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Report of the Fraser River Panel to the Pacific Salmon Commission on the 1995 Fraser River Sockeye and Pink Salmon Fishing Season

Prepared by the

Pacific Salmon Commission

March, 1998

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REPORT OF THE

FRASER RIVER PANEL

TO THE PACIFIC SALMON COMMISSION

ON THE 1995 FRASER RIVER SOCKEYE AND PINK

SALMON FISHING SEASON

1995 PANEL MEMBERS AND ALTERNATES

CANADA	UNITED STATES
A. Lill, Chair	L. Loomis, Vice-chair
D. Bailey	D. Austin
M. Forrest	J. Giard
M. Griswold	W. Robinson
R. Kendall	R. Allen
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FISHERIES MANAGEMENT DIVISION

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PACIFIC SALMON COMMISSION

March, 1998

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I. EXECUTIVE SUMMARY

1. The Fraser River Panel managed fisheries in 1995 under the terms of a July 27, 1995 agreement between Canada and the United States. The agreement limited United States catches of Fraser River sockeye and pink salmon in the Panel Area to shares of the Total Allowable Catches (TAC's) following defined formulas. It was agreed that United States catches of Early Summer, Summer and Late-run sockeye were to be in proportion to the TAC. Catches of Fraser sockeye in Alaska were excluded from the sharing formula, but were to be included in overall accounting.

2. Pre-season forecasts were for total runs of 10,700,000 Fraser River sockeye salmon and 18,000,000 Fraser River pink salmon. Canada set pre-season spawning escapement goals of 2,900,000 adult Fraser sockeye and 6,000,000 pink salmon.

3. As of July 27, 1995, when sharing arrangements for 1995 were reached, revised expectations were for a total sockeye run of 10,252,000 fish. Expectations for pink salmon were unchanged. Canada provided a revised spawning escapement goal of 2,770,000 sockeye. Among the TAC deductions was an agreed escapement goal adjustment of 144,000 sockeye. The sockeye TAC was projected to be 6,838,000 fish. Canada's gross escapement goal was 3,933,000 fish.

4. Expected United States shares were 1,405,000 Fraser sockeye and 3,079,000 Fraser pinks. A tiered plan allocated Washington fishers 20.55% of the sockeye TAC below 7,300,000, 10% of the TAC between 7,300,000-10,000,000, and 5% of the TAC between 10,000,000-11,600,000, to a maximum of 1,850,000 Fraser sockeye. The allocation of Fraser pinks was 25.7% of the TAC, to a maximum of 3,600,000 fish. Canadian shares of the TAC were expected to be 5,433,000 sockeye and 8,901,000 Fraser River pink salmon.

5. The United States domestic allocation plan for sockeye deviated from the normal 50:50 sharing between Treaty Indian and Non-Indians in Washington. If the Washington share was greater than 1,000,000 sockeye, then the goal was to obtain a catch differential of 200,000 fish in favor of Treaty Indian fishers compared to Non-Indian fishers. Otherwise, if the Washington share was less than or equal to 1,000,000 fish, then a 60:40 Treaty Indian:Non-Indian catch sharing was the goal. Treaty Indians in Areas 4B, 5 and 6C were allocated 12% of the Treaty Indian share, with the balance to be caught in Areas 6, 7 and 7A. Non-Indian catches were to be shared among gear types: 54% for seines, 41% for gillnets and 5% for reefnets. United States catches of pink salmon were to be divided equally between Treaty Indians and Non-Indians. Within the Non-Indian share, commercial trollers in Areas 3 and 4 had a harvest quota of 120,000 Fraser pinks.

6. Canadian domestic allocation goals for Fraser River sockeye salmon were to be calculated using a tiered scheme, with each gear allocated a percentage of the first 3,200,000 sockeye caught in commercial fisheries and a different percentage of catches exceeding this amount. In addition, there was a payback from gillnets to the other gear types to compensate for catch shortfalls in previous years, and further transfers between inside and outside trollers. The allocation of southerly migrating pink salmon was: purse seines - 58%; outside trollers - 29%; gillnets - 9%; and inside trollers - 4%.

7. The Fraser River Panel established a fishery regime and pre-season management plan based on forecast run sizes, migration timing and Johnstone Strait diversion rates; goals for catch and escapement; and conservation concerns for other species and stocks of salmon identified by the Parties. The peak Juan de Fuca Strait (Area 20) arrival timing of the two major sockeye stocks, Chilko and Adams/Lower Shuswap, was forecast to be August 13 and 14, respectively. Fraser River pink salmon were expected to peak on August 28, based on the

average weight of returning pink salmon. Forecast diversion rates through Johnstone Strait were 67% for sockeye and 56% for pink salmon.

8. To ensure that the various goals were achieved, the Panel met frequently (22 times) throughout the fishing season to enact regulations for Panel Area fisheries. As in past years, numerous meetings were necessary to enable the Panel to deal with the complex management issues involving Fraser River sockeye and pink salmon.

9. The total return of 4,006,000 Fraser River sockeye salmon was only 37% of the forecast 10,700,000, and was the smallest return on the cycle since 1975. For Fraser River pink salmon, the run of 12,877,000 fish was 72% of the forecast 18,000,000 fish.

10. Catches of Fraser sockeye totalled 2,255,000 fish in all fisheries. This was the smallest catch on the cycle since 1947. Canadian catches amounted to 1,735,000 fish, of which 799,000 were caught in commercial, 924,000 in First Nations and 12,000 in recreational fisheries. United States fishers caught 433,000 sockeye, including 405,000 in commercial fisheries in Washington and 23,000 in Alaska. Catches of Fraser pink salmon totalled 5,703,000 fish in all fisheries. Canadian catches amounted to 3,585,000 fish, of which 3,260,000 were caught in commercial, 161,000 in First Nations and 164,000 in recreational fisheries. United States fishers caught 2,029,000 pinks, including 1,996,000 in commercial and 33,000 in non-commercial fisheries in Washington. Included in United States non-commercial catches were 5,000 sockeye and 1,000 pink salmon in a Gear Modification Study to assess bird mortality in commercial fisheries. Catches in test fisheries authorized by the Fraser River Panel totalled 87,000 sockeye and 89,000 pink salmon.

11. The Stock Monitoring program provided in-season estimates of abundance, run timing and migration route proportions of Fraser River sockeye and pink stocks throughout the fishing season. The returning abundance of Fraser sockeye was substantially less than forecast for all major stock groups. The resulting fishery closures delayed run-size updates for Early Summer-run and Summer-run sockeye until a significant portion of each migration escaped past Mission. Particular difficulty was encountered with estimating Late-run sockeye abundance. Run-size estimates for these stocks, which are usually estimated using commercial catch data, were forced by the absence of commercial data to depend heavily on data from Juan de Fuca and Johnstone Straits test fisheries. Assessment of the Fraser pink migration was also complicated by the lack of fisheries in marine areas. Approximately 55% of Fraser sockeye and 55% of Fraser pink salmon migrated through Johnstone Strait.

12. In-season estimates of gross escapement, based on hydroacoustic data from Mission and test fishing catch-per-unit-effort data, and including Fraser River Indian catches below Mission, totalled 3,054,000 sockeye salmon. This estimate, when revised after the season to correct for an error in Mission hydroacoustic procedures in 1995, became 2,667,000 sockeye. The in-season estimate of pink salmon escapement to the Strait of Georgia was 6,500,000 fish.

13. The Racial Analysis program was successful in using scale and other characteristics to identify most major stock groups of Fraser River sockeye throughout the season, with two exceptions. First, two large Summer-run stocks, Chilko and Quesnel, were distinguished using data on the prevalence of the brain parasite, *Myxobolus articus*. Second, differences in migration behavior permitted Scotch/Seymour and Adams/Lower Shuswap stock groups to be separated. Genetic Stock Identification methods were used to identify Fraser River and other southerly migrating pink salmon stocks in mixed-stock fisheries.

14. Sockeye salmon spawning escapement estimates by Canada Department of Fisheries and Oceans totalled 1,731,000 adult and 20,000 jack Fraser sockeye. Escapements were 48% below brood year levels. Small returns of Late-run sockeye led to much reduced escapements of these stocks in 1995. Estimates of pink salmon spawning escapement total 7,174,000 fish.

15. Revised sockeye gross escapement goals based on the low returns were not available during the season, and thus the Panel's management was not directed towards achievement of such goals. Based on spawning escapement and Indian catch estimates, gross escapements were 130,000 Early Stuart, 240,000 Early Summer-run, 1,565,000 Summer-run and 688,000 Late-run sockeye, for a total of 2,623,000 adults. The gross escapement goal for Fraser River pink salmon was 6,000,000, compared to DFO's preliminary estimate of 7,328,000 fish based on spawning ground estimates and Fraser River Indian catches.

16. The preliminary estimate of TAC in 1995 was 1,768,000 Fraser River sockeye salmon, based on a run size of 4,006,000 fish and deductions (including spawning escapements, the Fraser River Indian fishery exemption of 400,000 and test fishing catches) totalling 2,238,000 fish. For Fraser River pink salmon, the run size, deductions and TAC are estimated to be 12,877,000, 7,263,000 and 5,614,000, respectively.

17. Catches of Fraser River sockeye salmon in United States Panel Area fisheries totalled 410,000 fish, 47,000 more than the goal of 363,000 Fraser sockeye. United States Panel Area catches of Early Stuart, Early Summer, Summer and Late-run sockeye were 1,000, 4,000, 2,000 and 40,000 fish over the goals, respectively. An additional 23,000 Fraser sockeye were caught in Alaska. United States catches of Fraser River pink salmon totalled 2,029,000 fish, 586,000 over the goal of 1,443,000 fish.

18. With respect to United States domestic allocations of Fraser sockeye in Panel Areas, Treaty Indians and Non-Indians were 4,000 fish under and 4,000 fish over the respective goals. Within the Treaty Indian group, the catch in Areas 4B, 5 and 6C was 11,000 fish more than the goal while in Areas 6, 7 and 7A the catch was under by the same amount. Non-Indian gillnets, purse seines and reefnets, respectively, caught 20,000 under, 13,000 over and 7,000 over their allocations. Treaty Indians were 197,500 under the catch goal for Fraser River pink salmon, while Non-Indians were over by 197,500 fish.

19. In Canada, gillnets and inside trollers exceeded the domestic allocations of Fraser River sockeye salmon by 71,000 and 12,000 fish, respectively. Outside trollers and purse seines were 37,000 and 46,000 fish under. With respect to allocations of southerly migrating pink salmon, outside trollers were 403,000 over, gillnets were 285,000 under, purse seines were 108,000 under and inside trollers were 10,000 under.

20. There were no major conflicts between the harvest of Fraser River sockeye salmon and the conservation of other species and stocks in 1995. Concerns identified by Canadian and United States agencies were taken into account during the design and implementation of the fishing plans. Restrained fishing due to the low abundance of sockeye stocks led to incidental catches of other species and stocks that were low or within previous ranges.

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 goals 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 goals 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.

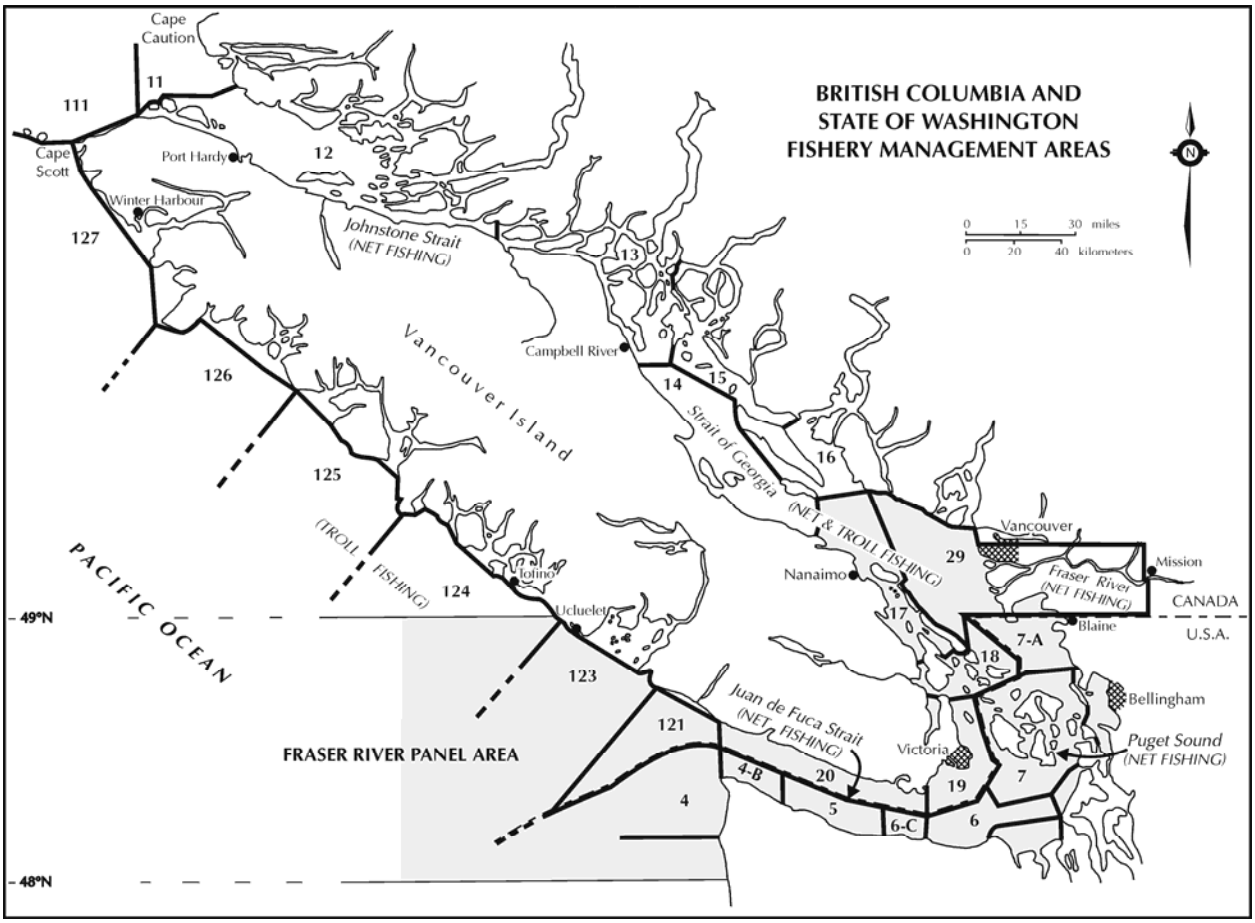

Figure 1. Fishery management areas and commercial gear used in the Fraser River Panel Area and Canadian south coast waters.

The pre-season management plan adopted by the PSC specifies a management scenario that is likely to achieve the goals, given the pre-season expectations. Using in-season commercial and test fishing data and various analyses from PSC staff, the Panel modifies the fishing times stated in the management plan to respond to deviations from pre-season expectations.

The activities of the Panel are facilitated by the Fraser River Panel Technical Committee. Members of this committee provide their respective national sections of the Panel with data and technical advice.

In 1995, following a July 27 agreement on international sharing arrangements by the Parties, the Panel began to exercise its regulatory mandate on August 2. The Panels' mandate in the Panel Area applied only to net fisheries, the Canadian inside (Strait of Georgia) troll fishery and the Washington Non-Indian coastal troll fishery. Development of management plans for other species and stocks intercepted in south coast regions is the responsibility of the Southern Panel and the Commission, with actual management in each region the responsibility of the appropriate country. Prior to the agreement and Panel regulatory control, some limited fishing under the management authority of domestic agencies occurred in United States areas.

Input to the decision making process occurs primarily through the national sections of the Panel where most fishery interests are represented. The Panel membership during the 1995 season was:

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

III. INTRODUCTION

The total return of Fraser River sockeye salmon in 1995 was 4,006,000 fish, the lowest number on the cycle since 1975 (Figure 2). The 1995 run was only about one-third as large as the previous cycle-year return (12,378,000 sockeye in 1991), despite most of the run having been produced by the largest escapement of adult spawners that has been recorded on the cycle (3,306,000 spawners in 1991). Approximately 25% of the return in 1995 was of 5-year-old fish from the 1990 brood year spawning. The total 4-year-old return of 2,999,000 fish in 1995 represented 1.7 fish per effective female spawner compared to an average of 10.6 (range: 1.7-22.0) fish per effective female for brood years 1948-90. This was the second lowest rate of age 4 recruitment since at least 1938, when the International Pacific Salmon Fisheries Commission initiated escapement records, and perhaps since the time of the Hells Gate blockages in the 1912-14 period.

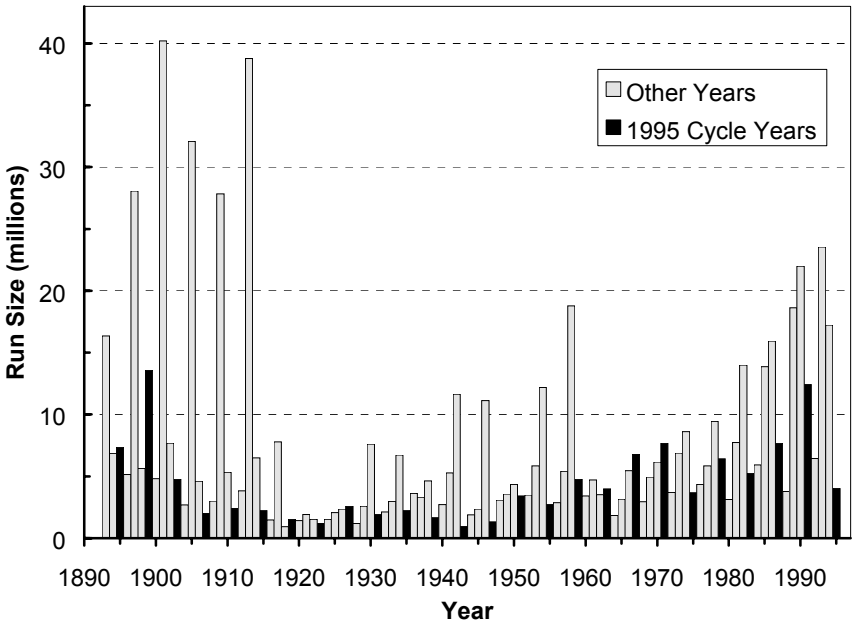

Figure 2. Total run sizes of Fraser River sockeye salmon between 1893-1995. Returns on the 1995 cycle are highlighted.

The low rate of return in 1995 does not appear to have been due to factors within the freshwater environment. For example, Chilko sockeye smolt production in 1993 from the 1991 spawning was the largest on record (39,700,000 fish). Rather, low ocean survival of Fraser River sockeye salmon smolts appears to be the cause, possibly linked to an El Nino event in 1993. Chilko River sockeye smolts that entered the ocean in the spring of 1993 survived at a rate of 2.7% compared to the long-term average of 9.9%. This was the second lowest rate of smolt-to-age 4_2 adult survival recorded for the stock. Predation by chub mackerel (*Scomber japonicus*), which were recorded as far north as Sitka, Alaska, in 1993, is a possible cause. Although actual consumption of sockeye smolts by mackerel was not recorded, returns of other salmon species to the south coast of British Columbia were similarly low and have been directly related to predation on juveniles by mackerel[1].

[1] Hargreaves, N.B. and R.M. Hungar. 1994. Robertson Creek chinook assessment and forecast for 1994. Part B: Early marine mortality. Pacific Stock Assessment Review Committee Working Paper S94-01.

The low total return (4,006,000 fish) compared to the pre-season forecast (10,700,000 fish) severely affected the management of the stocks in 1995. The small run and a large escapement goal resulted in a low Total Allowable Catch (TAC) and led to very restricted commercial fishing. Since much of the data used to make in-season run-size estimates are derived from commercial fishery catch and effort statistics, the lack of consistent fisheries affected the ability of Commission staff to accurately estimate the abundance of some stocks. The poor return of Late-run sockeye and the need to maintain low harvest rates on this stock created difficulties in harvesting Fraser River pink salmon.

The low return of Fraser sockeye also affected Panel activities in 1995. It caused the pre-season gross escapement goals to become unattainable, and revised goals based on the low returns were not available during the season. Ultimately, the bilateral Panel managed fisheries, primarily in United States waters, to achieve the international sharing of catch and United States domestic catch allocations. Fishery openings in Canadian Panel areas, and particularly in the Fraser River, were formulated by the Canadian section and adopted by the bilateral Panel.

Management of sockeye salmon in 1995 was also adversely affected by an error in Mission hydroacoustic estimates of escapement (see Stock Monitoring section). During its review of the 1994 Mission program, the Mission Hydroacoustic Facility Working Group of the Fraser River Sockeye Public Review Board (FRSPRB) suggested that the paper speed of the echosounder used at Mission during stationary soundings be increased to give more precision to the measurement of target widths on the echograms. This recommendation was implemented in 1995. However, after the end of the management season, PSC staff discovered that the change of paper speed had introduced an error into the estimates of daily escapement. Transformation of the data to compensate for the in-season error suggested that gross escapements were overestimated by about 387,000 fish (16%). The error primarily affected gross escapement estimates for Early Stuart, Early Summer and Summer-run stocks. The overestimate of Summer-run abundance led to an underestimate of harvest rates which, when applied to catches of Late-run stocks, resulted in overestimates of Late-run abundance and escapement to the Strait of Georgia. This error was unique to 1995 and did not occur in any other year.

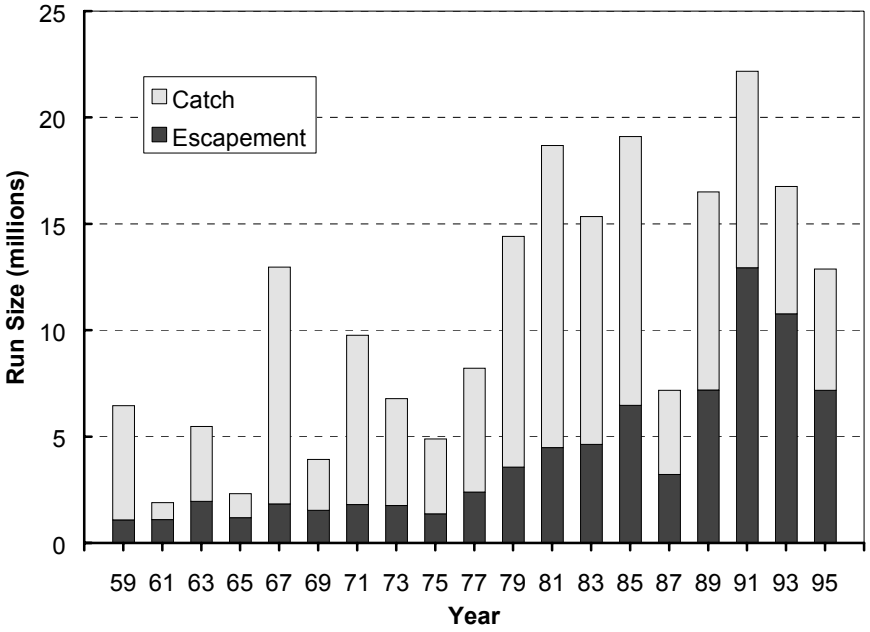

Figure 3. Catch, escapement and total returns of Fraser River pink salmon for odd years between 1959-1995.

Despite low returns and the hydroacoustic problem in 1995, the final effects on spawning escapements were not severe. Only limited fishing occurred during the passage of Early Stuart and Early Summer runs, so low escapements for these runs were primarily due to the small numbers of fish that returned. For Summer and Late runs, restricted fishing led to low harvest rates. Commercial fishery harvests amounted to a record low of 31% of the total run, while 66% of the run entered the Fraser River for gross escapement. Escapements of sockeye to the spawning grounds amounted to 44% of the 1995 run, which was the highest percentage escapement since 1962.

The Fraser River pink salmon return in 1995 was characterized by modest abundance and very small average size of fish. The estimated total was 12,877,000 fish, approximately 72% of the pre-season forecast of 18,000,000 fish. This was the second lowest return since 1977 (Figure 3). Body size of Fraser River pink salmon has decreased substantially from the mid 1970's. The mean weight of fish caught in Area 20 purse seines was 1.71 kg (3.77 lb), the smallest on record. As a result of the modest abundance, little targeted fishing was allowed on pink salmon in 1995.

IV. MANAGEMENT ACTIONS

A. Pre-season Forecasts, Goals and TAC

Canada provided the Panel with run-size forecasts and spawning escapement goals for Fraser River sockeye and pink salmon stocks on May 15, 1995 (Appendix A: Table 1). The forecast return of Fraser River sockeye salmon was 10,700,000 fish, with a spawning escapement goal of 2,900,000 adults. Subsequently, detailed forecasts of age-4 and age-5 returns were provided, which resulted in the following expectations: 703,000 Early Stuart, 903,000 Early Summer-run, 4,697,000 Summer-run and 4,382,000 Late-run sockeye. The forecast return of Fraser River pink salmon was 18,000,000 fish and the spawning escapement goal was set at 6,000,000 fish (Table 1).

At the time of the agreement between the Parties on July 27, the in-season estimate of Early Stuart run size was 230,000 fish and forecasts of Early Summer-run, Summer-run and Late-run abundance were 903,000, 4,747,000 and 4,372,000, respectively, for a total of 10,252,000 sockeye (Table 1). Corresponding spawning escapement goals were 150,000, 280,000, 1,050,000 and 1,290,000 fish, for a total of 2,770,000 adults. Also on July 27, the Parties discussed Canada's proposal to manage sockeye returns in a "risk-averse" manner. Canada's proposal involved increasing gross escapements to ensure spawning escapement goals would be achieved. Negotiation of these "escapement adjustments" or "buffers" was necessary because such adjustments would reduce the TAC available for international catch sharing. The agreed escapement adjustments were 131,000 Early Summer and 13,000 Summer-run sockeye. In addition, because the Early Stuart run was complete when the agreement was reached, the management adjustment used by Canada for this run is included in Table 1 (62,000, see footnote *2*). With anticipated catches in Fraser River Indian fisheries of totalling 956,000 sockeye, gross escapement goals were 229,000 Early Stuart, 498,000 Early Summer, 1,744,000 Summer and 1,461,000 Late-run sockeye for a total of 3,932,000 adults.

Table 1. Escapement goals, forecasts of run sizes and potential catches of Fraser River sockeye and pink salmon in 1995. Negotiated escapement adjustments are also shown. These were the values used at the time of the bilateral agreement on July 27, 1995.

Run	River & Ocean Catch *	Fraser Indian Catch	Escapement Adjustment	Escapement Goals Spawning	Escapement Goals Gross **	Total Run
Sockeye Salmon						
Early Stuart	1,000 *1*	17,000	62,000 *2*	150,000	229,000	230,000
Early Summer	405,000	87,000	131,000	280,000	498,000	903,000
Summer	3,003,000	681,000	13,000	1,050,000	1,744,000	4,747,000
Late	2,911,000	171,000	0	1,290,000	1,461,000	4,372,000
Total Adults	6,320,000	956,000	206,000	2,770,000	3,932,000	10,252,000
Pink Salmon						
Total Pink Salmon	12,000,000	n/a	0	6,000,000	6,000,000	18,000,000

* Includes catches in commercial, test, and other fisheries, excluding Fraser River Indian fisheries. These are calculated from the run size forecasts and gross escapement goals provided by Canada.

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

1 Early Stuart catch in U.S. fisheries prior to July 27 agreement.

2 Early Stuart escapement adjustment (63,000) minus actual U.S. catch (1,000). The Early Stuart escapement adjustment was not an agreed number, but was used by Canada until the agreement, which occurred after the Early Stuart run was complete.

International catch-sharing arrangements for Fraser River sockeye and pink salmon runs were reached on July 27, 1995. The agreement set out formulas for calculating United States shares of Fraser River sockeye and pink salmon (Table 2). Under the agreement, the maximum shares available to the United States in Panel Area waters would be 1,850,000 Fraser River sockeye and 3,600,000 Fraser pinks, which would be generated at TAC's of 11,600,000 sockeye and 14,008,000 pink salmon, respectively. Larger TAC's would not generate additional United States allocations. In addition, the Parties agreed that Alaska catches of Fraser sockeye would not be included in the United States share.

Table 2. Formulas for calculating Washington shares of Fraser River sockeye and pink salmon in 1995, from the July 27, 1995, agreement between the Parties.

TAC Range Minimum	TAC Range Maximum	Washington Share * Base	Washington Share * Incremental %	Washington Share * Maximum
Sockeye Salmon				
0	7,300,000	0	20.55%	1,500,000
7,300,000	10,000,000	1,500,000	10%	1,770,000
10,000,000	11,600,000	1,770,000	5%	1,850,000
11,600,000	. . .	1,850,000	0%	1,850,000
Pink Salmon				
0	14,008,000	0	25.7%	3,600,000
14,008,000	. . .	3,600,000	0.0%	3,600,000

* Share for a given TAC = Base share + (Incremental % x (Actual TAC - Minimum TAC))

Based on the in-season estimate of Early Stuart run size, forecast run sizes for Early Summer, Summer and Late runs, and the revised spawning escapement goals, the expected TAC's were 6,838,000 sockeye and 11,980,000 Fraser River pink salmon (Table 3). Catch goals for

Washington fishers were 1,405,000 sockeye and 3,079,000 pink salmon. Canadian shares were 5,433,000 sockeye, less catches of Fraser sockeye in Alaska, and 8,901,000 pink salmon. These Canadian shares were to be distributed among Indian, commercial and recreational fishers. However, the amounts allocated to each user group were not specified by Canada. United States catches of Early Summer, Summer and Late-run sockeye salmon were to be distributed across the main stock groupings, to the extent possible, in proportion to the TAC's of these groups.

Table 3. Projections (July 27, 1995) of the total allowable catch (TAC) and Washington and Canadian shares of Fraser River sockeye and pink salmon in 1995.

	Sockeye	Pink
TOTAL ALLOWABLE CATCH		
Total Run Size	10,252,000 *	18,000,000
Deductions		
Adult Escapement Goal	2,770,000	6,000,000
Escapement Adjustment	144,000	0
Fraser River Indian Food Fishery Exemption	400,000	0
Test Fishing	100,000	20,000
Total Deductions	3,414,000	6,020,000
Total Allowable Catch:	6,838,000	11,980,000
UNITED STATES		
Washington Share:	1,405,000	3,079,000
CANADA		
Canadian Share:	5,433,000	8,901,000

* Sockeye run size includes in-season (July 27) estimate of Early Stuart run size.

Table 4. Domestic allocation plan for Canadian commercial catches of Fraser River sockeye and southerly migrating pink salmon in 1995. Cumulative overages and underages in previous years are used to calculate payback amounts.

	Fraser River Sockeye Salmon				
	Allocation				Southerly Migrating Pink Salmon
Gear Type	Base Catch *	1st Stage Incremental Catch **	2nd Stage Incremental Catch **	Overage (Underage) ***	Allocation
Inside Troll	2.2%	22.2%	3.0% *1*	(6,000)	4.0% *2*
Outside Troll	10.8%	77.8%	18.5% *1*	(765,000)	29.0% *2*
Purse Seine	52.0%	0.0%	47.0%	(156,000)	58.0%
Gillnet	35.0%	0.0%	31.5%	927,000	9.0%
Total	100.0%	100.0%	100.0%	0	100.0%

* Base catch: First 3,200,000 sockeye in Canadian commercial catch.

** Incremental catch: Canadian commercial catch in excess of the base catch.
1st stage applies to the first 194,000 Canadian commercial catch above the base catch.
2nd stage applies to the Canadian commercial catch above the 1st stage catch.

*** The payback amount in a given year is the cumulative overage by a gear, to a maximum of 10% of the gear's allocation (base + incremental).

1 30.000 of outside troll allocation to be transferred to the inside troll allocation.

2 273,000 of outside troll allocation to be transferred to the inside troll allocation.

Canadian domestic allocation goals for commercial catches of Fraser River sockeye salmon (Table 4) were as follows. Each commercial gear was allocated a percentage of the first 3,200,000

sockeye caught ("base catch"). Any catch exceeding this number was to be "incremental catch". The first 194,000 of the incremental catch was to be divided between inside (22.2%) and outside (77.8%) trollers. For commercial catches in excess of 3,394,000 sockeye, a third set of percentages was to apply, and 30,000 fish from the outside troll allocation was to be transferred to the inside troll allocation. Finally, because of the policy of "Catch-up/Make-up" announced by the Minister of Fisheries on May 31, 1991, the allocations were adjusted to account for overages and underages in past years' sockeye catches. The maximum amount that any gear type would be required to pay back was limited to 10% of its allocation (base plus incremental).

Canadian allocations of southerly migrating pink salmon among commercial gear types was 4% for inside troll, 29% for outside troll, 58% for purse seine and 9% for gillnet. However, 273,000 pink salmon from the outside troll allocation were to be transferred to the inside troll allocation. No specific goals were set for catches of Fraser River pink salmon.

Goals for the domestic allocation of Fraser sockeye catches among Washington fishers were as follows: Treaty Indian - 850,000 and Non-Indian - 650,000, when the United States share in Washington State waters equalled 1,500,000 fish. The goal was to maintain a catch differential of 200,000 sockeye between Treaty Indian and Non-Indian fishers whenever run-size updates caused the Washington share to exceed 1,000,000 sockeye. In the event the Washington share was equal to or below 1,000,000, the goal was to maintain a catch sharing of 60:40, between Treaty Indian and Non-Indian fishers. Treaty Indians in Areas 4B, 5 and 6C were allocated 12% of the Treaty Indian share, with the balance to be caught in Areas 6, 7 and 7A. Non-Indian catches were to be shared among gear types: 54% for seines, 41% for gillnets and 5% for reefnets. United States catches of pink salmon were to be divided equally between Treaty Indian and Non-Indian fishers.

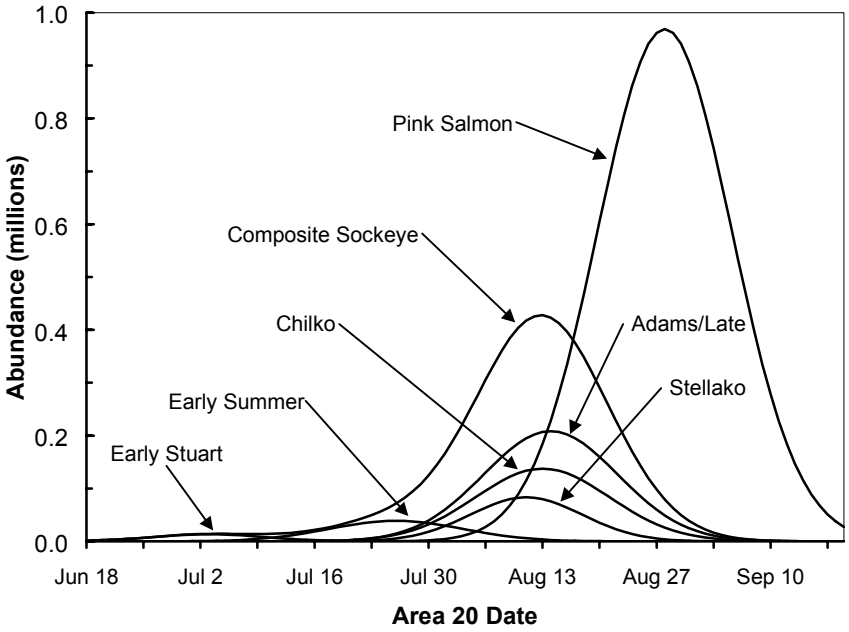

Figure 4. Expected daily abundance curves for migrating Fraser River sockeye and pink salmon in 1995 (Area 20 date), based on forecast abundances and timing patterns.

B. Pre-season Regulations

The 1995 Regulations and Management Plan for the Panel Area (from the July 27 agreement) were designed to achieve the catch and gross escapement goals described above. The timing and sequence of the proposed fisheries in the Plan were determined using the available forecasts of

run sizes, timing (Figure 4) and diversion rates through Johnstone Strait (Figure 5), that were available on July 26. These data were inputs for the fishery simulation model used to evaluate the impacts of management options on the goals of the Panel. The major targets of the 1995 sockeye fishery, the Chilko and Adams/Lower Shuswap stocks, were expected to peak in Area 20 about August 13 and August 14, respectively. These stocks were expected to comprise about 87% of the total catch of Fraser sockeye in 1995. Forecasts for Fraser River pink salmon were for an Area 20 peak migration date of about August 28, based on expected pink salmon average weights of 2.05 kg (4.5 lb). Diversion rates for Fraser River sockeye and pink salmon were forecast to be 67% and 56%, respectively.

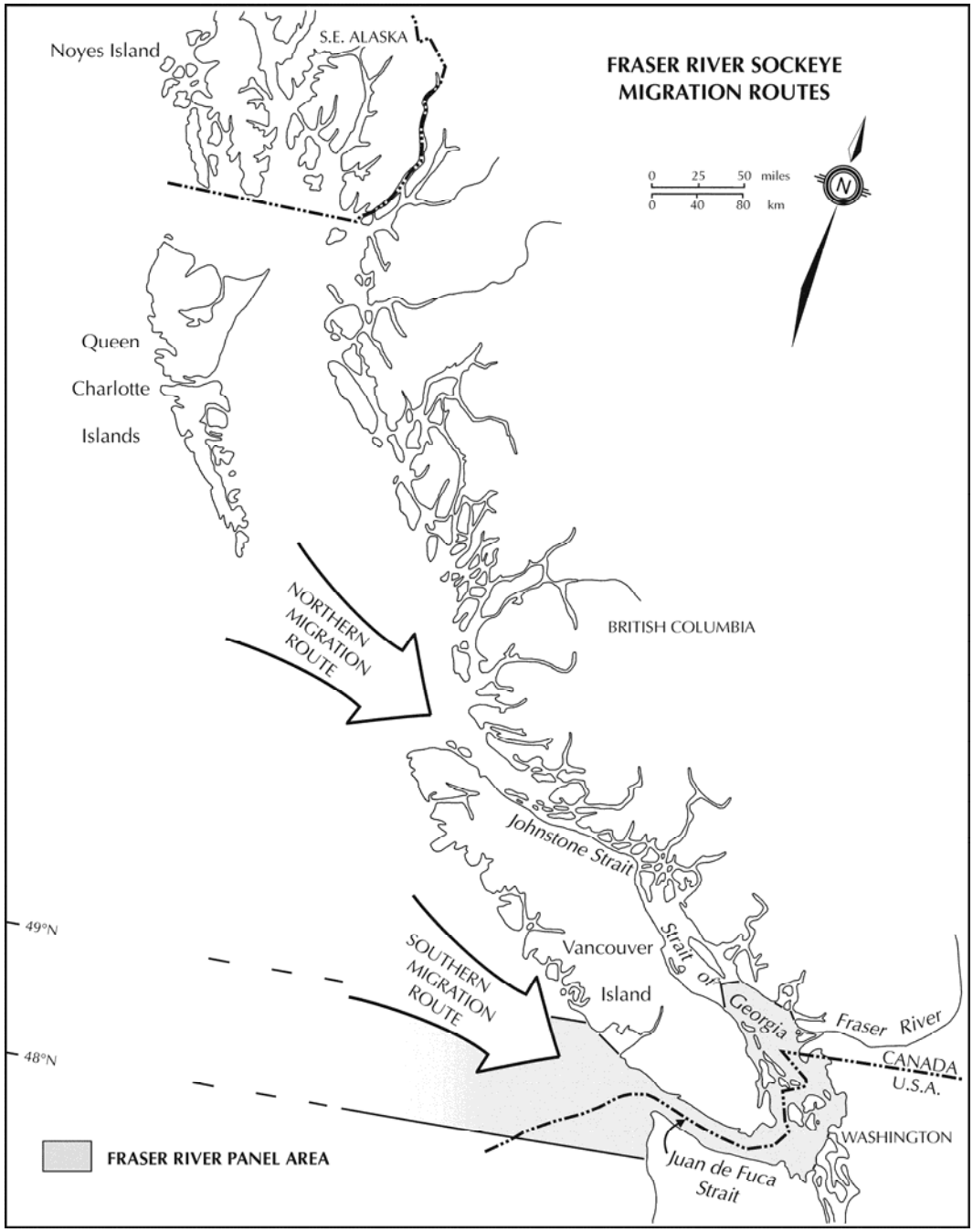

Figure 5. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migrating to the Fraser River.

The United States submitted a fishing schedule for the Non-Indian commercial troll fishery for pink salmon in Areas 3 and 4. This plan specified that the fishery was to close when either a harvest quota of 160,000 Fraser River pinks or a catch ceiling of 25,000 coho salmon was reached.

Both Canada and the United States identified stocks for which conservation or management concerns existed. Stocks identified by the United States included coho and chinook salmon generally, and Skagit River and Lake Washington sockeye. Canada identified concerns for Harrison River and lower Strait of Georgia chinook salmon stocks, Thompson River steelhead stocks, and "study area" pink salmon stocks. The Management Plan accommodated these concerns in the following ways:

1. To address United States and Canadian concerns, the by-catch of coho and chinook salmon was to be monitored in Panel Area fisheries, particularly in Area 20 purse seine fisheries, and reported in-season.

2. United States Areas 4B, 5, 6 and 6C were to be closed to Non-Indian net fishing for the entire season and Areas 4B, 5 and 6C were closed to Treaty Indian net fishing after September 2 to minimize the by-catch of coho salmon.

3. Non-Indian gillnet and seine fisheries in United States Areas 7 and 7A were to be closed after September 2 to minimize the coho by-catch.

4. United States Area 6A was closed to Treaty-Indian and Non-Indian fishers throughout the season to protect Skagit River sockeye, coho and summer chinook salmon, Stilliguamish River coho and chinook salmon and Snohomish River chinook salmon.

5. To protect Harrison River chinook and Thompson River Steelhead, sockeye fisheries in Canadian Area 29 were to close after September 2.

On July 27, 1995, the Panel adopted regulations (Appendix B) for regulatory control of the Panel Areas. The Commission accepted the regulations and submitted them to the Parties. As in previous years, fisheries regulated by the Panel were to be "Closed Unless Opened" by in-season Orders of the Panel (Appendix C).

The Panel finalized the Management Plan for 1995 on July 27, 1995. Proposed first openings for fisheries in Canadian Panel Areas were during the week of August 6-12 for net fisheries in Areas 20 and 29, and for trollers in Areas 18-1, 18-4, 18-11 and 29-5.

Proposed first openings of Treaty Indian fisheries in United States Panel Areas were on August 2 for Areas 4B, 5 and 6C and during the week of August 6-12 in Areas 6, 7 and 7A. For Non-Indian fisheries the dates were the week of August 6-12 in Areas 7 and 7A, and August 5 for troll fisheries in Areas 3 and 4.

C. In-season Regulations

Between July 27 and September 29, the Fraser River Panel conferred 22 times (by telephone or in-person) to enact in-season orders (Appendix C) to regulate the fisheries on Fraser River sockeye and pink salmon in the Panel Area.

The dominant feature of the 1995 season was the small sockeye return (4,006,000 fish) relative to the pre-season forecast (10,700,000 fish). Similarly, the pink salmon return (12,877,000 fish) was much smaller than the pre-season forecast (18,000,000 fish). It was necessary to scale back Panel Area fisheries from the pre-season expectations to prevent over-harvest of sockeye and

pink salmon. This was particularly evident in Canadian Area 20, where limited fisheries due to the poor sockeye return combined with high Johnstone Strait diversion resulted in a sockeye harvest of only 61,000 fish, which was taken incidentally during pink salmon directed fisheries in mid August through early September.

In United States Panel Areas, the majority of fisheries occurred in August. In scheduling these fisheries, the Panel attempted to allow enough fishing time for United States fishers to harvest their pink salmon allocation without exceeding their sockeye allocation.

The following paragraphs summarize the events of the season on a weekly basis, with an emphasis on what the Panel decided and why.

During the first in-season meeting on July 28, the United States announced an early closure of an ongoing Treaty Indian drift gillnet fishery in Areas 4B, 5 and 6C, in response to poorer than expected returns of the early segment of the Early Summer run.

During the week of July 30-August 5, the Panel approved a reduction from the pre-season forecast of Early Summer-run abundance from 903,000 to 400,000 fish, and a corresponding reduction in expected total Fraser sockeye returns to 9,700,000 fish. Canada's schedule of spawning escapement goals called for an escapement of 200,000 fish if the Early Summer-run abundance was 400,000 fish or less. Thus, the downward revision of Early Summer run size automatically reduced the escapement goal for all stocks to 2,690,000 fish. Staff also informed the Panel that while it was too early to change the pre-season forecast of Summer-run abundance, the Summer-run return would likely be less than forecast. Consequently, staff recommended the Panel adopt a conservative approach to management. During the week, sockeye directed fisheries for both Treaty Indians and Non-Indians were held in United States Panel Areas, primarily to pace the escapement of Summer-run fish into Area 29 and to achieve international allocation goals. The possibility of elevated diversion rates in the coming weeks was a factor in these decisions. A limited troll fishery, directed at pink salmon harvest, was approved for United States Panel Area 3 (north of 48°00'15") and Area 4.

On August 9, the Panel approved a further reduction in the estimated run size of Early Summer-run stocks to 250,000 fish. In addition, the Panel adopted a run size of 1,800,000 Summer-run sockeye. The Panel was also informed that indicators suggested a very poor Late-run return, perhaps as low as 1,000,000 fish. A provisional run size of 3,300,000 was approved by the Panel. The indications of poor sockeye returns resulted in all Panel Areas remaining closed to sockeye harvest through the week of August 6-12. However, the troll fishery in United States Panel Areas 3 and 4 was re-opened for pink salmon harvest. On the basis of the revised estimates of Summer and Late-run abundance, Canada adjusted spawning escapement goals on August 10 to 1,013,000 Summer and 750,000 Late-run sockeye.

Over the weekend of August 12-13, larger than expected escapements, in conjunction with elevated test fishing catches in Area 20, resulted in increased run-size estimates for Early Summer-run, Summer-run and Late-run stocks. At the Panel meeting on August 15, the Panel approved run-size upgrades as follows: 320,000 Early Summer-run sockeye, 2,500,000 Summer-run sockeye, 1,500,000 Late-run sockeye, and a total Fraser River sockeye return of 4,550,000. Canada subsequently revised the Late-run spawning escapement goal to 800,000 fish. With regard to pink salmon returns, staff advised the Panel that it was too early in the run to revise the pre-season forecast. For the purposes of controlling Summer-run escapement and achieving international allocations, fisheries were scheduled in Canadian Area 29 and in United States Panel Areas during the week of August 13-19. Data collected from commercial and test fisheries showed that Summer-run stocks comprised close to 50% of the samples. This indicated a protracted tail to the Summer-run migration and a general weakness of Late-run stocks.

The focus of Juan de Fuca and Johnstone Straits fisheries during the week of August 20-26 began to shift to the harvest of pink salmon. With this in mind, the Panel approved a 12-hour

purse seine fishery in Area 20 on August 22. However, the Area 20 gillnet fishery remained closed for domestic allocation of sockeye. The Area 29 gillnet fishery was opened for international allocation of sockeye and to control the escapement of Summer-run sockeye. To allow for harvest opportunities on pink salmon, and recognizing that additional sockeye catch was required for international allocation, the Panel approved the following fisheries in United States waters: a Treaty Indian gillnet fishery in Areas 4B, 5 and 6C and net fishery in Areas 6, 7 and 7A, and Non-Indian gillnet, purse seine and reefnet fisheries in Areas 7 and 7A. To prevent inadvertent harvest of delaying Late-run sockeye in the Strait of Georgia, the Iwersen Dock Line boundary (closes waters west of Point Roberts, i.e., Apex area) was in effect for all Area 7A fisheries. Later in the week, the Treaty Indian fisheries were extended in Areas 4B, 5 and 6C and in Areas 6, 7 and 7A, primarily for the purposes of achieving international and domestic sockeye allocations. The Iwersen Dock Line remained in effect. Canada was concerned about the potential over-harvest of Late-run sockeye in the scheduled United States fisheries, and pointed out that such over-harvest could affect the ability of the United States to prosecute pink salmon fisheries in future weeks. Canada revised the Late-run spawning escapement goal to 816,000 on August 18.

During the week of August 27-September 2, staff informed the Panel that the United States had exceeded their Late-run allocation by 25,000 fish, while Canada had 74,000 fish remaining in its allocation. With a remaining Late-run TAC of only 49,000 fish, most of the Late-run sockeye still approaching the Fraser River were required for escapement. However, Summer-run sockeye that were excess to escapement requirements were available for catch. Canadian fisheries for the week included Area 20 purse seine fishing for the harvest of pink salmon and an Area 29 gillnet fishery, excluding Area 29-1 to 10 where Late-run sockeye were delaying, for the harvest of Summer-run sockeye. In United States Panel Areas, a Treaty Indian fishery in Area 7 only was scheduled for pink salmon harvest. Area 7A remained closed due to concerns about the by-catch of Late-run sockeye. A Non-Indian reefnet fishery was scheduled for Area 7, with non-retention of sockeye salmon. Other Non-Indian gear types remained closed due to by-catch concerns for Late-run sockeye. Based on pink salmon catches during the current week, staff informed the Panel that the pre-season forecasts of pink salmon run size and TAC's remained valid working numbers. Consequently, there was a need to continue fishing for pink salmon, while minimizing the United States by-catch of Late-run sockeye. For these purposes, Area 7 was opened for Non-Indian purse seines and gillnets.

At the September 1 Panel meeting, the Panel adopted a revised Late-run run size of 1,900,000 fish, based on stronger than expected catches in the current week. In addition, staff informed the Panel that pink salmon run-size estimates ranged from 10,500,000 (catch and CPUE based models) to 17,000,000 fish (scale measurement model). Staff projected that the peak of the pink salmon run would likely occur during the following week and, therefore, the catch and CPUE based models were likely providing minimum run-size estimates. Based on the above information and the remaining Late-run TAC, the Panel approved pink salmon directed fisheries in Canadian and United States Panel Areas for the week of September 3-9. Canadian fisheries included an Area 20 purse seine fishery and an Area 18-4 troll fishery. In United States Panel Areas, Treaty Indians fished in Areas 6, 7 and 7A (with the East Point Light line in effect), and a Non-Indian fishery was conducted in Areas 7 and 7A (with the East Point Light line in effect) for purse seines, gillnets and reefnets. The reefnet fishery regulations specified non-retention of sockeye. In addition, a commercial troll fishery for pink salmon was approved for Area 3 (north of 48°00'15") and Area 4.

By September 5, significant reductions to catch estimates for the previous and current weeks indicated the abundance of Late-run sockeye was less than the estimate of 1,900,000 fish. Canada expressed concern that the United States was exceeding its sockeye and pink salmon allocation, and asked that consideration be given to closing ongoing United States fisheries earlier than planned. Further, Canada questioned whether the scheduled fisheries for the week of September 3-9 in Area 20 and in United States areas should proceed given the uncertainty about the Fraser pink salmon return.

At the September 8 Panel meeting, staff confirmed that total Late-run returns would be less than 1,900,000, and total returns of all Fraser sockeye would be approximately 5,000,000 fish. Based on the recently concluded fisheries, staff estimated the total return of Fraser pinks would reach 12,500,000 fish and that there were approximately 1,200,000 pink salmon remaining in the commercial TAC. However, the United States was 160,000 pinks over while Canada was 1,350,000 under its allocation. Canada expressed concern over the catch imbalances which existed in favour of the United States for both sockeye and pink salmon. Canada further suggested that because the United States fisheries were not closed early, as requested by Canada, the United States had exceeded its allocation of pink salmon. To address shortfalls in the Canadian pink salmon catch and to harvest fish surplus to gross escapement requirements, staff recommended an Area 20 fishery in sub-areas 3 and 4. Canada stated it would use purse seine test fishing results in Area 20 to assist in their decision to accept or decline the staff recommendation. However, the Panel did open Area 18-4 for commercial trolling for pink salmon. After reviewing purse seine test fishing results later in the day, Canada rejected the staff's recommendation, based on modest pink salmon catches and larger than desired coho catches.

At the September 15 Panel meeting, staff informed the Panel that the best estimate of total sockeye return was 4,900,000 fish, including 1,700,000 Late-run sockeye. The Late-run estimate assumed 750,000 Late-run sockeye remained in the Strait of Georgia. However, data from troll test fishing in the Strait of Georgia suggested that the total number of delaying Late-run sockeye was only 500,000, which would reduce the total Late-run return by about 250,000 fish. During the meeting the Panel approved additional troll fishing time for Area 18-4, and relinquished regulatory control of Area 20 and Areas 4B, 5 and 6C as per the pre-season plan.

At the September 22 Panel meeting, staff informed the Panel that troll test fishing data continued to indicate significantly fewer fish remained in the Strait of Georgia than suggested by other estimates of Late-run returns. No changes to run size were recommended. The Panel agreed to relinquish regulatory control of Areas 17, 18 and 29-5 in Canada, and Areas 6, 6A, 7 and 7A in the United States as per the pre-season plan.

Based on a recommendation from staff at the September 26 Panel meeting, the Panel agreed to accept test fishing at the Whonnock site (Above Bridge) as the main tool for assessing Late-run gross escapement. The reason for using test fishing rather than echosounding data was that large daily abundances of pink salmon mask the true abundance of sockeye in hydroacoustic estimates of passage. Based on the escapement data, the Panel approved a reduction in Late-run run size from 1,700,000 to 1,500,000 fish. Approximately 700,000 of these were available for net escapement, which was below the revised net escapement goal of 824,000 established by Canada on this date.

Net fishing times in Canadian Panel Areas are shown in Table 5. The number of Area 20 purse seine openings approved by the Panel was close to the number anticipated in the pre-season plan. However, the early season sockeye fishery planned for the week of August 6-12 was cancelled due to poor sockeye returns. The five fisheries that were allowed between August 22-September 5 were directed at the harvest of pink salmon, with sockeye catches taken incidentally. Eleven Area 20 gillnet fisheries were planned. However, due to concerns over domestic allocations and sockeye conservation, it was necessary to take relatively large gillnet catches in Area 29, so Area 20 gillnet fisheries were not approved. Three of four planned Area 29 fisheries were approved during the in-season management period. The fisheries were scheduled for the purposes of pacing Summer-run escapements and achieving international allocations.

Extensive fishing time was required in United States Panel Areas (Table 6), relative to the available TAC's, because above average Johnstone Strait diversion rates resulted in low abundances of sockeye in United States waters. For fisheries that occurred between mid August and early September, a delicate balance was required to allow the United States to obtain their pink salmon allocation yet not exceed their sockeye allocation. Proposed fishing times for United States areas were not available in 1995.

Table 5. Proposed versus actual fishing times (days) in major Canadian net fisheries in the Fraser River Panel Area in 1995.

	Area 20 *				Area 29 **	
	Purse Seine		Gillnet		Gillnet	
Date	Proposed	Actual	Proposed	Actual	Proposed	Actual
Jul.30-Aug.5	Closed	Closed	Closed	Closed	Closed	Closed
Aug.6-Aug.12	1	Closed	2	Closed	1	Closed
Aug.13-Aug.19	Closed	Closed	Closed	Closed	1	1
Aug.20-Aug.26	2	1	4	Closed	1	1
Aug.27-Sep.2	2	2	4	Closed	1	1
Sep.3-Sep.9	1	2	1	Closed	Closed	Closed
Sep.10-Sep.16	Closed	Closed	Closed	Closed	Closed	Closed
Sep.17-Sep.23	Relinq.	Relinq.	Relinq.	Relinq.	Closed	Closed
Sep.24-Sep.30					Closed	Closed
Oct.1-Oct.7					Closed	Closed
Oct.8-Oct.14					Relinq.	Relinq.
Total	6	5	11	0	4	3

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

Table 6. Actual fishing times (hours) in major United States net fisheries in the Fraser River Panel Area in 1995.

	Treaty Indian		Non-Indian		
	Areas	Areas	Areas 7 and 7A		
Date	4B, 5, 6C	6, 7, 7A	Purse Seine	Gillnet	Reefnet
Jul.2-Jul.8	Closed	Closed	Closed	Closed	Closed
Jul.9-Jul.15	Closed	12*	Closed	Closed	Closed
Jul.16-Jul.22	Closed	Closed	Closed	Closed	Closed
Jul.23-Jul.29	120*	Closed	Closed	Closed	Closed
Jul.30-Aug.5	72*+72	27	16	11	32
Aug.6-Aug.12	72	Closed	Closed	Closed	Closed
Aug.13-Aug.19	Closed	27	16	12	Closed
Aug.20-Aug.26	120	59	16	20	48
Aug.27-Sep.2	Closed	34	16	12	112
Sep.3-Sep.9	Closed	45	32	23	80
Sep.10-Sep.16	Closed	Closed	Closed	Closed	Closed
Sep.17-Sep.23	Relinq.	Closed	Closed	Closed	Closed
Sep.24-Sep.30		Relinq.	Relinq.	Relinq.	Relinq.
Total	456	204	96	78	272

* Before Fraser River Panel control.

Table 7. Preliminary estimates of fishery catches and total run of Fraser River sockeye salmon during the 1995 fishing season, by country and area.

		Number of Fish	% of Run
CANADA			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 121-124 Troll	*	9,000	
Area 20 Net		61,000	
Areas 17-18 and 29 Troll		1,000	
Area 29 Net		186,000	
Total		257,000	6.4%
Non-Panel Areas			
Areas 1-10 Troll and Net		43,000	
Areas 11-16 Troll and Net		476,000	
Areas 124-127 Troll	*	23,000	
Total		542,000	13.5%
Commercial Total		799,000	19.9%
FIRST NATIONS CATCH			
Marine Areas			
Areas 12-16, 18, 20, and 123-126		20,000	
Area 29-1 to 7		12,000	
Total		32,000	0.8%
Fraser River			
Below Sawmill Creek		577,000	
Above Sawmill Creek		315,000	
Total		892,000	22.3%
First Nations Total		924,000	23.1%
NON-COMMERCIAL CATCH			
Recreational Fishery		12,000	0.3%
CANADIAN TOTAL		1,735,000	43.3%
UNITED STATES			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 4B, 5 and 6C Net		40,000	
Areas 6 and 7 Net		140,000	
Area 7A Net		225,000	
Total		405,000	10.1%
Non-Panel Areas			
Alaska Net		23,000	0.6%
Commercial Total		428,000	10.7%
NON-COMMERCIAL CATCH			
Gear Modification Study		5,000	0.1%
UNITED STATES TOTAL		433,000	10.8%
TEST FISHING			
COMMISSION			
Areas 123-127, 20 and 29 Test Fishing		58,000	
Areas 7 and 7A Test Fishing		3,000	
Commission Total		61,000	1.5%
CANADA			
Area 12 Test Fishing		26,000	0.6%
TEST FISHING TOTAL		87,000	2.2%
TOTAL CATCH		2,255,000	56.3%
SPAWNING ESCAPEMENT		1,751,000	43.7%
TOTAL RUN		4,006,000	100.0%

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

V. CATCH SUMMARY

A. Sockeye Salmon

The total return of 4,006,000 Fraser River sockeye salmon (Table 7) was only 37% as large as the pre-season forecast of 10,725,000 fish, and was the smallest on the cycle since 1975 (Figure 2). This small run resulted in a catch of 2,255,000 sockeye, which was the smallest on the cycle since 1947 (675,000 fish), although four other cycle years in the intervening period (1951, 1955, 1963, 1975) had catches less than 3,000,000 sockeye. Spawning escapements totalled 1,751,000 fish. Commercial catches totalled 1,227,000 sockeye, which was 31% of the 1995 return and the lowest commercial harvest rate on record for any cycle. Catches were 1,735,000 sockeye in Canadian fisheries, 433,000 in United States fisheries and 87,000 in PSC and DFO test fisheries.

The gross landed value of the commercial catch was approximately $9,800,000 (Can) with a weight of 3,200,000 kg (7,000,000 lb).

Fraser sockeye were slightly smaller than average in 1995, despite there being approximately 25% age 5_2 fish in the run. The average weight of sockeye caught in commercial purse seine fisheries in Area 20 was 2.59 kg (5.72 lb), compared to 2.63 kg (5.80 lb) for the last four cycle years (1979, 1983, 1987, 1991). Weights of age 4_2 fish sampled from commercial purse seine catches in Canadian Areas 12 and 20 averaged 2.38 kg (5.25 lb).

i. Canada

Canada caught a total of 1,735,000 Fraser River sockeye salmon (Table 7) in all fisheries. The commercial catch was 799,000 fish, 257,000 in Panel Areas and 542,000 in non-Panel Areas. Because of the high diversion rate, the largest catches occurred in Johnstone Strait (Areas 11-16), and in and near the Fraser River (Area 29). Purse seines harvested the largest share (46.8%) of the commercial catch, followed by gillnets (40.4%), outside trollers (9.0%) and inside trollers (3.8%) (Table 8). Weekly catches in Canadian fishing areas are shown in Appendix D (Tables 1-4).

The First Nations catch of 924,000 fish (Table 7) consisted of 892,000 and 32,000 fish, respectively, caught in Fraser River and non-Fraser Indian fisheries. Most (577,000 fish) of the Fraser River Indian catch was taken below Sawmill Creek, with 315,000 harvested upriver[2] of this location (Appendix D: Table 5).

Non-commercial catches consisted of a recreational catch of 12,000 sockeye.

[2] The 1995 sockeye salmon catch by Fraser River First Nations in the area from Sawmill Creek (upstream of Yale) to Kelly Creek (upstream of Lillooet) was estimated in-season at 123,858 fish and the catch in the Thompson River downstream of the Bonaparte River at 2,013. In early 1996, the DFO Pacific Stock Assessment Review Committee (PSARC) reviewed the sampling and computational methods used in the 1995 catch assessment program. PSC staff and Professor Carl J. Schwarz, Department of Mathematics and Statistics, Simon Fraser University, Burnaby, B.C., participated in the review process and both concluded that incorrect assumptions in the methods used to compute catches in-season had generated catch estimates that were biased low. The results of the PSARC review prompted DFO to contract with Dr. Schwarz to 1) review the sampling methodology used in 1995, 2) examine data and estimation procedures for potential biases, 3) if required, provide recommendations for changes to sampling methodology and estimation procedures and 4) document findings. In his report entitled "Analysis of the 1995 Upper Fraser River Catch Monitoring Program of First Nations Fisheries" (June 14, 1996), Dr. Schwarz estimates the catch of sockeye in the Fraser River between Sawmill Creek and Kelly Creek at 267,529 fish. An additional 7,119 sockeye were estimated to have been caught in the Thompson River downstream of the Bonaparte River. While these are Dr. Schwarz's point estimates for sockeye salmon catches in each area, he acknowledges that potential biases in the sampling methodology may have caused these estimates to be between 30% high and 40% low.

Table 8. Preliminary estimates of Canadian commercial catches* of Fraser River sockeye salmon by gear type and area during the 1995 fishing season.

Areas	Inside Troll	Outside Troll	Purse Seine	Gillnet	Total
1-10	0	39,000	4,000	0	43,000
11-16	29,000	1,000	309,000	137,000	476,000
121-127	0	32,000	0	0	32,000
20	0	0	61,000	0	61,000
17, 18, 29	1,000	0	0	186,000	187,000
Total Catch	30,000	72,000	374,000	323,000	799,000
% of Catch	3.8%	9.0%	46.8%	40.4%	100.0%

* Preliminary catch data from DFO fish sales slips.

ii. United States

United States fishers caught 433,000 Fraser River sockeye salmon in 1995, including 405,000 in commercial Panel Area fisheries, 5,000 in a Gear Modification Study fishery (to assess bird mortality rates in commercial fishing gear), and 23,000 in Alaska District 104 (Table 7). Most of the catch was taken in net fisheries in Areas 6, 7 and 7A. Treaty Indian catches were 40,000 fish in Areas 4B, 5 and 6C and 202,000 fish in Areas 6, 7 and 7A, for a total of 242,000 Fraser sockeye (Table 9). Non-Indian catches were 101,000 fish in purse seines, 47,000 in gillnets and 15,000 in reefnets, for a total of 163,000 fish. Weekly catches of Fraser River sockeye salmon in United States Panel Areas are shown in Appendix D (Table 6).

Table 9. Preliminary estimates of United States commercial catches* of Fraser River sockeye salmon by user group, gear type and area during the 1995 fishing season.

Areas	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian				
4B, 5 and 6C	0	40,000	0	40,000
6 and 7	41,000	32,000	0	73,000
7A	40,000	89,000	0	129,000
6, 7 and 7A Total	81,000	121,000	0	202,000
% of Catch	40.1%	59.9%	0.0%	100.0%
Total Catch	81,000	161,000	0	242,000
% of Catch	33.5%	66.5%	0.0%	100.0%
Non-Indian				
7	37,000	15,000	15,000	67,000
7A	64,000	32,000	0	96,000
Total Catch	101,000	47,000	15,000	163,000
% of Catch	62.0%	28.8%	9.2%	100.0%
United States				
Panel Area Total	182,000	208,000	15,000	405,000
Alaska (District 104) Catch				23,000
Total Catch				428,000

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

Table 10. Preliminary estimates of fishery catches and total run of Fraser River pink salmon during the 1995 fishing season, by country and area.

		Number of Fish	% of Run
CANADA			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 121-124 Troll	*	244,000	
Area 20 Net		700,000	
Areas 17-18 and 29 Troll		32,000	
Area 29 Net		38,000	
Total		1,014,000	7.9%
Non-Panel Areas			
Areas 1-10 Troll and Net		363,000	
Areas 11-16 Troll and Net		1,555,000	
Areas 124-127 Troll	*	328,000	
Total		2,246,000	17.4%
Commercial Total		3,260,000	25.3%
FIRST NATIONS CATCH			
Marine Areas			
Areas 12-16, 18, 20, and 123-126		5,000	
Area 29-1 to 7		2,000	
Total		7,000	0.1%
Fraser River			
Below Sawmill Creek		149,000	
Above Sawmill Creek		5,000	
Total		154,000	1.2%
First Nations Total		161,000	1.3%
NON-COMMERCIAL CATCH			
Recreational Fishery		164,000	1.3%
CANADIAN TOTAL		3,585,000	27.8%
UNITED STATES			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 4B, 5 and 6C Net		28,000	
Areas 6 and 7 Net		1,547,000	
Area 7A Net		401,000	
Washington Troll	**	20,000	
Total		1,996,000	15.5%
Non-Panel Areas			
Alaska Net		0	0.0%
Commercial Total		1,996,000	15.5%
NON-COMMERCIAL CATCH			
Gear Modification Study		1,000	
Recreational Fishery		32,000	
Non-Commercial Total		33,000	0.3%
UNITED STATES TOTAL		2,029,000	15.8%
TEST FISHING			
COMMISSION			
Areas 123-127, 20 and 29 Test Fishing		43,000	
Areas 7 and 7A Test Fishing		0	
Commission Total		43,000	0.3%
CANADA			
Area 12 Test Fishing		46,000	0.4%
TEST FISHING TOTAL		89,000	0.7%
TOTAL CATCH		5,703,000	44.3%
SPAWNING ESCAPEMENT		7,174,000	55.7%
TOTAL RUN		12,877,000	100.0%

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

** Includes a small number of fish caught in Washington, Oregon and California non-Panel areas.

B. Pink Salmon

The return of 12,877,000 Fraser River pink salmon (Table 10) was 72% as large as the pre-season forecast of 18,000,000 fish. This total included a catch of 5,703,000 fish, which represents a 44% harvest rate, and a spawning escapement of 7,174,000 fish. Canadian, United States and Panel approved test fishing catches were 3,585,000, 2,029,000 and 89,000 fish, respectively. The commercial catch was 5,256,000 fish.

The gross landed value of the commercial catch was approximately $6,300,000 (Can) with a weight of 9,000,000 kg (19,800,000 lb).

The average size of pink salmon caught by purse seines in Area 20 in 1995 was 1.71 kg (3.77 lb), slightly smaller than the previous record for the smallest size that occurred in 1993 (1.72 kg, 3.8 lb) (Figure 6). Average pink salmon weights between 1987-95 (1.87 kg, 4.11 lb) were approximately 84% as large as during the 1979-85 period (2.21 kg, 4.87 lb), when run sizes increased to present levels (14,000,000 - 19,000,000 fish on odd-year runs), and about 72% as high as during the 1959-77 period (2.59 kg, 5.72 lb). In terms of total pink salmon biomass, the smaller body size of Fraser pinks has been more than compensated for by larger abundances in recent years. However, smaller fish have less market appeal than the larger fish of past years.

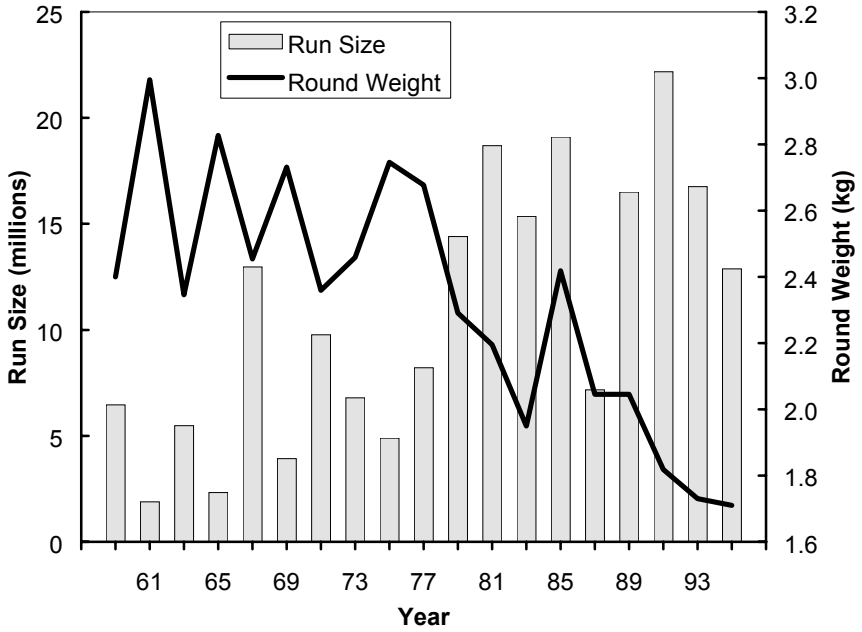

Figure 6. Total returns and round weight (kg) of Fraser River pink salmon for odd years between 1959-1995. The in-season estimate of run size is used for 1995.

i. Canada

Canada's catch of 3,585,000 Fraser River pink salmon (Table 10) consisted of a commercial catch of 3,260,000 fish, a First Nations catch of 161,000 and a non-commercial recreational catch of 164,000 fish. The commercial catch consisted of 1,014,000 fish caught in Panel Areas and 2,246,000 in other areas. Most of the catch (1,555,000 fish) occurred in commercial net fisheries in Areas 11-16, followed by net catches in Area 20 (700,000 fish). The distribution of the commercial catch among the gear was 57.9% in purse seines, 29.2% by outside trollers, 10.6% by inside trollers and 2.4% by gillnets (Table 11). Weekly catches in Canadian fishing areas are shown in Appendix D (Tables 7-10).

The First Nations catch of 161,000 fish included 154,000 in Fraser River Indian fisheries and 7,000 in non-Fraser Indian fisheries (Table 10). Most (149,000 fish) of the Fraser Indian catch was taken below Sawmill Creek (Appendix D: Table 11).

Table 11. Preliminary estimates of Canadian commercial catches* of Fraser River pink salmon by gear type and area during the 1995 fishing season.

Areas	Inside Troll	Outside Troll	Purse Seine	Gillnet	Total
1-10	0	339,000	20,000	4,000	363,000
11-16	312,000	41,000	1,167,000	35,000	1,555,000
121-127	0	572,000	0	0	572,000
20	0	0	700,000	0	700,000
17, 18, 29	32,000	0	0	38,000	70,000
Total Catch	344,000	952,000	1,887,000	77,000	3,260,000
% of Catch	10.6%	29.2%	57.9%	2.4%	100.0%

* Preliminary catch data from DFO fish sales slips.

Table 12. Preliminary estimates of United States commercial catches* of Fraser River pink salmon by user group, gear type and area during the 1995 fishing season.

Areas	Ocean Troll	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian					
4B, 5 and 6C	0	0	28,000	0	28,000
6 and 7	0	677,000	24,000	0	701,000
7A	0	68,000	20,000	0	88,000
6, 7 and 7A Total	0	745,000	44,000	0	789,000
% of Catch	0.0%	94.4%	5.6%	0.0%	100.0%
Total Catch	0	745,000	72,000	0	817,000
% of Catch	0.0%	91.2%	8.8%	0.0%	100.0%
Non-Indian					
Calif./Oregon/Wash.	20,000	0	0	0	20,000
7	0	712,000	20,000	114,000	846,000
7A	0	282,000	31,000	0	313,000
Total Catch	20,000	994,000	51,000	114,000	1,179,000
% of Catch	1.7%	84.3%	4.3%	9.7%	100.0%
United States					
Panel Area Total	20,000	1,739,000	123,000	114,000	1,996,000
Alaska (District 104) Catch					0
Total Catch					1,996,000

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

ii. United States

The United States caught a total of 2,029,000 Fraser River pink salmon (Table 10), 1,996,000 in commercial and 33,000 in other fisheries. The large majority of commercially caught pinks were taken in net fisheries in Areas 6, 7 and 7A. Treaty Indians caught 817,000 fish, 28,000 in Areas 4B, 5 and 6C, and 789,000 in Areas 6, 7 and 7A (Table 12). Non-Indian commercial catches totalled 1,179,000 Fraser pinks, with 994,000 of these caught in purse seines, 114,000 in reefnets, 51,000 in gillnets and 20,000 by trollers. Of the non-commercial catch, 32,000 fish were taken by sport fishers in Washington and Oregon coastal waters, Juan de Fuca Strait and Puget Sound, and 1,000 were caught in a gear modification study.

Weekly catches of Fraser River pink salmon in United States Panel Areas are shown in Appendix D (Table 12). Most (1,096,000, 55%) of the United States' catch of Fraser pinks in 1995 occurred during the week of September 3-9. The peak one-day catch of 458,000 fish on September 6 was the second largest on record.

VI. STOCK MONITORING

The purpose of the stock monitoring program is to assess run size, daily abundance, migration timing and diversion rate of Fraser River sockeye and pink salmon stocks during the fishing season. These data are required by the Panel to develop a fishing plan to attain annual escapement and catch allocation objectives. Commercial fishery catches provide much of the data used in the analyses. In addition, test fisheries (Table 13) conducted by the Commission or by DFO at the request of the Commission provide important data before and after the commercial fishing season and between fishing periods. Information about the upstream migration in the river is obtained by echosounding at Mission, visual observations at Hells Gate and analysis of Fraser River Indian catches.

Table 13. Test fishing operations that were approved by the Fraser River Panel for the 1995 fishing season.

Area	Gear	Dates	Operated by
Canadian Panel Areas			
123-124	Troll	July 24 - August 16	PSC
20	Purse Seine	July 28 - September 11	PSC
20	Gillnet	June 20 - September 3	PSC
29-13	Gillnet	June 28 - October 3	PSC
29-16	Gillnet	June 22 - October 5	PSC
29-1 to 6	Troll	August 15 - September 26	PSC
Canadian non-Panel Areas			
125-127	Troll	July 24 - August 16	PSC
12	Gillnet	June 26 - August 16	DFO
12	Purse Seine	July 28 - September 9	DFO
13	Purse Seine	July 28 - September 13	DFO
United States Panel Areas			
7	Gillnet	July 21 - July 31	PSC

The upstream passage of sockeye was monitored by the Mission hydroacoustic program between June 21-September 6. Estimates of daily gross escapements of sockeye and pink salmon were derived by combining Mission echosounding data with information on species composition from gillnet test fishing at Whonnock (Area 29-16). After September 6, daily gross escapements of pink salmon continued to be estimated using hydroacoustic data. However, sockeye abundance was estimated using CPUE models based on data from gillnet test fishing at Whonnock. Problems with hydroacoustic estimates that were encountered in 1995 are described later in this section. Also described later are the goals and results from a joint PSC:DFO split-beam echosounding program initiated in 1995.

Daily visual observations at Hells Gate between July 5-October 9 supplied qualitative information on upstream fish passage.

Run size estimation for Fraser River sockeye salmon by stock group and for total pink salmon is based primarily on catch, effort, racial composition and diversion rate data, which are analyzed using catch and catch-per-unit-effort, cumulative-normal and cumulative-passage-to-date models. Catch and catch-per-unit-effort (CPUE) models relate run sizes in previous years to commercial or test fishing catch, effort and duration data from purse seine or gillnet fisheries in Canadian Area 20 and Johnstone Strait. These regression models assume that run size is directly related to the magnitude of the largest daily or weekly catch of a particular stock group in each year, and that the migration pattern is consistent from year to year. Consequently, catch and CPUE estimates can be adversely affected by migration patterns that do not reflect model assumptions. In-season, catch, effort, duration and racial composition data are used by these models to estimate the run size of individual stocks or stock groups through Juan de Fuca and Johnstone Straits. Estimates for a given stock are generally reliable after the peak of the run has occurred in the approach route being assessed.

Cumulative-normal models are essentially a combination of "accounting" and linear regression methods. Estimates of catch and escapement for each stock group are accumulated for each day of migration. The number of these accounted fish are compared, using regression models, to estimates from 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 catch and CPUE models, estimates from cumulative-normal models are sensitive to unusual migration patterns and tend to stabilize (i.e., converge towards a single estimate) approximately one week after the migration peak in Juan de Fuca and Johnstone Straits.

Cumulative-passage-to-date models utilize historical daily catch and escapement data by stock, which are adjusted to a Mission timing date. Numerical reconstructions of daily passage are then calculated. The average daily percent reconstructed passage is then calculated for all available years referenced to a common mean peak date. Cumulative percent complete data are then calculated. During the season, daily catch and escapement data by stock are model inputs. The run accounting-to-date (referenced to Mission) is used along with the best in-season assessment of timing to generate an estimate of total run by stock. Accurate assessments of migration timing are required in order for accurate run-size estimates to be produced. These models are applied only to stocks that enter the Fraser River without delay (usually Summer-run stocks).

To estimate the run size of Fraser River pink salmon, the catch, CPUE and cumulative-normal models described above are used. In addition, biological models based on relationships between run size and weight and between run size and scale measurements are used. These latter models provide earlier estimates of run size than the CPUE and cumulative-normal models, because they do not depend on having seen a significant portion of the run. The accuracy of these biological models depends on having a high proportion of Fraser pinks in the samples used for the analysis.

A. Sockeye Salmon

The first Fraser River sockeye stock to arrive in coastal waters is the Early Stuart run. On July 3, gillnet test fishing CPUE and cumulative-normal model estimates of 138,000 - 250,000 fish indicated the run was considerably below the forecast of 703,000 fish. Estimates on July 7 ranged from 276,000 - 302,000, and a run-size estimate of 300,000 was recommended. By July 11, estimates ranged between 225,000 from the cumulative-normal model to 286,000 from the cumulative-passage-to-date model. At the end of the season, the estimated total return of Early Stuart sockeye was 227,000 fish with a gross escapement (escapement past Mission plus Indian catch below Mission) of 219,000. These were adjusted to 191,000 and 183,000 fish, respectively, using stochastically corrected target widths to re-estimate Mission escapement with in-season racial percentages (see section on Target Width Correction to Mission Escapement Estimates). The 50% migration date in Area 20 (July 1) was the same as the pre-season forecast and close to the long-term average (July 2).

Later in July and early August, the focus was on Early Summer-run sockeye stocks. Assessment of the Early Summer-run migration began in late July. Initial assessments from cumulative-normal and cumulative-passage models, which rely on Mission estimates, indicated a smaller return than the forecast of 903,000 fish. In particular, the early timed segment of the group, including Nadina and Gates stocks, appeared to be returning well below forecast with estimates of 175,000 - 200,000 fish. This early group appeared to show a very contracted run entry pattern. By August 3, the Scotch/Seymour group also appeared to be significantly less than forecast and by August 7, run-size estimates for the early timed and Scotch/Seymour groups were 125,000 and 100,000-200,000 fish, respectively. With the arrival of the Summer run, estimates of the abundance of Early Summer stocks were obtained using an approach that relied on catch and Mission escapement estimates. At the end of the season, the estimated total return of Early Summer sockeye was 329,000 with a gross escapement of 286,000 fish. These were adjusted after the season to 283,000 and 240,000, respectively, using the corrected Mission escapement estimates. Run-reconstruction estimates of the 50% migration date in Area 20 was July 25, close to the long-term average (July 27) for the cycle.

The pre-season forecast of Summer-run run size was 4,750,000 fish, with an in-season forecast of peak timing (50% date) in Area 20 of August 13. An early surge in the abundance of Summer-run sockeye in Juan de Fuca and Johnstone Straits during the last week in July prompted speculation that the run was earlier than forecast, and led to early initial openings of United States fisheries in Areas 6, 7 and 7A. Assessments on August 3 from cumulative-passage and cumulative-normal models, indicated a return of 1,250,000 - 2,000,000 fish, less than half the forecast. Low fishery catches in Johnstone Strait on August 7 indicated the Summer run was also considerably earlier than forecast. On August 9, the run-size estimate of 1,800,000 fish was approved by the Panel. This prompted closure of all fisheries. With these closures, run-size updates were delayed until a significant portion of the migration escaped past Mission. The largest daily abundance of sockeye migrated past Mission on August 13. On August 15, cumulative-passage and cumulative-normal model estimates of Summer-run abundance increased to 2,500,000 - 2,750,000 fish, due to larger-than-expected abundances of Summer-run sockeye in the river, that led to reopening fisheries. Estimates at the end of the season were for a total return of 2,649,000 Summer-run sockeye with a gross escapement of 1,911,000 fish. These estimates, after the target width correction was applied, decreased to 2,356,000 and 1,618,000 fish, respectively. The 50% migration date in Area 20 was August 10, which is three days earlier than the forecast (August 13). Arrival timing in 1995 was 7-8 days later than the long-term average (August 2-3), but the same as the average in recent years (August 9-10).

Assessments of Late-run sockeye migration were severely impeded by the closures of commercial fisheries in Juan de Fuca and Johnstone Straits and the resulting lack of commercial fishery catch data. Because of these closures, estimates from models that use commercial fishery data were not available. Thus, it was necessary to estimate the daily abundance of Late runs in the marine areas by comparing the proportions of Summer and Late-run sockeye in marine test fishing catches with estimates of Summer-run abundance in the Fraser River (commercial catch and escapement). This method assumes that test fisheries provide representative samples of the daily proportions of

stocks and that there is no delay in the migration of Summer-run sockeye up the Fraser River. Assessments of Late-run abundance began on August 15, with an estimate of 1,500,000 fish. This estimate was used throughout August. On September 1, the run-size estimate was increased to 1,900,000 fish, based on strong commercial purse seine catches during the last week of August. The migration then declined sharply and, by September 8, there was doubt as to whether the run would reach 1,900,000 fish. There was considerable uncertainty about the abundance of Late-run sockeye holding in the Strait of Georgia. Escapement to the Strait of Georgia, based on final in-season estimates of run size and catch, was estimated to be approximately 1,057,000 Late-run sockeye. However, CPUE estimates of abundance from troll test fishing indicated the potential escapement was only 500,000 - 800,000 fish. At the end of the season, the estimated total return of Late-run sockeye (including Birkenhead) was 1,252,000, with a gross escapement of 638,000 fish. This gross escapement was estimated primarily from Fraser River test fishing CPUE data, because the Mission hydroacoustic program was focused on the much larger pink salmon run. Application of the stochastic target width correction resulted in a small adjustment to the gross escapement estimate to 626,000 fish: the run-size estimate was unchanged. The Late-run sockeye migration was 50% complete in Area 20 on August 15 (run reconstruction estimate), one day later than the forecast (August 14) and three days earlier than the long-term average (August 18).

Expectations were for a high diversion (67%) of Summer and Late-run stocks through Johnstone Strait. On July 18, there were indications of about 70% Johnstone Strait migration, based on comparisons of CPUE data from Area 20 and Area 12 gillnet test fishing. This moderated later in July and by the beginning of August test fishing indicated a diversion rate of 45-50%. The post-season estimate of Johnstone Strait diversion is approximately 55%.

Cottonwood test fishing CPUE's are plotted with daily hydroacoustic estimates of sockeye passage at Mission (Figure 7). The Cottonwood data are lagged one to two days, which is the estimated travel time for sockeye between Cottonwood and Mission sites, to obtain Mission timing dates. The patterns of abundance shown by these two datasets are similar and are also consistent with patterns in previous years.

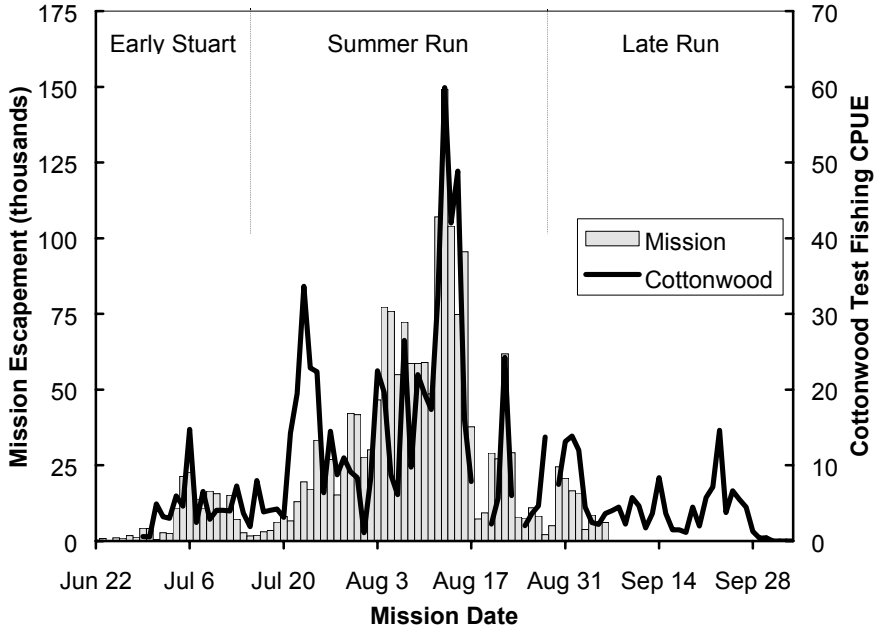

Figure 7. Daily escapements of sockeye salmon estimated at Mission by echosounding (with target width correction applied) compared with prior-day test fishing CPUE at Cottonwood during 1995.

Observations at Hells Gate indicated the passage of sockeye proceeded normally, with no delays in the migration.

B. Pink Salmon

Assessment of the return of Fraser River pink salmon was based on data from commercial and purse seine test fisheries. These assessments involved the use of catch, CPUE and cumulative-normal models, and to a lesser extent biological models based on mean weight and scale data. Estimates of escapement to the Strait of Georgia were derived by subtracting catches from the estimate of total run. Proportions of Fraser River and non-Fraser pink salmon in these catches were initially estimated using pre-season forecasts of racial composition. Approximately one week after each fishery, these proportions were replaced by estimates from genetic stock identification (GSI) analyses of muscle tissue samples taken from each fishery.

On August 31, pink salmon run-size estimates based on scale and weight data indicated a total return on 18,000,000-20,000,000 fish, close to the pre-season forecast of 18,000,000 fish . On September 8, catch, CPUE and reconstruction-based estimates indicated a total return of 12,500,000 fish, which left an estimated 6,500,000 fish for escapement to the Strait of Georgia after subtracting catch. This was the escapement estimate used for making in-season management decisions. In-river estimates of pink salmon escapement from the Mission hydroacoustic program are not used in-season because they are available too late to make management decisions concerning most pink salmon fisheries, and because hydroacoustic estimates in past years have tended to be low.

In 1995, approximately 55% of the Fraser River pink salmon run migrated through Johnstone Strait, compared to the long-term average of 35%. This was close to the pre-season forecast of 56%. The 50% migration date in Area 20 of August 29 was only one day later than the forecast and long-term average dates (August 28).

The pattern of daily pink salmon escapements in the Fraser River, as measured by corrected Mission hydroacoustic data and Cottonwood test fishing CPUE, are shown in Figure 8. Hydroacoustic estimates of daily pink salmon escapement were obtained by subtracting test fishing CPUE estimates of daily sockeye, chum, chinook and coho salmon passage from hydroacoustic estimates of total salmon escapement. Figure 8 shows that hydroacoustic estimates of daily pink salmon escapement, which is considered to be the best indicator of escapement patterns, were not well related to Cottonwood test fishing CPUE data. Whereas, hydroacoustic estimates were relatively normally distributed with a peak on September 23, Cottonwood CPUE's were bimodally distributed and neither CPUE peak matched the single hydroacoustic peak. Test fishing catches were very low in 1995, possibly due to the record small body size of pink salmon. The first test fishing peak was comprised mainly of males, which is typical of the early part of the run. The size of pink salmon increased after mid September, possibly because of the influx of Late-run pink salmon stocks. The larger size of pink salmon may then have increased catch rates and produced the second peak in test fishing CPUE. Pink salmon CPUE at the Duncan Bar tagging site peaked on September 19-20 (Mission dates September 20-21), a few days before the hydroacoustic peak at Mission.

Pink salmon migrated upstream past Hells Gate without accumulation or delay. However, the abundance of pinks above Hells Gate could not be confirmed in 1995 (as in 1993), due to discontinuation of the spawning ground enumerations in the Bridge River, Seton Creek and Thompson River that had been conducted between 1957-91.

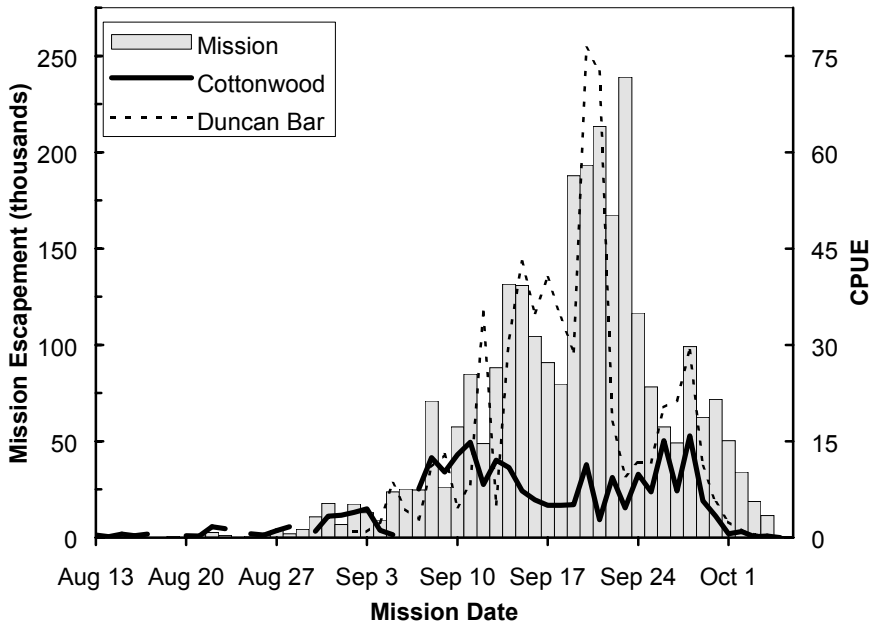

Figure 8. Daily escapements of pink salmon in 1995, estimated at Mission by echosounding (target width correction applied) compared with test fishing CPUE at Cottonwood two days prior and at Duncan Bar (10^{-1}) one day prior.

C. Target Width Correction to Mission Escapement Estimates

As described in the Introduction, in-season Mission escapements were overestimated in 1995. The error stemmed from changes to Mission operating procedures that were made in response to suggestions by the Mission Hydroacoustic Facility Working Group of the FRSPRB, which was investigating the large difference between Mission (hydroacoustic) and upstream (Indian catch plus spawning escapement) estimates of gross escapement past Mission in 1994. Specifically, the Working Group suggested that the PSC use a faster paper speed for the chart recorder during stationary soundings. These soundings are used to collect duration-in-beam data in the form of target widths. The purpose of the faster paper speed was to create larger target records on the echograms, which would allow for more precise measurement of target widths and of the duration-in-beam of fish moving past the hydroacoustic site. This suggestion was implemented in 1995 and a paper speed was used during the stationary soundings that was twice the previously used speed. The normal, slower paper speed continued to be used during the transect soundings, which are used to obtain target density information (i.e. targets per transect). Duration-in-beam and target density data are both required to estimate escapement.

During the migration, estimates of daily sockeye abundance appeared to be consistent with the expected number, except that reported catches in the Indian fishery between Mission and Sawmill Creek appeared to be low at the peak of the Summer-run sockeye migration. However, after the season two pieces of information suggested the estimates could be inaccurate, namely:

1. Estimates of sockeye salmon abundance using the "new" method[3] for calculating escapement were 9% above estimates obtained using the "old" method, in contrast to 8% below obtained in 1993 and 6% below obtained in 1994.

[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.

2. Upstream estimates of Indian fishery catch plus spawning escapement were considerably less than the Mission estimate.

As a result of these indicators, an intensive review of the 1995 Mission hydroacoustic program was conducted. Briefly, the review found that the chart recorder collects several insonifications before printing each line, and then prints the results for only the strongest returns in the group. These printer characteristics meant that targets measured in 1995 were not simply twice as large as targets in past years (the expected result from doubling the paper speed), but were less than this amount, resulting in underestimates of duration-in-beam and overestimates of fish abundance. Also, because the relationship was complex, a simple model for transforming the data gathered at the fast paper speed to equivalent measurements at the slow paper speed was not possible. Thus, to obtain corrected abundance estimates for 1995, a stochastic transformation of stationary target measurements was necessary.

Table 14 shows in-season estimates of sockeye escapement past Mission in 1995 compared to estimates (using in-season racial data) revised by the stochastic transformation. Revised estimates for Early Stuart, Early Summer, Summer and Late-run sockeye (specifically, the Birkenhead stock) were 36,000, 46,000, 293,000 and 12,000 less than the in-season estimates, for a total difference of 387,000 fish. Estimates for Early Stuart, Early Summer and Summer-run sockeye were primarily obtained from echosounding data, while Late-run sockeye estimates were based mainly on Whonnock test fishing data.

Table 14. Comparison of in-season estimates of sockeye salmon escapement past Mission in 1995 and revised estimates incorporating the stochastic target width correction. In-season racial estimates were used for both.

	Mission Escapement *		
Run	In-season	Revised	Difference
Early Stuart	219,000	183,000	36,000
Early Summer	267,000	221,000	46,000
Summer	1,737,000	1,444,000	293,000
Late	580,000	568,000	12,000
Adults	2,803,000	2,416,000	387,000

* Excludes Indian fishery catch of 251,000 fish below Mission.

D. Split-Beam Echosounding Study at Mission

As a result of recommendations by the Mission Hydroacoustic Facility Working Group of the FRSPRB, a joint PSC and DFO program that employed a shore-based split-beam echosounder at the Mission hydroacoustic site was initiated in 1995. The objective of the program was to examine assumptions regarding salmon behavior and distribution that are implicit to the standard method (employing stationary and transecting soundings) used to hydroacoustically estimate escapement past Mission[4]. In particular, the study focused on questions pertaining to:

- Upstream and downstream movement of salmon, including swimming speed and orientation, and evidence of milling;
- Vertical distribution of salmon, including proximity to the surface where salmon may not be insonified, and the river bottom where salmon may be difficult to resolve from the bottom echo;
- Distribution across the river, including near-shore areas that the survey vessel cannot sample;
- Evidence of boat avoidance by salmon as the PSC's survey vessel transects the river; and
- Changes in salmon distribution with time-of-day and tidal stage.

[4] Ibid.

The 1995 split-beam work, which constituted Phase I of the program, focused on developing the tools and practices necessary to address the objectives:

- Design field experiments to acquire the required split-beam data; and
- Develop software and signal processing protocols to extract the necessary statistics from the split-beam data.

The findings of the study[5] were:

- More than 98% of detected fish were migrating upstream. Very few salmon-sized targets were detected moving downstream and most of these occurred when salmon abundances were low, suggesting they were resident fish rather than salmon;
- Most upstream swimming fish followed trajectories parallel to the river bank;
- Upstream swimming speed ranged from 0.5 to 1.0 m/s, and was negatively correlated with river velocity;
- Sockeye salmon were distributed fairly uniformly in the water column, showing low to moderate densities (not dense clumps), and with very few fish near the river surface and bottom, making the detection of individual fish possible;
- Pink salmon migrated close to the river bottom and shore in large schools, making hydroacoustic estimation difficult;
- In some cases pink salmon may have reacted to approaching vessels by deviating from normal upstream trajectories.

Using the experimental designs and tools developed during Phase I, field work for Phase II of the joint program was conducted in 1996. Phase II will expand on the above results and address the objectives of the program with more certainty.

VII. RACIAL IDENTIFICATION

In 1995, PSC staff conducted programs designed to identify the stock proportions of Fraser River sockeye and pink salmon in commercial and test fishing catches. Data collected from the racial identification program provides information on the abundance and timing of these stocks as they migrate to the Fraser River. The data are also used to account for international and domestic catches of Fraser River sockeye and pink salmon in coastal waters, and to apportion the daily sockeye escapement estimates at Mission into discrete stock groups. The pink salmon stock identification program estimates the contribution rates of Fraser River pink salmon in mixed-stock fisheries, but is unable to reliably separate Fraser 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). In 1995 the age 4_2 baseline standards consisted of nine stock groups. Each stock group was formed by one or more individual stocks exhibiting similar scale traits and migratory timing.

Stock-specific baseline standards used for in-season racial analysis models come from two sources. First, age 4_2 standards are constructed using scales from prior year spawning ground returns

[5] 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 1995. Pacific Salmon Comm. Tech. Rep. No. 8: 32p.

of age 3_2 jacks, and age 5_2 standards are similarly created using scales from age 4_2 returns. Second, when prior year data are unavailable, baseline standards are developed using data for the same age class in previous years. In recent years, low returns of age 3_2 Fraser 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 can reduce the accuracy of in-season baseline standards compared to years when large numbers of prior year age 3_2 scales are available.

Linear discriminant function analysis (DFA) is used to distinguish among baseline standards, to combine individual sockeye stocks into stock groups and, subsequently, to estimate contribution rates of each stock group in mixed-stock fishery samples. We use linear DFA for the following reasons: 1) it has proven to be useful in applications involving scale data; 2) computer programs for linear DFA are readily available; and 3) 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. Where applicable, the implementation of these findings could result in future modifications to stock identification methodologies.

The differentiation of stock groups in samples of unknown mixture composition was achieved using four scale variables: 1) circuli count to the first freshwater annulus, 2) circuli count in the freshwater spring growth zone, 3) distance from the focus to the fifth circulus, and 4) distance from the focus to the first freshwater annulus. Supplementary data used in stock identification assessments include age composition, fish length and historical patterns of stock-specific timing and behaviour[6].

Scale analyses of commercial and test fishing catches were conducted daily, beginning in late June and continuing through mid 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. Finally, the Alaska Department of Fish and Game (ADF&G) obtained scale samples from the District 104 net fishery at landing sites in Petersburg and Ketchikan. In total, approximately 46,000 sockeye scales were aged and digitized by PSC staff in 1995.

In addition to sampling traditional commercial fisheries as outlined above, DFO has in recent years attempted to arrange for weekly scale sampling from Fraser River First Nations' fisheries at six fishing areas: Chilliwack, Yale, Lytton, Bridge River, Williams Lake and below Prince George. The number of scales obtained from these sites in 1995 include: 2,063 scales from the Yale fishing area, 1,588 scales from the Lytton fishing area, 792 scales from the Bridge River fishing area and 611 scales from the Williams Lake fishing area. No scales were received from either the Chilliwack or Prince George fishing areas in 1995. Sample sizes were sufficient in most weeks to permit comparison of stock composition estimates derived from post-season analyses of the scale samples with those generated through reconstruction modelling techniques.

In 1995, the numerically dominant stocks were Early Stuart, Chilko, Quesnel, Stellako, Birkenhead, and Adams/Lower Shuswap. These stocks, in combination with other smaller stocks were pooled to form nine unique stock groups. The nine stock groups were Early Stuart, Fennell/Bowron, Nadina/Gates/Pitt, Scotch/Seymour, Chilko/Quesnel, Late Stuart/Stellako, Birkenhead, Adams/Lower Shuswap and Weaver. The individual stocks comprising each stock group are listed in Table 15. For most of the period of active commercial fishing in 1995, the nine stock groups were incorporated into two categories of in-season models: 1) models with Early Summer-run and Summer-run stock complexes, and 2) models with Summer-run and Late-run stock complexes.

[6] 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: 36p.

Table 15. Individual stocks comprising the stock groups used in 1995.

Stock Group	Component Stocks
Early Stuart	Early Stuart stocks
Fennell/Bowron	Fennell, Bowron, Raft, Upper Adams, Chilliwack, Nahatlatch
Nadina/Gates/Pitt	Nadina, Gates, Pitt
Scotch/Seymour	Scotch, Seymour, miscellaneous early South Thompson stocks
Chilko/Quesnel	Chilko river, north and south end Chilko Lake, Taseko, Upper and Lower Horsefly, McKinley, Mitchell
Late Stuart/Stellako	Tachie, Middle, Stellako
Birkenhead	Birkenhead
Adams/Lower Shuswap	Adams, Lower and Middle Shuswap, miscellaneous Shuswap Lakes stocks
Weaver	Weaver, Cultus, Harrison, Portage, Widgeon, Big Silver

Classification matrices developed from the 1995 in-season DFA models show that the Scotch/Seymour stock group (the dominant Early Summer-run group) was well differentiated from Summer-run stocks with a 90% expected classification accuracy (Table 16). Also, the dominant Summer-run group, Chilko/Quesnel, was accurately distinguished from the Late-run stocks. For example, Chilko/Quesnel sockeye were only slightly mis-classified into Adams/Lower Shuswap (2%), Birkenhead (2%), and Weaver (4%) groups. However, the other Summer-run group, Late Stuart/Stellako, showed higher rates of misclassification with Late-run stocks, and specifically Birkenhead (17%) and Weaver (17%). The dominant Late-run stock group, Adams/Lower Shuswap, was very accurately distinguished from other Late-run and Summer-run stocks, with a 99% classification accuracy. To correct for misclassifications between stock groups, bias correction[7] was applied.

Notwithstanding the generally good performance of the in-season models, some significant problems were anticipated in their use. For example, the matrices showed that misclassification rates of 18 - 29% were expected between two Summer-run stocks, namely Chilko and Quesnel. To improve the overall classification of the DFA models, the baseline standards of the Chilko and Quesnel stocks were pooled in the models used for analysis of samples from all commercial fisheries. However, differences in the escapement goals for the two stocks necessitated that their escapement past Mission be assessed separately. To estimate escapement uniquely for each of the two stocks, data on the presence or absence of the brain parasite, *Myxobolus articus*, was collected from key fishery samples during the season. From past years' samples, the Quesnel stock was known to have a relatively high incidence (prevalence) of *Myxobolus*, while for Chilko and other co-migrating stocks the parasite is absent or has a low prevalence. By matching scale and *Myxobolus* data from key test fisheries and commercial fisheries, escapement estimates were made for both the Chilko and Quesnel stocks.

In addition to concern about potential misclassifications between Chilko and Quesnel stocks, the separation of Scotch/Seymour and Adams/Lower Shuswap stock groups was also of concern in 1995. These stocks all rear in Shuswap Lake and therefore cannot be distinguished on the basis of freshwater scale characteristics. However, differences in behaviour exhibited by the two stock groups provide a means by which they can be differentiated. Scotch/Seymour sockeye are included in the

[7] 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.

Early Summer run with an average peak timing of July 28 in Area 20, and of August 3 in Area 29. Also, this stock group does not typically delay off the mouth of the Fraser River prior to its' upstream migration. In contrast, Adams/Lower Shuswap fish are Late-run sockeye with an average peak timing of August 18 in Area 20. Also of significance, Adams and Lower Shuswap fish delay for a period of three to four weeks off the mouth of the Fraser River prior to migrating upstream. Consequently, while these two stock groups are jointly intercepted in outside migratory fisheries, their timing does not overlap in the Fraser River.

Table 16. Summary of expected classification matrices of DFA models based on in-season standards for age 4_2 sockeye in 1995.

Early Summer- and Summer-run Period (Chilko and Quesnel separate)

	From Stock Group					
To Stock Group	Fennell Bowron	Nadina Gates Pitt	Scotch Seymour	Chilko	Quesnel	Late Stuart Stellako
Fennell/Bowron	**65%**	1%	9%	13%	13%	3%
Nadina/Gates/Pitt	0%	**64%**	0%	12%	9%	14%
Scotch/Seymour	10%	0%	**90%**	0%	0%	5%
Chilko	12%	10%	0%	**53%**	29%	3%
Quesnel	7%	8%	0%	18%	**32%**	14%
Late Stuart/Stellako	6%	17%	1%	4%	17%	**61%**
Total	100%	100%	100%	100%	100%	100%

Early Summer- and Summer-run Period (Chilko and Quesnel combined)

	From Stock Group				
To Stock Group	Fennell Bowron	Nadina Gates Pitt	Scotch Seymour	Chilko Quesnel	Late Stuart Stellako
Fennell/Bowron	**66%**	2%	9%	17%	4%
Nadina/Gates/Pitt	0%	**67%**	0%	15%	15%
Scotch/Seymour	10%	0%	**90%**	0%	4%
Chilko/Quesnel	13%	12%	0%	**61%**	8%
Late Stuart/Stellako	11%	19%	1%	7%	**69%**
Total	100%	100%	100%	100%	100%

Summer- and Late-run Period

	From Stock Group				
To Stock Group	Chilko Quesnel	Late Stuart Stellako	Adams Lower Shuswap	Birkenhead	Weaver
Chilko/Quesnel	**84%**	12%	1%	0%	6%
Late Stuart/Stellako	8%	**49%**	0%	10%	14%
Adams/L. Shuswap	2%	5%	**99%**	10%	0%
Birkenhead	2%	17%	0%	**80%**	1%
Weaver	4%	17%	0%	0%	**79%**
Total	100%	100%	100%	100%	100%

The differences in behaviour were used to generate separate estimates for Scotch/Seymour and Adams/Lower Shuswap stock proportions in the following manner. For all Area 29 commercial and test fishery samples analyzed from mid July to the end of August, a percentage was estimated for the

Scotch/Seymour and Chilko/Quesnel stock groups. The ratio between these groups was then calculated. In marine fisheries, the contribution of the Chilko/Quesnel stock group was estimated, as was the combined contribution of the Scotch/Seymour and Adams/Lower Shuswap stock group complex. Using appropriate lag times, the Area 29 Scotch/Seymour:Chilko/Quesnel ratio was then used to estimate the proportion of Scotch/Seymour sockeye in individual marine fisheries. The Adams/Lower Shuswap stock group was assigned the remaining portion of the combined Scotch/Seymour and Adams/Lower Shuswap complex.

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 1995 spawning ground scale samples (Table 17). The major component stocks in each stock group (Table 15) were the same in the post-season as in the in-season DFA models (Table 16).

Table 17. Summary of expected classification matrices of DFA models based on post-season standards for age 4_2 sockeye in 1995.

Early Summer- and Summer-run Period (Chilko and Quesnel combined)

	From Stock Group				
To Stock Group	Fennell Bowron	Nadina Gates Pitt	Scotch Seymour	Chilko Quesnel	Late Stuart Stellako
Fennell/Bowron	**57%**	3%	18%	15%	5%
Nadina/Gates/Pitt	1%	**74%**	0%	8%	10%
Scotch/Seymour	21%	1%	**79%**	1%	2%
Chilko/Quesnel	17%	8%	1%	**67%**	12%
Late Stuart/Stellako	4%	15%	1%	8%	**71%**
Total	100%	100%	100%	100%	100%

Summer- and Late-run Period

	From Stock Group				
To Stock Group	Chilko Quesnel	Late Stuart Stellako	Adams Lower Shuswap	Birkenhead	Weaver
Chilko/Quesnel	**86%**	9%	1%	3%	8%
Late Stuart/Stellako	8%	**67%**	4%	8%	11%
Adams/Lower Shuswap	0%	12%	**95%**	3%	1%
Birkenhead	3%	8%	0%	**84%**	0%
Weaver	3%	5%	0%	1%	**80%**
Total	100%	100%	100%	100%	100%

The expected classification accuracy of post-season DFA models for Early Summer and Summer-run stocks (Table 17) was similar to the in-season models (Table 16). However, Summer-run stock groups were more accurately distinguished from Late-run stock group s in the post-season DFA models.

To obtain early indications of the presence of Fraser River sockeye, data on the prevalence of the body cavity parasite, *Philonema oncorhynchi*, were collected from sockeye harvested in north coast fisheries. In 1995, *Philonema* data were used in conjunction with scale based age composition data to provide in-season estimates of Fraser sockeye proportions in north coast fishery catches. Past years data have shown that *Philonema* based analyses produce estimates similar to post-season DFA estimates generated from scale data.

The total return of approximately 137,000 Early Stuart sockeye was well below the pre-season forecast of 703,000. Recorded catches for this stock included 7,000 in river and ocean fisheries, and 7,000 in Fraser River Indian fisheries (Table 18). The exploitation rate for all catch areas was 10%.

Table 18. Catches, escapements and adult exploitation rates for Fraser River sockeye and pink salmon by stock group in 1995.

Stock Group	River & Ocean Catch *	Gross Escapement: Fraser Indian Catch	Gross Escapement: Spawning Escapement	Run Size: Adult	Run Size: Jacks	Portion of Run	Adult Exploitation Rate: River & Ocean	Adult Exploitation Rate: All Areas
Sockeye Salmon								
Early Stuart	7,000	7,000	123,000	137,000	0	3%	5%	10%
Early Summer-run								
Fennell/Bowron/Raft	8,000	23,000	50,000	81,000	0	2%	10%	38%
Nadina/Gates/Pitt	11,000	25,000	37,000	73,000	12,000	2%	15%	49%
Seymour/Scotch/U.Adams	29,000	31,000	74,000	134,000	0	3%	22%	45%
Total	48,000	79,000	161,000	288,000	12,000	7%	17%	44%
Summer-run								
Quesnel/Chilko	572,000	460,000	750,000	1,782,000	6,000	45%	32%	58%
Late Stuart/Stellako	132,000	179,000	176,000	487,000	0	12%	27%	64%
Total	704,000	639,000	926,000	2,269,000	6,000	57%	31%	59%
Late-run								
Birkenhead/Big Silver	90,000	16,000	40,000	146,000	5,000	4%	62%	73%
Adams/L.Shuswap	410,000	143,000	412,000	965,000	0	24%	42%	57%
Weaver/Portage	99,000	8,000	69,000	176,000	2,000	4%	56%	61%
Total	599,000	167,000	521,000	1,287,000	7,000	32%	47%	60%
Total Adults	1,358,000	892,000	1,731,000	3,981,000	25,000	100%	34%	57%
Total Jacks	5,000	0	20,000	25,000				
Total	1,363,000	892,000	1,751,000	4,006,000				
Portion of Total Run	34%	22%	44%	100%				
Pink Salmon								
Total **	5,549,000	154,000	7,174,000	12,877,000	0	100%	43%	44%
Portion of Total Run	43%	1%	56%	100%				

* Includes ocean and river catches in commercial, test and other fisheries, excluding the Fraser River Indian fishery.

** In-season spawning escapement and run-size estimates are used, because DFO's spawning ground estimate of escapement is not yet available.

Early Summer-run returns of adult sockeye were about one-third the pre-season forecast (903,000 fish). These early-timed stocks had a total return of 288,000 adults, including a catch of 48,000 in river and ocean fisheries and 79,000 in Fraser River First Nations' fisheries. The adult exploitation rate on Early Summer stocks in all catch areas was 44%.

Total production of adult Summer-run sockeye was 2,269,000 fish, less than half the pre-season forecast of 4,778,000. The Chilko/Quesnel stock group dominated the production of Summer-run sockeye with a total return of 1,782,000. The second largest Summer-run group, Late Stuart/Stellako, had a total return of 487,000. The total Summer-run catch in river and ocean fisheries was

approximately 704,000, while the catch in Fraser River Indian fisheries was 639,000. The adult exploitation rate on Summer-run stocks in all fisheries was 59%.

In total, 1,287,000 Late-run adults returned, or 27% of the forecast abundance of 4,707,000. The dominant Adams/Lower Shuswap group produced a total return of approximately 965,000 fish. Approximately 146,000 Birkenhead adults returned along with 176,000 Weaver and miscellaneous Late-run adults. Estimated catches of Late-run sockeye were 599,000 fish in river and ocean fisheries and 167,000 fish in Fraser River Indian fisheries. The adult exploitation rate on Late-run stocks was 60%.

The total 1995 return of Fraser River sockeye was 4,006,000 fish, including 25,000 jack sockeye. Catches in all fisheries accounted for 57% of the run while 44% reached the spawning grounds. Of the 57% harvest component, river and ocean fisheries harvested 34% while Fraser River Indian fisheries accounted for 22% (Table 18).

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 the pink salmon stocks. During in-season commercial fishing periods, muscle tissue samples from 150 fish or more were collected from fisheries where Fraser River pink salmon were expected to be present. After electrophoretic screening of the in-season collections of 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 combination of stocks contributing to the fisheries.

In 1995, in-season sampling of pink salmon extended from late July to mid September. Pink salmon caught in commercial fisheries were sampled at Canadian fish processing plants in Prince Rupert, Winter Harbour, Port Hardy, Alert Bay, Ucluelet, Tofino, Quathiaski Cove, and Steveston, and at United States processors in Blaine, Bellingham, and Neah Bay. In total, 6,300 pink salmon were sampled and electrophoretically analyzed.

GSI samples were collected weekly from the Canadian Area 101 troll fishery from the end of July to late August. As in prior years, the earlier samples showed low proportions (approximately 7%) of Fraser pinks with the contribution building to 32% by the end of August. Samples taken from the Canadian Area 142 troll fishery during the first and last weeks of August indicated that Fraser pinks constituted 40% and 56% of the catches, respectively. Approximately, 6.4% (363,000 fish) of the total harvest of Fraser River pink salmon occurred in fisheries north of Cape Caution.

Purse seine fisheries in Johnstone Strait (Areas 12 and 13) also showed stock composition trends similar to previous years. Analyses indicated that 41% of the pink salmon catch were Fraser pinks in early August and about 80% in late August. Fraser pinks dominated (approximately 95%) the catches in these areas by early September.

Catches from commercial troll fisheries off the west coast of Vancouver Island (Areas 123 to 127) were sampled at processing plants between late July and early September. The first collections in late July and early August showed Fraser contributions of about 60%. Samples taken later in August contained larger Fraser components of approximately 90%. The proportion of Fraser pinks in Canadian Area 20 purse seine catches increased from 78% in late August to about 85% by early September.

Pink salmon from United States purse seine fisheries that occurred off Point Roberts (Area 7A) and Salmon Banks (Area 7) were sampled from the middle of August to early September. Over this period the proportion of Fraser River pinks in these fisheries increased from an average of 80% to about 95%.

Catches of Fraser River pink salmon totalled 5,549,000 in river and ocean fisheries and 154,000 in Fraser River Indian fisheries (Table 18). These catches, when subtracted from the in-season run-size estimate of 12,500,000 fish, left an estimated spawning escapement of 6,797,000 fish. DFO's estimate of spawning escapement is 7,174,000 fish, yielding a post-season run-size estimate of 12,877,000 fish. The preliminary estimate of total exploitation rate on Fraser pinks was 44% in 1995.

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 9). These data, along with biological samples from the spawners, are provided to the Commission so that PSC staff can revise in-season racial analyses, estimate total production for each stock and assess Commission programs for stock monitoring.

A. Sockeye Salmon

Sockeye salmon escapements to spawning grounds in the Fraser River watershed totalled 1,751,000 fish, including 1,731,000 adults (4- and 5-year-old fish) and 20,000 jacks (3-year-old fish) (Appendix D: Table 13). The 1995 escapement was 48% below the large 1991 escapement of 3,306,000 sockeye, but was the third largest escapement recorded on the cycle.

Escapements for the past several return years on the 1995 cycle can be compared to evaluate the variation in escapement over time (Table 19). As evident from the data, much of the variability has occurred in Late-run escapements. This has been caused, in part, by the great variation in production of Adams/Lower Shuswap sockeye on the 1995 cycle, which is the sub-dominant cycle for this stock. In 1991, a record cycle return of 4,400,000 Adams/Lower Shuswap sockeye produced a large increase in escapement, relative to the brood year, to 1,254,000 adults (Appendix D: Table 13). The 1995 return totalled 931,000 fish and the spawning escapement dropped to 412,000 fish. Even more dramatically, the escapement of 294,000 Birkenhead adults in 1991 produced only 95,000 4-year-old adults in 1995. From these returns and 46,000 5-year-olds from the 1990 brood, an escapement of only 39,000 Birkenhead spawners was recorded in 1995. The total Late-run return in 1995 was 1,253,000 fish, compared to the brood year escapement of 1,638,000 spawners. Even if every Late-run sockeye that returned to the coast had escaped to spawn in 1995, the total escapement would have been substantially lower (i.e., by 385,000 fish) than observed in 1991. The reduction of over 1,100,000 in Late-run escapement combined with the reduction of 439,000 in Early Summer and Summer-run escapement produced the observed decrease of 48% in total escapement.

Escapements to Early Stuart spawning streams (tributaries to Takla and Trembleur Lakes, A; Figure 9) totalled 123,000 adults. This escapement was 13% and 17% below the 1991 and 1987 escapements, respectively. Spawning on the 1995 cycle is normally concentrated in Middle River tributaries. This was the case in 1995 with 62% of adult spawners in these streams.

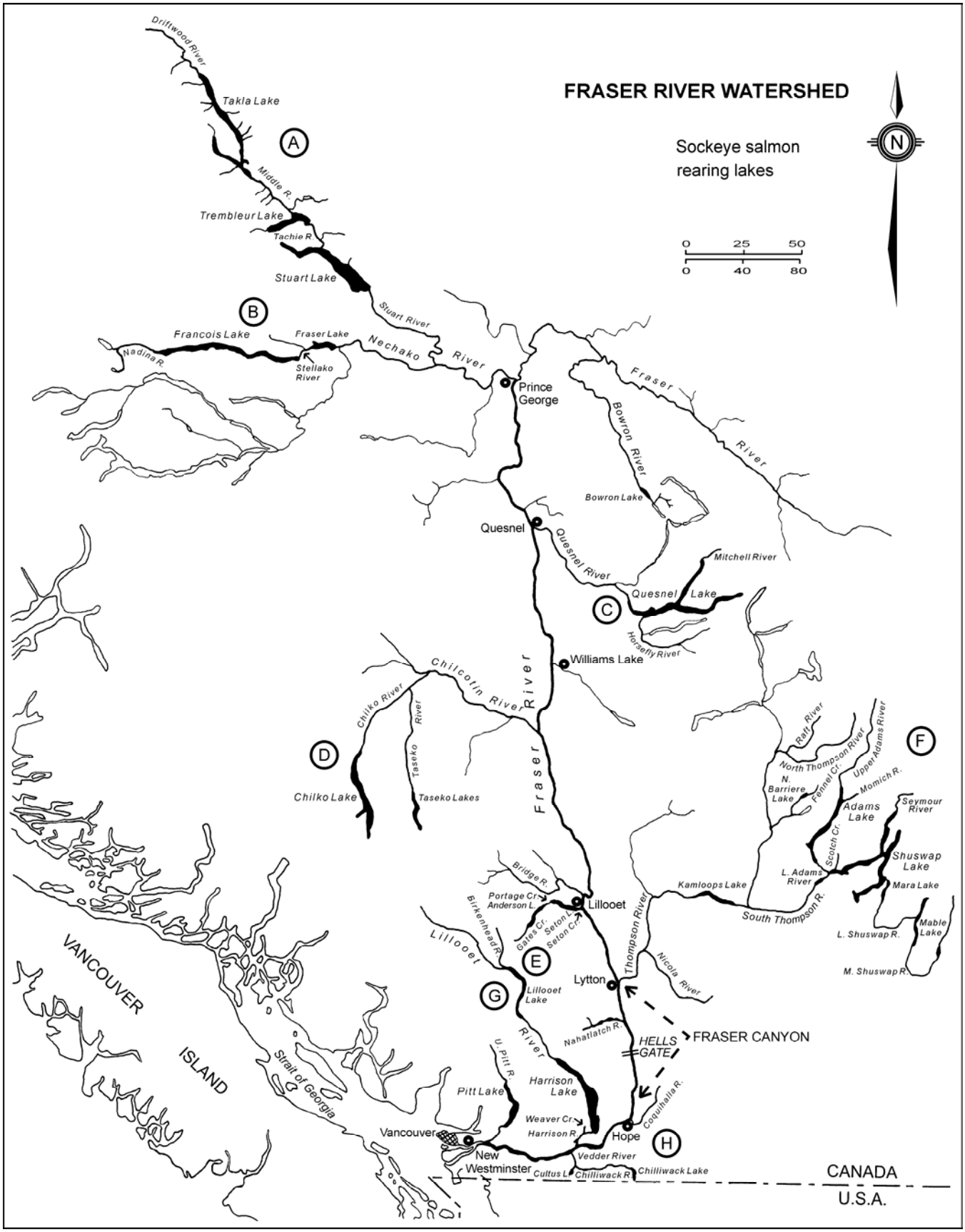

Figure 9. Sockeye salmon spawning grounds in the Fraser River watershed.

Table 19. Adult sockeye salmon escapements by run on the 1995 cycle for 1979-1995.

	Spawning Escapement				
Run	1979	1983	1987	1991	1995
Early Stuart	93,000	24,000	148,000	141,000	123,000
Early Summer	207,000	102,000	200,000	271,000	161,000
Summer	581,000	511,000	659,000	1,256,000	926,000
Late	487,000	328,000	889,000	1,638,000	521,000
Adults	1,368,000	965,000	1,896,000	3,306,000	1,731,000

Late Stuart sockeye salmon spawn in Middle and Tachie Rivers and in several small tributaries to these rivers and to Stuart Lake. The escapement of 34,000 sockeye was concentrated in Tachie River (22,000) and Middle River (7,500). The total was approximately 55% below the brood year (1991) escapement of 77,000 spawners.

Stocks in the Nechako watershed (B; Figure 9) are normally abundant on the cycle but spawning populations in 1995 reflected the moderate returns for these stocks. Stellako River sockeye were one of the few stocks to show increased escapements in 1995. The 1995 return was 368,000 fish, including 79,000 5-year-olds. The spawner population increased 49% from 95,000 fish in 1991 to 142,000 fish in 1995. Juveniles from the Stellako River reside in Fraser Lake for one year before migrating to sea. Although Fraser Lake is much smaller than the other major lake in the Nechako watershed, Francois Lake, it supports a larger sockeye population. Nadina River sockeye provide the majority of fry that rear in Francois Lake. Returns of Nadina sockeye totalled 42,000 fish from a record spawning escapement of 61,000 in 1991. From this return in 1995, 25,000 fish escaped to spawn, which was 60% below the brood year abundance. Of the total, 21,500 entered the spawning channel on the Nadina River.

The 1995 spawning escapement of Quesnel Lake area sockeye (C; Figure 9) reached a cycle record of 214,000 adults, which was nearly five times the brood year escapement (46,000 fish). Escapement to Horsefly River spawning areas was 179,000 fish. Mitchell River escapement also increased substantially to 35,000 spawners from the brood year level of 7,700 fish. The level of escapement recorded in 1995 was similar to dominant cycle line (1993 cycle) escapements as recently as 1973 (278,000) and sub-dominant cycle line (1994 cycle) escapements in 1986 (181,000). Five-year-old sockeye from the 1990 brood contributed 77% of the spawners. DFO reported excellent spawning success for upper and lower Horsefly River and Mitchell River populations.

Escapements of Chilko River and Lake area stocks (D; Figure 9) in 1995 were substantially less than in the brood year. The record escapement of 1,017,000 fish in the brood year (1991) resulted in a total production of only 1,021,000 age-4 fish in 1995, and a total escapement of 525,000 spawners. Most spawners in 1995 (84%) were 4-year-olds from the 1991 spawning but approximately 16% were 5-year-old fish from the 1990 brood. Of the total escapement, 8,300 fish entered the spawning channel. The distribution of spawners between river and lake spawning areas was not estimated.

Escapements in 1995 to spawning areas in the Seton-Anderson system (E; Figure 9) decreased from 1991 levels. Gates Creek spawners totalled 7,000 fish in the river and spawning channel, compared to 9,000 fish in 1991. All fish spawned in Gates Creek because the spawning channel was not operated in 1995. Escapements of Portage Creek sockeye, a Late-run stock, declined from 12,000 in 1991 to 8,000 in 1995.

Thompson River sockeye stocks (F; Figure 9) normally produce well on the 1995 cycle. In the North Thompson River watershed, Fennell Creek sockeye escapement declined 45% from 20,000 in 1991 to 11,000 in 1995. As well, most South Thompson River Summer-run stocks

showed lower spawning escapements compared to 1991. Seymour River sockeye produced 84,000 4-year-old fish from the escapement of 128,000 spawners in 1991. Seymour River escapements decreased 59% to 52,000 fish in 1995. Scotch Creek escapements, however, reached 15,000 fish, an increase of 49% from the brood year. South Thompson River Late-run escapements had increased in 1987 and again in 1991, but decreased substantially in 1995. Spawners in the Adams River area totalled 400,000 fish in 1995 compared to 1,240,000 in the brood year. In the Lower Shuswap River, 12,000 spawners arrived in 1995 compared to 16,000 in 1991.

A lower total escapement was also observed in the Harrison-Lillooet system (G; Figure 9). Birkenhead River sockeye escapement decreased from 294,000 in 1991 to 39,000 adult spawners in 1995. This 87% decrease was due to the poor return of 4-year-old sockeye from the 1991 spawning. On the other hand, returning adults to the second large stock in the watershed, Weaver Creek sockeye, generated a spawning population that was relatively unchanged from the brood year. A total of 34,000 fish utilized areas in the spawning channel (21,200) and creek (12,800) compared to 38,000 in 1991. Harrison River sockeye showed an escapement of 17,000 fish, similar to 1991 (15,000). Most of these were 4-year-olds from the 1991 brood. However, because Harrison sockeye migrate to sea in their first year of life, these fry entered the ocean in 1992 rather than 1993, which was the year that most Fraser sockeye that returned as 4-year-old fish in 1995 migrated to sea. This behavior provided Harrison sockeye with a higher recruitment rate compared to most Fraser River stocks from the 1991 spawning.

Lower Fraser River tributaries (H; Figure 9) showed mixed results in spawning populations. Nahatlatch River and Lake stocks were estimated at 2,300 spawners, a slight decrease from 2,800 in 1991. Upper Pitt River escapements (mostly 5-year-old adults) totalled only 5,500 fish, one of the lowest escapements in recent years. Flooding in November of 1990 appears to have reduced the survival of that brood, resulting in a much reduced return and escapement in 1995. The 1995 cycle has been the largest for Cultus Lake sockeye for many years. Escapements have been between 20,000 and 32,000 for the past four cycle years. However, in 1995, total production was only 27,000 fish and the escapement was 10,000 fish.

The estimated spawning success for the whole Fraser River watershed was 91%, yielding an effective female (females that successfully deposited eggs) population of 861,000 fish, a decrease of 51% compared to 1991. In many sockeye spawning areas in the watershed, low water levels occurred during spawning and throughout the winter during incubation of eggs and alevins. These conditions often result in good egg-to-fry survival.

B. Pink Salmon

In 1995, DFO obtained a single estimate of pink salmon spawning abundance for the Fraser River watershed, similar to that obtained in 1993 (Appendix D: Table 14). The enumeration program was limited to tagging in the lower river at Duncan Bar and, to estimate the untagged:tagged ratio, recovering fish at three sites. These recovery sites were Strawberry Island and Ridgedale Bar, where migrating fish were caught by beach seines and drift gillnets, and the mainstem Fraser spawning grounds, where carcasses were examined in a dead recovery program. Biases were detected in the recovery data from Ridgedale Bar and the mainstem spawning grounds, which led DFO to use only the Strawberry Island recoveries[8] to produce the final escapement estimate of 7,174,000 pink salmon.

[8] Schubert, N.D., T.R. Whitehouse and A.J. Cass. 1997. Design and evaluation of the 1995 Fraser River pink salmon (*Oncorhynchus gorbuscha*) escapement estimation study. Can. Tech. Rep. Fish. Aquat. Sci. 2178: 75p.

The Fraser River Panel and Commission staff remain concerned[9] about the adequacy of the pink salmon escapement estimation program that DFO conducted in 1993 and 1995, because the program did not estimate individual populations in the major spawning areas of the Fraser watershed. Therefore, there is a critical gap in the long (since 1957) dataset of specific spawning area abundances. This gap will grow larger with each passing year at a time when escapement abundances may well exceed past escapements on a regular basis. Data that extend the previously observed ranges in escapements are crucial for any analysis involving recruitment data, and are especially important when significant long-term changes in environmental conditions may be influencing survival rates. Thus, the loss of tributary escapement data will seriously compromise the future ability of scientists and management biologists to accurately project returns based on spawner-recruit relationships and environmental conditions using information on individual stocks. Vital data on stock performances related to habitat perturbations would be lacking in the future, as well.

IX. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage fisheries in the Panel Area to achieve the annual goals for gross escapement of Fraser River sockeye and pink salmon, for international sharing of the TAC and for domestic allocation of the catch within each country's share. The Panel is also required to consider conservation concerns for other stocks and species of salmon when planning and conducting the fisheries. In 1995, Canada's pre-season gross escapement goals for sockeye salmon that were based on the forecast returns became unattainable due to the low return. In the absence of revised goals, the bilateral Panel continued to manage fisheries, primarily in United States waters, to achieve the international sharing of catch and United States domestic catch allocations. Fisheries in Canadian Panel areas and particularly in the Fraser River were formulated by the Canadian section and adopted by the bilateral Panel.

A. Escapement

The primary objective of the Fraser River Panel is to ensure that gross escapement goals are achieved. The achievement of these goals for sockeye salmon in 1995 cannot be assessed given the lack of in-season goals. Mission estimates of gross escapement in 1995 (revised by the target width correction), are 183,000 Early Stuart, 240,000 Early Summer, 1,618,000 Summer and 626,000 Late-run adults for a total of 2,667,000 sockeye (Table 20). Upriver estimates from Fraser River Indian catches and spawning escapements are 130,000 Early Stuart, 240,000 Early Summer, 1,565,000 Summer and 688,000 Late-run adults for a total of 2,623,000 sockeye.

The in-season goal for gross escapement of Fraser River pink salmon was 6,000,000 fish (Table 20). In-season, the estimate of pink salmon escapement to the Strait of Georgia was 6,500,000 fish. DFO's upriver estimate of pink salmon gross escapement based on the Duncan Bar tagging program and Indian fishery catches below Mission is 7,328,000 fish.

[9] Pacific Salmon Commission. 1996. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1993 Fraser River sockeye and pink salmon fishing season. Vancouver, B.C.

Table 20. Comparison of final in-season goals, in-season estimates (with target width correction for sockeye) and upriver estimates (Fraser River Indian catches + spawning escapements) of gross escapements of Fraser River sockeye and pink salmon in 1995.

Run	Gross Escapement In-season Goals		Mission Estimates *	Upriver Estimates**
Sockeye Salmon				
Early Stuart	n/a	*1*	183,000	130,000
Early Summer	n/a	*1*	240,000	240,000
Summer	n/a	*2*	1,618,000	1,565,000
Late	n/a	*2*	626,000	688,000
Adults	n/a		2,667,000	2,623,000
Pink Salmon				
Pink Salmon	6,000,000		6,500,000	7,328,000

* Sockeye estimates are the in-season Mission estimates with target width corrections and in-season racial data, and including 251,000 fish caught in Fraser River Indian fisheries below Mission. The pink salmon estimate is the in-season run size minus catch estimate.

** Estimates include 251,000 sockeye and 61,000 pink salmon caught in Fraser River Indian fisheries below Mission, B.C.

1 Gross escapement goals were not available since FRP control did not commence until Early Stuart and Early Summer migrations were almost complete.

2 Gross escapement goals were not available during the in-season period.

B. International Allocation

Achieving the international catch allocation objectives of the Treaty is the second priority of the Fraser River Panel during the fishing season. Based on the preliminary run-size estimate of 4,006,000 fish (Table 21) and deductions totalling 2,238,000 fish, the TAC in 1995 was 1,768,000 Fraser sockeye. For Fraser River pink salmon, the preliminary run-size estimate was 12,877,000 fish and deductions totalled 7,263,000 fish, leaving a TAC of 5,614,000.

For 1995, the United States share of Fraser sockeye in the Panel Area was 363,000 fish. Estimated Washington catches totalled 410,000 fish, 47,000 more than the goal. Washington catches of Fraser sockeye were to be taken in proportion to the TAC's of each run. Early Stuart, Early Summer, Summer and Late-run catches in Washington totalled 1,000, 19,000, 210,000 and 180,000 sockeye, respectively. These catches were 1,000, 4,000, 2,000 and 40,000 over the goals. The Alaska catch of 23,000 Fraser sockeye was excluded from the sharing formula as agreed by the Parties.

The Washington catch of Fraser pinks was 2,029,000, which was 586,000 fish over the goal of 1,443,000 fish.

Table 21. Preliminary calculations of total allowable catch and international shares of Fraser River sockeye and pink salmon in 1995.

		Sockeye	Pink
TOTAL ALLOWABLE CATCH			
Total Run Size		4,006,000	12,877,000
Deductions			
Escapement	*	1,731,000	7,174,000
Jack Escapement		20,000	0
Fraser River Indian Fishery Exemption		400,000	0
Test Fishing		87,000	89,000
Total Deductions:		2,238,000	7,263,000
Total Allowable Catch:		1,768,000	5,614,000
UNITED STATES			
Washington Catch		410,000	2,029,000
Washington Catch Goal	**	363,000	1,443,000
Deviation:		47,000	586,000
Alaska Catch		23,000	0
Total United States Catch:		433,000	2,029,000
CANADA			
Canadian Catch		1,335,000	3,585,000
Canadian Share		1,382,000	4,171,000
Deviation:		(47,000)	(586,000)

* Spawning escapement:
Sockeye: Mission escapement - Indian catch above Mission.
Pink: Total run - catch.

** Washington allocations according to agreement between the Parties:
Sockeye: (20.55% of TAC below 7,300,000)
+ (10% of TAC between 7,300,000 and 10,000,000
+ (5% of TAC above 10,000,000), to a maximum of 1,850,000.
Pink: 25.7% of TAC, to a maximum of 3,600,000.

C. Domestic Allocation

The third priority of the Panel is to achieve the domestic allocation goals of the Parties. The ability of the Panel to meet this objective is somewhat limited because the Panel manages only those fisheries that occur within the Panel Area and are directed at Fraser River sockeye and pink salmon. In 1995, these included Canadian net fisheries in Areas 20 and 29, troll fisheries in Area 18-1, -4 and -11 and Area 29, United States net fisheries in Areas 4B, 5, 6, 6C, 7 and 7A and Non-Indian troll fishing in Area 3 (north of 48°00'15"N) and Area 4. Canadian outside troll fisheries, including fisheries in Panel Areas 121-124, were regulated by Canada. DFO regulates Canadian fisheries in non-Panel areas (Johnstone Strait, all fisheries north of 49°N on the west coast of Vancouver Island and all fisheries north of Vancouver Island) with the objective of ensuring that the combined fisheries achieve the goals for escapement, international allocation and Canadian domestic allocation.

Canadian catches of Fraser River sockeye by gear type deviated somewhat from the goals (Table 22). The largest discrepancy was for gillnetters, who caught 71,000 more than their allocation of 252,000 sockeye. Purse seiners, outside trollers and inside trollers caught 46,000 less, 37,000 less and 12,000 more than their respective allocations.

Table 22. Preliminary estimates of domestic overages and underages in Canadian and Washington catches of Fraser River sockeye salmon in 1995.

User Category	Actual Catches Fish	%	Catch Goals Fish	%	Overage/ (Underage)
Canada: by Gear					
Inside Troll	30,000	3.8%	18,000	2.3%	12,000
Outside Troll	72,000	9.0%	109,000	13.6%	(37,000)
Purse Seine	374,000	46.8%	420,000	52.6%	(46,000)
Gillnet	323,000	40.4%	252,000	31.5%	71,000
Canadian Total:	799,000	100.0%	799,000	100.0%	0
Washington: by Area or Gear					
Treaty Indian					
Areas 4B, 5 and 6C	40,000	16.5%	29,000	12.0%	11,000
Areas 6, 7 and 7A	202,000	83.5%	213,000	88.0%	(11,000)
Total:	242,000	100.0%	242,000	100.0%	0
Non-Indian					
Purse Seine	101,000	62.0%	88,000	54.0%	13,000
Gillnet	47,000	28.8%	67,000	41.0%	(20,000)
Reef Net	15,000	9.2%	8,000	5.0%	7,000
Gear Modification Study	5,000	n/a	5,000	n/a	n/a
Total:	168,000	100.0%	168,000	100.0%	0
Washington: between Treaty Indian and Non-Indian Users					
Treaty Indian	242,000	59.0%	246,000	60.0%	(4,000)
Non-Indian	168,000	41.0%	164,000	40.0%	4,000
Washington Total:	410,000	100.0%	410,000	100.0%	0

The United States requested that the Panel attempt to obtain a 60:40 sharing between Treaty Indian and Non-Indian fishers, if the Washington share was equal to or less than 1,000,000. This goal was achieved almost exactly, with a Treaty Indian catch of 242,000 (59%) and a Non-Indian catch of 168,000 (41%, includes Gear Modification Study catch). Within the Treaty Indian group, the catch in Areas 4B, 5 and 6C was over the allocation (12% of Treaty Indian catch) by 11,000 fish, while the catch in Areas 6, 7 and 7A was under the allocation by the same amount. Among Non-Indians, purse seiners caught 62.0% of the commercial Non-Indian catch, gillnetters caught 28.8%, and reefnetters caught 9.2%, which represents 13,000 over, 20,000 under and 7,000 over the respective allocations for these gear.

Pink salmon allocation in Canada was for all "southerly migrating pink salmon stocks", including Fraser River, southern British Columbia and Washington State stocks. The largest discrepancy from the goals set by Canada was in the outside troll catch, which was 403,000 over the allocation of 935,000 fish (Table 23). Gillnetters caught 285,000 fewer pinks than their allocation, purse seines caught 108,000 fish fewer and inside trollers caught 10,000 fish fewer than their allocation.

The Fraser River pink catch was to be divided equally between Treaty-Indians and Non-Indians. Estimated catches were 817,000 pinks by Treaty Indians, 197,500 under their allocation, and 1,212,000 by Non-Indians (includes recreational and Gear Modification Study catches), 197,500 over their allocation (Table 23). The catch quota of 160,000 pink salmon in the Areas 3 and 4 Non-Indian troll fishery was not taken although fishing opportunities were provided.

Table 23. Preliminary estimates of domestic overages and underages in catches of a) southerly migrating pink salmon in Canada and b) Fraser River pink salmon in the United States in 1995.

User Category	Actual Catches Fish	Actual Catches %	Catch Goals Fish	Catch Goals %	Overage (Underage)
a) Canada: Southerly Migrating Pink Salmon					
Inside Troll	430,000	10.3%	440,000	10.6% *	(10,000)
Outside Troll	1,338,000	32.1%	935,000	22.4% *	403,000
Purse Seine	2,308,000	55.4%	2,416,000	58.0%	(108,000)
Gillnet	90,000	2.2%	375,000	9.0%	(285,000)
Canadian Total:	4,166,000	100.0%	4,166,000	100.0%	0
b) United States: Fraser River Pink Salmon					
Treaty Indian	817,000	40.3%	1,014,500	50.0%	(197,500)
Non-Indian	1,212,000	59.7%	1,014,500	50.0%	197,500
Total:	2,029,000	100.0%	2,029,000	100.0%	0

* 273,000 fish transferred from outside troll to inside troll.

D. Conservation of Other Stocks

Part of the mandate of the Fraser River Panel is to accommodate the conservation and management needs of other salmon species and stocks during the management of Fraser River sockeye and pink salmon fisheries in Panel Areas. Conservation concerns about Lake Washington, Skagit River and Early Stuart sockeye were not relevant to management decisions by the Fraser River Panel in 1995. This was because the migrations of these stocks through Panel Areas were complete prior to the July 27 agreement that vested the Fraser River Panel with management control in Panel Areas. However, United States conservation concerns regarding coho by-catch in Areas 4B, 5 and 6C did lead to late-season restrictions of fisheries. Similar concerns by Canada for the by-catch of Strait of Georgia coho salmon in Area 20 fisheries later in the season, led to the cancellation of a proposed September fishery which would have been directed at pink salmon harvest. Canada also requested that no commercial gillnet fisheries take place in Area 29 in September to reduce the by-catch of Harrison River chinook salmon and Thompson River steelhead. Catches of other species in all Panel Area net fisheries were low. About 15,000 chinook, 51,000 coho and 2,000 chum salmon were caught (Table 24). Catches of non-Fraser pink salmon totalled 282,000 fish.

Table 24. Preliminary estimates of catches of non-Fraser sockeye and pink salmon and of other salmon species in commercial net fisheries regulated by the Fraser River Panel in 1995. *

Area	Non-Fraser Sockeye	Non-Fraser Pink	Chinook	Coho	Chum
United States					
Areas 4B, 5 and 6C Net	0	21,200	4,700	12,800	100
Areas 6, 7 and 7A Net	0	132,300	5,300	4,200	100
Total	0	153,500	10,000	17,000	200
Canada					
Area 20 Net	0	128,800	600	33,800	1,500
Area 29 Net	0	0	4,000	400	300
Total	0	128,800	4,600	34,200	1,800
Total Catch	0	282,300	14,600	51,200	2,000

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

X. ALLOCATION STATUS

Because international catch sharing arrangements in 1995 were specified in an isolated, one-year-only agreement, there is no allocation status to report for Fraser River sockeye and pink salmon.

XI. APPENDICES

APPENDIX A: PRE-SEASON FORECASTS AND SPAWNER ESCAPEMENT GOALS FOR FRASER RIVER SOCKEYE AND PINK SALMON IN 1995.

Table 1. Pre-season forecasts and spawner escapement goals for Fraser River sockeye and pink salmon in 1995 (Provided to the Panel by Canada Department of Fisheries and Oceans on May 15, 1995).

Stock / Run	Forecast Return	Spawning Escapement Goal
Sockeye Salmon		
Early Stuart	700,000	200,000
Early Summer	800,000	300,000
Summer	4,300,000	1,100,000
Late	4,300,000	1,300,000
Age 5	600,000 *1*	n/a *2*
Total Adult	10,700,000	2,900,000
Pink Salmon		
Total Pink Return	18,000,000	6,000,000

1 All stocks combined except Birkenhead and Pitt which are within stock groups.
2 Included in escapement targets by stock group.

Table 2. Fraser River sockeye and pink salmon forecasts and schedule of escapement targets for ranges of returns in 1995 (in thousands of fish). (Provided to the Panel by Canada Department of Fisheries and Oceans on May 15, 1995).

SOCKEYE			Range of				
		Forecast	Returns (a)			Escapement	
Stock Group	Stock	Return				Goal	
EARLY STUART			0	-	400	150	b
		692	**450**	**-**	**800**	200	b
			880	-	1,050	280	b
			>1,120	-		350	b
EARLY SUMMER			0	-	400	200	c
		817	**480**	**-**	**1,100**	280	c
			1,170	-	1,500	350	c
			>1,600			450	c
SUMMER	Chilko		0	-	1,500	450	b
		2,837	**1,650**	**-**	**3,000**	600	
			3,225	-	7,000	825	
			>7,000			-	d
	Late Stuart, Stellako, Quesnel	**1,432**				**450**	c
LATE	Birkenhead	**984**				**300**	c
	Adams/Shuswap		0	-	2,000	600	b
		2,990	**2,300**	**-**	**4,000**	**900**	
			4,300	-	6,000	1,200	b
			>6,000			-	d
	Late Misc.	**298**				**90**	c
PINK		**20,000**	**0**	**-**	**20,000**	**6,000**	
			>20,000			-	e

a. The difference between steps is designated for escapement.

b. Priority objectives:
Early Stuart - achieve targets for all ranges of returns,
Chilko - achieve the minimum target,
Adams - achieve the minimum target,
Adams - do not exceed the maximum target.

c. Passively managed unless the stocks can be harvested differentially.

d. Under review.

e. Target set by a harvest rate of 70%.

APPENDIX B: 1995 REGULATIONS

The Fraser River Panel approved regulations for the management of the Fraser River sockeye and pink salmon fishery in Panel Area waters and submitted these to the Pacific Salmon Commission. The Commission approved the Fishery Regime and Regulations and submitted these to the respective national governments for approval on July 28, 1995.

Canadian Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends to Canada the adoption of the following Fishing Regime developed by the Fraser River Panel as per Annex IV, Chapter 4 (1) (d) of the Treaty, namely:

1. a) No person shall commercially fish for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 with nets from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 16th day of September, 1995, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 16th day of September, 1995, both dates inclusive.

2. a) No person shall commercially fish for sockeye or pink salmon in Pacific Fishery Management Areas 17 and 18 with nets from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 23rd day of September, 1995, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1, 4 and 11 from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 23rd day of September, 1995, both dates inclusive.

3. a) No person shall commercially fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29 from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 14th day of October, 1995, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 14th day of October, 1995, both dates inclusive.

4. The following Fraser River Panel Area waters are excluded:

   a) High Seas westerly of the Bonilla Point-Tatoosh Island Lighthouse Line.

   b) Pacific Fishery Management Area 19, Area 20-2 and 5 to 7 and Area 29-8.

   c) Commercial troll fishing in Pacific Fishery Management Area 17, Area 18-2, 3 and 5 to 10.

During the 1995 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the attached 1995 Management Plan adopted on July 27, 1995 by the Panel. This Plan is designed to achieve Pacific Salmon Treaty-mandated international allocations of the catch and domestic goals of the Parties.

United States Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends to the United States Government the adoption of the following Fishing Regime developed by the Fraser River Panel as per Annex IV, Chapter 4 (1) (d) of the Treaty, namely:

Treaty Indian Fisheries:

1. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5 and 6C with drift gillnets or purse seines from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 16th day of September, 1995, both dates inclusive.

2. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 23rd day of September, 1995, both dates inclusive.

3. No Treaty Indian shall commercially fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 24th day of September, 1995 to the 30th day of September, 1995, both dates inclusive.

All-Citizen Fisheries:

1. No person shall troll commercially for sockeye or pink salmon in Coastal Salmon Management and Catch Reporting Area 4 and that part of Area 3 north of 48°N. latitude (Carroll Island) from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 9th day of September, 1995, both dates inclusive.

2. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, and 6C with nets from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 16th day of September, 1995, both dates inclusive.

3. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from 12:00 p.m., noon, on the 2nd day of August, 1995 to the 23rd day of September, 1995, both dates inclusive.

4. No person shall fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 24th day of September, 1995 to the 30th day of September, 1995, both dates inclusive.

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

Treaty Indian Fisheries:

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

Treaty Indian and All-Citizen Fisheries:

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

During the 1995 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the attached 1995 Management Plan adopted on July 27, 1995 by the Panel. This Plan is designed to achieve Pacific Salmon Treaty-mandated international allocations of the catch and domestic goals of the Parties.

APPENDIX C: 1995 FRASER RIVER PANEL IN-SEASON ORDERS

To provide for adequate escapement of the various stocks of Fraser River sockeye and pink salmon and for the prescribed allocation of catch (a) internationally, between the United States and Canada and (b) domestically, among the commercial user groups in Canada and the United States, the Fraser River Panel formulated the following orders to regulate Panel Area fisheries in 1995:

August 1 — United States

Treaty Indian Fishery

Areas 4B, 5, and 6C:

Drift gillnets open 12:00 p.m. (noon), August 2, to 12:00 p.m. (noon), August 5.

Areas 6, 7, and 7A:

Open to net fishing 6:00 p.m., August 2, to 9:00 p.m., August 3.

All-Citizen Fishery

Areas 7, 7A:

Reefnets open 5:00 a.m. to 9:00 p.m., August 2 and August 3.

August 2 — United States

All-Citizen Fishery

Areas 7, 7A:

Gillnets open 9:00 p.m. August 3, to 8:00 a.m. August 4.

Purse seines open 5:00 a.m. to 9:00 p.m. August 4.

August 4 — United States

Treaty Indian Fishery

Areas 4B, 5, and 6C:

Drift gillnets open 12:00 p.m. (noon) August 6 to 12:00 p.m. (noon) August 9.

All-Citizen Fishery

Area 4 and Area 3 (north of 48°00'15"N):

Open to commercial trolling 12:01 a.m. August 5 to 11:59 p.m. August 8.

August 9 — United States

All-Citizen Fishery

Area 4 and Area 3 (north of 48°00'15"N):

Open to commercial trolling 12:01 a.m. August 12 to 11:59 p.m. August 15.

August 15 — Canada

Area 29-1 to 7 and 9 to 17:

Gillnets open 12:00 p.m. (noon) August 17 to 12:00 p.m. (noon) August 18.

United States

Treaty Indian Fishery

Areas 6, 7 and 7A:

Open to net fishing 6:00 p.m. August 16 to 9:00 p.m. August 17.

All-Citizen Fishery

Area 4 and Area 3 (north of 48°00'15"N):

Open to commercial trolling 12:01 a.m. August 19 to 11:59 p.m. August 22.

Areas 7 and 7A:

Gillnets open 6:00 a.m. to 6:00 p.m. August 16.

Purse seines open 5:00 a.m. to 9:00 p.m. August 18.

August 18 — Canada

Area 20-1, 3 and 4:

Purse seines open 7:00 a.m. to 7:00 p.m. August 22.

Area 29-1 to 7 and 9 to 17:

Gillnets open 12:00 p.m. (noon) August 22 to 12:00 p.m. (noon) August 23.

United States

Treaty Indian Fishery

Areas 4B, 5, and 6C:

Drift gillnets open 12:00 p.m. (noon) August 21 to 12:00 p.m. (noon) August 23.

Areas 6, 7 and 7A (Iwersen's Dock Line):

Open to net fishing 5:00 a.m. August 21 to 9:00 a.m. August 22.

All-Citizen Fishery

Areas 7 and 7A (Iwersen's Dock Line):

Gillnets open 9:00 a.m. August 22 to 5:00 a.m. August 23.
Purse seines open 5:00 a.m. to 9:00 p.m. August 23.
Reefnets open 5:00 a.m. to 9:00 p.m. August 24.

August 21 Canada

Area 29-1 to 7 and 9 to 17:

Cancel gillnet opening scheduled for 12:00 p.m. (noon) August 22.

Area 29-1 to 7 and 9 to 17:

Gillnets open 8:00 a.m. August 23 to 8:00 a.m. August 24.

August 22 Canada

Area 18-4:

Open to commercial trolling 12:01 a.m. August 24 to 11:59 p.m. August 28.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C:

Drift gillnets extended from 12:00 p.m. (noon) August 23 to 12:00 p.m. (noon) August 26.

Areas 6, 7 and 7A (Iwersen's Dock Line):

Open to net fishing 5:00 a.m. August 24 to 12:00 p.m. (noon) August 25.

All-Citizen Fishery

Areas 7 and 7A (Iwersen's Dock Line):

Reefnets open 5:00 a.m. to 9:00 p.m. August 24, August 25, and August 26, with non-retention of sockeye salmon.

August 25 Canada

Area 20-1, 3 and 4:

Purse seines open 7:00 a.m. to 7:00 p.m. August 28 and August 29.

Area 29-11 to 17:

Gillnets open 7:00 a.m. to 7:00 p.m. August 28.

Area 18-4:

Closes to commercial trolling at 11:59 p.m. August 27, and re-opens to commercial trolling 12:01 a.m. August 30 to 11:59 p.m. September 3.

United States

Treaty Indian Fishery

Areas 6 and 7:

Open to net fishing 5:00 a.m. August 28 to 9:00 a.m. August 29.

All-Citizen Fishery

Area 7:

Reefnets open 5:00 a.m. to 9:00 p.m. August 27, August 28, August 29, and August 30, with non-retention of sockeye salmon.

August 29 United States

All-Citizen Fishery

Area 7:

Reefnets open 5:00 a.m. to 9:00 p.m. August 30, August 31, September 1, and September 2, with non-retention of sockeye salmon.
Purse seines open 5:00 a.m. to 9:00 p.m. August 31.
Gillnets open 9:00 p.m. August 31 to 9:00 a.m. September 1.

September 1 Canada

Area 20-1, 3 and 4:
Purse seines open 7:00 a.m. to 7:00 p.m. September 5 and September 6.

Area 18-4:
Open to commercial trolling 12:01 a.m. September 6 to 11:59 p.m. September 10.

United States

Treaty Indian Fishery

Areas 6, 7 and 7A (East Point Line):
Open to net fishing 6:00 p.m. September 2 to 9:00 p.m. September 4.

All-Citizen Fishery

Area 4 and Area 3 northerly of 48°00'15"N:
Open to commercial trolling 12:01 a.m. September 2 to 11:59 p.m. September 3.

Areas 7 and 7A (East Point Line):
Gillnets open 8:00 p.m. September 5 to 8:00 a.m. September 6, and 8:00 p.m. September 6 to 7:00 a.m. September 7.
Purse seines open 5:00 a.m. to 9:00 p.m. September 5 and September 6.
Reefnets open 5:00 a.m. to 9:00 p.m. September 3, September 4, September 5, September 6, and September 7, with non-retention of sockeye salmon.

September 8 Canada

Area 18-4:
Open to commercial trolling 12:01 a.m. September 13 to 11:59 p.m. September 17.

September 15 Canada

Area 18-4:
Open to commercial trolling 12:01 a.m. September 20 to 11:59 p.m.. September 24.

The Fraser River Panel relinquished regulatory control of the remaining Panel Areas on October 14, as scheduled. This completed the Panel's responsibility in the Panel Area for the 1995 fishing season.

All times herein cited are Pacific Daylight Savings Time.

APPENDIX D: 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 1983-1995.

Date *	1983	1987	1991	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	2,000	0	0	0
Jul. 23-Jul. 29	3,000	0	0	0
Jul. 30-Aug. 5	2,000	0	52,000	0
Aug. 6-Aug. 12	0	210,000	134,000	0
Aug. 13-Aug. 19	1,000	124,000	0	0
Aug. 20-Aug. 26	4,000	124,000	801,000	15,000
Aug. 27-Sep. 2	1,000	5,000	285,000	43,000
Sep. 3-Sep. 9	0	0	6,000	3,000
Sep. 10-Sep. 16	0	0	0	0
Sep. 17-Sep. 23	0	0	0	0
Sep. 24-Sep. 30	0	0	0	0
Oct. 1-Oct. 7	0	0	0	0
Total	13,000	463,000	1,278,000	61,000

* Dates for 1995. 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 1983-1995.

Date *	1983	1987	1991	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	1,000	0	125,000	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	1,000	0	0	0
Jul. 23-Jul. 29	80,000	0	118,000	0
Jul. 30-Aug. 5	111,000	145,000	242,000	0
Aug. 6-Aug. 12	2,000	185,000	156,000	0
Aug. 13-Aug. 19	2,000	180,000	17,000	54,000
Aug. 20-Aug. 26	146,000	38,000	152,000	88,000
Aug. 27-Sep. 2	16,000	62,000	19,000	45,000
Sep. 3-Sep. 9	34,000	13,000	63,000	0
Sep. 10-Sep. 16	73,000	11,000	33,000	0
Sep. 17-Sep. 23	90,000	0	1,000	0
Sep. 24-Sep. 30	1,000	0	8,000	0
Oct. 1-Oct. 7	1,000	0	1,000	0
Total	558,000	634,000	935,000	187,000

* Dates for 1995. 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 1983-1995. The landing dates shown lag an average of five days behind catch dates.

Date *	1983	1987	1991	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	0	0	0	0
Jul. 23-Jul. 29	3,000	0	1,000	0
Jul. 30-Aug. 5	10,000	10,000	29,000	8,000
Aug. 6-Aug. 12	3,000	204,000	77,000	12,000
Aug. 13-Aug. 19	9,000	246,000	334,000	0
Aug. 20-Aug. 26	7,000	4,000	929,000	11,000
Aug. 27-Sep. 2	2,000	0	20,000	2,000
Sep. 3-Sep. 9	2,000	0	0	0
Sep. 10-Sep. 16	1,000	0	0	0
Sep. 17-Sep. 23	0	0	2,000	0
Sep. 24-Sep. 30	0	0	0	0
Oct. 1-Oct. 7	0	0	0	0
Total	37,000	464,000	1,392,000	33,000

* Dates for 1995. 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 1983-1995.

Date *	1983	1987	1991	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	3,000	0	0	0
Jul. 9-Jul. 15	8,000	0	0	0
Jul. 16-Jul. 22	48,000	1,000	0	0
Jul. 23-Jul. 29	173,000	0	4,000	0
Jul. 30-Aug. 5	496,000	333,000	85,000	0
Aug. 6-Aug. 12	692,000	690,000	455,000	300,000
Aug. 13-Aug. 19	537,000	363,000	876,000	0
Aug. 20-Aug. 26	450,000	173,000	689,000	53,000
Aug. 27-Sep. 2	102,000	33,000	231,000	97,000
Sep. 3-Sep. 9	32,000	0	15,000	24,000
Sep. 10-Sep. 16	45,000	0	62,000	6,000
Sep. 17-Sep. 23	0	0	1,000	0
Sep. 24-Sep. 30	0	0	2,000	0
Oct. 1-Oct. 7	0	0	0	0
Total	2,586,000	1,593,000	2,420,000	480,000

* Dates for 1995. 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 1983-1995. *

Fishing Area		1983	1987	1991	1995	
Fraser River Mainstem						
Below Port Mann	*1*	6,023	26,501	70,115	131,722	
Port Mann to Mission	*1*	5,647	8,458	15,461	119,627	
Mission to Hope		72,018	89,917	142,932	111,857	
Hope to Sawmill Cr.	*2*	87,356	158,359	190,380	213,753	
Sawmill Cr. to Kelly Cr.	*2*	87,285	100,277	94,977	267,528	*4*
Kelly Creek to Naver Cr.	*3*	23,850	11,645	31,196	6,857	
Above Naver Cr.	*3*	3,085	2,534	5,004	2,079	
Total		285,264	397,691	550,065	853,423	
Tributaries						
Harrison/Lillooet System		10,081	7,680	1,806	0	
Thompson System		1,255	3,525	261	8,215	*4*
Chilcotin System		44,600	28,134	34,593	19,231	
Nechako System		15,241	22,311	11,562	3,943	
Stuart System		5,115	8,682	7,643	7,366	
Total		76,292	70,332	55,865	38,755	
Total Catch		361,556	468,023	605,930	892,178	

* 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 Schwarz, C.J. 1996. Analysis of the 1995 Upper Fraser River Catch Monitoring Program of First Nations Fisheries. Prepared for the Department of Fisheries and Oceans, [Vancouver, B.C.].

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 1983-1995.

Date *	1983	1987	1991	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	43,000	2,000
Jul. 16-Jul. 22	1,000	0	0	0
Jul. 23-Jul. 29	54,000	16,000	0	8,000
Jul. 30-Aug. 5	122,000	341,000	17,000	142,000
Aug. 6-Aug. 12	74,000	355,000	126,000	12,000
Aug. 13-Aug. 19	38,000	853,000	659,000	74,000
Aug. 20-Aug. 26	61,000	278,000	564,000	134,000
Aug. 27-Sep. 2	10,000	93,000	139,000	14,000
Sep. 3-Sep. 9	2,000	0	163,000	23,000
Sep. 10-Sep. 16	5,000	0	78,000	0
Sep. 17-Sep. 23	1,000	0	27,000	0
Sep. 24-Sep. 30	0	0	1,000	0
Oct. 1-Oct. 7	0	0	0	0
Total	368,000	1,936,000	1,817,000	409,000

* Dates for 1995. 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 1989-1995.

Date *	1989	1991	1993	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	24,000	0	0	0
Jul. 23-Jul. 29	0	0	0	0
Jul. 30-Aug. 5	4,000	1,000	6,000	0
Aug. 6-Aug. 12	41,000	2,000	18,000	0
Aug. 13-Aug. 19	43,000	0	0	1,000
Aug. 20-Aug. 26	233,000	228,000	2,000	97,000
Aug. 27-Sep. 2	674,000	743,000	1,000	395,000
Sep. 3-Sep. 9	262,000	12,000	0	203,000
Sep. 10-Sep. 16	82,000	0	0	4,000
Sep. 17-Sep. 23	2,000	0	0	0
Sep. 24-Sep. 30	22,000	0	0	0
Oct. 1-Oct. 7	2,000	0	0	0
Oct. 8-Oct. 14	0	0	0	0
Total	1,389,000	986,000	27,000	700,000

* Dates for 1995. 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 1989-1995.

Date *	1989	1991	1993	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	0	0	0	0
Jul. 23-Jul. 29	0	0	0	0
Jul. 30-Aug. 5	1,000	0	1,000	0
Aug. 6-Aug. 12	2,000	3,000	1,000	0
Aug. 13-Aug. 19	6,000	12,000	4,000	3,000
Aug. 20-Aug. 26	39,000	16,000	0	19,000
Aug. 27-Sep. 2	86,000	55,000	96,000	34,000
Sep. 3-Sep. 9	70,000	25,000	87,000	10,000
Sep. 10-Sep. 16	7,000	63,000	45,000	3,000
Sep. 17-Sep. 23	1,000	18,000	12,000	1,000
Sep. 24-Sep. 30	98,000	1,000	7,000	0
Oct. 1-Oct. 7	0	2,000	1,000	0
Oct. 8-Oct. 14	0	0	0	0
Total	310,000	195,000	254,000	70,000

* Dates for 1995. 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 1989-1995. The landing dates shown lag an average of five days behind catch dates.

Date *	1989	1991	1993	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	19,000	0	0	4,000
Jul. 9-Jul. 15	75,000	1,000	0	15,000
Jul. 16-Jul. 22	15,000	9,000	4,000	27,000
Jul. 23-Jul. 29	83,000	20,000	6,000	60,000
Jul. 30-Aug. 5	68,000	25,000	12,000	4,000
Aug. 6-Aug. 12	100,000	49,000	90,000	59,000
Aug. 13-Aug. 19	53,000	123,000	72,000	3,000
Aug. 20-Aug. 26	211,000	490,000	36,000	149,000
Aug. 27-Sep. 2	363,000	74,000	52,000	195,000
Sep. 3-Sep. 9	299,000	158,000	35,000	50,000
Sep. 10-Sep. 16	16,000	128,000	34,000	4,000
Sep. 17-Sep. 23	3,000	23,000	9,000	3,000
Sep. 24-Sep. 30	0	5,000	8,000	0
Oct. 1-Oct. 7	0	0	0	0
Oct. 8-Oct. 14	0	0	0	0
Total	1,305,000	1,105,000	358,000	573,000

* Dates for 1995. 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 1989-1995.

Date *	1989	1991	1993	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	1,000	0	0	0
Jul. 9-Jul. 15	2,000	0	0	0
Jul. 16-Jul. 22	8,000	0	0	0
Jul. 23-Jul. 29	41,000	0	1,000	0
Jul. 30-Aug. 5	92,000	3,000	14,000	0
Aug. 6-Aug. 12	125,000	91,000	279,000	58,000
Aug. 13-Aug. 19	276,000	394,000	731,000	0
Aug. 20-Aug. 26	599,000	995,000	56,000	277,000
Aug. 27-Sep. 2	748,000	720,000	1,293,000	806,000
Sep. 3-Sep. 9	889,000	37,000	471,000	208,000
Sep. 10-Sep. 16	696,000	965,000	72,000	187,000
Sep. 17-Sep. 23	7,000	18,000	105,000	15,000
Sep. 24-Sep. 30	28,000	39,000	4,000	4,000
Oct. 1-Oct. 7	0	1,000	0	0
Oct. 8-Oct. 14	0	0	0	0
Total	3,512,000	3,263,000	3,026,000	1,555,000

* Dates for 1995. 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 1989-1995. *

Fishing Area		1989	1991	1993	1995
Fraser River Mainstem					
Below Port Mann	*1*	4,729	17,065	5,862	28,499
Port Mann to Mission	*1*	5,726	10,404	4,814	32,367
Mission to Hope		40,755	54,580	4,074	50,907
Hope to Sawmill Cr.	*2*	17,582	21,621	1,260	37,214
Sawmill Cr. to Kelly Cr.	*2*	3,425	111	1,012	5,096
Kelly Creek to Naver Cr.	*3*	0	0	0	47
Above Naver Cr.	*3*	0	0	0	0
Total		72,217	103,781	17,022	154,130
Tributaries					
Harrison/Lillooet System		1	0	0	0
Thompson System		225	1	0	364
Chilcotin System		0	0	0	0
Nechako System		0	0	0	0
Stuart System		0	0	0	0
Total		226	1	0	364
Total Catch		72,443	103,782	17,022	154,494

* 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 1989-1995.

Date *	1989	1991	1993	1995
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	4,000	0	0	0
Jul. 23-Jul. 29	0	0	0	2,000
Jul. 30-Aug. 5	6,000	3,000	14,000	21,000
Aug. 6-Aug. 12	22,000	8,000	62,000	6,000
Aug. 13-Aug. 19	18,000	75,000	170,000	50,000
Aug. 20-Aug. 26	45,000	91,000	404,000	536,000
Aug. 27-Sep. 2	210,000	110,000	701,000	265,000
Sep. 3-Sep. 9	1,029,000	1,067,000	383,000	1,096,000
Sep. 10-Sep. 16	565,000	1,008,000	0	0
Sep. 17-Sep. 23	161,000	314,000	0	1,000
Sep. 24-Sep. 30	68,000	0	0	0
Oct. 1-Oct. 7	0	0	0	0
Oct. 8-Oct. 14	0	0	0	0
Total	2,128,000	2,676,000	1,734,000	1,977,000

* Dates for 1995. For other years, data from the nearest week were used.

Table 13. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1983, 1987, 1991 and 1995. *

DISTRICT	1995 Period of	Estimated Number of Adult Sockeye *				Jacks
Stream/Lake	Peak Spawning	1983	1987	1991	1995	1995
NORTHEAST						
Upper Bowron R.		6,451	11,071	4,919	34,417	14
STUART						
Early Runs						
Driftwood R.		Present	Present	2,746	4,046	0
Takla L. Streams		3,130	27,614	25,857	15,134	0
Middle R. Streams		18,491	100,706	81,071	76,619	6
Trembleur L. Streams		2,246	19,874	31,445	26,911	0
Early Stuart Total		23,867	148,194	141,119	122,710	6
Late Runs						
Middle R.		639	2,441	16,331	7,462	0
Tachie R.		853	2,398	50,841	22,368	0
Miscellaneous		754	1,633	9,688	4,532	0
Late Stuart Total		2,246	6,472	76,860	34,362	0
NECHAKO						
Nadina R. (Late)		3,035	7,890	5,000	2,499	1
Nadina Channel		23,841	29,734	56,074	21,499	7
Stellako R.		121,692	211,085	94,884	141,813	167
QUESNEL						
Upper Horsefly R.		1,998	14,531	14,000	178,533	0
Lower Horsefly R.		-	2,201	5,754	- *1*	-
Horsefly Channel		-	-	18,815	- *1*	-
McKinley Cr.		38	63	0	380	0
Mitchell R.		119	3,751	7,690	35,190	0
Quesnel Total		2,155	20,546	46,259	214,103	0
CHILCOTIN						
Chilko R.		329,220	239,601	1,017,242	526,243	4,539
Chilko Channel		-	-	20,495	8,318	170
Chilko L.-South End		53,613	181,414	- *2*	- *2*	-
SETON-ANDERSON						
Gates Cr.	Aug.31-Sept.6	811	1,725	952	7,181	10,617
Gates Channel		6,573	7,692	8,088	- *3*	-
Portage Cr.	Nov.3-9	7,747	6,820	12,053	7,875	572
NORTH THOMPSON						
Raft R.		2,780	1,436	464	1,040	6
Fennell Cr.		4,977	16,633	20,466	11,235	16
SOUTH THOMPSON						
Summer Runs						
Seymour R.	Sept.3-7	29,831	84,315	128,253	51,723	5
Scotch Cr.	Aug.29-Sept.3	239	2,089	9,954	14,815	1
Anstey R.	Aug.29-Sept.5	382	2,257	5,011	3,562	0
Eagle R.		72	879	3,677	3,679	0
Late Runs						
Adams R.		201,610	567,989	1,204,153	378,903	0
Little R.		- *4*	17,998	13,500	9,125	0
Lower Shuswap R.		7,308	10,343	15,678	12,330	0
Misc. Late Runs		2,447	20,995	22,460	11,473	0
HARRISON-LILLOOET						
Birkenhead R.		44,029	164,849	293,626	38,588	3,458
Harrison R.		4,239	5,228	15,000	16,618	142
Weaver Cr.		20,727	26,272	10,179	12,832	110
Weaver Channel		18,614	33,696	27,942	21,199	248
LOWER FRASER						
Nahatlatch R./L.	Sept.6-13	2,186	13,501	2,755	2,297	32
Cultus L.		19,944	32,184	20,157	10,316	33
Upper Pitt R.		16,852	13,637	22,500	5,500	0
MISCELLANEOUS		7,429	9,402	6,552	4,838	93
ADULTS		964,917	1,895,947	3,306,272	1,731,093	20,237
JACKS		10,984	18,796	35,191	20,237	
TOTAL NET ESCAPEMENT		975,901	1,914,743	3,341,463	1,751,330	

* 1983 data are from the PSC. Estimates for 1987, 1991 and 1995 are from DFO.

1 Included in Upper Horsefly River estimate.

2 Included in Chilko River estimate.

3 Gates Creek Channel not operated in 1995.

4 Included in Lower Adams River estimate.

Table 14. Escapements of pink salmon to Fraser River spawning areas for cycle years 1989, 1991, 1993 and 1995, from DFO. Spawner abundances for individual spawning areas in the Fraser River watershed are not available after 1991.

RUN DISTRICT River/Stream	1995 Period of Peak Spawning	Estimated Number of Adult Pink Salmon			
		1989	1991	1993 *	1995 *
EARLY RUNS					
LOWER FRASER					
Main Fraser		4,780,703	9,281,051		
Ruby Creek		-	6,783		
Total		4,780,703	9,287,834	N/A	N/A
FRASER CANYON					
Coquihalla River		13,559	71,555		
Jones Creek		4,958	3,558		
Nahatlatch River		9,334	35,100		
Miscellaneous Tributaries		13,194	18,333		
Total		41,045	128,546	N/A	N/A
SETON-ANDERSON					
Seton Creek		872,460	1,272,395		
Upper Seton Channel		21,522	13,056		
Lower Seton Channel		40,041	32,059		
Cayoosh Creek		-	87,388		
Portage Creek		21,096	29,008		
Bridge River		104,000	184,327		
Gates Creek		372	595		
Total		1,059,491	1,618,828	N/A	N/A
THOMPSON					
Thompson River and Tributaries		281,640	769,800	N/A	N/A
UPPER FRASER TRIBUTARIES		6,535	2,309	N/A	N/A
EARLY-RUN TOTAL		6,169,414	11,807,317	N/A	N/A
LATE RUNS					
LOWER FRASER TRIBUTARIES		1,056	6,929	N/A	N/A
HARRISON					
Harrison River		681,572	947,812		
Weaver Creek		3,315	12,419		
Weaver Channel		2,493	2,391		
Total		687,380	962,622	N/A	N/A
CHILLIWACK-VEDDER					
Chilliwack-Vedder Rivers		328,020	158,876		
Sweltzer Creek		3,290	5,364		
Total		331,310	164,240	N/A	N/A
MISCELLANEOUS		26	8,210	N/A	N/A
LATE-RUN TOTAL		1,019,772	1,142,001	N/A	N/A
TOTAL NET ESCAPEMENT		7,189,186	12,949,318	10,775,000	7,174,000

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

APPENDIX E: STAFF OF THE PACIFIC SALMON COMMISSION IN 1995

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
Mr. M. Lapointe, Sockeye Racial Analysis Biologist
Mr. B. White, Pink Racial Analysis Biologist
Ms. C. Lidstone, Senior Scale Analyst
Ms. J. Andersen, 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
Dr. Y. Xie, Hydroacoustic Scientist (Term)