributaries was 43% below 1993 estimates. The largest difference occurred in Driftwood River and tributaries where only 29,600 fish arrived compared to 430,000 in the brood year. The later-timed Driftwood sockeye appear to have been more severely affected by the high water event in the Fraser Canyon. Fish of all populations were reported to be in poor condition upon arrival at the spawning grounds. A high proportion of the successful arrivals were males (66%), which are larger than females and presumably more capable of reaching the spawning grounds in a high water year such as 1997. Spawning success was 81.2% for females, the lowest in recent years.

Late Stuart sockeye migrate upstream almost a month later than the Early Stuart run. River conditions during the Late Stuart migration in August were considerably improved over conditions experienced by Early Stuart sockeye. An estimated 908,000 Late Stuart adults arrived on the spawning grounds (A; Figure 14), a decrease of 50% from the 1993 escapement of 1,805,000 adult sockeye. Of the total, 491,000 spawned in Tachie River, 281,000 in Middle River and 108,000 in Kuzkwa Creek, a tributary of Tachie River. In contrast to Early Stuart spawners, the Late Stuart sex ratio was near normal at 52.0% females. Success of spawning was 87.9%, which was lower than normal for these populations.

Stocks in the Nechako watershed (B; Figure 14) have not been abundant on the 1997 cycle. The Nadina River sockeye escapement in 1997 was 9,500 adults, unchanged from 1993. Of this total, 4,900 entered the spawning channel. Female spawning success was low (61.2%) in the channel but high (100%) in the creek. Nearly half of the escapement was comprised of 5-year-old fish from the successful 1992 brood. The other major stock in the watershed, Stellako River sockeye, declined 40% in escapement from 91,000 in 1993 to 55,000 in 1997. Success of spawning was near normal at 93.4%. Five-year-old fish comprised 66% of the escapement to Stellako River in 1997, similar to the 1993 escapement.

Quesnel Lake watershed (C; Figure 14) sockeye provided the largest component of the 1997 escapement. An estimated 1,859,000 sockeye spawned in the watershed. Escapement to the Horsefly River and tributaries was 1,234,000 fish, of which 262,000 spawned in McKinley Creek, the largest population recorded in that stream. The remaining spawning populations were: 534,000 spawners in Mitchell River and tributaries and 98,000 spawners in smaller Quesnel Lake tributaries and beach spawning areas. The total spawning population in the watershed was 29% below the brood year but similar to the 1989 spawning population of 1,871,000 sockeye. Spawning success in the Quesnel system was 89.3%, mainly due to a low spawning success rate in McKinley Creek (62.1%) where the highest density of spawners was located.

Spawning escapements to Chilko River and Lake (D; Figure 14) increased sharply in 1997 compared to 1993. Through 1989 this cycle was the lowest producing cycle line for Chilko sockeye. A sharp increase in production and escapement occurred in 1993 and again in 1997. The escapement was estimated at 986,000 fish, which is the third largest on record and 78% above the 1993 escapement of 555,000. As well, 1997 was the second consecutive large escapement to this system with the 1996 escapement of 974,000 being only slightly smaller. Spawning success was 91.5%.

Escapements to the Seton-Anderson system (E; Figure 14) on the 1997 cycle showed increases in 1989 and 1993, but dropped sharply in 1997. Gates Creek sockeye spawn in both the creek and the spawning channel, with a combined abundance of 6,500 fish compared to 18,000 in 1993. Spawning success was low at 62.8% in the channel and 22.5% in the creek. The Late-run Portage Creek sockeye escapement was 9,800 fish compared to 19,800 in 1993, a 51% decrease.

The 1997 cycle is an off-cycle for all South Thompson sockeye stocks (F; Figure 14). Escapements in 1997 were generally below brood year levels for both early and late timed stocks.

Early arriving stocks had 6,000 spawners compared to 19,300 in 1993. The largest decline occurred in the Seymour River where the escapement was 2,300 compared to 10,000 in the brood year. Scotch Creek had 3,100 fish, down from 8,400 in 1993. Adult escapements of Late-run sockeye to the Lower Adams River and Lower Shuswap River were similar to the brood year with 1,000 and 100 fish, respectively. However, only 300 jack sockeye were recorded in 1997 compared to 9,600 in 1993. The lack of jack sockeye, particularly in the Adams River, was unprecedented for a year preceding a dominant cycle (i.e., 1998) return of 4-year-old adults.

North Thompson sockeye spawner populations showed slight increases in escapements in 1997. Fennell Creek sockeye abundance was 9,000 fish, an increase of 19% over the brood year. Raft River also had a small increase, from 5,000 in 1993 to 6,100 in 1997. Although Raft River sockeye experienced some pre-spawning mortality, 82.5% of the female population successfully spawned.

Much smaller escapements were observed for Late-run stocks that spawned in the Harrison-Lillooet Lake system (G; Figure 14) in 1997 compared to the brood year. Late-run sockeye throughout the Fraser watershed showed declines from the brood year amounting to a cumulative 75% reduction. The Birkenhead River spawning population was estimated at 50,000 adults, 79% below the 1993 spawning of 245,000. The second major stock, Weaver Creek sockeye, declined 68% from 84,000 in 1993 to 25,500 in 1997. Approximately 4,000 of the sockeye that arrived at Weaver Creek and spawning channel were Summer-run fish from upper Fraser stocks that strayed into Weaver Creek. Harrison River sockeye declined 56% from 3,300 to 1,400 in 1997.

Lower Fraser tributaries (H; Figure 14) showed variable spawning populations. Nahatlatch River and Lake stocks (Early Summer) were estimated at 10,000 fish compared to 2,100 in 1993. Approximately 79% of the adult escapement was 5-year-old fish. Upper Pitt River also showed a increase of 57% from 22,800 in 1993 to 35,800 in 1997. The age composition was 66% 5-year-old fish and 32% 4-year-old fish. The Upper Pitt population is the only sockeye stock in the Fraser system that consistently produces primarily 5-year-old fish. Late-run Cultus Lake sockeye showed a sharp decline in escapement from 1,100 in 1993 to less than 100 fish in 1997. This stock has had poor escapements on the cycle since the 1970's.

The estimated spawning success for the whole Fraser River watershed was 89.4%, yielding an effective female population of 2,004,000 fish. This was a decrease of 46% from the record effective female escapement in 1993 but above the 1985 and 1989 spawner populations.

B. Pink Salmon

Beginning in 1993, DFO obtained estimates of pink salmon escapement via tagging and live fish recovery programs in the lower Fraser River. In 1997, application of this method resulted in an estimated spawning escapement of 2,878,000 pink salmon (Appendix C; Table 14). No information was collected on the distribution of spawning, spawner sex ratio or spawning success in the watershed.

IX. ACHIEVEMENT OF OBJECTIVES

In the absence of an agreed international catch sharing arrangements for Fraser River sockeye and pinks, the Panel was unable to establish objectives for 1997.

X. APPENDICES

APPENDIX A: PRE-SEASON FORECASTS AND SPAWNER ESCAPEMENT TARGETS FOR FRASER RIVER SOCKEYE AND PINK SALMON IN 1997.

Table 1. Pre-season forecasts and spawner escapement targets for Fraser River sockeye and pink salmon in 1997 (Provided to the Panel by Fisheries and Oceans Canada on May 15, 1997).

Stock/Timing	50%	75%	90%
Sockeye			
Early Stuart	1,044,000	717,000	509,000
Early Summer	351,000	187,000	105,000
Fennel	47,000	25,000	14,000
Bowron	12,000	7,000	4,000
Raft	20,000	11,000	6,000
Gates	115,000	66,000	39,000
Nadina	15,000	10,000	6,000
Pitt	62,000	33,000	18,000
Seymour	30,000	20,000	14,000
Scotch	50,000	20,000	9,000
Summer	15,691,000	6,307,000	2,742,000
Chilko	1,992,000	1,258,000	826,000
Quesnel	9,961,000	3,262,000	1,143,000
Stellako	471,000	307,000	207,000
Late Stuart	3,267,000	2,211,000	1,547,000
Birkenhead	689,000	395,000	238,000
Late	455,000	263,000	158,000
Late Shuswap	10,000	4,000	1,000
Cultus	6,000	3,000	2,000
Portage	84,000	41,000	21,000
Weaver	355,000	221,000	142,000
Total	18,230,000	7,668,000	3,476,000
Pink	11,387,000	7,533,000	5,104,000

Table 2. Fraser River sockeye and pink salmon forecasts and schedule of escapement targets for ranges of returns in 1997 (in thousands of fish). (Provided to the Panel by Fisheries and Oceans Canada on May 15, 1997).

Stock group	Range of returns	Escapement target	Harvest rate plan
Early Stuart	0 - 575	-	Max 15%
	576 - 1,667	500	15 to 70%
	>1,667	500 a	b
Early Summer	0 - 95	-	Max 15%
	96 - 277	83	15 to 70%
	>277	-	70%
Summer	0 - 3,593	-	Max 15%
	3,594 - 10,413	3,124 a	15 to 70%
	>10,413	3,124 a	b
Late	0 - 407	-	Max 15%
	408 - 1,180	354	15 to 70%
	>1,180	-	70%
Pink	0 - 6,900	-	Max 15%
	6,901 - 20,000	6,000 a	15 to 70%
	>20,000	6,000 a	b

a. Interim goals.

b. Harvest rate dependent on inseason estimates of co-migrating stocks and species.

APPENDIX B: ACTUAL FISHING TIMES IN MAJOR CANADIAN AND UNITED STATES NET FISHERIES IN THE FRASER RIVER PANEL AREA IN 1997.

CANADA (days)

	Area 20 *		Area 29 **
Date	Purse Seine	Gillnet	Gillnet
Jun.22-Jun.28	Closed	Closed	Closed
Jun.29-Jul.5	Closed	Closed	Closed
Jul.6-Jul.12	Closed	Closed	1
Jul.13-Jul.19	Closed	Closed	Closed
Jul.20-Jul.26	Closed	Closed	1
Jul.27-Aug.2	Closed	Closed	Closed
Aug.3-Aug.9	Closed	Closed	1
Aug.10-Aug.16	2	2	1
Aug.17-Aug.23	2	2	1
Aug.24-Aug.30	4	Closed	2
Aug.31-Sep.6	Closed	Closed	3
Sep.7-Sep.13	Closed	Closed	Closed
Sep.14-Sep.20	Closed	Closed	Closed
Sep.21-Sep.27	Closed	Closed	Closed
Sep.28-Oct.4	Closed	Closed	Closed
Oct.5-Oct.11	Closed	Closed	Closed
Total	8	4	10

* Area 20 fishing times are measured in 12-hour days.
** Area 29 fishing times are measured in 24-hour days.

UNITED STATES (hours)

	Treaty Indian		Non-Indian		
	Areas	Areas	Areas 7 and 7A		
Date	4B, 5, 6C	6, 7, 7A	Purse Seine	Gillnet	Reefnet
Jun.22-Jun.28	Closed	Closed	Closed	Closed	Closed
Jun.29-Jul.5	Closed	Closed	Closed	Closed	16
Jul.6-Jul.12	Closed	27	Closed	17	Closed
Jul.13-Jul.19	8	Closed	6	Closed	Closed
Jul.20-Jul.26	10	Closed	14	17	Closed
Jul.27-Aug.2	156	Closed	32	17	48
Aug.3-Aug.9	168	53	32	34	112
Aug.10-Aug.16	168	102	32	17	96
Aug.17-Aug.23	168	123	13	16	32
Aug.24-Aug.30	144	51	32	48	64
Aug.31-Sep.6	Closed	75	46	32	63
Sep.7-Sep.13	Closed	124	15	32	45
Sep.14-Sep.20	Closed	52	Closed	Closed	Closed
Sep.21-Sep.27	Closed	51	12	16	Closed
Total	822	658	234	246	476

* Before Fraser River Panel control.

APPENDIX C: TABLES 1-14

Table 1. Commercial net catches of Fraser River sockeye salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1985-1997.

Date *	1985	1989	1993	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	0	0	0
Jul. 6-Jul. 12	0	0	0	0
Jul. 13-Jul. 19	0	17,000	0	0
Jul. 20-Jul. 26	0	0	0	0
Jul. 27-Aug. 2	0	266,000	10,000	0
Aug. 3-Aug. 9	587,000	570,000	136,000	0
Aug. 10-Aug. 16	877,000	1,399,000	314,000	37,000
Aug. 17-Aug. 23	945,000	826,000	0	105,000
Aug. 24-Aug. 30	134,000	198,000	0	117,000
Aug. 31-Sep. 6	56,000	9,000	0	0
Sep. 7-Sep. 13	9,000	1,000	0	0
Sep. 14-Sep. 20	3,000	0	0	0
Sep. 21-Sep. 27	0	0	0	0
Sep. 28-Oct. 4	0	0	0	0
Total	2,611,000	3,286,000	460,000	259,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 2. Commercial net and troll catches of Fraser River sockeye salmon in Canadian Areas 17, 18 and 29 (Strait of Georgia and lower Fraser River) by week for cycle years 1985-1997.

Date *	1985	1989	1993	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	96,000	0	0
Jul. 6-Jul. 12	0	267,000	0	98,000
Jul. 13-Jul. 19	0	50,000	0	0
Jul. 20-Jul. 26	0	0	141,000	60,000
Jul. 27-Aug. 2	53,000	108,000	50,000	0
Aug. 3-Aug. 9	204,000	130,000	60,000	18,000
Aug. 10-Aug. 16	334,000	436,000	164,000	119,000
Aug. 17-Aug. 23	171,000	965,000	260,000	282,000
Aug. 24-Aug. 30	313,000	416,000	0	451,000
Aug. 31-Sep. 6	286,000	12,000	1,970,000	302,000
Sep. 7-Sep. 13	21,000	2,000	74,000	4,000
Sep. 14-Sep. 20	11,000	0	30,000	0
Sep. 21-Sep. 27	5,000	3,000	10,000	0
Sep. 28-Oct. 4	4,000	0	8,000	0
Total	1,402,000	2,485,000	2,767,000	1,334,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 3. Commercial troll landings of Fraser River sockeye salmon in Canadian Areas 121 to 127 (west coast of Vancouver Island) by week for cycle years 1985-1997. The landing dates shown lag an average of five days behind catch dates.

Date *	1985	1989	1993	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	11,000	0	0
Jul. 6-Jul. 12	0	15,000	0	0
Jul. 13-Jul. 19	4,000	2,000	0	0
Jul. 20-Jul. 26	4,000	42,000	0	0
Jul. 27-Aug. 2	19,000	223,000	0	0
Aug. 3-Aug. 9	164,000	450,000	3,000	0
Aug. 10-Aug. 16	407,000	16,000	352,000	0
Aug. 17-Aug. 23	249,000	136,000	253,000	0
Aug. 24-Aug. 30	87,000	143,000	0	0
Aug. 31-Sep. 6	31,000	9,000	7,000	0
Sep. 7-Sep. 13	8,000	0	5,000	0
Sep. 14-Sep. 20	2,000	0	4,000	0
Sep. 21-Sep. 27	2,000	0	0	0
Sep. 28-Oct. 4	0	0	1,000	0
Total	977,000	1,047,000	625,000	0

* Dates for 1997. For other years, data from the nearest week were used.

Table 4. Commercial net and troll catches of Fraser River sockeye salmon in Canadian Areas 11 to 16 (Johnstone Strait and northern Strait of Georgia) by week for cycle years 1985-1997.

Date *	1985	1989	1993	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	4,000	0	0
Jul. 6-Jul. 12	0	30,000	0	46,000
Jul. 13-Jul. 19	1,000	40,000	0	0
Jul. 20-Jul. 26	9,000	161,000	20,000	7,000
Jul. 27-Aug. 2	109,000	776,000	29,000	502,000
Aug. 3-Aug. 9	451,000	973,000	477,000	827,000
Aug. 10-Aug. 16	445,000	2,038,000	3,503,000	2,069,000
Aug. 17-Aug. 23	1,160,000	621,000	2,904,000	1,255,000
Aug. 24-Aug. 30	638,000	265,000	252,000	726,000
Aug. 31-Sep. 6	261,000	61,000	1,285,000	573,000
Sep. 7-Sep. 13	54,000	15,000	184,000	147,000
Sep. 14-Sep. 20	19,000	0	21,000	173,000
Sep. 21-Sep. 27	3,000	0	8,000	83,000
Sep. 28-Oct. 4	0	0	1,000	0
Total	3,150,000	4,984,000	8,684,000	6,408,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 5. Catches of Fraser River sockeye salmon in the Canadian Fraser River Indian fishery by area (Fraser River mainstream or tributary areas) for cycle years 1985-1997. *

Fishing Area		1985	1989	1993	1997
Fraser River Mainstem					
Below Port Mann	*1*	19,700	28,500	139,300	197,100
Port Mann to Mission	*1*	6,600	10,400	57,200	193,400
Mission to Hope		75,000	153,200	189,600	104,000
Hope to Sawmill Cr.	*2*	113,600	132,500	254,900	299,700
Sawmill Cr. to Kelly Cr.	*2*	100,300	146,800	134,200	191,000
Kelly Creek to Naver Cr.	*3*	55,400	59,500	42,400	53,200
Above Naver Cr.	*3*	6,900	3,200	2,600	6,900
Total		377,500	534,100	820,200	1,045,300
Tributaries					
Harrison/Lillooet System		3,000	3,200	*4*	*4*
Thompson System		100	500	100	200
Chilcotin System		9,000	11,300	16,500	15,600
Nechako System		18,400	11,100	3,400	1,900
Stuart System		16,400	11,800	7,800	12,200
Total		46,900	37,900	27,804	29,904
Total Catch		424,400	572,000	848,004	1,075,204

* Data supplied by DFO.
1 Prior to 1995, the divisions were Steveston, and Deas to Mission.
2 Prior to 1993, the divisions were Hope to North Bend, and North Bend to Churn Creek.
3 Prior to 1994, the divisions were Churn Creek to Hixon, and Above Hixon.
4 No estimate.

Table 6. Commercial net catches of Fraser River sockeye salmon in United States Areas 4B, 5, 6, 6C, 7, 7A and 7B (Juan de Fuca Strait and northern Puget Sound) by week for cycle years 1985-1997.

Date *	1985	1989	1993	1997
Jun. 22-Jun. 28	0	17,000	0	0
Jun. 29-Jul. 5	0	119,000	0	11,000
Jul. 6-Jul. 12	3,000	26,000	0	86,000
Jul. 13-Jul. 19	0	49,000	0	11,000
Jul. 20-Jul. 26	1,000	0	0	18,000
Jul. 27-Aug. 2	174,000	205,000	4,000	36,000
Aug. 3-Aug. 9	538,000	872,000	235,000	91,000
Aug. 10-Aug. 16	654,000	598,000	672,000	190,000
Aug. 17-Aug. 23	921,000	128,000	909,000	238,000
Aug. 24-Aug. 30	282,000	183,000	343,000	138,000
Aug. 31-Sep. 6	253,000	41,000	495,000	274,000
Sep. 7-Sep. 13	48,000	10,000	34,000	225,000
Sep. 14-Sep. 20	13,000	0	0	19,000
Sep. 21-Sep. 27	1,000	0	0	1,000
Sep. 28-Oct. 4	0	0	0	0
Total	2,888,000	2,248,000	2,692,000	1,338,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 7. Commercial net catches of Fraser River pink salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1991-1997.

Date *	1991	1993	1995	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	0	0	0
Jul. 6-Jul. 12	0	0	0	0
Jul. 13-Jul. 19	0	0	0	0
Jul. 20-Jul. 26	0	0	0	0
Jul. 27-Aug. 2	1,000	6,000	0	0
Aug. 3-Aug. 9	2,000	18,000	0	0
Aug. 10-Aug. 16	0	0	1,000	17,000
Aug. 17-Aug. 23	228,000	2,000	97,000	107,000
Aug. 24-Aug. 30	743,000	1,000	395,000	177,000
Aug. 31-Sep. 6	12,000	0	203,000	0
Sep. 7-Sep. 13	0	0	4,000	0
Sep. 14-Sep. 20	0	0	0	0
Sep. 21-Sep. 27	0	0	0	0
Sep. 28-Oct. 4	0	0	0	0
Oct. 5-Oct. 11	0	0	0	0
Total	986,000	27,000	700,000	301,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 8. Commercial net and troll catches of Fraser River pink salmon in Canadian Areas 17, 18 and 29 (Strait of Georgia and lower Fraser River) by week for cycle years 1991-1997.

Date *	1991	1993	1995	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	0	0	0
Jul. 6-Jul. 12	0	0	0	0
Jul. 13-Jul. 19	0	0	0	0
Jul. 20-Jul. 26	0	0	0	0
Jul. 27-Aug. 2	0	1,000	0	0
Aug. 3-Aug. 9	3,000	1,000	0	1,000
Aug. 10-Aug. 16	12,000	4,000	3,000	0
Aug. 17-Aug. 23	16,000	0	19,000	6,000
Aug. 24-Aug. 30	55,000	96,000	34,000	48,000
Aug. 31-Sep. 6	25,000	87,000	10,000	109,000
Sep. 7-Sep. 13	63,000	45,000	3,000	3,000
Sep. 14-Sep. 20	18,000	12,000	1,000	2,000
Sep. 21-Sep. 27	1,000	7,000	0	0
Sep. 28-Oct. 4	2,000	1,000	0	0
Oct. 5-Oct. 11	0	0	0	0
Total	195,000	254,000	70,000	169,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 9. Commercial troll landings of Fraser River pink salmon in Canadian Areas 121 to 127 (west coast of Vancouver Island) by week for cycle years 1991-1997. The landing dates shown lag an average of five days behind catch dates.

Date *	1991	1993	1995	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	0	4,000	0
Jul. 6-Jul. 12	1,000	0	15,000	0
Jul. 13-Jul. 19	9,000	4,000	27,000	0
Jul. 20-Jul. 26	20,000	6,000	60,000	0
Jul. 27-Aug. 2	25,000	12,000	4,000	0
Aug. 3-Aug. 9	49,000	90,000	59,000	1,000
Aug. 10-Aug. 16	123,000	72,000	3,000	1,000
Aug. 17-Aug. 23	490,000	36,000	149,000	5,000
Aug. 24-Aug. 30	74,000	52,000	195,000	2,000
Aug. 31-Sep. 6	158,000	35,000	50,000	2,000
Sep. 7-Sep. 13	128,000	34,000	4,000	0
Sep. 14-Sep. 20	23,000	9,000	3,000	0
Sep. 21-Sep. 27	5,000	8,000	0	0
Sep. 28-Oct. 4	0	0	0	0
Oct. 5-Oct. 11	0	0	0	0
Total	1,105,000	358,000	573,000	11,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 10. Commercial net and troll catches of Fraser River pink salmon in Canadian Areas 11 to 16 (Johnstone Strait and northern Strait of Georgia) by week for cycle years 1991-1997.

Date *	1991	1993	1995	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	0	0	0
Jul. 6-Jul. 12	0	0	0	0
Jul. 13-Jul. 19	0	0	0	0
Jul. 20-Jul. 26	0	1,000	0	0
Jul. 27-Aug. 2	3,000	14,000	0	37,000
Aug. 3-Aug. 9	91,000	279,000	58,000	152,000
Aug. 10-Aug. 16	394,000	731,000	0	319,000
Aug. 17-Aug. 23	995,000	56,000	277,000	297,000
Aug. 24-Aug. 30	720,000	1,293,000	806,000	533,000
Aug. 31-Sep. 6	37,000	471,000	208,000	682,000
Sep. 7-Sep. 13	965,000	72,000	187,000	572,000
Sep. 14-Sep. 20	18,000	105,000	15,000	342,000
Sep. 21-Sep. 27	39,000	4,000	4,000	60,000
Sep. 28-Oct. 4	1,000	0	0	9,000
Oct. 5-Oct. 11	0	0	0	4,000
Total	3,263,000	3,026,000	1,555,000	3,007,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 11. Catches of Fraser River pink salmon in the Canadian Fraser River Indian fishery by area (Fraser River mainstream or tributary areas) for cycle years 1991-1997. *

Fishing Area		1991	1993	1995	1997
Fraser River Mainstem					
Below Port Mann	*1*	17,100	5,900	28,500	2,200
Port Mann to Mission	*1*	10,400	4,800	32,400	4,200
Mission to Hope		54,600	4,100	50,900	14,700
Hope to Sawmill Cr.	*2*	21,600	1,300	37,200	6,600
Sawmill Cr. to Kelly Cr.	*2*	100	1,000	5,100	900
Kelly Creek to Naver Cr.	*3*	0	0	0	0
Above Naver Cr.	*3*	0	0	0	0
Total		103,800	17,100	154,100	28,600
Tributaries					
Harrison/Lillooet System		0	0	0	0
Thompson System		0	0	400	0
Chilcotin System		0	0	0	0
Nechako System		0	0	0	0
Stuart System		0	0	0	0
Total		0	0	400	0
Total Catch		103,800	17,100	154,500	28,600

* Data supplied by DFO.

1 Prior to 1995, the divisions were Steveston, and Deas to Mission.

2 Prior to 1993, the divisions were Hope to North Bend, and North Bend to Churn Creek.

3 Prior to 1994, the divisions were Churn Creek to Hixon, and Above Hixon.

Table 12. Commercial net catches of Fraser River pink salmon in United States Areas 4B, 5, 6, 6C, 7, 7A and 7B (Juan de Fuca Strait and northern Puget Sound) by week for cycle years 1991-1997.

Date *	1991	1993	1995	1997
Jun. 22-Jun. 28	0	0	0	0
Jun. 29-Jul. 5	0	0	0	0
Jul. 6-Jul. 12	0	0	0	0
Jul. 13-Jul. 19	0	0	0	0
Jul. 20-Jul. 26	0	0	2,000	1,000
Jul. 27-Aug. 2	3,000	14,000	21,000	2,000
Aug. 3-Aug. 9	8,000	62,000	6,000	4,000
Aug. 10-Aug. 16	75,000	170,000	50,000	20,000
Aug. 17-Aug. 23	91,000	404,000	536,000	68,000
Aug. 24-Aug. 30	110,000	701,000	265,000	260,000
Aug. 31-Sep. 6	1,067,000	383,000	1,096,000	596,000
Sep. 7-Sep. 13	1,008,000	0	0	536,000
Sep. 14-Sep. 20	314,000	0	1,000	55,000
Sep. 21-Sep. 27	0	0	0	4,000
Sep. 28-Oct. 4	0	0	0	0
Oct. 5-Oct. 11	0	0	0	0
Total	2,676,000	1,734,000	1,977,000	1,546,000

* Dates for 1997. For other years, data from the nearest week were used.

Table 13. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1985, 1989, 1993 and 1997. *

DISTRICT Stream/Lake	1997 Period of Peak Spawning	Estimated Number of Adult Sockeye * 1985	 1989	 1993	 1997	Jacks 1997
NORTHEAST						
Upper Bowron R.	Aug.27-Sep.1	6,419	2,534	1,184	4,811	0
STUART						
Early Runs						
Driftwood R.		93,959	250,301	430,226	29,639	0
Takla L. Streams		42,192	54,937	124,892	136,485	2
Middle R. Streams		72,856	47,876	71,551	64,465	4
Trembleur L. Streams		25,512	31,685	61,296	35,108	0
Early Stuart Total		234,519	384,799	687,965	265,697	6
Late Runs						
Kazchek Cr.		1,955	767	8,568	6,746	0
Kuzkwa Cr.		2,624	4,122	51,779	107,560	0
Middle R.		114,115	276,131	388,937	281,472	0
Tachie R.		155,641	287,290	1,339,755	491,098	0
Miscellaneous		286	7,387	15,930	20,776	0
Late Stuart Total		274,621	575,697	1,804,969	907,652	0
NECHAKO						
Nadina R. (Late)		1,516	545	1,000	4,588	0
Nadina Channel		12,291	4,395	8,595	4,911	0
Stellako R.		42,099	43,179	91,071	55,343	42
QUESNEL						
Upper Horsefly R.		762,261	658,452	1,649,829	929,821	139
Lower Horsefly R.		274,991	814,818	- *2*	- *2*	-
Horsefly Channel		-	23,300	17,891	0	0
McKinley Cr.		97,552	117,830	169,368	262,082	18
Mitchell R.		207,041	240,521	725,030	534,431	0
Miscellaneous		-	15,899	58,336	132,318	0
Quesnel Total		1,341,845	1,870,820	2,620,454	1,858,652	157
CHILCOTIN						
Chilko R.		71,435	51,580	549,845	978,328	7,415
Chilko Channel		-	1,459	5,381	7,499	12
Chilko L.-South End		540	10,229	- *1*	- *1*	-
SETON-ANDERSON						
Gates Cr.		662	2,968	1,188	777	30
Gates Channel		3,916	13,995	16,764	5,721	339
Portage Cr.		1,765	7,900	19,760	9,766	8
NORTH THOMPSON						
Raft R.	Aug.26-30	3,638	1,647	5,047	6,093	0
Fennell Cr.	Aug.28-Sep.1	1,598	3,988	7,546	9,000	0
SOUTH THOMPSON						
Summer Runs						
Seymour R.		5,620	5,507	10,114	2,254	0
Scotch Cr.	Aug.28-Sep.5	3,385	7,236	8,359	3,085	10
Late Runs						
Lower Adams R.		422	73	540	979	263
Lower Shuswap R.		817	488	745	138	24
HARRISON-LILLOOET						
Birkenhead R.		11,905	29,334	244,954	50,202	670
Harrison R.		5,097	2,934	3,258	1,418	0
Weaver Cr.		17,009	4,864	34,555	4,275	1
Weaver Channel		20,010	12,303	49,901	21,229	18
LOWER FRASER						
Nahatlatch R./L.		1,257	3,628	2,078	9,959	0
Cultus L.		424	418	1,063	88	3
Upper Pitt R.		3,560	16,037	22,835	35,798	32
MISCELLANEOUS		11,316	1,563	202,330	3,658	8
ADULTS		2,077,686	3,060,120	6,401,501	4,251,921	9,038
JACKS		60,914	47,337	25,724	9,038	
TOTAL NET ESCAPEMENT		2,138,600	3,107,457	6,427,225	4,260,959	

* 1985 data are from the PSC. Estimates for 1989, 1993 and 1997 are from DFO.
1 Included in Chilko River estimate.
2 Included in Upper Horsefly estimate.

Table 14. Escapements of pink salmon to Fraser River spawning areas for cycle years 1991, 1993, 1995 and 1997, from DFO. Spawner abundances for individual spawning areas in the Fraser River watershed are not available after 1991.

RUN DISTRICT River/Stream	1997 Period of Peak Spawning	Estimated Number of Adult Pink Salmon 1991	1993 *	1995 *	1997 *
EARLY RUNS					
LOWER FRASER					
Main Fraser		9,281,051			
Ruby Creek		6,783			
Total		9,287,834	N/A	N/A	N/A
FRASER CANYON					
Coquihalla River		71,555			
Jones Creek		3,558			
Nahatlatch River		35,100			
Miscellaneous Tributaries		18,333			
Total		128,546	N/A	N/A	N/A
SETON-ANDERSON					
Seton Creek		1,272,395			
Upper Seton Channel		13,056			
Lower Seton Channel		32,059			
Cayoosh Creek		87,388			
Portage Creek		29,008			
Bridge River		184,327			
Gates Creek		595			
Total		1,618,828	N/A	N/A	N/A
THOMPSON					
Thompson River and Tributaries		769,800	N/A	N/A	N/A
UPPER FRASER TRIBUTARIES		2,309	N/A	N/A	N/A
EARLY-RUN TOTAL		11,807,317	N/A	N/A	N/A
LATE RUNS					
LOWER FRASER TRIBUTARIES		6,929	N/A	N/A	N/A
HARRISON					
Harrison River		947,812			
Weaver Creek		12,419			
Weaver Channel		2,391			
Total		962,622	N/A	N/A	N/A
CHILLIWACK-VEDDER					
Chilliwack-Vedder Rivers		158,876			
Sweltzer Creek		5,364			
Total		164,240	N/A	N/A	N/A
MISCELLANEOUS		8,210	N/A	N/A	N/A
LATE-RUN TOTAL		1,142,001	N/A	N/A	N/A
TOTAL NET ESCAPEMENT		12,949,318	10,775,000	7,174,000	2,878,000

* Spawner abundances for individual spawning areas in the Fraser River watershed are not available after 1991.

APPENDIX D: STAFF OF THE PACIFIC SALMON COMMISSION IN 1997

EXECUTIVE OFFICE

Mr. I. Todd, Executive Secretary
Ms. J. Abramson, Secretary
Mrs. V. Ryall, Meeting Planner
Ms. T. Tarita, Librarian/Records Administrator

FINANCE AND ADMINISTRATION

Mr. K. Medlock, Comptroller
Ms. B. Dalziel, Accountant

FISHERIES MANAGEMENT DIVISION STAFF

Dr. J. Woodey, Chief

BIOMETRICS / CATCH STATISTICS GROUP

Mr. I. Guthrie, Head
Mr. D. Stelter, Catch Statistician

COMPUTER SERVICES GROUP

Ms. K. Mulholland, Computer System Manager

RACIAL IDENTIFICATION GROUP

Mr. J. Gable, Head
Ms. J. Andersen, Senior Scale Analyst
Ms. H. Derham, Scale Lab Assistant
Mr. K. Forrest, Racial Data Biologist
Mr. M. Lapointe, Sockeye Racial Analysis Biologist
Ms. M. Reichardt, Scale Analyst
Mr. B. White, Pink Racial Analysis Biologist

STOCK MONITORING GROUP

Mr. J. Cave, Head
Ms. S. Allison, Test Fishing Biologist (Term)
Mr. P. Cheng, Hydroacoustics Biologist
Dr. Y. Xie, Hydroacoustic Scientist