
**Report of the
Fraser River Panel
to the
Pacific Salmon Commission
on the
1992 Fraser River Sockeye
Salmon Fishing Season**



Prepared by the
**Pacific Salmon Commission
May, 1996**

**REPORT OF THE
FRASER RIVER PANEL
TO THE PACIFIC SALMON COMMISSION
ON THE 1992 FRASER RIVER
SOCKEYE SALMON FISHING SEASON**

1992 PANEL MEMBERS AND ALTERNATES

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Prepared by the
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May, 1996

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I. EXECUTIVE SUMMARY

1. The 1992 fishing season was the final year of the second four-year cycle (1989-92) covered by agreements in Annex IV, Chapter 4 of the Pacific Salmon Treaty. This year was unusual because the Parties were unable to agree on the United States allocation, so each country managed its own fisheries.
2. Pre-season forecasts were for a total run of 5,900,000 and a total allowable catch (TAC) of 3,710,000 Fraser River sockeye salmon. A very high proportion (75%) of Fraser River bound sockeye was forecast to migrate through Johnstone Strait, due to warm ocean temperatures in the north Pacific Ocean caused by an El Nino event.
3. Canada set a pre-season spawning escapement goal of 1,597,000 sockeye. They estimated that a gross escapement of 2,241,000 fish would provide for this goal and for Fraser River Indian fishery catches.
4. The United States share of the TAC in 1992 was the subject of a dispute between the Parties that was not resolved prior to the 1992 fishing season. At issue was whether catches of Fraser River sockeye in Alaska counted towards the United States cumulative catch limit of 7,000,000 fish in the 1989-92 period. As a result, the Fraser River Panel did not establish pre-season regulations and a management plan, did not manage the sockeye fisheries in the Fraser River Panel Area, and was not responsible for achieving catch allocation and escapement goals. The national sections of the Panel consulted frequently with PSC staff to obtain data, which they used to develop domestic regulations for fisheries in the Panel Area.
5. Returns of Fraser River sockeye salmon totalled 6,493,000 fish, 593,000 fish more than forecast. This was the largest run on the cycle for the period of records beginning in 1893.
6. Catches of Fraser River sockeye salmon totalled 4,220,000 fish in commercial fisheries, 420,000 in reported Indian fisheries and 31,000 in other fisheries. United States commercial fishermen caught 609,000 in Panel Areas and 83,000 in Alaska, for a total of 692,000 fish. Canadian commercial fishermen caught 3,528,000 Fraser River sockeye.
7. The Stock Monitoring program provided in-season assessments of abundance, run timing and migration route of Fraser River sockeye stocks throughout the fishing season. Difficulties encountered in making the assessments were due to high diversion rates through Johnstone Strait, unusual fishing patterns in Canadian Juan de Fuca Strait fisheries and imprecise in-season catch estimates for Johnstone Strait gillnet fisheries. The diversion rate of Fraser sockeye through Johnstone Strait was about 70%, close to the forecast.
8. Current estimates indicate there was a difference of 702,000 adult sockeye between gross escapement estimates of Early Stuart, early summer and summer run sockeye from Mission echo sounding (1,783,000 fish) and those obtained by DFO from estimates of up-river catches plus spawning escapements (1,081,000). Canada appointed an independent advisor, Dr. Peter H. Pearse, to direct investigations into the reasons for the shortfall in upriver estimates. Dr. Pearse concluded that the difference was 482,000 fish based on preliminary estimates provided at the time and was primarily the result of unreported in-river catches and natural and fishing-induced mortalities. The current estimate of 702,000 is based on revisions to Mission hydroacoustic estimates and Indian catch estimates. It does not take into account a preliminary estimate for unmonitored Indian fisheries which was included in the Pearse Report. The change in the discrepancy does not affect the basic conclusions of the Pearse Report, but would result in changes to the numbers of fish attributed to catch and mortality.

9. The Racial Analysis program identified the major stock groups of Fraser River sockeye throughout the season, using scale and other characteristics. Post-season analyses incorporating spawning ground scale samples showed that in-season models slightly underestimated Early Stuart, early summer-run and late-run proportions, and overestimated summer-run proportions.
10. Spawning escapements of sockeye salmon in the Fraser watershed totalled 1,069,000 adults and 51,000 jacks. The adult sockeye escapement was the second highest recorded on the cycle. Escapements of most Early Stuart and early summer-run stocks were lower in 1992 than in the parent brood year (1988). Later-timed stocks generally had the same or higher escapements.
11. Since the Panel was not responsible for management of fisheries in Panel Area waters, no evaluation of the achievement of goals is presented.

II. FRASER RIVER PANEL

Since 1986, the Fraser River Panel has been responsible for pre-season planning and in-season management of fisheries targeted on Fraser River sockeye and pink salmon in the Panel Area (Figure 1). Typically, the Panel recommends fishing regulations and a management plan to the Commission before the fishing season begins. The Commission then acts on the recommendations and proposes to the Parties that they adopt the plan. During the fishing season, the Panel regulates Panel Area fisheries to achieve Treaty allocations and the domestic goals and objectives of the Parties.

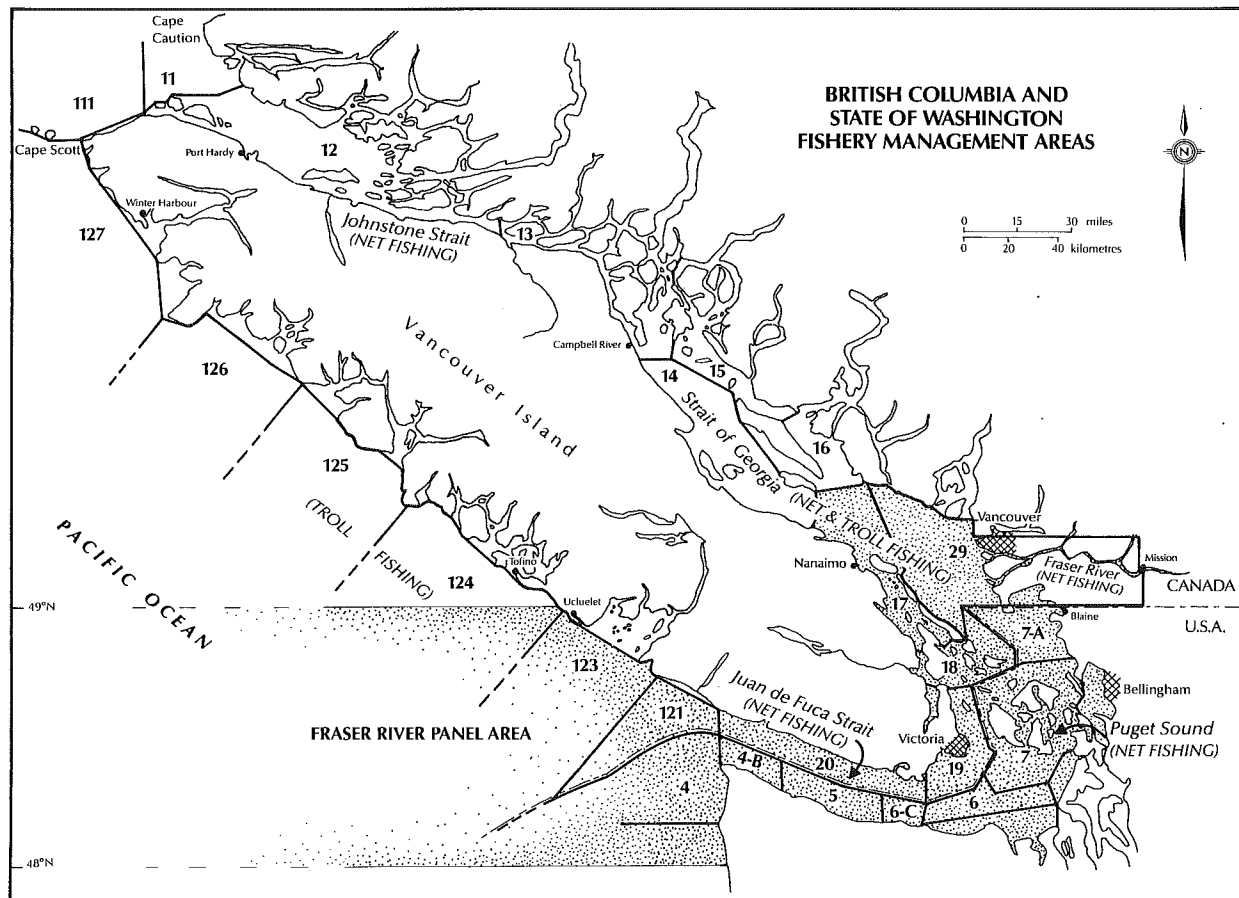


Figure 1. Fishery management areas and commercial gear used in the Fraser River Panel Area and Canadian south coast waters.

In 1992, the Panel did not perform these tasks due to unresolved differences between the Parties on the interpretation of Annex IV, Chapter 4 of the Pacific Salmon Treaty, which relates to the allocation of Fraser River sockeye salmon to United States fishermen. Specifically, the dispute focused on whether Alaska catches of Fraser River sockeye salmon should be included in the United States catch ceiling of 7,000,000 Fraser sockeye for the 1989-92 period.

Membership of the Panel in 1992 was as follows:

CANADA	UNITED STATES
Members	
Mr. F. Fraser, Chair Department of Fisheries and Oceans	Mr. D. Austin, Vice-Chair Washington Department of Fisheries
Mr. E. Crey Fraser River Indian fishermen	Ms. L. Loomis Treaty Indian tribes
Mr. M. Forrest Gillnet fishermen	Mr. R. Schmitten National Marine Fisheries Service
Mr. J. Hill Salmon processing industry	Mr. R. Zuanich Commercial salmon fishing industry
Ms. R. Kendall Freshwater sport fishermen	
Mr. L. Wick Purse seine fishermen	
Alternates	
Mr. V. Fiamengo Purse seine fishermen	Mr. R. Allen Treaty Indian tribes
Mr. M. Griswold Inside troll fishermen	Mr. B. Robinson National Marine Fisheries Service
Ms. K. McGivney Department of Fisheries and Oceans	Mr. B. Suggs Commercial salmon fishing industry
Mr. M. Medenwaldt Outside troll fishermen	
Mr. R. Nugent Gillnet fishermen	

III. INTRODUCTION

Several factors converged to make 1992 a difficult year for managing fisheries on Fraser River sockeye salmon. First, because the Parties did not agree on a United States catch allocation for 1992, the Panel operated only as a forum for exchanging information. Pre-season, the abundance of Fraser River sockeye was forecast to be low (compared to other cycles), and the diversion through Johnstone Strait was expected to be unusually high. Later, the unusual nature of commercial fisheries in Juan de Fuca Strait, combined with high diversion rates via Johnstone Strait greatly reduced the reliability of in-season run-size estimates produced by Commission staff. Finally, large differences between sockeye gross escapements enumerated hydroacoustically at Mission and estimated upstream in Indian fishery catches and spawning escapements led Canada to conduct a special investigation into the source of the discrepancies.

The dispute between Canada and the United States focused on the allocation of the total allowable catch (TAC). The issue was whether or not Alaska catches of Fraser River sockeye salmon were included in the United States catch ceiling of 7,000,000 Fraser sockeye for the 1989-92 period. After the 1991 fishing season, the number of fish in question totalled 510,000 sockeye. Because agreement was not reached, the PSC could not concur on the 1992 United States allocation and the Fraser River Panel was unable to perform its normal functions. Each country pursued fisheries in its portion of Panel Area Waters through implementation of domestic regulations.

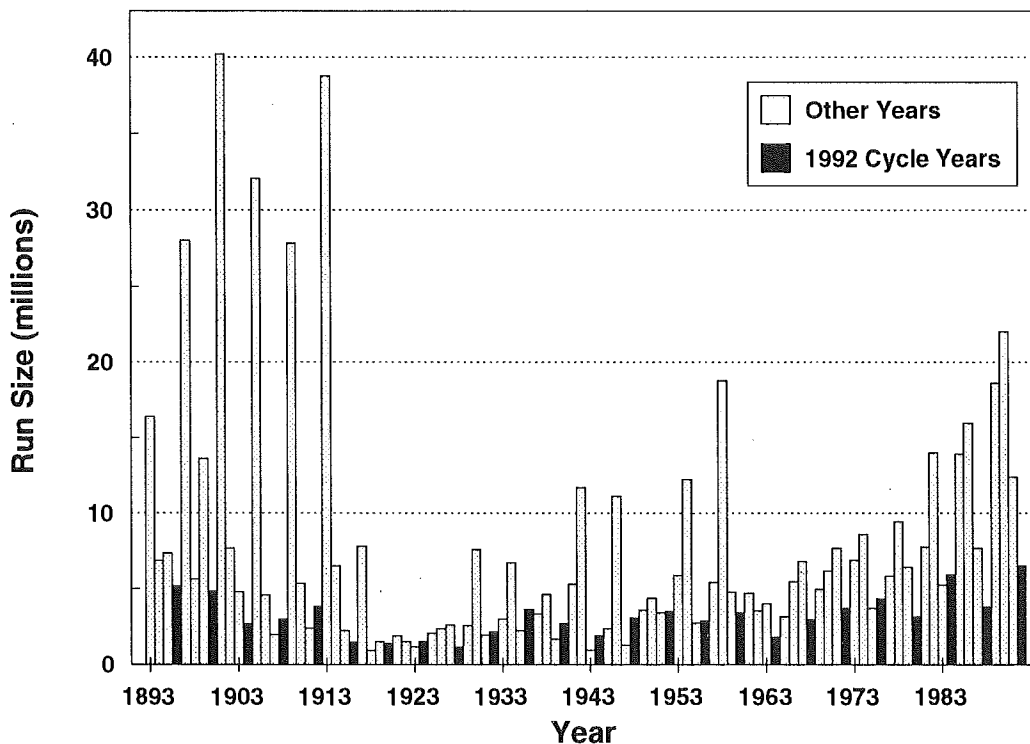


Figure 2. Total run sizes of Fraser River sockeye salmon between 1893-1992. Returns on the 1992 cycle are highlighted.

The forecast of low Fraser River sockeye abundances in 1992 (5,900,000 fish) was expected because the 1992 cycle is the least abundant of the four Fraser sockeye cycles. The actual return of 6,493,000 sockeye, although low compared to the other cycles, was the largest on the 1992 cycle since record-keeping began in the late 1800's (Figure 2). The largest previous run on the cycle occurred in 1984 when 5,917,000 sockeye returned. Catches totalled 4,220,000 sockeye in

commercial fisheries and 451,000 in non-commercial fisheries. Canadian commercial catches amounted to 3,528,000 sockeye and United States harvests were 692,000 fish.

The forecast 75% diversion rate through Johnstone Strait (Figure 3) was much higher than the average rate of 25%. This high forecast was due to the 1992 El Nino event that caused higher-than-usual water temperatures in the North Pacific. On years such as this, Fraser sockeye have a more northerly landfall and tend to approach the Fraser River through Johnstone Strait rather than Juan de Fuca Strait. The actual diversion rate in 1992 (70%) was close to the forecast.

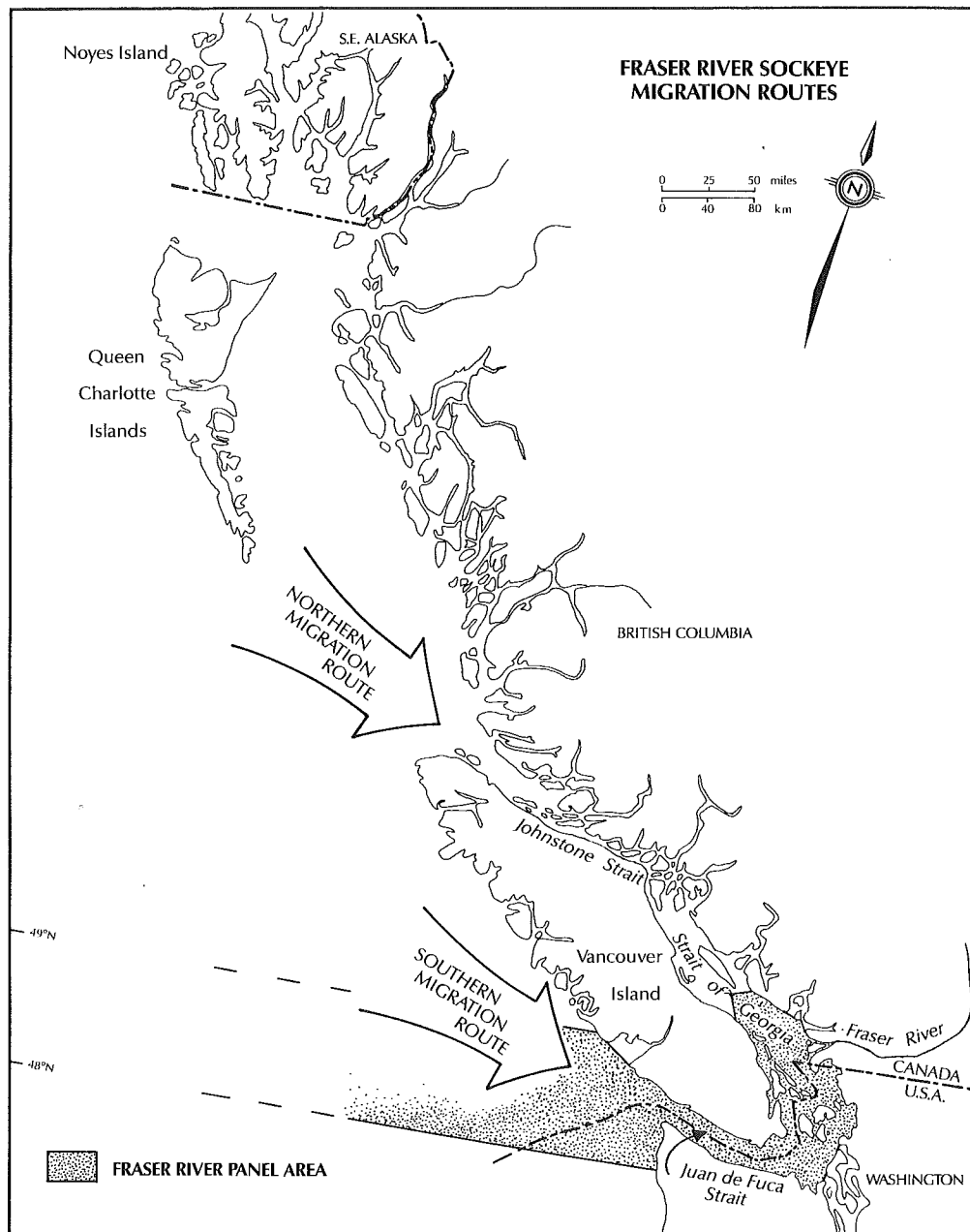


Figure 3. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye salmon migrating to the Fraser River.

Canadian fisheries in Juan de Fuca and Johnstone Straits were sufficiently different from historical patterns that the reliability of in-season models used by Commission staff to estimate run strengths of returning sockeye stocks was diminished. For example, Area 20 fisheries are usually scheduled on a weekly basis and are 1 to 3 days in duration, while in 1992, Canada conducted one 19-day opening. The Juan de Fuca Strait run-size estimates were negatively affected by this fishing pattern. This effect was exacerbated by the high diversion rate, which resulted in a large fraction of the run-size estimates being of fish that migrated via Johnstone Strait. Fishing there was limited to three one-day openings.

Commercial fisheries harvested 4,220,000 Fraser River sockeye in 1992. Canadian catches were largest in Johnstone Strait (2,049,000) and Area 20 (880,000). United States fisheries harvested 692,000 Fraser River sockeye including 609,000 in Washington waters and 83,000 in Alaska. Of the Washington catch, a portion (approximately 175,000) were sockeye caught at Point Roberts (Area 7A) which had arrived in the Strait of Georgia via Johnstone Strait.

As the season progressed, differences were observed between hydroacoustic estimates of gross escapements of Early Stuart and some early summer-run stocks at Mission and Indian catches plus spawning escapements above Mission. By the end of the season, these differences totalled 702,000 sockeye. While differences in estimates of escapement at Mission and catch and escapement above Mission have differed on an annual basis since the hydroacoustic program was initiated in 1977, such differences have never been of the magnitude identified in 1992 for Early Stuart, early summer-run and summer-run stocks.

As a result of the large differences between Mission hydroacoustic estimates and upstream estimates of catch and escapement, Canada's Minister of Fisheries and Oceans appointed an independent advisor, Dr. P.H. Pearse, to investigate reasons for this discrepancy and recommend corrective measures. Dr. Pearse requested PSC staff to participate in several reviews, including a review of the escapements derived from the PSC's hydroacoustic program at Mission (Appendix A). Dr. Pearse concluded¹ that most of the difference, which he determined to be 482,000 from preliminary data provided to him, was the result of unreported catches and fishing-induced mortalities above Mission. Based on post-season reviews of PSC Mission hydroacoustic escapement estimates and stock identification proportions, and DFO-reported escapements and Indian catches, the difference totalled 702,000 sockeye (including 89,000 fish estimated to have been caught in unmonitored Indian fisheries and reported to Dr. Pearse but which are not included in official DFO estimates and a 131,000 fish increase in PSC hydroacoustic estimates).

¹ Pearse, P. H. 1992. Managing salmon in the Fraser: report to the Minister of Fisheries and Oceans on the Fraser River salmon investigation with scientific and technical advice from Peter A. Larkin. Canada. Department of Fisheries and Oceans, Vancouver, B.C. 36 p.

IV. MANAGEMENT ACTIONS

A. Pre-season Forecasts, Goals and TAC

Canada provided the Panel with run-size forecasts and pre-season net escapement goals for Fraser River sockeye salmon on May 20, 1992 (Appendix B). Preliminary gross escapement goals were unofficially provided on May 25, 1992, for pre-season planning purposes. The total run was forecast to be 5,830,000 adults, with a spawning escapement goal of 1,558,000 and a preliminary gross escapement goal of 2,202,000 adults. The resulting pre-season forecasts of catches and escapements of Fraser sockeye are shown in Table 1.

Table 1. Pre-season goals for gross¹ and spawning escapement², and forecasts² of run sizes and catches of Fraser River sockeye salmon runs for 1992, provided by DFO.

Run	River & Ocean Catch *	Goal		Total Run
		Spawning Escapement	Gross ** Escapement	
Early Stuart	298,000	200,000	402,000	700,000
Early Summer	924,000	351,000	497,000	1,421,000
Summer	1,413,000	650,000	902,000	2,315,000
Late	993,000	357,000	401,000	1,394,000
Total Adults	3,628,000	1,558,000	2,202,000	5,830,000
Jacks	31,000	39,000	39,000	70,000
Total Sockeye	3,659,000	1,597,000	2,241,000	5,900,000

1 Preliminary gross escapement goals were unofficially provided on May 25, 1992, for initial pre-season planning purposes.

2 Provided officially on May 20, 1992.

* Includes catches in commercial, test and other fisheries, excluding Fraser River Indian fisheries.

** Gross escapement = Fraser River Indian catch + spawning escapement.

Based on the forecasts and goals, the Canadian escapement add-on benefit and total allowable catch (TAC) were projected to be 193,000 and 3,710,000 fish, respectively (Table 2). United States and Canadian shares were not determined because the dispute between the Parties about the disposition of Alaska catches of Fraser sockeye prevented bilateral agreement on the United States 1992 catch allocation.

Table 2. Pre-season estimate of the total allowable catch of Fraser River sockeye salmon in 1992.

Total Run Size	5,900,000
Canadian Escapement Add-on Benefit *	193,000
Total Available to Share:	5,707,000
Deductions	
Adult Escapement Goal	1,558,000
Jack Escapement	39,000
Fraser River Indian Food Fishery Exemption	400,000
Total Deductions	1,997,000
Total Allowable Catch:	3,710,000

* Calculation from Fraser River Panel agreement, February 8, 1991.

Pre-season expectations of the timing and relative abundance of sockeye arrivals in Juan de Fuca Strait, based on historical patterns, are shown in Figure 4.

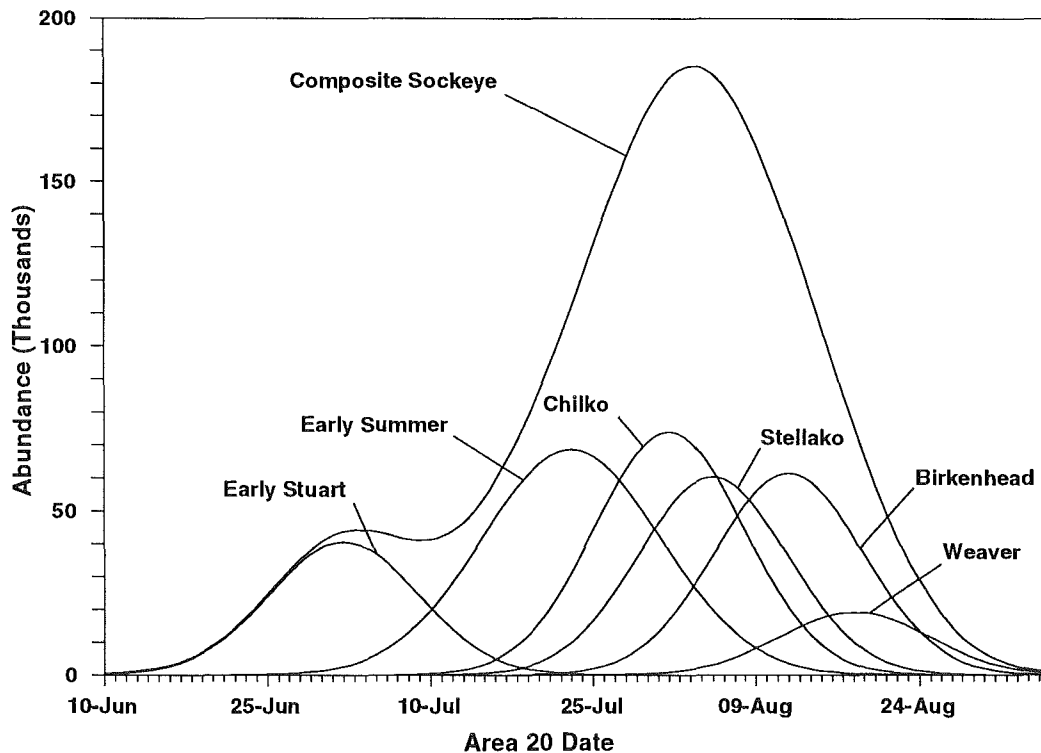


Figure 4. Pre-season expectations of the abundances of migrating Fraser River sockeye salmon in Area 20 in 1992.

B. In-season Regulations

Lack of PSC agreement on international shares meant that the Fraser River Panel could not manage the fisheries in 1992. 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 goals, international and domestic catch allocations, or for addressing conservation concerns for other species and stocks.

Fishing times for the major net fisheries in 1992, as provided by the Parties, are summarized in Appendix C.

Canada updated adult sockeye gross escapement goals twice during the fishing season in response to changes in run-size estimates. On July 30 the goal was increased from 2,202,000 (Table 1) to 2,249,000 sockeye, which included a smaller Early Stuart goal (322,000 fish) and larger goals for early summer (573,000 fish), summer (952,000 fish) and late runs (402,000 fish). The goal for summer-run sockeye was raised from 952,000 to 1,269,000 fish on August 19, with a corresponding increase in the total goal to 2,566,000 adult sockeye.

Table 3. Preliminary estimates of fishery catches and total run of Fraser River sockeye salmon during the 1992 fishing season, by country and area.

	Number of Fish	% of Run
COMMERCIAL CATCH		
CANADA		
Fraser River Panel Area		
Areas 121-124 Troll *	103,000	
Area 20 Net	880,000	
Areas 17-18 and 29 Troll	4,000	
Area 29 Net	257,000	
Total	1,244,000	19.2%
Non-Panel Areas		
Areas 1-10 Troll and Net	169,000	
Areas 11-16 Troll and Net	2,049,000	
Areas 124-127 Troll *	66,000	
Total	2,284,000	35.2%
CANADA TOTAL	3,528,000	54.3%
UNITED STATES		
Fraser River Panel Area		
Areas 4B, 5 and 6C Net	26,000	
Areas 6 and 7 Net	213,000	
Area 7A Net	370,000	
Total	609,000	9.4%
Non-Panel Areas		
Alaska Net	83,000	1.3%
UNITED STATES TOTAL	692,000	10.7%
COMMERCIAL TOTAL	4,220,000	65.0%
NON-COMMERCIAL CATCH		
CANADA		
Areas 12-13, 18, 20, 29, 123-124 Indian Fishery	52,000	
Area 12 Test Fishing	2,000	
Other Catches (Charters, etc.)	4,000	
Fraser River Indian Fishery **	368,000	
Recreational Fishery	7,000	
Total	433,000	6.7%
UNITED STATES		
Ceremonial and Test Fishing	0	0.0%
COMMISSION		
Areas 123-127, 20 and 29 Test Fishing	16,000	
Areas 7 and 7A Test Fishing	2,000	
Total	18,000	0.3%
NON-COMMERCIAL TOTAL	451,000	6.9%
TOTAL CATCH	4,671,000	71.9%
SPAWNING ESCAPEMENT	1,120,000	17.2%
DIFFERENCE IN GROSS ESCAPEMENT ESTIMATES ***	702,000	10.8%
TOTAL RUN	6,493,000	100.0%

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

** Mixed commercial and non-commercial catches in accordance with Canada's Aboriginal Fishing Strategy.

*** Estimated additional gross escapement above Mission, primarily attributed to unreported catches and natural and fishing induced en-route mortality (Pearse 1992).

V. CATCH SUMMARY

The total return of 6,493,000 Fraser sockeye (Table 3) was 593,000 fish more than forecast and the catch total of 4,671,000 fish was 368,000 larger than projected (Table 1). Commercial catches totalled 4,220,000 sockeye. Non-commercial catches were 451,000 sockeye, including reported catches of 368,000 in Fraser River native fisheries and 52,000 in native fisheries seaward of the Fraser River.

Fraser sockeye in 1992 were smaller than average for this cycle. Weights of age 4₂ fish sampled from commercial purse seine catches in Areas 12, 13 and 20 averaged 2.36 kg (5.19 lb). For sockeye (combined ages) in Area 20 commercial seine fisheries, the average weight was 2.57 kg (5.66 lb). Long-term averages have been 2.57 kg (1984-91) and 2.72 kg (1977-91), respectively.

The gross landed value of the commercial catch (11,000,000 kg) was approximately \$58,000,000 (CDN).

The average weight of Fraser sockeye in 1992 (2.61 kg) was close to the average (2.65 kg) for recent cycle years (1980, 1984, 1988).

A. Canada

Canadian fishermen caught a total of 3,961,000 Fraser sockeye, 3,528,000 in commercial fisheries and 433,000 in non-commercial fisheries (Table 3). Of commercial catches, 1,244,000 fish were caught in Panel Areas and 2,284,000 in non-Panel Areas. The largest catches occurred in net fisheries in Johnstone Strait (Areas 11-16) and Juan de Fuca Strait (Area 20). Purse seines caught the largest share (53.6%), followed by gillnets (36.6%), outside trollers (6.1%) and inside trollers (3.7%) (Table 4). Weekly catches in Canadian Panel Areas are shown in Appendix D (Tables 1-4).

Table 4. Preliminary estimates of Canadian catches* of Fraser River sockeye salmon by gear type and area during the 1992 fishing season.

Areas	Inside Troll	Outside Troll	Purse Seine	Gillnet	Total
1-10	0	12,000	154,000	3,000	169,000
11-16	126,000	34,000	1,008,000	881,000	2,049,000
121-127	0	169,000	0	0	169,000
20	0	0	730,000	150,000	880,000
17, 18, 29	4,000	0	0	257,000	261,000
Total Catch	130,000	215,000	1,892,000	1,291,000	3,528,000
% of Catch	3.7%	6.1%	53.6%	36.6%	100.0%

* Preliminary catch data from fish sales slips from DFO.

Most Canadian non-commercial catches were taken in the Fraser River Indian fishery (Table 3). The reported Fraser River Indian catch (368,000 fish) includes fish that were sold in accordance with Canada's Aboriginal Fisheries Strategy. This policy permitted the sale of fish caught under communal licenses issued to Musqueam, Tsawwassen and Sto:lo bands in the lower Fraser River. Since the disposition of the fish was through a mix of aboriginal fishing agreements, the catch is included in the non-commercial category as Fraser River Indian fishery catches have been reported in previous years. Reported Fraser Indian catches in each in-river area are shown in Appendix D (Table 5). The remaining non-commercial catches were split among the non-Fraser Indian (52,000), recreational (7,000), test (2,000) and charter (4,000) fisheries.

Additional catches occurred in the Fraser River which were not included in the catch category. These are included in the differences in gross escapement estimates (Table 3) which represents a combination of unreported catch and natural and fishing-induced en-route mortality.

B. United States

United States catches of Fraser sockeye totalled 692,000 fish, 609,000 in Panel Areas and 83,000 in Alaska net fisheries (Table 3). Most Washington State catches were taken in net fisheries in Areas 6, 7 and 7A. Treaty Indian catches were 26,000 in Areas 4B, 5 and 6C and 267,000 in Areas 6, 7 and 7A, for a total of 293,000 fish (Table 5). All Non-Indian catches occurred in Areas 6, 7 and 7A and totalled 316,000 sockeye. Among Non-Indian gear, 54.1% were caught by purse seines and 45.9% by gillnets; reefnets were not fished in 1992. Weekly catches in United States Panel Areas are shown in Appendix D (Table 6).

Approximately, 175,000 of the catch in Area 7A were fish which had entered the Strait of Georgia via Johnstone Strait. These fish were taken in directed United States fisheries near the International Boundary at Point Roberts.

Table 5. Preliminary estimates of United States catches* of Fraser River sockeye salmon by user group, gear type and area during the 1992 fishing season.

Areas	Test and Ceremonial	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian					
4B, 5 and 6C	0	0	26,000	0	26,000
6 and 7	0	40,000	57,000	0	97,000
7A	0	34,000	136,000	0	170,000
6, 7 and 7A Total	0	74,000	193,000	0	267,000
% of Catch	0.0%	27.7%	72.3%	0.0%	100.0%
Total Catch	0	74,000	219,000	0	293,000
% of Catch	0.0%	25.3%	74.7%	0.0%	100.0%
Non-Indian					
4B, 5 and 6C		0	0	0	0
6 and 7		52,000	64,000	0	116,000
7A		119,000	81,000	0	200,000
Total Catch		171,000	145,000	0	316,000
% of Catch		54.1%	45.9%	0.0%	100.0%
United States					
Panel Area Total	0	245,000	364,000	0	609,000
Alaska (District 104) Catch					83,000
Total Catch					692,000

* Preliminary Washington catch data from Washington Department of Fisheries "soft system" totals.

VI. STOCK MONITORING

The purpose of the stock monitoring program is to assess run sizes, daily abundances, timing and migration pathways of Fraser River sockeye and pink salmon stocks on their migration. These data are required for developing fishing plans to attain annual escapement and catch allocation objectives. Commercial catches provide much of the data used in the analyses. The Commission also conducts test fisheries to provide data before and after the commercial fishing season and between fishing periods. Test fisheries conducted by DFO in Canadian non-Panel areas also provide important data. Information about the upstream migration in the river is obtained by echo sounding at Mission and visual observations at Hells Gate.

Test fishing operations in 1992 were conducted by the Commission in the following areas:

Canadian Panel Areas		
Areas 123-124	Troll	August 9 - 16
Area 20	Gillnet	June 21 - August 27
Area 29-13	Gillnet	June 25 - September 29
Area 29-16	Gillnet	June 25 - October 11
Areas 29-1 to 6	Troll	August 24 - September 17
United States Panel Areas		
Area 7	Gillnet	July 21 - 31

At the request of the Commission, DFO operated a gillnet test fishery in Area 12 between July 15-August 27.

The upstream passage of sockeye was monitored by echo sounding at Mission between June 25-September 10 with a wide-beam, 50 Khz echo sounder. Estimates of daily gross escapements of late-run sockeye after September 10 were derived using information from gillnet test fishing at Cottonwood (Area 29-13) and Whonnock (Area 29-16). Seals caused considerable net-damage and preyed on test fishing catches at Cottonwood, which resulted in closure of this operation after September 29.

Daily visual observations at Hells Gate between July 4-September 9 supplied information on upstream fish passage.

Run size estimation for Fraser River sockeye salmon by stock group is based primarily on catch, effort, racial composition and diversion rate data. These data are analyzed using catch-per-unit-effort (CPUE) and cumulative-normal models. Catch-per-unit-effort models relate run sizes in previous years to commercial or test fishing catch and effort data, primarily from purse seine and gillnet fisheries in Canadian Area 20 and in Johnstone Strait. For these regression models, we assume that annual run size is directly related to the magnitude of the largest daily or weekly catch of a particular stock group, and that migration patterns are consistent from year to year. In-season catch, effort and racial composition estimates are "plugged" into these models to generate run-size estimates. These run-size estimates tend to stabilize soon after the peak catch of a given stock group in the major net fisheries. Run size estimates from CPUE models are sensitive to unusual fishing and migration patterns.

Cumulative-normal models are essentially a combination of "accounting" and linear regression methods. Estimates of daily catches and escapements for each stock group are accumulated over the migration. The daily cumulative number of these fish are compared, using regression models, to normally-distributed, simulated migrations that differ in abundance and timing parameters. For each stock group, the simulated migration that most closely matches the observed abundance pattern represents estimates of both run size and timing. As with the CPUE models, the estimates are sensitive to unusual fishing and migration patterns and they tend to stabilize after migration peaks in major net fishing areas.

The first Fraser River sockeye stock to arrive in coastal waters is the Early Stuart run. When it first arrived in 1992, the run appeared to be later than normal and much smaller than the forecast of 700,000 fish. On July 10, run-size estimates ranged from 300,000-400,000 fish. By July 15, the estimates had stabilized at 300,000-350,000. Post-season assessments of catches and escapements above Mission indicated a total run of 350,000 and gross escapements of 344,000.

Later in July and throughout August, the focus was on early summer- and summer-run sockeye stocks. Test fishing in Area 20 and Area 7 was halted after July 31, when commercial fisheries were open continuously in those areas. These continuous fisheries were a departure from fishing regimes in previous years and affected both the amount of gear and pattern of catches that normally occurred in weekly one- to three-day fisheries.

Assessments of the timing and size of the early summer run (including Chilko Lake sockeye) began in late July. Initial assessments indicated a later than normal migration and smaller run than the forecast 1,421,000 fish. In early August, the early summer run was estimated at 1,000,000-1,250,000 sockeye, based on commercial catch rates. The post-season estimate was 765,000 adults, excluding Chilko Lake sockeye. Gross escapements past Mission totalled 412,000 fish.

On August 14, run sizes of summer-run stocks (Chilko, Stellako, Horsefly and Late Stuart) were estimated to total 4,500,000 fish. This estimate was revised to 4,100,000 fish on August 28 based on lower than expected terminal area abundance. The post-season estimate of run size was 4,422,000 adult sockeye, including Chilko Lake fish.

Summer-run gross escapements (1,108,000 fish) were several hundred thousand fish short of in-season goals due to several factors. The run via Johnstone Strait was slightly overestimated based on available data. Subsequently, underestimation of gillnet catch in Johnstone Strait fisheries resulted in the subtraction of too few fish from the run-size estimate. The net result was an erroneously high projection of escapements to the Strait of Georgia.

The misleading effect of the inflated escapement estimate was compounded by the removal of a portion of the Johnstone Strait escapement to the Strait of Georgia by fisheries at Point Roberts. This conclusion is based, first, on the observation that most fish that migrated through Juan de Fuca Strait were caught in the intensive fisheries in Canadian Area 20 and United States Areas 6 and 7. Second, the strength of the Point Roberts catch (370,000 fish) was very strong relative to the Salmon Banks catch (213,000 fish). Thus, the Point Roberts fishery caught fish (approximately 175,000) that had migrated through Johnstone Strait and were delaying in the Strait of Georgia prior to migrating into the river. The combined effect of the over-estimated escapement from Johnstone Strait and the unexpectedly large catch of Johnstone Strait fish at Point Roberts was a much lower than projected abundance of summer-run sockeye in the Fraser River in mid August.

Assessments of late-run stocks are based entirely on marine area fisheries since these stocks delay in the Strait of Georgia for several days before migrating upstream (Birkenhead, 7-10 days; Weaver and other Late runs stocks, 21-45 days). Because of the difficulties encountered with assessments of summer-run stocks, run sizes and escapements of late-run stocks to the Strait of Georgia were also uncertain. In addition, the migration period appeared to be contracted and the catches of these stocks were lower than anticipated. In-season run-size estimates for late-run sockeye were 900,000-1,100,000 fish. Post-season estimates of run size and gross escapements were 866,000 and 274,000 adults, respectively.

Before the season, DFO scientists estimated that the El Nino event in 1992 would cause approximately 75% of Fraser River sockeye to return via Johnstone Strait. The estimated actual proportion that migrated through Johnstone Strait was 70%. However, markedly different diversion rates were recorded for early-timed stocks. Early Stuart sockeye showed a near-normal 15-20% diversion via Johnstone Strait. Early summer-run sockeye arriving in late July and early August showed an increasing diversion rate each week. Approximately 50% of the run arrived via Johnstone Strait during the first week of August. Subsequently, diversion rates in the second and third weeks of August were approximately 75% via Johnstone Strait. Because the peak of the dominant summer run occurred in these weeks, the weighted estimate of Johnstone Strait diversion for the 1992 Fraser River sockeye run was 70%.

Escapements of Early Stuart sockeye at the Mission echo sounding site between July 10-17 (Figure 5) showed an early peak. After relatively low daily abundances for ten days, early summer-run migrants began to increase in numbers on July 28. Fisheries began to affect Mission escapements with the first commercial opening in the Fraser River on August 3. The effect of marine fisheries in Canadian Area 20 beginning August 1 and in United States areas beginning August 2 was observed soon after.

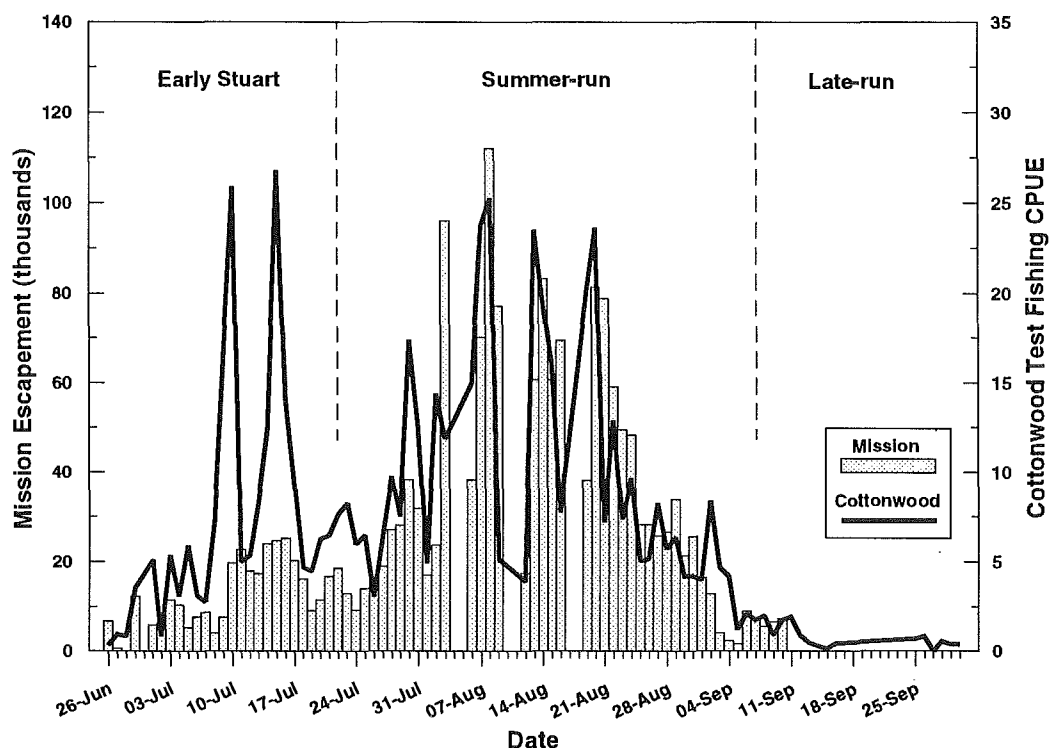


Figure 5. Daily escapements of sockeye salmon estimated at Mission by echo sounding compared with prior-day test fishing CPUE at Cottonwood during 1992.

Large escapements of early summer- and summer-run sockeye were seen on August 6-9 and of summer-run fish on August 13-16. Non-Indian commercial fishing in the river ended August 18. All Canadian marine areas and the mainstem of the Fraser River were closed to fishing on August 20, by order of the Minister of Fisheries. These closures had an immediate effect of allowing large upstream migrations of Chilko River sockeye on August 19-24. Escapements after August 25 were not affected by commercial fisheries in marine areas. Due to low abundances of late-run stocks, the echo sounding program was discontinued on September 10.

Due to expected low daily abundance of late-run sockeye during their upstream migration in September and October, estimates of species composition in the river were expected to be poor, thus invalidating the hydroacoustic estimates of sockeye at Mission in this time period. Therefore, test fishing at Cottonwood and Whonnock was used to estimate escapements of these stocks between September 11-October 15. In 1992, this program was subject to serious problems with seals "stealing" fish from the gillnets. Because test fishing CPUE's are used to estimate escapements, these removals likely contributed to late-run escapements being underestimated.

Observations at Hells Gate indicated that there were no delays in the migration of sockeye between Mission and Hells Gate. The highest abundances of the 1992 season were recorded at Hells Gate after the August 20 closure of all fisheries in the Fraser River and Canadian marine areas.

VII. RACIAL IDENTIFICATION

The PSC carried out programs to identify the racial contributions of Fraser River sockeye salmon in commercial and test fishing catches in 1992. Racial identification data are used to assess the abundance and timing of Fraser River sockeye stocks en route to the Fraser River, to account for catches of these stocks in both Panel and non-Panel Areas, and to apportion daily gross escapements at Mission into discrete stock groups.

Identification of sockeye stocks in mixed-stock fishery samples is conducted using scale pattern analysis, supplemented with information on age composition, fish length and historical patterns of stock-specific timing and behaviour. Stock-specific baseline standards are developed for the two dominant age-classes in Fraser River sockeye (age 4₂ and 5₂). These baseline standards are obtained from prior-years' spawning ground samples, including jacks from the previous year and adults from past cycle years. The 1992 baseline standards consisted of eight stock groups. Each group was formed from one or more individual stocks exhibiting similar scale traits and migratory timing.

Four scale variables were used to differentiate between stocks in mixed-stock samples: (1) circuli counts to the end of the freshwater growth zone, (2) circuli counts in the "plus-growth" scale zone, (3) distance from the focus to the fifth circulus, and (4) distance from the focus to the end of the freshwater growth zone.

Since 1987, the PSC has used linear discriminant function analysis (DFA) with bias correction² to distinguish among baseline standards, and to classify fishery mixtures to their probable stocks of origin. This statistical technique was chosen for several of reasons³. First, DFA has proven to be useful in numerous applications involving scale data. Second, computer programs for performing DFA are readily available. Third, our scale data generally conform to the assumptions required for DFA. As a result of the Pearse investigation, the PSC is testing the relative accuracy and precision of Fraser River stock identification estimates generated using DFA versus Maximum Likelihood Estimation (MLE) techniques (see Appendix A).

Scale analyses of commercial and test fishing catches were conducted daily beginning in late June and continuing through early October. Commission staff sampled commercial sockeye landings at sites in Bellingham and Blaine in Washington State, and Vancouver, Steveston, Port Renfrew, Port Hardy, Ucluelet, Winter Harbour and Prince Rupert in British Columbia. In addition, scale samples from sockeye catches in Alaska District 104 were obtained by the Alaska Department of Fish and Game (ADFG) at landing sites in Petersburg and Ketchikan. In total, approximately 33,000 sockeye scales were aged and digitized during the fishing season to obtain readings for the four scale variables. Samples were analyzed for Fraser River stock proportions and the resulting estimates were multiplied by catches in each fishery to generate estimates of catches by stock group by area.

There were two main challenges for the scale analysis program in 1992. The first was to differentiate two early summer-run groups (Nadina/Gates group and a second group composed of minor stocks) from summer-run groups (dominated by Chilko River fish, with a smaller group composed of Stellako, Late Stuart and Horsefly fish). The second challenge was to separate summer-run from late-run stocks (dominated by Birkenhead and Weaver Creek fish). These challenges were successfully met in 1992, with scale pattern analysis only slightly underestimating Early Stuart, early summer- and late-run proportions, and slightly overestimating summer-run proportions (see Pearse Investigations in Appendix A).

² 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(2):415-423.

³ J. H. Gable and S. F. Cox-Rogers. 1993. Stock Identification of Fraser River Sockeye Salmon: Methodology and Management Application. Pacific Salmon Comm. Tech. Rep. No. 5: 36p.

In 1992, as in other recent years, DFO was requested by the Commission to obtain sockeye scale samples from the Fraser River Indian fishery at sites near Chilliwack, Yale, Lytton, Lillooet, Quesnel and Prince George. Scale samples were obtained only from Chilliwack, Yale and Lillooet. A post-season analysis will be conducted, to the extent the available data allows, to compare stock composition estimates derived from Indian fishery scale samples with those generated through reconstruction modelling techniques.

The Early Stuart stock arrived approximately five days later than normal and in lower abundances than forecast. Recorded catches for this stock included 6,000 in fisheries from commercial catch areas and 103,000 in Fraser River Indian fisheries (Table 6). In addition, 175,000 fish were classified as unreported catches and en-route mortalities between the Mission echo-sounding site and the spawning grounds (Appendix A, Table 1). The run was estimated to total 350,000 fish.

Table 6. Catches and escapements of Fraser River sockeye salmon by stock group in 1992.

Stock Group	River & Ocean Catch *	Gross Escapement					Portion of Total Run	Exploitation	
		Fraser Indian Catch	Spawning Escapement	Unreported **		River & Ocean		All Areas	
				Catch & En-route Mortality	Run Size				
					Adults				Jacks
<u>Early Stuart</u>	6,000	103,000	66,000	175,000	350,000	0	5%	2%	31%
<u>Early Summer-run</u>									
Fennell/Bowron	132,000	54,000	52,000	89,000	327,000	0	5%	40%	57%
Nadina/Gates	221,000	59,000	50,000	108,000	438,000	6,000	7%	50%	63%
Total	353,000	113,000	102,000	197,000	765,000	6,000	12%	46%	60%
<u>Summer-run</u>									
Chilko	2,330,000	111,000	512,000	223,000	3,176,000	11,000	49%	73%	77%
Hfly/L.Stu/Stel	984,000	32,000	123,000	107,000	1,246,000	31,000	20%	77%	80%
Total	3,314,000	143,000	635,000	330,000	4,422,000	42,000	69%	74%	77%
<u>Late-run</u>									
Birkenhead	287,000	9,000	190,000	#N/A	486,000	37,000	8%	55%	57%
Weav/Port/Adam	303,000	0	74,000	#N/A	377,000	4,000	6%	80%	80%
Harr/Cult/Widgeon	2,000	0	2,000	#N/A	4,000	0	0%	50%	50%
Total	592,000	9,000	266,000	#N/A	867,000	41,000	14%	65%	66%
Total Adults	4,265,000	368,000	1,069,000	702,000	6,404,000	89,000	100%	66%	71%
Total Jacks	38,000	0	51,000	0	89,000				
Total	4,303,000	368,000	1,120,000	702,000	6,493,000				
Portion of Total Run	66%	6%	17%	11%	100%				

* Includes catches in commercial, test and other fisheries, excluding Fraser River Indian fisheries.

** The unreported catch and en-route mortality of Early Stuart, early summer-run and summer-run fish are the PSC gross escapement estimates at Mission, minus spawning escapements and reported Indian catches (Appendix A, Table 1). Pitt River sockeye estimates were derived from DFO spawning escapement estimates. Late-run estimates are unavailable because the Mission echo-sounding program was discontinued on September 10, mid-way through the late-run migration. The only complete estimate of late-run gross escapements, therefore, is derived from spawning escapements and Indian catches.

*** Includes reported catches only.

Early summer-run stocks arrived approximately seven days later than normal. The cumulative abundance of these early-timed stocks was about 765,000 adult sockeye, close to the pre-season forecast. There were reported catches of 353,000 fish in commercial fishing areas and 113,000 in Fraser River Indian fisheries. Above Mission, unreported catches and en-route mortalities caused by fishing and natural causes totalled 197,000 fish (Appendix A, Table 1). The exploitation of early summer stocks in commercial fishery catches, excluding Indian catches, was 46% (Table 6).

Returns of the dominant summer-run group, the Chilko River and Lake group, were almost two weeks late and significantly larger than the pre-season forecast, totalling 3,187,000 sockeye. Returns of Chilko Area sockeye stocks were larger than expected, producing a total of 3,176,000 adult fish compared to the forecast of 1,785,000. In total, the production of summer-run stocks was approximately 4,422,000 adults. Adult catches in commercial fishing areas totalled 3,314,000 fish, and reported catches in Fraser River Indian fisheries totalled 143,000 fish. Also, unreported

catches and en-route mortalities totalling 330,000 fish occurred above Mission (Appendix A, Table 1). The exploitation rate for summer-run stocks in commercial fisheries was 74%.

Late-run stocks arrived with normal timing. Approximately 486,000 adult Birkenhead fish returned, which was about half the forecast abundance. The other late-run stocks returned in numbers slightly above pre-season expectations at approximately 381,000 fish. Adult catches of late-run stocks totalled 592,000 in commercial fisheries and 9,000 in Fraser River Indian fisheries. The exploitation rate for late-run stocks was 65%. This exploitation rate is lower than for summer-run stocks because fisheries in commercial marine areas were closed on August 20, part-way through the late-run migration.

The 1992 return of Fraser River sockeye totalled 6,493,000 fish, including 89,000 jacks. Reported catches in all fisheries accounted for 71% of the total, including 66% in commercial fisheries and 5% in Fraser River Indian fisheries. Seventeen percent reached the spawning grounds and 11% were unreported catches and en-route mortalities above Mission. Of the total run, 82% were age 4₂, 16% were age 5₂, 1% were age 5₃ and 1% were age 3₂. The return of 4,950,000 age 4₂ fish was the largest for the cycle. The large return of 1,036,000 age 5 fish was from the successful 1987 spawning, which produced 11,000,000 age 4₂ fish in 1991.

Two pilot studies, initiated in past years, were continued by the Racial Identification Group in 1992. The first was a screening project for the parasite *Philonema oncorhynchi* that was started in 1990. The second was a sockeye morphometric measurement project first begun in 1988. The objective of these projects is to assess the utility of additional variables for stock identification of Fraser River sockeye salmon.

Philonema oncorhynchi is a nematode parasite found near the swim-bladder in adult sockeye salmon. The parasite is not believed harmful to the fish and since it is eliminated during evisceration, it also does not affect the marketability of the fish. Previous studies have established that Fraser River sockeye salmon show a low prevalence of *Philonema* compared to most north coast sockeye stocks (e.g., Skeena, Nass and southeast Alaska stocks). After a thorough evaluation of its utility, *Philonema* prevalence may help distinguish between Fraser River and north coast sockeye salmon in fisheries where intermingling occurs. In this event, *Philonema* prevalence will be a discriminating variable, along with scale characters, in future DFA models.

In 1992, at sampling sites in Prince Rupert and Vancouver, PSC staff screened purse seine and gillnet catches (Canadian Areas 1, 2W, 3, 4, 12, 20 and 29) for prevalence of *Philonema*. Staff from ADFG, with funding provided by the PSC, performed a similar screening (Alaska Districts 101, 104 and 106). For each sample, 115 fish were examined for *Philonema* during regular sampling for scales, sex data and length data.

In addition, spawning sockeye from selected streams in the Fraser River watershed and in Alaska watersheds were screened for *Philonema* prevalence. The goal of this program is to build an extensive baseline documenting *Philonema* prevalence for individual stocks across a number of years.

A second component of the 1992 study was the laboratory verification of *Philonema* prevalence data collected from field sampling in B.C. and Alaska. By comparing the field and detailed laboratory assessments of *Philonema* prevalence, the accuracy of field assessments and the potential need for a correction formula can be assessed.

Although additional work is required, preliminary results indicate that *Philonema* prevalence alone resulted in smaller estimates of Fraser River sockeye catches in north coast fisheries in 1992 than did scale pattern analyses. Prior to integration of *Philonema* data as a variable in the DFA models, the consistency of prevalence data between years must be confirmed, as must the rates of *Philonema* prevalence in all major stocks potentially contributing to north coast catches.

Morphometric variation, the subject of the second pilot study, refers to differences in body shape among stocks. Several studies have shown that morphometric measurements can be a useful stock identification tool. Initial spawning ground assessments conducted by the Racial Identification Group in 1988, 1989 and 1991 showed that morphometric variation exists for Fraser River sockeye salmon, especially in the posterior body region. Morphometric screening in 1992 was conducted at several sockeye spawning streams: Pitt River, Gates Creek, Fennell Creek, Raft River, Seymour River, Chilko River, Stellako River, Birkenhead River and Weaver Creek. In addition, morphometric data were collected from Early Stuart sockeye caught in lower Fraser River test fisheries in early July. These investigations are anticipated to continue through 1993, after which an initial assessment of the in-season utility of the technique will be done.

VIII. ESCAPEMENT

Escapements of sockeye salmon to spawning grounds in the Fraser River watershed are enumerated annually by DFO. These data are used to evaluate the management of fisheries and to forecast returns four years hence. In 1992, adult (4- and 5-year-old) escapements totalled 1,069,000 fish (Appendix D: Table 7), the second largest on the cycle since thorough estimates began in the late 1930's. However, this was a decline of 22% from 1988 and 42% below the revised in-season escapement goal. In addition, 51,000 jack (3-year-old) sockeye reached the spawning grounds for total escapements of 1,120,000 fish. Escapements of Early Stuart sockeye declined 63% from 180,000 in 1988 to 66,000 adult spawners in 1992. Early summer-run escapements declined 50% from 206,000 adults in 1988 to 102,000 in 1992. However, after deducting 46,000 escapements of the enhanced (spawning channels) Gates Creek and Nadina River stocks from the early summer total, only 56,000 spawners were recorded among the naturally-reproducing stocks. For these naturally-reproducing stocks, this is a 68% decrease compared to 175,000 spawners in 1988. Summer-run sockeye escapements decreased from 757,000 adults in 1988 to 635,000 (-16%). Late-run escapements, however, were slightly higher at 266,000 (+16%) adults in 1992 compared to 228,000 in 1988.

Early Stuart escapements totalled 66,000 fish (A; Figure 6). Of these, 63% spawned in Middle River tributaries, which is the same proportion as in the brood year. Although escapements to Takla Lake tributaries (12,000 spawners) declined 50% compared to 1988, the proportion of these spawners in the Early Stuart total increased from 12% in 1988 to 18%. Larger escapements in Takla Lake tributaries may be the key to increasing Early Stuart production in non-dominant cycle years. Thus, the higher proportion arriving in Takla tributaries was welcome, but lower total escapements are a reversal of recent trends. A high proportion (50-60%)⁴ of Early Stuart spawners were net-marked (normal is less than 25%).

Late Stuart escapements increased nearly three-fold to 19,500 adults. Of these, 16,000 spawned in Tachie River and Kuzkwa Creek. In addition, there were 4,400 jack sockeye from the 1989 dominant cycle spawning. This is the largest jack abundance observed since record-keeping began in the late 1940's.

Sockeye escapements to the Nechako River watershed (B; Figure 6) showed variable trends. Nadina River sockeye had 7,700 escapements compared to 8,700 in 1988. Of these, 6,900 entered the spawning channel. Stellako River escapements, however, declined from 368,000 in 1988 to 98,000 in 1992. Escapements in 1988 were the largest on record and resulted from a low harvest rate caused by the need to conserve a weak co-migrating Chilko River run. Escapements were expected to be lower in 1992, but the decline was more severe than expected. Approximately 14% of Stellako River escapements were 5-year-olds from the 1987 brood.

⁴ Pearse. 1992. Managing salmon in the Fraser.

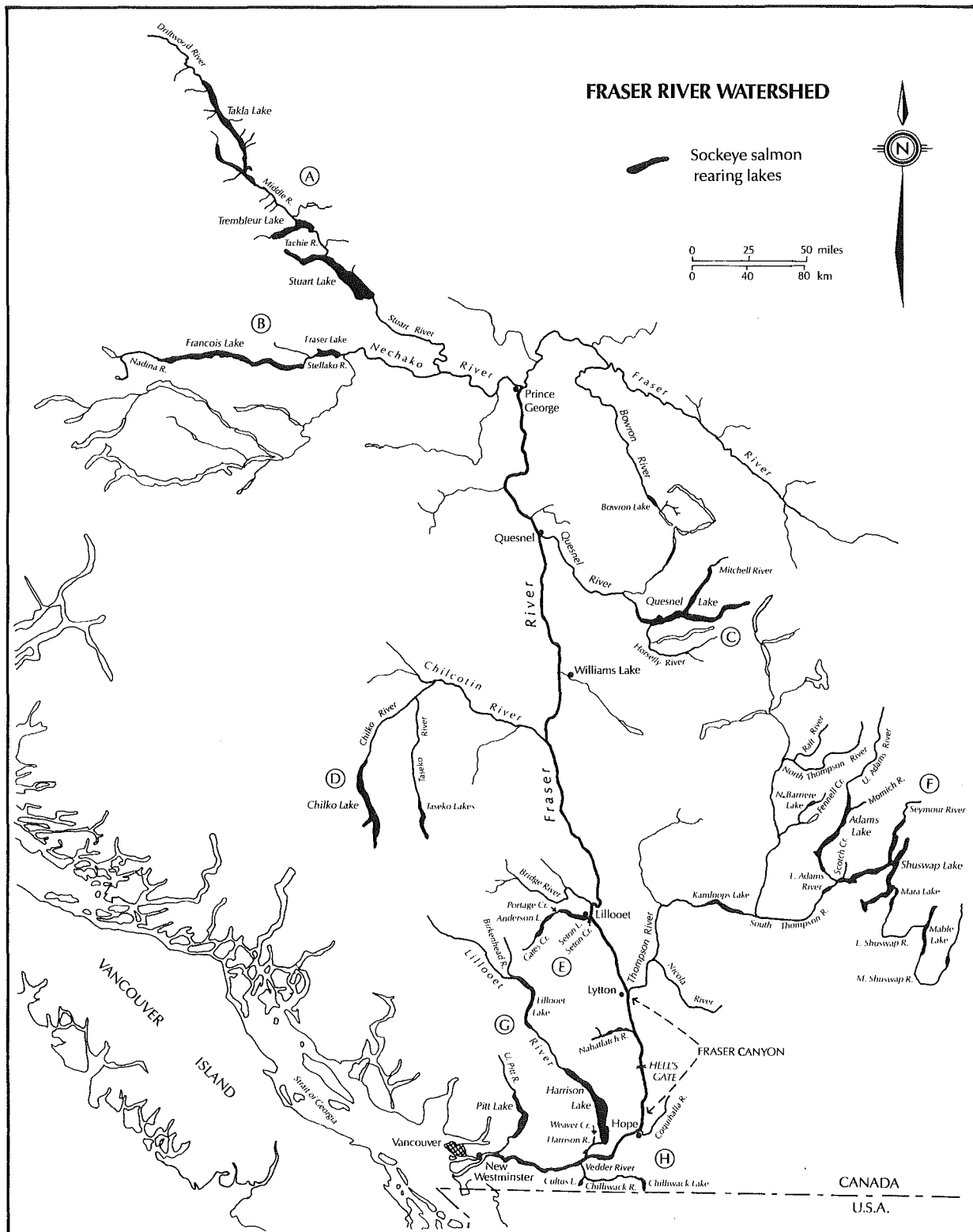


Figure 6. Sockeye salmon spawning grounds in the Fraser River watershed.

Quesnel Lake stocks (C; Figure 6), which includes Horsefly River sockeye, are normally dominated by jacks on the 1992 cycle. These 3-year-old fish return one year before the 1993 dominant cycle return of 4-year-olds. For the first time in recent cycle years, adults (5,900) outnumbered jacks (3,000). Adult abundances were similar to the brood year in the Horsefly River. Jack abundances were the lowest prior to a dominant cycle year since 1980.

Bowron River escapements declined 80% to 2,600 fish in 1992. Recent (1989, 1991 and 1992) escapements to this stream have declined from prior brood-year levels. This stock has a history of changing patterns of cyclic abundance, alternating between periods with relatively even returns among cycles and periods with a strong abundance of one cycle. The most abundant cycle has also shifted to a different cycle, which is unusual among Fraser sockeye stocks.

Historically, the 1992 cycle has been the dominant line for Chilko River sockeye (D; Figure 6). A strong return in 1992 resulted in total escapements of 511,000 adult sockeye to Chilko Lake and River spawning grounds. This was 41% above the 1988 brood year return of 363,000 spawners. The recovery of Chilko sockeye in 1992 from the low production and escapement in 1988 was accentuated in catches: 2,441,000 fish were taken in 1992 (Table 6) compared to 493,000 in 1988. The 1992 spawning was the third consecutive year of large escapements in which the run has shown dramatic production increases compared to the parent brood. Escapements to the Chilko watershed averaged 791,000 fish in this 1990-92 period compared with 382,000 on these cycles in 1982-88. Data on the distribution of spawners between Chilko River and Chilko Lake spawning grounds in 1992 are unavailable.

Sockeye returns to Gates Creek (E; Figure 6) are most abundant on the 1992 cycle. Escapements to the spawning channel and creek totalled 42,000 adults in 1992, compared to 45,000 in 1988. This escapement was the second largest since record-keeping began in the late 1930's. Approximately 39,000 fish entered the channel, the largest number since the channel was constructed in 1968. Unfortunately, many fish arrived in poor physical condition and pre-spawning mortalities were the highest in several years. Approximately 63% of females that entered the spawning channel died before depositing eggs. Females that spawned in the creek were subject to a lower mortality rate (50%).

Portage Creek showed a substantial increase in escapements from 1,100 in 1988 to 2,700 in 1992. The 1992 cycle is the lowest of the four cycles. However, escapements in 1992 were the largest on the cycle.

Disappointingly low escapements were recorded for early summer-run stocks in the Thompson River watershed (F; Figure 6). North Thompson stocks at Fennell Creek and Raft River declined an average of 62% from brood year levels to 9,100 and 8,200 fish, respectively. In the South Thompson watershed, stocks that spawn in Adams and Shuswap Lake tributaries were similarly affected. Momich River escapements dropped 58% to 2,500 adults and Upper Adams escapements dropped 58% to 3,000 adults. The Upper Adams escapement was particularly disappointing, because the Upper Adams River has a large under-utilized spawning and rearing capacity at current population levels. This stock produces large abundances only on the 1992 cycle. Rebuilding the Upper Adams stock to historical levels could significantly increase total Fraser sockeye returns.

Streams flowing into Shuswap Lake experienced varied patterns in escapements. Seymour River spawners declined 66% to 5,700 fish. However, Scotch Creek escapements doubled from 1,100 in 1988 to 2,200 adult sockeye in 1992. There were poor returns of 4-year-old Scotch Creek and Seymour River fish from the 1988 spawning. Seymour River and Scotch Creek spawners were 73% and 74% 5-year-olds, respectively. These 5-year-old fish are from the 1987 brood, which produced well and provided strong escapements of 4-year-olds in 1991.

Late-run stocks in the Thompson River watershed were at the low point in their cycle in 1992. However, a very good cycle-year escapement of 12,300 adult spawners was recorded in the Adams River. Although this number is 168% above the 1988 level, the majority (86%) of spawners were 5-year-old fish from the strong 1987 brood.

Sockeye spawning populations in the Harrison-Lillooet system (G; Figure 6) were close to brood year levels. Birkenhead River had escapements of 186,000 adult and 33,000 jack sockeye. This adult escapement was 11% higher than spawned in 1988, and was the third largest spawning population on record (1986 and 1991 were larger). There was a very high proportion (67%) of 5-year-old spawners.

Harrison River escapements totalled 300 spawners, the lowest on record. Juvenile sockeye from this stock rear in lower Fraser River sloughs and the estuary for approximately four months before migrating to the Strait of Georgia as under-yearling smolts. Survival of these juveniles may be related to environmental conditions in quite different ways than for yearling smolts of other stocks.

Weaver Creek and channel had 59,000 adult spawners, an increase of 19% from 49,000 fish in 1988. Egg-to-fry survival in the channel was much lower than normal for the 1988 brood. However, reduced fishing after mid-August probably boosted adult escapements in 1992. Of the total, 36,000 spawners entered the spawning channel.

Lower Fraser watershed (H; Figure 6) sockeye escapements generally declined in 1992. Nahatlatch River and Lake spawners declined 71% to 4,100 fish. Upper Pitt River escapements were down 76% from 1988 levels to 9,100 spawners. Chilliwack Lake and tributary spawners decreased from 6,600 in 1988 to 3,900 in 1992. Cultus Lake sockeye increased from 900 in 1988 to 1,200 in 1992.

Pre-spawning mortality rates in 1992 were higher than average for Early Stuart (12% loss), Gates channel (63%) and Gates Creek (50%) females. For the entire Fraser system, successful female spawners totalled 594,000 fish (95% of the female run). This is a 17% reduction in the spawning population compared to 1988. The effect of a smaller spawning population on overall success was likely magnified by the small size of fish in 1992. Small sockeye tend to have fewer eggs.

IX. ACHIEVEMENT OF OBJECTIVES

Since the Fraser River Panel was not responsible for the management of fisheries in Panel Area waters in 1992, we cannot evaluate the achievement of objectives by the Panel in this report.

X. ALLOCATION STATUS

The international allocation status for Fraser River sockeye salmon cannot be determined at this time. Total United States catches over the 1989-92 period are estimated at 7,411,000 sockeye (6,803,000 in Washington waters and 608,000 in Alaska waters).

XI. APPENDICES

APPENDIX A: PSC STAFF ACTIVITIES RELATED TO THE PEARSE INVESTIGATION

As a result of an unexpected numerical difference between Mission hydroacoustic estimates and upstream estimates of catch and spawning escapement of sockeye salmon in 1992, the Canadian Minister of Fisheries and Oceans, the Honourable John Crosbie, appointed an independent advisor to investigate reasons for this discrepancy and recommend corrective measures. Pearse (1992)⁵ concluded that unreported catch and fishing-induced mortality were mainly responsible for the shortfall of 482,000 sockeye spawners.

During the investigation, Dr. Pearse requested that PSC staff participate in several aspects of the investigation. The reviews by the PSC staff were submitted directly to Pearse and were not subject to approval by the Parties. These reviews are summarized below; however, the numbers have been updated to reflect the most recent estimates. Mission hydroacoustic estimates have been revised to incorporate changes due to an in-season error of 131,000 fish. The best estimate of the difference between Mission and upstream sources is 702,000 including 89,000 fish estimated by DFO in unmonitored fisheries.

A. Mission Hydroacoustic Program

First, DFO hydroacoustics experts and PSC staff reviewed the operation and analytical procedures of the PSC's hydroacoustic program at Mission. This review found our procedures to be reliable and sound. Among other findings, our procedures and even the personnel involved in the program have been remarkably consistent over the sixteen years (since 1977) of program operation.

Second, staff were asked to develop statistically sound methods for calculating variance for gross escapement estimates from this program. This work will soon be completed. A potential bonus of this research are refinements to our procedures that will improve the accuracy and precision of Mission escapement estimates.

Third, echo sounding crews count the number of sockeye carcasses they see during their transects. Although this task is not rigorously pursued, the counts are useful indices of sockeye mortalities during the migration. In 1992, carcass counts were substantially higher than usual, especially considering the small run. This evidence, although not conclusive, supports other indications of high migration mortalities. For example, extensive net marking of spawners from early-timed stocks, particularly the Early Stuart run, suggests that the upriver gillnet fishery was very intense and may have contributed to the higher mortalities observed at Mission⁶.

Finally, PSC staff compared historical gross escapement estimates from Mission echo sounding against upriver estimates from accounting of Indian catches and spawning escapements. Excluding 1992, fifteen years (1977-91) of corresponding hydroacoustic and upstream estimates were available. Hydroacoustic estimates are from IPSFC records (1977-85) and the PSC (1986-91). Upstream estimates are the sum of DFO's estimates of Indian fishery catches plus the IPSFC's (1977-85) and DFO's (1986-91) spawning escapement estimates.

⁵ Pearse, . 1992. Managing salmon in the Fraser.

⁶ Larkin, P. A. 1992. Analysis of possible causes of the shortfall in sockeye spawners: technical appendix to Managing salmon on the Fraser by Peter H. Pearse. Canada. Department of Fisheries and Oceans, Vancouver, B.C. 33 p.

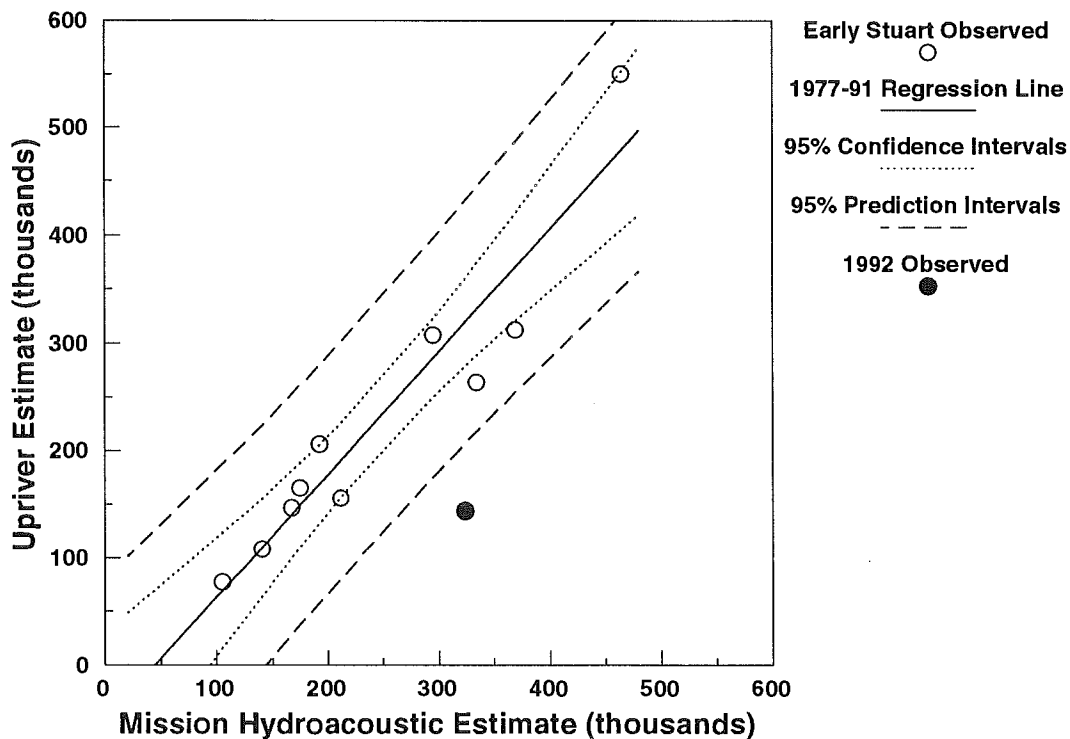


Figure 1. Upstream estimates (Indian catches plus spawning escapements) versus echo-sounding estimates of gross escapement above Mission for Early Stuart sockeye stocks for 1977-92.

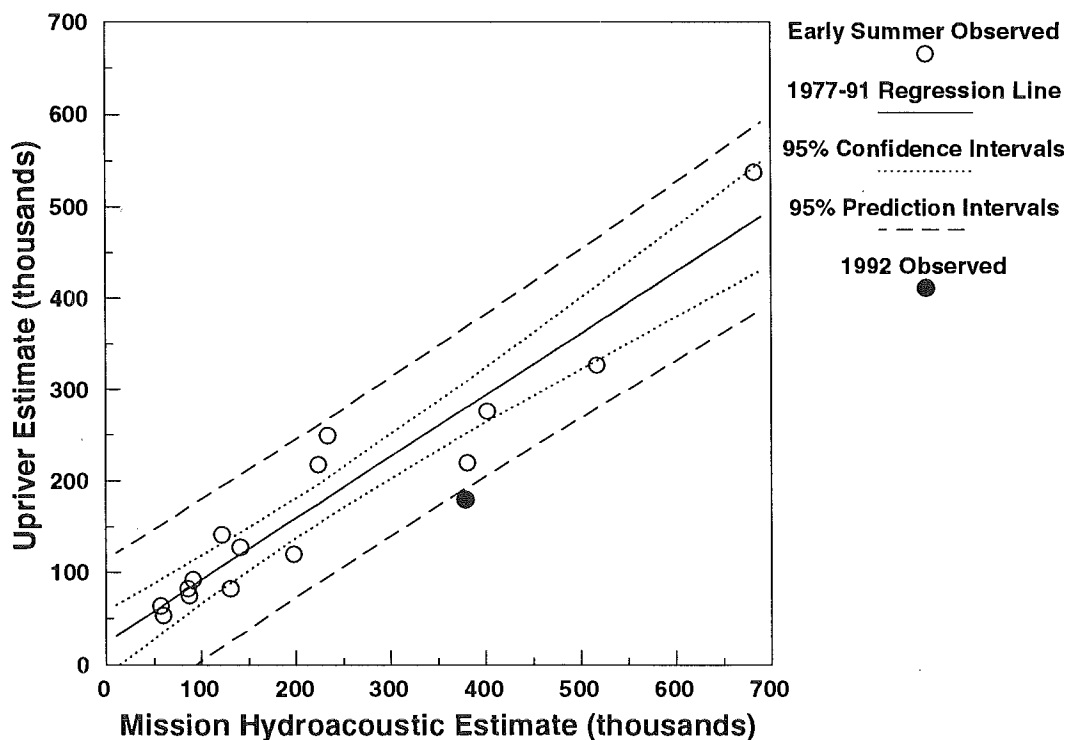


Figure 2. Upstream estimates (Indian catches plus spawning escapements) versus echo-sounding estimates of gross escapement above Mission for early summer-run sockeye stocks for 1977-92.

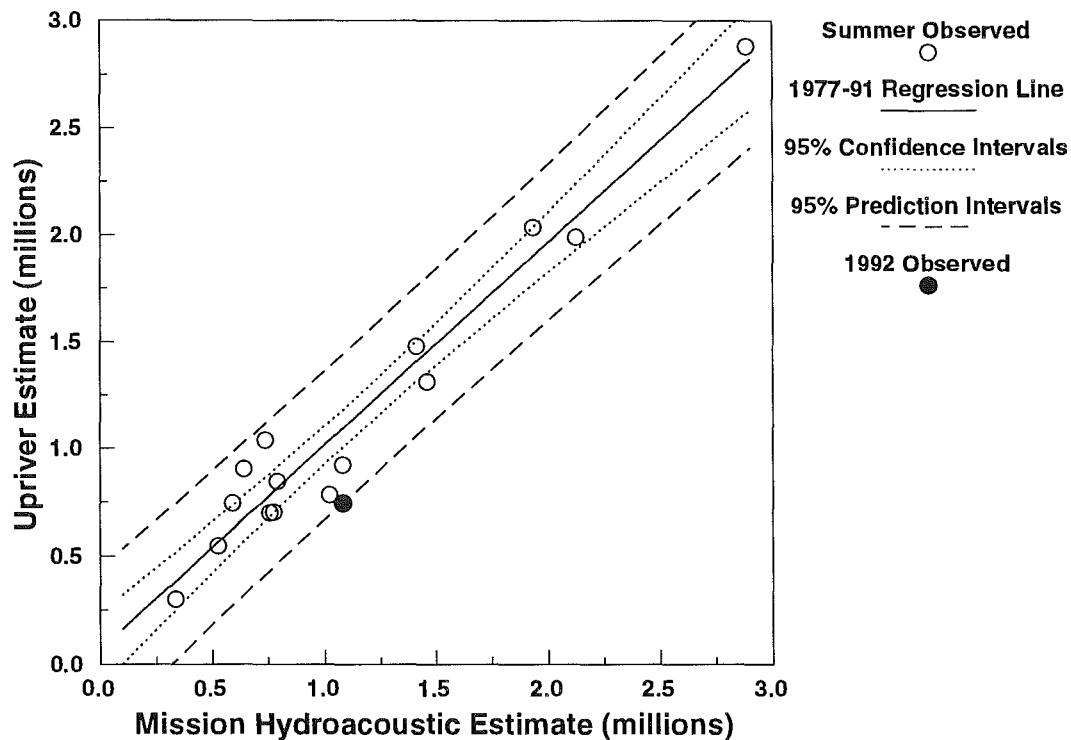


Figure 3. Upstream estimates (Indian catches plus spawning escapements) versus echo-sounding estimates of gross escapement above Mission for summer-run sockeye stocks for 1977-92.

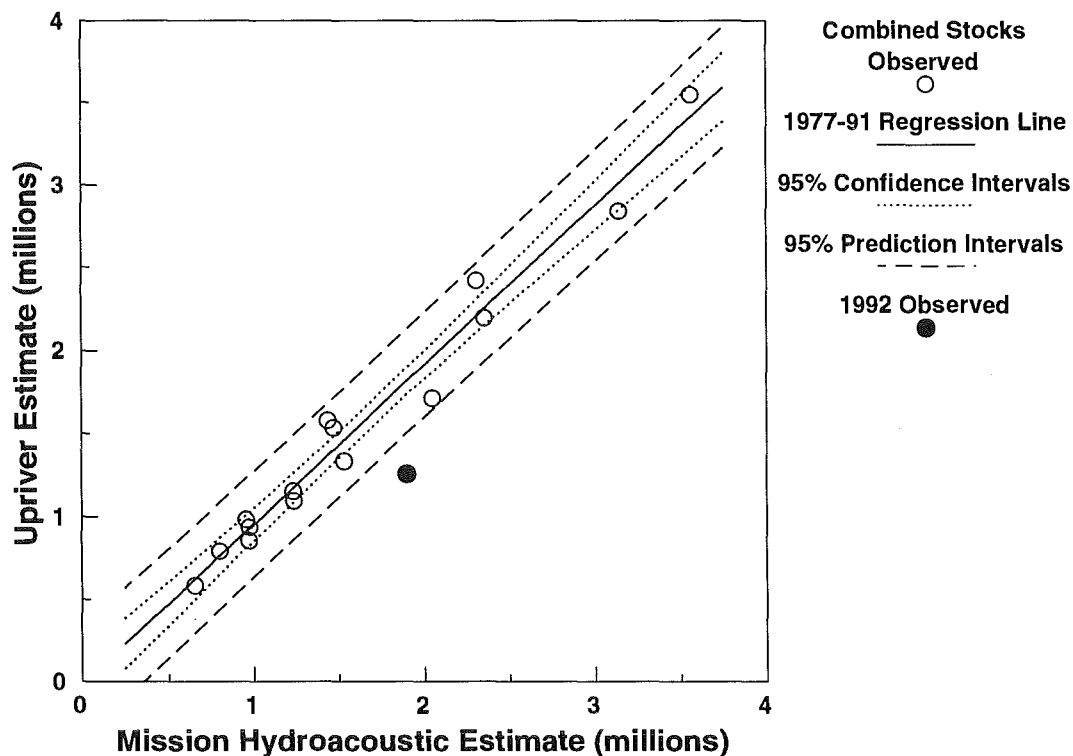


Figure 4. Upstream estimates (Indian catches plus spawning escapements) versus echo-sounding estimates of gross escapement above Mission for all sockeye stocks between late June and early September for 1977-92.

Since neither of these sources provide absolute gross escapements, these comparisons show the degree of agreement between the estimates, not actual levels of accuracy. We assume that a high degree of correlation shows that both estimates have been reliable and accurate. No other estimates of gross escapement are available.

Over the fifteen years (1977-91) of program operation prior to 1992, Mission and upriver estimates have been very close for Early Stuart (Figure 1), early summer-run (Figure 2) and summer-run (Figure 3) stocks, both separately and combined (Figure 4). However, in 1992 the upriver estimates were at or below the lower 95% prediction intervals of hydroacoustic estimates in all cases. Assuming these events are independent, the probability that they occurred randomly is almost zero. Because the conduct of the Mission program was unchanged from previous years while upriver fisheries (i.e., Canada's Aboriginal Fishing Strategy) and monitoring (i.e., catches in some areas were not monitored, Appendix D: Table 5) were very different in 1992, the discrepancies were likely due to error in the upriver catch estimates⁷. Fishing-induced and natural mortality probably also contributed to the differences.

Escapements of Early Stuart, early summer- and summer-run sockeye past Mission between late June and early September totalled 1,783,000 sockeye (Table 1). Upstream estimates of Indian catches and spawning populations of these stocks amounted to 1,081,000 fish. The discrepancy between the estimates is 702,000 sockeye salmon.

Table 1. Calculation of the number of sockeye salmon that passed Mission but then did not reach the spawning grounds and were not reported as catches in 1992.

Stock Group	Mission Gross Escapement	Estimates Above Mission			Unreported Catch & En-route Mortality *
		Indian Catch	Spawning Escapement	Total	
Early Stuart	324,000	83,000	66,000	149,000	175,000
Early Summer-run					
Fennell/Bowron/Raft/Pitt **	180,000	39,000	52,000	91,000	89,000
Nadina/Gates	199,000	41,000	50,000	91,000	108,000
Total	379,000	80,000	102,000	182,000	197,000
Summer-run					
Chilko	825,000	90,000	512,000	602,000	223,000
Horsefly/Late Stuart/Stellako	255,000	25,000	123,000	148,000	107,000
Total	1,080,000	115,000	635,000	750,000	330,000
Total	1,783,000	278,000	803,000	1,081,000	702,000

* PSC gross escapement estimates at Mission, minus reported Indian catches and spawning escapements above Mission. Discrepancies in the estimates of late-run fish are zero, because the Mission echo-sounding program was discontinued on September 10, mid-way through the late-run migration. The only complete estimate of late-run gross escapements, therefore, is derived from spawning escapements and Indian catches.

** DFO spawning escapement estimates were used for Pitt River gross escapements, therefore there is no discrepancy for Pitt River sockeye.

⁷ Pearse. 1992. Managing salmon in the Fraser.

B. Racial Analysis

The Racial Identification Group was involved in two reviews. First, they worked closely with DFO personnel to compare the PSC's current statistical technique for performing racial analysis (discriminant function analysis) against DFO's preferred technique (maximum likelihood estimation). This study found that the two techniques produced essentially the same results.

Second, they assessed whether in-season estimates of racial proportions in catches and gross escapements in 1992 was biased by the use of pre-season scale standards, compared to when post-season standards from the spawning grounds were used. Pre-season standards were constructed from scale data from 1991 jacks or prior-year age 4₂ fish. Post-season standards were developed using scales collected from 1992 spawning ground escapements. The results of analyses that used the post-season standards were compared to the original in-season analyses that used pre-season standards. The differences in escapement estimates by stock group provided a measure of the error associated with using in-season standards as opposed to using "true" post-season spawning ground standards.

The retrospective analysis showed that scale pattern analysis performed well in 1992 in separating Early Stuart stocks from early summer-run stocks, early summer-run stocks from summer-run stocks, and summer-run stocks from late-run stocks (Table 2). However, the in-season models tended to slightly underestimate Early Stuart, early summer- and late-run proportions, and slightly overestimate the proportion of summer-run stocks.

Table 2. Comparison of adult gross escapement estimates for Fraser River sockeye salmon runs in 1992, generated using in-season and post-season racial models.

Run	Adult Gross Escapement Past Mission *					
	In-season	-	Post-season	=	Difference	
	Models		Models		Fish	%
Early Stuart	309,000		324,000		(15,000)	(4.6%)
Early Summer	406,000		410,000		(4,000)	(1.0%)
Summer	1,111,000		1,081,000		30,000	2.8%
Late	210,000		221,000		(11,000)	(5.0%)
Total	2,036,000		2,036,000		0	

* Early Stuart, early summer- and summer-run escapement estimates are from the Mission echo-sounding program, but also includes the in-season estimate of Pitt River gross escapements (41,000 fish). Late-run escapements are a combination of Mission echo-sounding estimates and estimates from Cottonwood test fishing CPUE models. The estimates exclude sockeye salmon caught in Fraser River Indian fisheries below Mission.

C. Test Fishing

Test fishing operations in the Fraser River were also reviewed to assess whether changes to the PSC test fishing net at the Cottonwood site in 1992 affected the CPUE-based estimates of abundance and stock composition estimates obtained there. Data from test fishing catches and from Mission echo sounding for 1987-92 were examined to determine 1) whether test fishing CPUE was related to Mission hydroacoustic estimates of abundance and 2) whether the variable-mesh gillnet used at Cottonwood was effective in capturing all sizes of sockeye salmon.

The analysis showed that significant predictive relationships existed between abundance estimates from test fishing CPUE data (using variable-mesh and standard 5 1/8" mesh gillnets) and Mission echo sounding. Therefore, we conclude that CPUE data can be used for short-term estimates of abundance (replaced by echo sounding 1-2 days later). Stock composition estimates in 1992 were considered to be unbiased because the variable-mesh gillnet showed less selectivity in the size range of most sockeye salmon than the 5 1/8" mesh net used previously. Introduction of the variable-mesh gillnet in 1992 had no negative effect and probably improved stock composition estimates obtained from samples collected from the Cottonwood test fishery.

D. Analysis of Migrational Data

A review of in-season run size estimates for early-timed sockeye stocks in 1992 indicated that actual run sizes were larger than accounted in catch and spawning escapement. These data provided independent verification of the accuracy of Mission escapement estimates and the number of unaccounted-for fish.

Daily catches of sockeye in Indian fisheries and daily escapements estimated at Mission were analyzed to assess the accuracy of escapement estimates. Indian fisheries near Steveston on Early Stuart sockeye removed 31-36% of the fish estimated to be present in the fishing area during the open periods, while fisheries between Mission and Sawmill Creek (Fraser Canyon) removed 27-44% of available fish, confirming the effectiveness of Indian fisheries on Early Stuart sockeye. Had fewer fish than estimated actually escaped, harvest rates in Indian fisheries would have been even higher, a result that is not likely.

Comparison of the estimated passage at Mission and spawning escapements showed that Early Stuart and early summer-run sockeye were intensively exploited in Indian fisheries. Arrivals on spawning grounds averaged 24% of the numbers estimated to have passed Mission.

Indian fishery impacts on summer-run sockeye stock migrating past Mission prior to August 16 were high as well. However, removal rates were close to zero for fish migrating after that date, as these fish were protected by closure of mainstem Fraser River commercial and Indian fisheries by the Minister of Fisheries. Arrival of Chilko sockeye at a counting site below Chilko Lake showed that nearly 100% of Chilko fish that migrated past Mission after August 16 arrived at the site, compared to 21% of fish that migrated from August 2-8 and 52% of fish that migrated from August 9-15 (this latter group was partially protected by upstream closures).

**APPENDIX B: 1992 PRE-SEASON FORECASTS AND ESCAPEMENT GOALS FOR
FRASER RIVER SOCKEYE SALMON. (provided to the Fraser River Panel by
Canada Department of Fisheries and Oceans).**

<u>Stock / Run</u>	<u>Forecast Return</u>	<u>Spawner Escapement Goal</u>	<u>Expected Catch</u>
Sockeye Salmon by Stock			
Early Stuart	700,000	200,000	501,000
Bowron	65,000	16,000	49,000
Fennell	100,000	25,000	75,000
Raft	55,000	14,000	41,000
Pitt	100,000	25,000	75,000
Gates	240,000	59,000	183,000
Late Nadina	70,000	17,000	53,000
Chilko Lake	510,000	126,000	384,000
Scotch	12,000	3,000	10,000
Seymour	90,000	22,000	68,000
Early Miscellaneous	179,000	44,000	135,000
Late Stuart	100,000	36,000	69,000
Horsefly	40,000	14,000	41,000
Chilko	1,275,000	400,000	875,000
Stellako	900,000	200,000	700,000
Birkenhead	1,060,000	250,000	815,000
Weaver	250,000	80,000	171,000
Harrison	25,000	8,000	17,000
Cultus	5,000	2,000	3,500
Portage	20,000	6,000	14,500
Late Miscellaneous	34,000	11,000	23,000
Total Adult	5,830,000	1,558,000	4,303,000
Jacks	70,000	39,000	
Total Sockeye Return	5,900,000	1,597,000	
Sockeye Salmon by Run			
Early Stuart	700,000	200,000	501,000
Early Summer	1,421,000	351,000	1,073,000
Summer	2,315,000	650,000	1,685,000
Late	1,394,000	357,000	1,044,000
Total Adult	5,830,000	1,558,000	4,303,000
Jacks	70,000	39,000	
Total Sockeye Return	5,900,000	1,597,000	

APPENDIX C: ACTUAL FISHING TIMES IN MAJOR CANADIAN (days) AND UNITED STATES (hours) NET FISHERIES IN THE FRASER RIVER PANEL AREA IN 1992. (Fishing times were provided by the Parties).

CANADA			
<u>Date</u>	<u>Area 20 *</u>		<u>Area 29 **</u>
	<u>Purse Seine</u>	<u>Gillnet</u>	<u>Gillnet</u>
July 5-11	Closed	Closed	Closed
July 12-18	Closed	Closed	Closed
July 19-25	Closed	Closed	Closed
July 26-Aug. 1	Closed	Closed	Closed
Aug. 2-8	6	7	1
Aug. 9-15	7	7	1
Aug. 16-22	6	7	1
Aug. 23-29	Closed	Closed	Closed
Aug. 30-Sept. 5	Closed	Closed	Closed
Sept. 6-12	Closed	Closed	Closed
Sept. 13-19	Closed	Closed	Closed
Sept. 20-26	Closed	Closed	Closed
Sept. 27-Oct. 3	Closed	Closed	Closed
Total	19	21	3

* Area 20 fishing times are measured in 12- or 13-hour days to correspond with the duration of openings.

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

UNITED STATES					
<u>Date</u>	<u>Treaty Indian</u>		<u>Non-Indian</u>		
	<u>Areas 4B, 5, 6C</u>	<u>Areas 6, 7, 7A</u>	<u>Purse Seine</u>	<u>Gillnet</u>	<u>Reefnet</u>
July 5-11	Closed	Closed	Closed	Closed	Closed
July 12-18	Closed	Closed	Closed	Closed	Closed
July 19-25	114	Closed	Closed	Closed	Closed
July 26-Aug. 1	150	Closed	Closed	Closed	Closed
Aug. 2-8	168	47	37	38	Closed
Aug. 9-15	168	84	42	42	Closed
Aug. 16-22	168	91	36	42	Closed
Aug. 23-29	168	113	24	38	Closed
Aug. 30-Sept. 5	12	7	Closed	Closed	Closed
Sept. 6-12	Closed	Closed	Closed	Closed	Closed
Sept. 13-19	Closed	Closed	Closed	Closed	Closed
Sept. 20-26	Closed	Closed	Closed	Closed	Closed
Sept. 27-Oct. 3	Closed	Closed	Closed	Closed	Closed
Total	948	342	139	160	0

APPENDIX D: TABLES 1-7.

Table 1. Commercial net catches of Fraser River sockeye salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1980-1992.

Date *	1980	1984	1988	1992
July 5-11	0	0	0	0
July 12-18	0	0	0	0
July 19-25	0	0	0	0
July 26-Aug. 1	15,000	0	0	0
Aug. 2-8	29,000	94,000	0	113,000
Aug. 9-15	60,000	68,000	140,000	497,000
Aug. 16-22	0	168,000	58,000	252,000
Aug. 23-29	2,000	204,000	21,000	18,000
Aug. 30-Sept. 5	0	5,000	0	0
Sept. 6-12	0	0	0	0
Sept. 13-19	0	0	0	0
Sept. 20-26	0	0	0	0
Sept. 27-Oct. 3	0	0	0	0
Oct. 4-Oct. 10	0	0	0	0
Oct. 11-17	0	0	0	0
Total	106,000	539,000	219,000	880,000

* Dates for 1992. For other years, data from the nearest week was 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 1980-1992.

Date *	1980	1984	1988	1992
July 5-11	0	0	0	0
July 12-18	0	0	1,000	0
July 19-25	4,000	0	0	0
July 26-Aug. 1	0	89,000	51,000	0
Aug. 2-8	20,000	103,000	148,000	93,000
Aug. 9-15	102,000	439,000	143,000	42,000
Aug. 16-22	54,000	155,000	28,000	124,000
Aug. 23-29	74,000	129,000	2,000	2,000
Aug. 30-Sept. 5	22,000	22,000	0	0
Sept. 6-12	17,000	22,000	0	0
Sept. 13-19	7,000	13,000	204,000	0
Sept. 20-26	7,000	4,000	152,000	0
Sept. 27-Oct. 3	0	7,000	19,000	0
Oct. 4-Oct. 10	6,000	0	8,000	0
Oct. 11-17	0	0	2,000	0
Total	313,000	983,000	758,000	261,000

* Dates for 1992. For other years, data from the nearest week was 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 1980-1992. Landing (ticket) dates lag an average of five days behind catch dates.

Date *	1980	1984	1988	1992
July 5-11	1,000	0	0	0
July 12-18	1,000	0	5,000	2,000
July 19-25	1,000	0	32,000	25,000
July 26-Aug. 1	3,000	1,000	5,000	65,000
Aug. 2-8	5,000	3,000	1,000	0
Aug. 9-15	3,000	10,000	0	77,000
Aug. 16-22	1,000	10,000	1,000	0
Aug. 23-29	1,000	4,000	0	0
Aug. 30-Sept. 5	0	1,000	0	0
Sept. 6-12	0	0	0	0
Sept. 13-19	0	0	0	0
Sept. 20-26	0	0	0	0
Sept. 27-Oct. 3	0	0	0	0
Oct. 4-Oct. 10	0	0	0	0
Oct. 11-17	0	0	0	0
Total	16,000	29,000	44,000	169,000

* Dates for 1992. For other years, data from the nearest week was 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 1980-1992.

Date *	1980	1984	1988	1992
July 5-11	6,000	0	0	0
July 12-18	9,000	0	1,000	1,000
July 19-25	30,000	14,000	2,000	6,000
July 26-Aug. 1	58,000	86,000	8,000	15,000
Aug. 2-8	229,000	229,000	6,000	314,000
Aug. 9-15	548,000	342,000	70,000	1,103,000
Aug. 16-22	141,000	264,000	45,000	565,000
Aug. 23-29	29,000	195,000	17,000	43,000
Aug. 30-Sept. 5	7,000	73,000	0	2,000
Sept. 6-12	1,000	0	0	0
Sept. 13-19	0	1,000	5,000	0
Sept. 20-26	0	3,000	0	0
Sept. 27-Oct. 3	1,000	0	0	0
Oct. 4-Oct. 10	0	0	0	0
Oct. 11-17	0	0	0	0
Total	1,059,000	1,207,000	154,000	2,049,000

* Dates for 1992. For other years, data from the nearest week was used.

Table 5. Catches of Fraser River sockeye salmon in the Canadian Fraser River Indian fishery by area (Fraser River mainstem or tributary areas) for cycle years 1980-1992. *

Fishing Area	1980	1984	1988	1992
Fraser River Mainstem				
Steveston	3,983	14,277	25,387	64,101
Deas to Mission	3,870	4,019	11,073	16,668
Mission to Hope	45,507	76,787	86,392	110,876
Hope to Sawmill Creek	20,855 **	110,412 **	96,328 **	116,936
Sawmill Creek to Churn Creek	61,255 **	45,093 **	111,589 **	12,007
Churn Creek to Hixon	2,182	16,350	14,605	5,105
Above Hixon	1,000	3,019	1,290	2,825
Total	138,652	269,957	346,664	328,518
Tributaries				
Harrison/Lillooet System	11,850	10,136	8,974	7,562
Thompson System	1,000	0	174	0 ***
Chilcotin System	17,022	56,874	32,279	23,014
Nechako System	13,589	15,276	16,926	3,712
Stuart System	3,853	5,286	11,005	4,920
Total	47,314	87,572	69,358	39,208
Total Catch	185,966	357,529	416,022	367,726

* Data supplied by DFO.

** Prior to 1992, the divisions were Hope to North Bend, and North Bend to Churn Creek.

*** Catches not monitored in 1992.

Table 6. Commercial net catches of Fraser River sockeye salmon in United States Areas 4B, 5, 6, 6C, 7 and 7A (Juan de Fuca Strait and northern Puget Sound) by week for cycle years 1980-1992.

Date *	1980	1984	1988	1992
July 5-11	0	0	0	0
July 12-18	0	0	31,000	0
July 19-25	29,000	6,000	15,000	4,000
July 26-Aug. 1	15,000	164,000	362,000	23,000
Aug. 2-8	111,000	268,000	0	110,000
Aug. 9-15	185,000	739,000	93,000	349,000
Aug. 16-22	111,000	331,000	106,000	109,000
Aug. 23-29	0	116,000	53,000	13,000
Aug. 30-Sept. 5	5,000	12,000	16,000	0
Sept. 6-12	1,000	0	0	0
Sept. 13-19	0	0	0	0
Sept. 20-26	0	0	0	0
Sept. 27-Oct. 3	3,000	0	0	0
Oct. 4-Oct. 10	1,000	0	3,000	0
Oct. 11-17	0	0	0	0
Total	461,000	1,636,000	679,000	608,000

* Dates for 1992. For other years, data from the nearest week was used.

Table 7. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1980, 1984, 1988 and 1992. *

DISTRICT	1992 Period of	Estimated Number of Adult Sockeye				Jacks
<u>Stream/Lake</u>	<u>Peak Spawning</u>	<u>1980</u>	<u>1984</u>	<u>1988</u>	<u>1992</u>	<u>1992</u>
NORTHEAST						
Upper Bowron River	Aug.25-31	2,894	10,461	12,780	2,560	0
STUART						
<u>Early Runs</u>						
Takla Lake Streams	Aug.5-15	676	4,337	23,453	11,789	156
Middle River Streams	Aug.3-13	16,014	38,830	114,216	41,059	194
<u>Trembleur Lake Streams</u>	Aug.1-10	249	2,034	42,138	12,769	70
Early Stuart Total		16,939	45,201	179,807	65,617	420
<u>Late Runs</u>						
Middle River	Sep.21-28	165	184	1,203	1,832	166
Tachie River	Sep.21-29	756	810	3,137	15,056	3,889
<u>Miscellaneous</u>		25	234	2,777	2,625	324
Late Stuart Total		946	1,228	7,117	19,513	4,379
NECHAKO						
Nadina River (Late)		57	659	794	862	0
Nadina Channel (Late)		3,268	6,411	7,950	6,866	0
Stellako River		72,050	60,957	367,702	97,979	6
QUESNEL						
Horsefly River Area		308	894	5,876	5,862	3,039
Mitchell River		0	20	954	-	-
CHILCOTIN						
Chilko River		467,812	452,618	249,989	504,236	4,346
Chilko Channel		---	---	4,679	7,031	50
Chilko Lake-South End		29,947	127,561	108,721	0 **	0
Taseko Lake		679	2,771	11,138	970	0
SETON-ANDERSON						
Gates Creek		4,289	2,646	17,512	2,774	277
Gates Channel		20,799	26,253	27,401	38,973	4,625
Portage Creek		1,800	1,710	1,068	2,706	89
NORTH THOMPSON						
Raft River	Aug.31-Sep.8	5,418	19,086	19,851	8,236	6
Fennell Creek	Aug.25-30	8,437	11,021	26,927	9,139	35
SOUTH THOMPSON						
<u>Summer Runs</u>						
Seymour River	Aug.28-Sep.4	8,309	17,172	16,781	5,742	23
Scotch Creek	Aug.30-Sep.4	107	409	1,060	2,156	125
Upper Adams River	Aug.30-Sep.4	560	3,502	7,169	2,990	0
Momich / Cayenne Crk	Aug.27-Sep.2	3,345	5,854	5,912	2,486	0
<u>Late Runs</u>						
Lower Adams River	Oct.3-10	2,464	4,183	4,578	12,270	17
Lower Shuswap River	Oct.3-10	18	75	194	240	115
HARRISON-LILLOOET						
Birkenhead River	Sep.27-Oct.1	78,613	40,245	166,591	185,908	32,625
Harrison River		5,092	1,267	1,544	313	0
Weaver Creek		32,668	14,171	23,958	22,851	497
Weaver Channel		41,162	45,431	25,299	35,835	575
LOWER FRASER						
Nahatlatch River		1,323	1,513	16,446	4,120	10
Cultus Lake		1,657	994	861	1,203	2
Upper Pitt River	Sep.14-18	17,101	15,797	37,747	9,129	6
<u>MISCELLANEOUS</u>						
ADULTS		829,754	922,059	1,370,339	1,068,806	51,367
JACKS		18,566	9,612	47,960	51,367	
<u>TOTAL NET ESCAPEMENT</u>		848,320	931,671	1,418,299	1,120,173	

* 1980 and 1984 data are from the Pacific Salmon Commission. Estimates for 1988 and 1992 are from DFO.

** South-end Chilko Lake spawners included in Chilko River total.

APPENDIX E: STAFF OF THE PACIFIC SALMON COMMISSION IN 1992

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 Biologist

BIOMETRICS AND CATCH STATISTICS GROUP

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

COMPUTER SERVICES GROUP

Ms. K. Mulholland, Computer Systems Manager

RACIAL IDENTIFICATION GROUP

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

STOCK MONITORING GROUP

Mr. J. Cave, Head
Mr. P. Cheng, Hydroacoustics Biologist
Ms. V. Craig, Test Fishing Biologist