1
9
9
6

Report of the Fraser River Panel to the Pacific Salmon Commission on the 1996 Fraser River Sockeye Salmon Fishing Season

Prepared by the

Pacific Salmon Commission

April, 1999

Pacific Salmon Commission
600-1155 Robson Street
Vancouver, B.C.
V6E 1B5
(604) 684-8081

REPORT OF THE

FRASER RIVER PANEL

TO THE PACIFIC SALMON COMMISSION

ON THE 1996 FRASER RIVER

SOCKEYE SALMON FISHING SEASON

1996 PANEL MEMBERS AND ALTERNATES

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

Prepared by

FISHERIES MANAGEMENT DIVISION

of the

PACIFIC SALMON COMMISSION

April, 1999

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

1. Under the Pacific Salmon Treaty, the Fraser River Panel is responsible for in-season management of fisheries that target on Fraser River sockeye and pink salmon within the Panel Area. Prior to the onset of the fishing season, the Panel recommends a fishery regime and a management plan for Panel Area fisheries to the Pacific Salmon Commission. The plan is based on abundance forecasts and escapement targets for Fraser River sockeye and pink salmon stocks provided by Fisheries and Oceans Canada, international allocation goals set by the agreements between the Parties, domestic allocation goals set by each country, and management concerns for other stocks and species also identified by each country.

2. The Panel uses commercial and test fishing data and various analyses from Pacific Salmon Commission staff in-season to modify the fishing times in the management plan to achieve the objectives of the management plan approved by the Pacific Salmon Commission.

3. Achievement of the domestic allocation goals of Canada and the United States has been a major focus of in-season management and, in general, has been met successfully by the Panel. Resource conservation and international allocation goals take precedence over domestic allocation objectives, when trade-offs among these three objectives are necessary.

4. Canada provided the Fraser River Panel with an official pre-season run-size forecast of 1,560,000 sockeye, and a spawning escapement goal of 1,092,000 fish on March 18, 1996. The pre-season forecast was calculated using a technical "risk-averse" computation procedure with a 75% probability that the actual run abundance would equal or exceed the pre-season number.

5. Canada and the United States reached a catch-sharing agreement on July 19, 1996. The United States agreed to deduct 400,000 sockeye from the gross TAC for Canadian aboriginal fisheries. At the pre-season risk-averse forecast level, Canada and United States agreed that the United States could conduct a limited fishery to take up to 50,000 sockeye to "meet basic needs". If run sizes exceeded the forecast sufficiently to create a TAC, the United States catch share in Panel Areas would be 16.1% of the TAC below 2,000,000 fish, and smaller percentage shares at larger TAC's up to a cap of 800,000 sockeye. Early Stuart and Early summer-run stocks would not be subject to directed fisheries in Washington.

6. The United States specified domestic goals for allocating catch between Treaty Indian and Non-Indian fishers, and between Treaty Indian fishers in Juan de Fuca Strait and Puget Sound. No pre-season goals were provided by Canada for allocating commercial catches among gear types.

7. Canada provided a gross escapement target of 1,612,000 on August 2. A negotiated risk-averse adjustment of 314,000 fish resulted in an adjusted gross target of 1,926,000 fish. The United States accepted the adjusted targets to allow Panel activities to proceed, but did not agree with the methodology used to calculate the adjustments.

8. The 1996 Panel management season was particularly difficult because of the large difference between Canada's pre-season risk averse forecast of 1,560,000 sockeye and the actual return which is estimated at 4,519,000 fish. The Panel was not able to schedule fisheries in the planning phase of the season because the pre-season forecast did not identify a harvestable surplus for commercial fisheries in Canada or the United States. This limited the Pacific Salmon Commission staff's ability to provide the Panel with early projections of run-size in-season. The Commission was forced to rely on test fishing indices rather than on the catches in commercial fisheries for estimation of abundance. Since test catches are less precise indicators of abundance, escapements past the Commission's hydroacoustic site near Mission, B.C. became the primary source of information on abundance. However, as this site was so far along the migration route, by the time sufficiently precise estimates of abundance were available, the peak

of each stock group was past outside fishing areas. Concern for the abundance of certain key stocks also limited the Panel's ability to schedule fisheries early enough to achieve international and domestic allocation objectives. This process has also led to excess numbers of fish to escape in the Early Summer, Summer and Late run stock groups.

9. Difficulty was encountered in achieving catch goals for late-run sockeye. Because these fish normally delay in the Strait of Georgia for several weeks before migrating upstream, run-size estimates for these stocks depended heavily on test fishing data from Juan de Fuca and Johnstone straits. A record early migration into the Fraser River of Weaver sockeye that overlapped the normal Birkenhead migration confounded attempts to harvest these stocks separately. Conservation concerns for Birkenhead sockeye prevented river fisheries on late runs.

10. The return of Fraser River sockeye salmon in 1996 totalled 4,519,000 fish, almost three times the official pre-season risk-averse forecast (1,560,000). This was the fourth largest return on the cycle since 1900.

11. Approximately 35% of Fraser sockeye migrated through Johnstone Strait, close to the pre-season forecast of 38%.

12. Pre-season forecasts of the 50% migration date to Area 20 were July 7 for Early Stuart and August 7 for Chilko sockeye. Post-season assessments of the 50% date were July 7 for Early Stuart, July 24 for Early Summer, August 6 for Summer and August 8 for Late-run stocks.

13. The total catch of Fraser sockeye was 2,187,000 fish, the smallest since 1964. This harvest amounted to 48% of the total return, the lowest harvest rate on record. Commercial, non-commercial and Canadian First Nations' harvests totalled 1,248,000, 185,000 and 754,000 sockeye, respectively. The commercial harvest rate (28% of the run) was the lowest on record, while the First Nations' harvest rate (17% of the run) was the second highest on record.

14. Canadian catches totalled 1,802,000 Fraser sockeye, 955,000 in commercial, 93,000 in non-commercial, 76,000 in non-Fraser Indian and 678,000 in Fraser River Indian catches. Of the commercial catch, 782,000 fish were caught in Panel Areas and 173,000 fish in non-Panel Areas. Gillnets, purse seines, inside trollers and outside trollers caught 83%, 13%, 4% and 0% of the commercial catch, representing a significant deviation from catch distributions in past years. The proportion caught by Area 29 gillnets (74%) was the largest since 1968. Included in the non-commercial catch is a terminal catch of 78,000 Weaver sockeye that were made available to an Excess Salmon to Spawning Requirements (ESSR) fishery.

15. Washington catches totalled 270,000 Fraser sockeye, 257,000 in commercial fisheries and 13,000 in Gear Modification Study test fisheries. Treaty Indian catches totalled 224,000 fish, 30,000 in Juan de Fuca Strait and 194,000 in Puget Sound. Non-Indian catches totalled 33,000 fish, 25,000 in purse seines and 8,000 in gillnets, also a significant deviation from catch distributions in past years. Catches of Fraser River sockeye in Alaska totalled 36,000 fish.

16. Preliminary spawning escapement estimates from Canada total 2,062,000 adult sockeye, plus 29,000 jacks. This was the largest adult spawning escapement on record for the cycle. Although several stocks had record escapements, of particular note was the Upper Adams River escapement of 25,000 fish, which was likely the largest since 1909. In addition, a difference between estimates of Weaver sockeye at Mission and upstream of 241,000 fish was used as the estimate of terminal mortality for this stock.

17. Adjusted gross escapement targets for Early Summer, Summer, and Late-run stocks were exceeded by 259,000 fish, as measured in-season.

18. Given the preliminary estimates of run size (4,519,000 fish) and deductions (2,902,000 fish), the TAC was 1,617,000 fish. Corresponding United States (Washington) and Canadian shares

were 260,000 and 1,321,000 fish. United States catches totalled 257,000 fish, 3,000 less than their share, while Canada caught 3,000 more than their share.

19. Given the actual United States catch of 257,000 Fraser sockeye and their stated objectives for domestic allocation, Treaty Indian and Non-Indian allocations were 220,000 and 37,000 fish, respectively (not adjusted for the 17,000 fish transfer from the Treaty Indian share to the Non-Indian share on August 19), compared to actual catches of 224,000 (4,000 over) and 33,000 fish (4,000 under). Allocations of the actual Treaty Indian catch of 224,000 fish were 45,000 fish for Areas 4B, 5 and 6C and 179,000 fish for Areas 6, 7 and 7A, compared to catches of 30,000 (15,000 under) and 194,000 fish (15,000 over) in these areas. No domestic allocation goals within the Non-Indian group were provided in 1996.

20. Canadian domestic allocation goals were provided late in the season once a significant commercial TAC was identified. By that time most remaining fishing opportunities were in the Fraser River. Goals for each gear group within the Canadian commercial sector, however, were not provided formally to the Panel.

21. During the fishing season, both Canada and the United States identified stocks for which conservation or management concerns existed. However, the restrained fisheries in 1996 averted by-catch problems.

II. FRASER RIVER PANEL

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

The pre-season management plan adopted by the Pacific Salmon Commission (PSC) specifies a management scenario that is likely to achieve the targets, 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 plan to respond to deviations from pre-season expectations.

The activities of the Panel are facilitated by the Fraser River Panel Technical Committee, who provide the respective National sections of the Panel with technical advice.

In 1996, the Panel exercised its regulatory mandate in the Panel Area for commercial net fisheries and the Canadian inside (Strait of Georgia) 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.

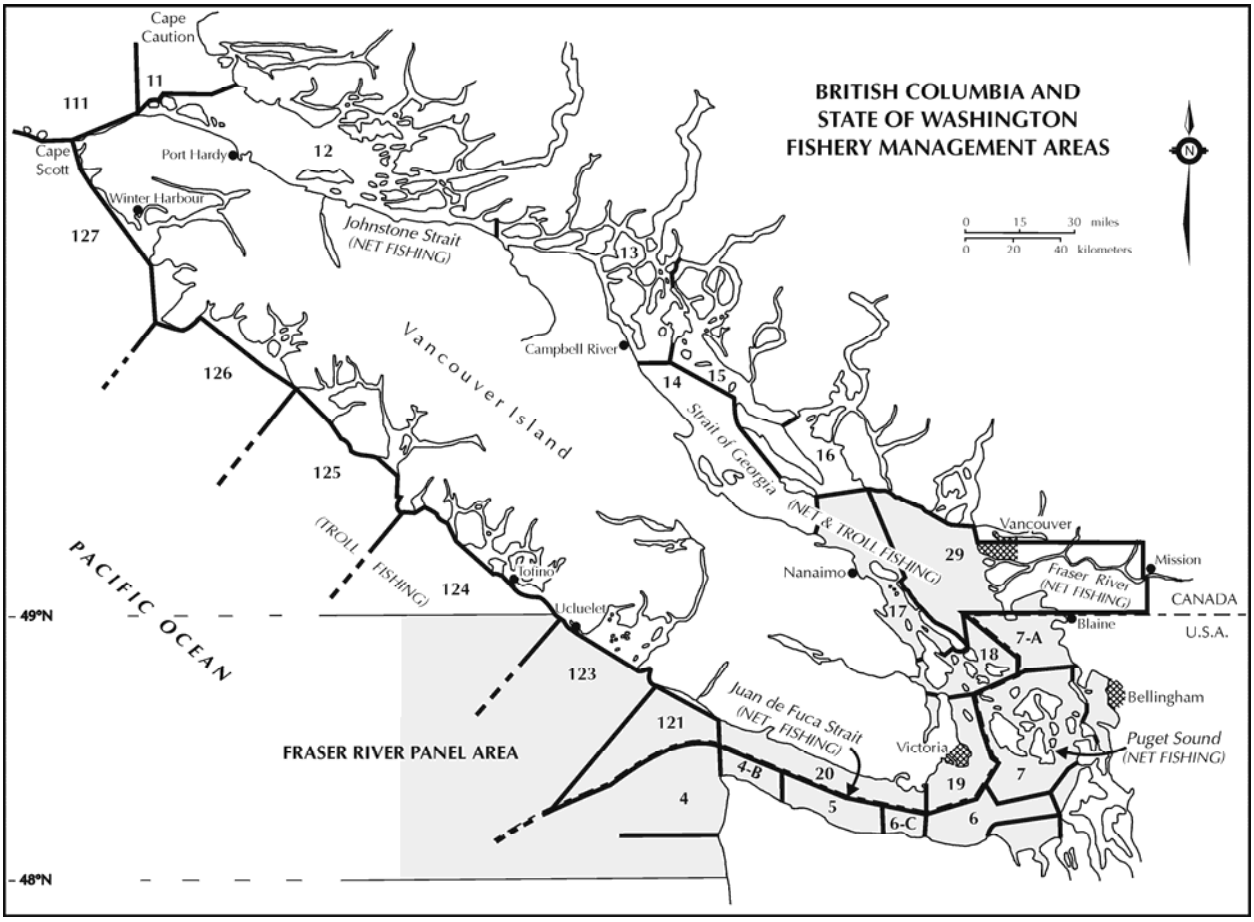

Figure 1. Fishery management areas and commercial gear used in the Fraser River Panel Area and Canadian south coast waters.

Input to the decision making process occurs primarily through the national sections of the Panel where most user groups are represented. The Panel membership and their affiliations during the 1996 season were:

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

III. INTRODUCTION

Returns of Fraser River sockeye salmon follow a recurring four-year pattern of abundance. This pattern is due primarily to the four year life span of Fraser sockeye where, for example, most progeny from the 1992 spawning returned as mature fish in 1996. Of the resulting four "cycles" of Fraser sockeye abundance, returns on the 1996 cycle have frequently been the lowest since at least the early 1900's (Figure 2), when catch records began.

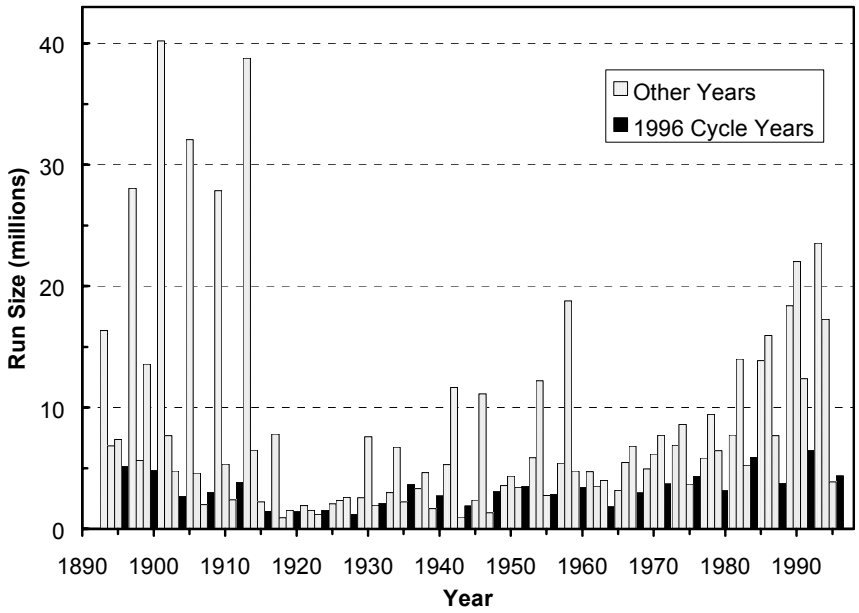

Figure 2. Total run sizes of Fraser River sockeye salmon between 1893-1996. Returns on the 1996 cycle are highlighted.

In 1996, the total return of Fraser River sockeye salmon was 4,519,000 fish. This was the third largest return on the 1996 cycle since 1900 indicating a positive response to co-operative efforts to increase abundance from low levels in the early part of the century due to over-fishing, Hells Gate obstructions and other detrimental human activities. The four largest years on this cycle have all occurred since 1976, as policies have been implemented to increase escapement targets.

A. Management Challenges in 1996

The 1996 Panel management season was particularly difficult because of the large difference between Canada's pre-season risk-averse forecast of 1,560,000 sockeye and the actual return of 4,519,000 fish. The Panel was not able to schedule fisheries in the planning phase of the season because the pre-season forecast did not identify a harvestable surplus for commercial fisheries in Canada or the United States. This limited the Pacific Salmon Commission staff's ability to provide the Panel with early projections of run-size in-season. The Commission was forced to rely on test fishing indices rather than on the catches in commercial fisheries for estimation of abundance. Since test catches are less precise indicators of abundance, escapements past the Commission's hydroacoustic site near Mission, B.C., became the primary source of information on abundance. However, as this site was so far along the migration route, by the time sufficiently precise estimates of abundance were available, the peak of each stock group was past outside fishing areas. Concern for the abundance of certain key stocks also limited the Panel's ability to schedule fisheries early enough to achieve international and domestic allocation objectives. This

process also led to excess numbers of fish escaping in the Early Summer, Summer and Late run stock groups.

The 1996 forecast was part of a "precautionary management" policy instituted by Canada to address concerns regarding the achievement of spawning escapement targets caused by escapement shortfalls in both 1994 and 1995. Pre-season forecasts of sockeye salmon returns are annually provided to the Fraser River Panel by Fisheries and Oceans Canada. These forecasts are an important element of the pre-season planning process, and are used to develop plans for managing Panel Area fisheries. In the past, these forecasts represented "point" estimates of abundance, meaning the probability that the forecasts were too high was the same as the probability that they were too low. However, in 1996, Canada presented forecasts for which there was a 75% probability that actual abundances would equal or exceed the forecasts. The objective of these "risk-averse" forecasts was to improve the probability that spawning escapement targets would be achieved. The risk-averse forecast provided to the Panel was 1,560,000 fish, compared to the point estimate of 2,662,000 fish.

In presenting the risk-averse forecasts, Canadian managers pointed out that the first priority of the Panel, i.e., conservation, had not been achieved in 1994 and 1995, a fact which justified the precautionary approach taken in the forecast. As well, Canada argued that the forecast itself was sufficiently uncertain that to approach the season on an optimistic note would transmit a message to the industry that could not be justified.

Because the low risk-averse forecast generated a total allowable catch (TAC) of zero for Canadian commercial fishers, no Canadian commercial fishing opportunities were planned in 1996. Thus, the usual commercial purse seine fisheries in Juan de Fuca (Area 20) and Johnstone Straits (Areas 12 and 13) during the Summer-run period did not occur. These fisheries normally provide important data for in-season estimation of run size. Without these data, the Panel lacked timely, reliable assessments of run size on which to base fishery decisions when Fraser sockeye returned in larger than forecast abundances. Instead, to obtain run-size estimates, PSC staff were forced to rely on gillnet and purse seine test fishing data and on estimates of escapement at Mission. Run-size estimates based on test fishing data, although potentially as timely as estimates from commercial purse seine models, are inherently more variable than estimates from the commercial purse seine models. The consequent lack of confidence in these test fishing based estimates meant that run-size assessments in 1996 were largely tied to hydroacoustic estimates of escapement at Mission.

Reliance on Mission estimates strongly affected the timeliness of assessments and management decisions. First, because of the amount of time it takes fish to travel from Juan de Fuca and Johnstone Straits to Mission, Mission-based estimates of run size occur about one week later than estimates from commercial purse seine models. Second, many Summer-run sockeye in 1996 delayed in the Strait of Georgia before entering the Fraser River, causing further uncertainty about abundance estimates and shifting run-size assessment to an even later date. By the time reasonably accurate estimates of run size were available, most Summer-run sockeye had migrated upriver or were clear of net fishing areas in Juan de Fuca and Johnstone Straits. Panel management options were severely restricted by this sequence of events. Thus, most (74%) of the Canadian commercial sockeye catch was taken by gillnets in the Fraser River, because it was the only fishery option available in Canadian Panel Areas given the late date of run-size assessments. This was the highest proportion of the Canadian catch taken in Area 29 since 1968 and compares to an average of 26% for the 1969-95 period.

A second aspect of Canada's precautionary management policy were increased gross escapement targets for Early Stuart, Early Summer and Summer-run stocks, which Canada negotiated with the United States. These adjusted gross escapement targets were also for the stated intention of ensuring that spawning escapement targets were achieved. The adjusted targets consisted of basic gross escapement targets plus upward adjustments that meant there was a 75% probability the basic targets would be met or exceeded in upstream estimates of catch and

spawning escapement. Even these risk-averse gross escapement targets were exceeded, however, largely due to the lateness of run-size updates. Spawning escapement targets for Early Stuart, Early Summer and Summer-run stocks were consequently exceeded, some by a considerable margin.

Management difficulties were also encountered due to unusual migration patterns of Late-run sockeye into the river in 1996. Birkenhead sockeye usually migrate upriver from mid August to mid September, while Weaver and other Late-run stocks normally delay in the Strait of Georgia for several weeks before migrating upstream in late September and early October. These patterns usually result in separation of Birkenhead and Weaver stocks in the Strait of Georgia and Fraser River, allowing directed fishing or conservation of these stocks separately. However, in 1996, the migration of Weaver sockeye into the River began in mid-August and was virtually complete by mid September. This was the earliest Weaver migration since at least the mid-1960's, when consistent monitoring of Late-run migration on low abundance years began. The resulting overlap in the migrations of Birkenhead and Weaver sockeye, combined with conservation concerns for Birkenhead sockeye, eliminated the possibility of a directed harvest of the large Weaver return. The gross escapement target for Weaver sockeye was consequently exceeded. A portion of this excess escapement (78,000) was harvested in or near Weaver Creek. In addition, a substantial but unknown mortality occurred in the Harrison River and in Morris Lake and Slough. The difference between Mission hydroacoustic and terminal area abundance estimates (241,000 fish) is assumed to be a reasonable estimate of this mortality.

B. Upper Adams Sockeye Salmon Recovery

Much of the growth in Fraser River sockeye abundance in recent years has been due to the recovery of stocks that were almost extirpated by human actions in the early 1900's. Such actions include over-fishing, and dumping waste rock from railroad construction into the river (1912-1914) which resulted in a migration blockage at Hells Gate. Less well known actions include the construction of dams at the outlet of Adams Lake for log driving and at the outlet of Quesnel Lake for gold mining. One of the most severely affected stocks was the Upper Adams River stock. Reports in 1909 and 1913 by J.P. Babcock, the Commissioner of Fisheries for British Columbia, indicate a very substantial population spawned in this river in 1901, 1905 and 1909 (i.e., 1993 cycle)[1]. Operation of the splash dam from 1908 to 1921 along with difficult passage conditions at Hells Gate appear to have been the main causes of this stock's decline. By the late 1930's and 1940's, surveys of Upper Adams River spawning grounds failed to detect the presence of spawning sockeye.

Beginning in 1949, the International Pacific Salmon Fisheries Commission (IPSFC) attempted to re-introduce sockeye to the Upper Adams River by transplanting eggs, fry and smolts, but with little success. Short-term rearing of fry began in 1980 and by 1988 the spawning escapement had increased to 7,200 adults. An apparent reduction in escapement occurred in 1992. However, a DFO program of egg incubation and short-term rearing of fry from the 1992 brood, combined with nearly complete fishery closures on Early Summer sockeye in 1996, caused the escapement to rebound to 25,000 spawners.

Similar recoveries have occurred for other stocks over the past seventy years. Lower Adams River sockeye quickly recovered from the periodic flooding and drying caused by the splash dam at the outlet of Adams Lake, soon after operation of the dam was discontinued in 1922. Sockeye stocks in the Quesnel watershed were reduced to the extent that only 1,000 fish spawned in the Horsefly River in 1941. With improved passage conditions beginning in 1945, when the IPSFC built the first of several fishways at Hells Gate[2], Quesnel stocks began a long rebuilding process

[1] Roos, J.F. 1991. Restoring Fraser River sockeye salmon: A history of the International Pacific Salmon Fisheries Commission 1937-1985. Pacific Salmon Commission, Vancouver.
[2] Ibid.

that culminated in the run of 12,000,000 fish in 1989. Sub-dominant and off cycle returns to the Quesnel system have also rebuilt to a considerable degree in recent years.

These and other successes in stock rebuilding give confidence in the long-term health of Fraser River sockeye stocks. In the period between the depletion of Fraser stocks in the early 1900's by over-fishing and migratory obstructions and when regulatory jurisdiction was vested in the IPSFC beginning in 1946, great losses in catch were experienced by fishers of both countries. Co-operative management by Canada and the United States, through the IPSFC (until 1985) and PSC (since 1986), has been the means by which much of the restoration of depleted stocks has occurred.

IV. MANAGEMENT ACTIONS

A. Forecasts of Returns, Escapement Targets and Potential TAC

Canada provided the Panel with an official pre-season run-size forecast of 1,560,000 Fraser sockeye and a spawning escapement target of 1,092,000 fish on March 18, 1996 (Appendix A). The pre-season forecast was calculated using a "risk-averse" computation procedure with a 75% probability that the actual run abundance would equal or exceed the pre-season number. The mid-point of Canada's forecast total return was 2,662,000 fish, 70% larger than the risk-averse forecast. Canada's stated intention in providing risk-averse forecasts was to increase the probability that spawning escapement targets were met.

On July 8, Canada revised the pre-season forecasts for Early Summer and Summer-run sockeye to 233,000 and 1,069,000 fish, primarily by moving Early Chilko from the Summer to the Early Summer-run group. Spawning escapement targets were also revised to 120,000 Early Stuart (66,000 minimum), 280,000 Early Summer, 619,000 Summer and 300,000 Late-run spawners.

Canada and the United States reached a catch-sharing agreement for Fraser River sockeye salmon on July 19, 1996. The Parties agreed on the TAC definition: *"the remaining portion of the annual aggregate Fraser River sockeye run after the spawning escapements, the Fraser River Indian fishery exemption, and the catch in Panel authorized test fisheries including the U.S. gear modification study up to 15,000 fish have been deducted"*. The Fraser Indian fishery exemption was to be the amount up to 400,000 Fraser sockeye that was harvested by Canadian First Nations fisheries. At the risk-averse pre-season forecast run size, Canada and the United States agreed that the United States could conduct a limited fishery to take up to 50,000 sockeye to "*meet basic needs*". If run sizes exceeded the forecast sufficiently to create a TAC, the United States catch share in Panel Areas would be 16.1% of the TAC below 2,000,000 fish, and smaller percentage shares at larger TAC's up to a maximum catch of 800,000 sockeye (Table 1). Washington fisheries were to focus on Summer-run stocks and minimize catches of Early Stuart and Early Summer-run stocks.

Within Washington, the first 183,500 fish of any Washington catch share was reserved for Treaty Indian fishers. Washington catches above 183,500 fish were to be shared equally by Treaty Indians and Non-Indians. Later, on August 19, an additional 17,000 fish would be transferred from the Treaty Indian to the Non-Indian share. Of the Treaty Indian share, 20% was assigned to tribes fishing in Juan de Fuca Strait and the remaining 80% to Puget Sound tribes. Allocations among Non-Indian users were not specified. By domestic agreement, reef nets did not fish in 1996.

Table 1. Rules for calculating Washington shares of Fraser River sockeye salmon in 1996, from the July 19, 1996, agreement between the Parties.

TAC Range		Washington Share *		
			Incremental	
Minimum	Maximum	Base	%	Maximum
0	2,000,000	50,000	16.1%	322,000
2,000,000	5,000,000	322,000	8.0%	562,000
5,000,000	10,950,000	562,000	4.0%	800,000
10,950,000	. . .	800,000	0.0%	800,000

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

With respect to allocations of Canadian commercial catches among gear types, no pre-season goals were provided in 1996. While not an issue at the risk-averse run-size forecast, the lack of commercial allocations and gross escapement targets did not allow Pacific Salmon Commission staff to provide recommendations for commercial fisheries in Canadian Panel Area waters if a TAC was identified.

B. Pre-season Regulations

The 1996 Regulations and Management Plan for the Panel Area were developed using the risk-averse run-size forecasts and the spawning escapement targets identified above. Also considered were DFO's forecasts of: 1) the proportion of the run (38%) anticipated to migrate through Johnstone Strait (Figure 3) and 2) expected 50% timing dates for Early Stuart (July 12) and Chilko (August 12) runs to the lower Fraser River. These timing dates were equivalent to July 7 and August 7, respectively, in Canadian Area 20 (mouth of Juan de Fuca Strait). A "50% timing date" is the date when 50% of a run has passed a given point on the migration route, and is usually close to the peak of the run. Expected timing curves for the major stock groups in Area 20 are shown in Figure 4.

Conservation and management concerns for other species and stocks were not provided by the Parties during the pre-season planning because commercial fisheries were not expected at the pre-season abundance forecasts.

On July 25, 1996, the Panel adopted regulations (Appendix B) for regulatory control of 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.

The Panel finalized the Management Plan for 1996 on July 25. No Canadian commercial or United States fisheries were specifically proposed for either country, except for United States Treaty Indian fisheries for "basic needs" in Areas 4B, 5 and 6C and Areas 6, 7 and 7A between July 30-August 10.

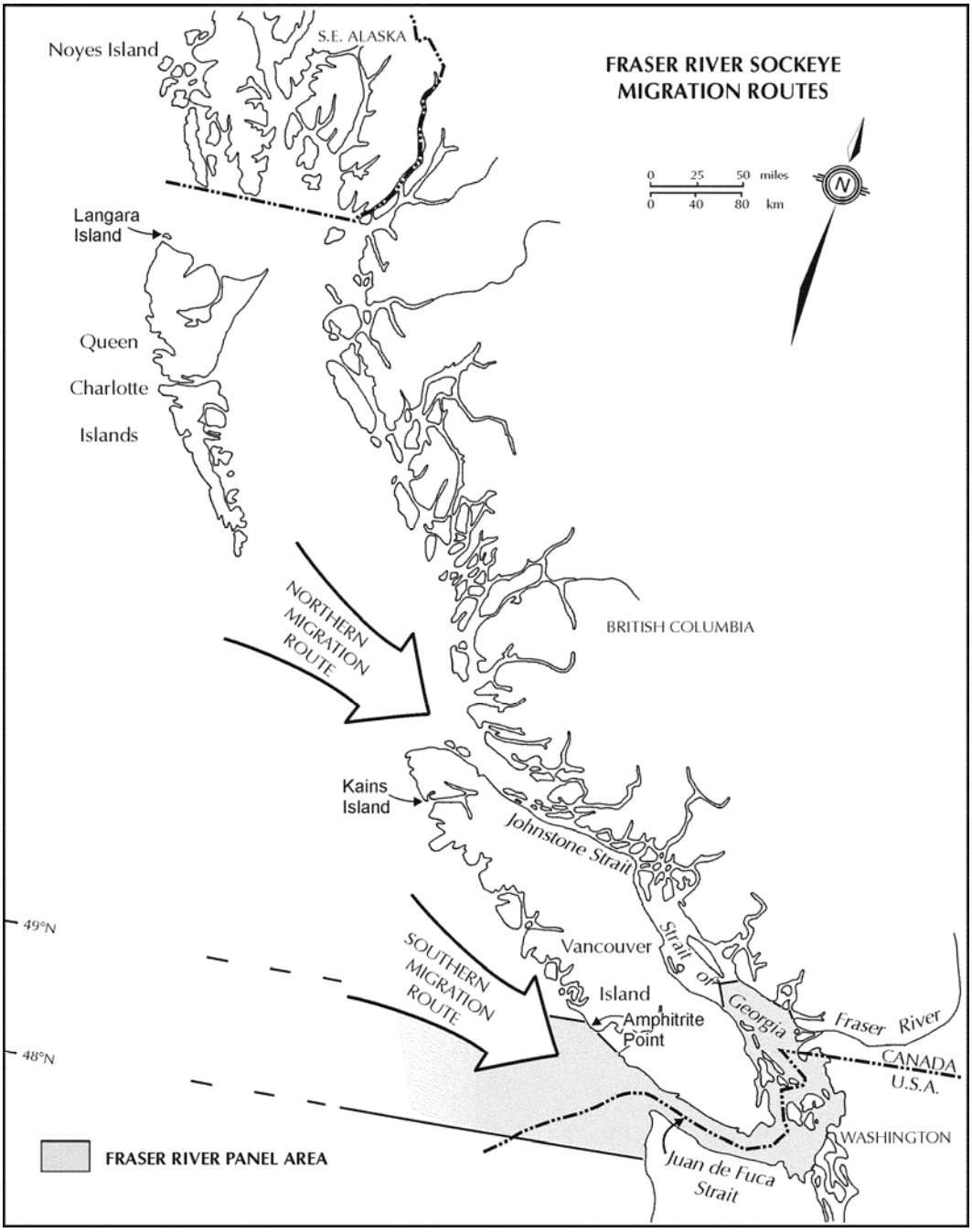

Figure 3. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye salmon migrating to the Fraser River.

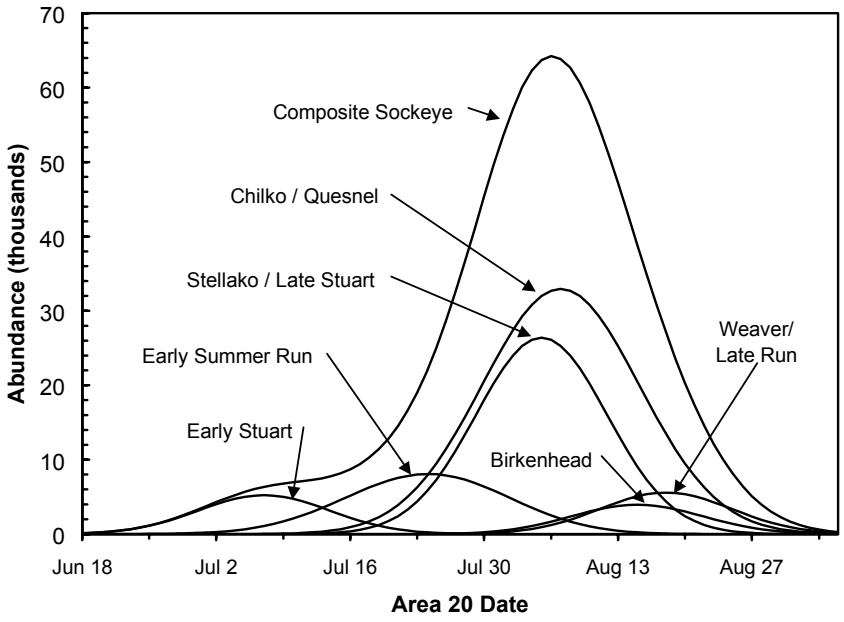

Figure 3. Expected daily abundance curves for migrating Fraser River sockeye salmon in 1996 (Area 20 date), based on DFO's pre-season forecasts of arrival timing and abundance.

C. In-season Regulations

Prior to the July 19 agreement between the Parties, the Fraser River Panel met six times in manager-to-manager meetings to brief the national sections on the status of Fraser River sockeye returns. After the agreement, the Panel conferred twenty times, either by telephone or in-person. The purpose of the meetings was to receive updates from PSC staff on the status of the runs, discuss management options and enact in-season orders (Appendix C) to regulate Panel Area fisheries. Panel meetings spanned the period from July 19 to September 25.

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

At the manager-to-manager meeting on July 16, Pacific Salmon Commission staff advised the Parties that the Early Stuart run size would be approximately 130,000 fish. Subsequently, at the Panel's first meeting on July 19, this estimate was confirmed. While this number was above Canada's pre-season spawning escapement target of 90,000, it was only marginally above Canada's stated objective of 120,000 spawners. Consequently, no directed fisheries on Early Stuart sockeye were considered.

During the week of July 21-27, there were no significant changes to stock status. The Early Stuart migration into the Fraser River was essentially complete and totalled approximately 120,000 fish. It was too early to update Early Summer-run abundance. On July 24, at a Fraser River Panel Technical Committee meeting, Canada presented revised spawning escapement targets: 66,000 Early Stuart (with an actual target of 115,000 if run size permitted); 227,000 Early Summer, 619,000 Summer and 159,000 Late-run spawners (with an actual target of 300,000 if run size permitted). These were operational numbers given the in-season estimate of 120,000 Early Stuart sockeye, and the pre-season run-size forecasts (DFO's July 8 update) of 233,000 Early Summer, 1,069,000 Summer and 164,000 Late-run sockeye. At an in-person meeting on July 25,

the Panel reviewed the 1996 agreements and adopted a management plan for the remainder of the fishing season.

Test fishing data indicated a strong flow of fish moving toward the Fraser River from both Juan de Fuca and Johnstone Straits, during the week of July 28-August 3. On July 30, the Panel approved a run-size increase for Early Summer-run stocks to 500,000 fish. This resulted in Canada raising the Early Summer-run spawning escapement target to 280,000 fish. Meanwhile, Early Summer-run proportions in Area 20 were rapidly declining. Also, PSC staff analyses suggested that Summer-run abundance could be significantly higher than the risk-averse pre-season forecast. Consequently, the Panel approved a Treaty Indian fishery in Areas 4B, 5 and 6C, with the proviso that the catch not exceed 10,000 sockeye. Later in the week, on August 2, the Panel adopted provisional run-size estimates of 600,000 Early Summer and 1,815,000 Summer-run fish, subject to confirmation that projected escapements materialized. To control the passage of fish into the Fraser River from Juan de Fuca Strait and for international allocation, the Panel scheduled a Treaty Indian net fishery in Areas 6, 7 and 7A for August 7, with the hours to be decided at a meeting to be held August 5. Pending further run-size assessments, a decision was delayed on an Area 29 gillnet fishery that was recommended by PSC staff to pace Summer-run escapements.

At the August 2 meeting, Canada presented the Panel with gross escapement targets by run (Table 2), thus allowing the Panel to calculate Canadian commercial TAC. The gross escapement targets included revised spawning escapement targets of 1,118,000 fish, projected Fraser River Indian catches of 494,000 fish and further additions, in the form of "escapement adjustments", that totalled 314,000 fish. The United States accepted the adjusted targets to allow Panel management activities to proceed, but did not agree with the methodology used to calculate the escapement adjustments or the resulting targets and TAC.

Table 2. Escapement targets and adjustments (provided by Canada on August 2), and expected run sizes and catches of Fraser River sockeye salmon in 1996. *

	River	Fraser	Spawning	Gross Escapement ***			
	& Ocean	Indian	Escapement		Adjust	Adjusted	Total
Run	Catch **	Catch	Target	Target	-ment	Target	Run
Early Stuart	5,000	2,000	66,000	68,000	47,000	115,000	120,000
Early Summer	97,000	67,000	280,000	347,000	156,000	503,000	600,000
Summer	660,000	425,000	619,000	1,044,000	111,000	1,155,000	1,815,000
Late	11,000	0	153,000	153,000	0	153,000	164,000
Total Adults	773,000	494,000	1,118,000	1,612,000	314,000	1,926,000	2,699,000

* Early Chilko included with Early Summer runs.

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

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

On August 5, the Panel adopted a Summer-run abundance of 1,815,000 fish for management purposes and approved a Treaty Indian fishery in Areas 4B, 5 and 6C for United States domestic allocation purposes. In addition, the Panel set the duration of the previously approved Treaty Indian fishery in Areas 6, 7 and 7A to 16 hours. For international allocation and to obtain escapement proportional to abundance of Summer-run stocks, the Panel approved a gillnet fishery in Area 29 on August 7. Also, for domestic allocation purposes, the Panel approved a two-day troll fishery in Area 18-4.

By the August 9 Panel meeting, comparisons of test fishing CPUE's in Areas 12 and 20 with Mission escapements indicated there could be up to 400,000 Summer-run fish delaying in the Strait of Georgia. This delay made it difficult to assess run size, particularly in the absence of Juan de Fuca and Johnstone Straits commercial net fisheries. Due to the uncertain run strength of

Summer-run stocks, PSC staff recommended that no commercial fishing proceed until more precise estimates were available.

During the week of August 11-17, the Panel met five times. By the August 11 meeting, the Summer-run fish delaying in the Strait of Georgia had begun to migrate into the Fraser River. It seemed likely that the run size of Early Summer and Summer-run stocks would exceed the current estimates of 600,000 and 1,815,000, respectively, and that Late-run abundances would reach or exceed 600,000 fish. Based on PSC staff's recommendation, the Panel adopted a run-size estimate of 600,000 Late-run fish. However, Canada stipulated that the run-size increase be accompanied by the addition of an adjustment of 100,000 fish to the gross escapement target, to ensure adequate escapements of Birkenhead sockeye. Therefore, the Late-run spawning escapement target was increased to 300,000 and the gross escapement target, including the 100,000 fish escapement adjustment, was increased to 400,000 fish. The Panel also approved Treaty Indian fisheries in Areas 4B, 5 and 6C and in Areas 6, 7 and 7A (with the East Point Light Line in effect to protect against the harvest of delaying sockeye), to achieve international allocation goals.

On August 12, the Panel approved an increase in Summer-run abundance to 2,000,000 fish, bringing the total estimated Fraser sockeye return to 3,320,000 fish. The Panel approved the following fisheries in Canada: an Area 29 gillnet fishery to harvest Summer-run fish in excess of gross escapement requirements, an Area 20 purse seine fishery for international and domestic allocation purposes, and an Area 18-4 troll fishery for domestic allocation purposes. The Panel also extended the Treaty Indian fishery in Areas 4B, 5 and 6C for domestic allocation purposes.

On August 14, the Panel approved a run-size increase to 4,220,000 Fraser sockeye, including 700,000 Early Summer, 2,600,000 Summer and 800,000 Late-run sockeye. In response, Canada increased the Summer-run spawning escapement target to 780,000 fish. The primary focus of fishery recommendations this week was the harvest of Summer-run fish surplus to gross escapement requirements. Thus, Area 29 was opened to obtain proportional Summer-run escapements, but also for international allocation purposes. Staff informed the Panel that most of the remaining Canadian harvest of Summer-run fish would have to occur in Area 29, because most of the run was in inside waters. The Panel approved an Area 20 purse seine fishery to harvest Summer-run fish still in the area. In Washington, the Treaty Indian fishery in Areas 4B, 5 and 6C was extended for domestic allocation purposes. Also, the Panel approved a Non-Indian fishery in Areas 7 and 7A, to harvest available Summer-run fish and to achieve international and domestic allocation goals. The East Point Light Line was in place for the Area 7A fishery to prevent the harvest of delaying Late-run sockeye.

On August 16, the Panel approved an increased Summer-run estimate of 2,800,000 fish, bringing the total sockeye return to 4,420,000 fish. Canada presented the Panel with updated gross escapement targets as follows: Early Stuart and Early Summer-run targets were unchanged at 114,000 and 503,000 fish, but targets for Summer and Late-run stocks were increased to 1,607,000 and 482,000 fish, respectively. With the exception of the Summer-run spawning escapement target, which Canada increased to 840,000 fish, spawning escapement targets remained unchanged. Canada stated that all remaining Summer-run fish in the Canadian TAC were required for gross escapement to satisfy First Nations harvest requirements. For domestic allocation purposes in the respective countries, the Panel extended the Treaty Indian fishery in Areas 4B, 5 and 6C and the troll fishery in Canadian Area 18-4. On August 19, the United States transferred 17,000 fish from the Treaty Indian to the Non-Indian share.

During the week of August 18-24, the Panel met three times. At the August 19 meeting, the Panel approved a Non-Indian fishery in Areas 7 and 7A (with the Iwersen's Dock Line in effect to prevent the harvest of delaying Late-run sockeye) for the purposes of international and domestic allocation. The abundance of both Summer and Late-run sockeye migrating through Juan de Fuca Strait declined rapidly through the week. This resulted in very poor catches in United States fisheries. At the August 23 meeting, the estimated run size for Early Summer-run sockeye was

increased to 720,000 fish (based on accounting assessments) and for Summer-run sockeye was decreased to 2,700,000 fish (based on accounting and incoming migration assessments). The updated Summer-run return resulted in a reduced spawning escapement goal of 810,000 fish. Canada announced they would give priority over the following two weeks to maximizing gross escapements of Birkenhead sockeye, and would consider harvesting Weaver Creek sockeye after the upstream migration of Birkenhead sockeye was complete. The United States objected to this decision because in-river AFS fisheries that would catch these stocks were proceeding in Canada, and because there was international TAC available for Late-run stocks. The Panel agreed to relinquish regulatory control, effective August 25, in Area 20 and Areas 4B, 5 and 6C.

On August 27, the Panel approved a run-size decrease to 2,650,000 Summer-run sockeye. In response, Canada decreased the spawning escapement goal to 795,000 fish. Canada followed up at the August 30 Panel meeting with a reduction in the gross escapement target to 1,564,000 Summer runs. Canada also announced a 50,000 fish reduction in the Late-run gross escapement target to 432,000 fish, citing limited opportunities to harvest Late-run stocks in-river because of conservation concerns for Birkenhead sockeye. The United States had 34,000 sockeye remaining in their total allocation. Because there was Late-run TAC remaining and because purse seine test fishing indicated that fish were available, the Panel approved a Non-Indian fishery in Area 7A for August 28, with the proviso that the fishery be closely monitored and closed on short notice if the remaining Washington share was harvested.

On September 4, the Panel relinquished regulatory control of Areas 6, 7 and 7A, southerly and easterly of the East Point Roberts to East Point Light Line on September 7, as scheduled. The following week, on September 11, the Panel relinquished regulatory control of the balance of Area 7A (westerly and northerly of the East Point Roberts to East Point Light Line), and of Canadian Areas 17, 18 and 29-5 effective September 15. A decision on a PSC staff recommendation to increase the Late-run run-size estimate from 800,000 to 900,000 fish was not reached.

Specific dates for fisheries were not proposed in the management plan. Actual fishing times in major net fisheries are shown in Table 3 for Canadian areas and Table 4 for Washington areas. Fishing in Washington areas was less than usual, due to the small United States share. Treaty Indian fisheries in Areas 4B, 5 and 6C were the most extensive, although fishing time was also well below average.

Table 3. Actual fishing times (days) in major Canadian net fisheries in the Fraser River Panel Area in 1996.

	Area 20			Area 29	
Date	Purse Seine		Gillnet	Gillnet	
Jul.28-Aug.3	Closed		Closed	Closed	
Aug.4-Aug.10	Closed		Closed	1	*
Aug.11-Aug.17	2	*	Closed	2	**
Aug.18-Aug.24	Closed		Closed	Closed	
Aug.25-Aug.31	Relinq.		Relinq.	Closed	
Sep.1-Sep.7				Closed	
Sep.8-Sep.14				Closed	
Sep.15-Sep.21				Closed	
Sep.22-Sep.28				Closed	
Sep.29-Oct.5				Closed	
Oct.6-Oct.12				Closed	
Oct.13-Oct.19				Relinq.	
Total	2		0	3	

* Fishing times are measured in 12-hour days.
** Fishing times are measured in 24-hour days.

Table 4. Actual fishing times (hours*) in major United States net fisheries in the Fraser River Panel Area in 1996.

	Treaty Indian Areas		Non-Indian Areas 7 and 7A		
Date	4B, 5, 6C	6, 7, 7A	Purse Seine	Gillnet	Reefnet
Jul.21-Jul.27	Closed	Closed	Closed	Closed	Closed
Jul.28-Aug.3	48	Closed	Closed	Closed	Closed
Aug.4-Aug.10	24	16	Closed	Closed	Closed
Aug.11-Aug.17	151	28	4	4	Closed
Aug.18-Aug.24	132	Closed	12	12	Closed
Aug.25-Aug.31	Relinq.	Closed	12	12	Closed
Sep.1-Sep.7		Closed	Closed	Closed	Closed
Sep.8-Sep.14		Closed	Closed	Closed	Closed
Sep.15-Sep.21		Relinq.	Relinq.	Relinq.	Relinq.
Total	355	44	28	28	0

* Times rounded to nearest hour

V. CATCH SUMMARY

Catches of Fraser River sockeye salmon in all fisheries totalled 2,187,000 fish (Table 5). Canadian catches amounted to 1,802,000 sockeye. United States fishers caught 270,000 in Washington waters and 36,000 in Alaska. Catches in test fisheries authorized by the Fraser River Panel totalled 79,000 sockeye. Spawning escapements totalled 2,091,000 sockeye salmon. An additional 241,000 Weaver sockeye are unaccounted for in catch or spawning escapement. The majority of these fish died unspawned near the mouth of Weaver Creek.

The gross landed value of the commercial catch was approximately $15,400,000 (Can), with a weight of approximately 3,500,000 kg (7,700,000 lb).

Mean body weights in Area 20 purse seine catches are usually reported in this section of the Annual Report. In 1996, however, the single purse seine fishery in Area 20 occurred late in the season and harvested relatively few fish, making the mean weight from this fishery unrepresentative of the entire run. Instead, an average weight for Fraser sockeye (all ages) caught in commercial purse seine fisheries in Areas 12, 13, and 20 and Area 20 purse seine test fishing is presented: 2.99 kg (6.59 lb). This composite mean is larger than the mean weight (all ages) for Area 20 purse seine catches for the preceding four cycle years (1980-1992) (2.65 kg, 5.84 lb), and is the largest on any cycle since 1988. Large four-year-old Late-run sockeye (Weaver and Birkenhead) predominated in the commercial purse seine catches and influenced the average. Fraser River gillnet fishery catches which were primarily Summer-run sockeye averaged 2.86 kg (6.30 lb). Five-year-old fish from the 1991 brood contributed approximately 10% of the 1996 return.

Table 5. Preliminary estimates of fishery catches and total run of Fraser River sockeye salmon during the 1996 fishing season, by country and area.

		Number of Fish	% of Run
CANADA			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 121-124 Troll	*	1,000	
Area 20 Net		69,000	
Areas 17-18 and 29 Troll		4,000	
Area 29 Net		708,000	
Total		782,000	17.3%
Non-Panel Areas			
Areas 1-10 Troll and Net		0	
Areas 11-16 Troll and Net		173,000	
Areas 124-127 Troll	*	0	
Total		173,000	3.8%
Commercial Total		955,000	21.1%
FIRST NATIONS CATCH			
Marine Areas			
Areas 12-16, 18, 20, and 123-126		60,000	
Area 29-1 to 7		16,000	
Total		76,000	1.7%
Fraser River			
Below Sawmill Creek		462,000	
Above Sawmill Creek		216,000	
Total		678,000	15.0%
First Nations Total		754,000	16.7%
NON-COMMERCIAL CATCH			
ESSR Fishery	**	78,000	
Recreational Fishery		15,000	0.3%
Non-Commercial Total		93,000	2.1%
CANADIAN TOTAL		1,802,000	39.9%
UNITED STATES			
COMMERCIAL CATCH			
Fraser River Panel Area			
Areas 4B, 5 and 6C Net		30,000	
Areas 6 and 7 Net		95,000	
Area 7A Net		132,000	
Total		257,000	5.7%
Non-Panel Areas			
Alaska Net		36,000	0.8%
Commercial Total		293,000	6.5%
NON-COMMERCIAL CATCH			
Gear Modification Study		13,000	0.3%
UNITED STATES TOTAL		306,000	6.8%
TEST FISHING			
COMMISSION			
Areas 123-127, 20 and 29 Test Fishing		67,000	
Areas 7 and 7A Test Fishing		4,000	
Commission Total		71,000	1.6%
CANADA			
Area 12 Test Fishing		8,000	0.2%
TEST FISHING TOTAL		79,000	1.7%
TOTAL CATCH		2,187,000	48.4%
SPAWNING ESCAPEMENT		2,091,000	46.3%
DIFFERENCE BETWEEN ESTIMATES (WEAVER CREEK)	***	241,000	5.3%
TOTAL RUN		4,519,000	100.0%

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

** Terminal catch of Weaver sockeye taken under contract from Excess Salmon to Spawning Requirements.

*** Mission hydroacoustic estimate less reported First Nations fishery catch, ESSR fishery catch, misc. terminal area removals and spawning escapement.

A. Canada

Canada caught a total of 1,802,000 Fraser River sockeye salmon (Table 5) in commercial, First Nations and non-commercial fisheries. The commercial catch was 955,000 fish, 782,000 in Panel Areas and 173,000 in non-Panel Areas. The large majority of catches occurred in and near the Fraser River (Area 29), followed by Johnstone Strait (Areas 11-16). The proportion of the Canadian catch that occurred in Area 29 (74%) was the largest since 1968 (94%). Gillnets took the largest share (83.4%) of the total commercial catch, followed by purse seines (12.8%), inside trollers (3.7%) and outside trollers (0.1%) (Table 6). Weekly catches in Canadian fishing areas are shown in Appendix D (Tables 1-4).

First Nations catches totalled 754,000 sockeye, with 76,000 fish caught in non-Fraser fisheries and 678,000 in Fraser Indian fisheries (Table 5). Most of the Fraser Indian catch (462,000 fish) was taken below Sawmill Creek, with 216,000 harvested upriver of this location (Appendix D: Table 5). The proportion of the total run harvested by First Nations fishers was 16.7%.

Canadian non-commercial catches totalled 93,000 fish, including 15,000 sockeye in recreational fisheries and 78,000 Weaver Creek sockeye in an Excess Salmon to Spawning Requirements (ESSR) fishery (Table 5).

Table 6. Preliminary estimates of Canadian commercial catches* of Fraser River sockeye salmon by gear type and area during the 1996 fishing season.

Areas	Purse Seine		Gillnet			Troll			Total
	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	
1-10	0		0			0			0
11-16		53,000		89,000	0		0	31,000	173,000
121-127		0		0			1,000		1,000
20		69,000			0		0		69,000
17, 18, 29		0			708,000			4,000	712,000
Total Catch	0	122,000	0	89,000	708,000	0	1,000	35,000	955,000
% of Catch	0.0%	12.8%	0.0%	9.3%	74.1%	0.0%	0.1%	3.7%	100.0%

*Catch data from DFO preliminary catch statistics.

B. United States

The United States caught 306,000 Fraser River sockeye salmon in 1996, 257,000 in Panel Area commercial fisheries, 13,000 in Gear Modification Study test fisheries and 36,000 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 30,000 fish in Areas 4B, 5 and 6C and 194,000 fish in Areas 6, 7 and 7A for a total of 224,000 Fraser sockeye (Table 7). Non-Indian catches were 25,000 fish in purse seines and 8,000 in gillnets, for a total of 33,000 fish. Reef nets did not fish in 1996. Weekly catches of Fraser River sockeye salmon in United States Panel Areas are shown in Table 5 of Appendix D.

Table 7. Preliminary estimates of United States commercial catches* of Fraser River sockeye salmon by user group, gear type and area during the 1996 fishing season.

Areas	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian				
4B, 5 and 6C	0	30,000	0	30,000
6 and 7	60,000	29,000	0	89,000
7A	40,000	65,000	0	105,000
6, 7 and 7A Total	100,000	94,000	0	194,000
% of Catch	51.5%	48.5%	0.0%	100.0%
Total Catch	100,000	124,000	0	224,000
% of Catch	44.6%	55.4%	0.0%	100.0%
Non-Indian				
7	5,000	1,000	0	6,000
7A	20,000	7,000	0	27,000
Total Catch	25,000	8,000	0	33,000
% of Catch	75.8%	24.2%	0.0%	100.0%
United States				
Panel Area Total	125,000	132,000	0	257,000
Alaska (District 104) Catch				36,000
Total Catch				293,000

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

The total return of 4,519,000 Fraser River sockeye salmon (Table 5) was almost three times as large as the pre-season risk-averse forecast of 1,560,000 fish. The total run in 1996 was similar to the recent year average return on the catch (1972-92; 4,552,000) (Table 8). However, the commercial exploitation rate (28%) was the lowest on record, resulting in the smallest commercial catch (1,221,000 fish) since 1964. The total harvest rate (48%) was similarly the lowest on record. Consequently, the spawning escapement comprised the highest percentage of the run on record (46%).

Table 8. Comparison of recent Fraser River sockeye salmon run sizes, harvests and escapements on the 1996 cycle.

		Commercial Catch		Total Catch		Spawning Escapement	
Year	Total Run	#	%	#	%	#	%
1972	3,708,000	2,743,000	74.0%	2,878,000	77.6%	830,000	22.4%
1976	4,341,000	3,284,000	75.7%	3,517,000	81.0%	823,000	19.0%
1980	3,133,000	2,069,000	66.0%	2,285,000	72.9%	848,000	27.1%
1984	5,919,000	4,572,000	77.2%	4,988,000	84.3%	932,000	15.7%
1988	3,774,000	1,868,000	49.5%	2,355,000	62.4%	1,418,000	37.6%
1992	6,442,000	4,164,000	64.6%	4,925,000	76.5%	1,120,000	17.4%
1996	4,519,000	1,248,000	27.6%	2,187,000	48.4%	2,091,000	46.3%

VI. STOCK MONITORING

A. Methods

The purpose of the stock monitoring program is to assess run size, daily abundance, timing and diversion rate of Fraser River sockeye salmon at different points along their migration route during the fishing season. These data are required for developing fishing plans to attain annual escapement and catch allocation objectives. Commercial catches usually provide much of the data used in the analyses. In addition, test fisheries (Table 9) 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. Run-size estimation models based on commercial catch data from fisheries near the peak of the runs could not be used in 1996 since data were not available. Information about the upstream migration of Fraser sockeye in the river was obtained via a hydroacoustic program at Mission. Test fisheries and the Mission hydroacoustic program were particularly important for gathering data in 1996, due to the lack of commercial net fisheries in Juan de Fuca and Johnstone Straits.

Table 9. Test fishing operations that were approved by the Fraser River Panel for the 1996 fishing season.

Area	Gear	Dates	Operated by
Canadian Panel Areas			
20	Purse Seine	August 5 - August 18	PSC
20	Gillnet	June 20 - August 20	PSC
29-13	Gillnet	July 4 - September 17	PSC
29-16	Gillnet	June 24 - September 23	PSC
29-1 to 6	Troll	August 10 - September 9	PSC
Canadian non-Panel Areas			
12	Gillnet	July 16 - August 12	DFO
12	Purse Seine	July 23 - August 22	DFO
United States Panel Areas			
7	Gillnet	July 25 - August 18	PSC
7	Purse Seine	August 26	PSC

An echo-sounder was operated at Mission from June 27-September 18 to estimate the daily upstream passage of salmon. Species and stock composition of the daily passage was estimated from catches in the gillnet test fishery at Whonnock (Area 29-16). In addition, the second year of an experimental split-beam echosounding program was jointly conducted by PSC and DFO at the Mission site.

Daily visual observations at Hells Gate between July 13-August 30 supplied information on the success of upstream fish passage through the Fraser Canyon.

Run-size estimation for Fraser River sockeye salmon by stock group is based primarily on catch, effort, racial composition and diversion rate data, which are analyzed using purse seine catch, cumulative-normal and cumulative-passage-to-date models. These models are described in

the Pacific Salmon Commission's Technical Report No. 6[3] and in the Fraser River Panel's 1995 Annual Report[4].

Canadian commercial fisheries were not anticipated in the pre-season plan, because the Canadian TAC was zero at the risk-averse pre-season forecast. The resulting lack of commercial purse seine fisheries in Juan de Fuca and Johnstone Straits severely constrained in-season estimation of run size by commercial fishery models. Test fisheries in Areas 12 and 20 in 1996 were redesigned in an attempt to replace this commercial fishery information. However, catch data from one or two test fishing boats are inherently more variable than data from fleets of up to several hundred vessels. Thus, when test fishing data are used to generate run-size estimates there is a high degree of uncertainty in the results. Consequently, for Summer runs there was considerable reliance on Mission echosounding estimates of upstream passage, which delayed run-size estimation and management decisions approximately one week compared to past years. Further delays in making run-size estimates and management decisions in 1996 were caused by the three to five day delay of migrating Summer-run sockeye in the Strait of Georgia.

Particular problems were encountered with estimating Late-run abundance. Because Late-run sockeye delay in the Strait of Georgia for several days to several weeks, estimates of escapement through the lower Fraser usually occur too late to be useful for making in-season management decisions for these stocks. Thus, data from commercial purse seine fisheries in Juan de Fuca and Johnstone Straits have proven to be the most accurate way to measure the abundance of these stocks. In the absence of these commercial fisheries in 1996, daily abundance of Late-run sockeye in migratory areas were determined from gillnet and purse seine test fisheries. CPUE's of Late-run sockeye in gillnet test fisheries were multiplied by historical expansion lines to estimate daily abundance. Attempts were made to verify these Late-run estimates by comparing the proportion of Summer-run sockeye in the purse seine test fisheries with estimates of Summer-run passage in the Fraser River. However, the delay of Summer-run fish in the Strait of Georgia seriously confounded this effort.

B. In-Season Run-Size Estimates

The first Fraser River sockeye stock to arrive in coastal waters was the Early Stuart run. Analyses in early July indicated the run was slightly later than normal (July 3 in Area 20), and was probably larger than the pre-season risk-averse forecast of 90,000 fish but smaller than the point estimate of 154,000 fish. By July 12, the range of estimates was 87,000-190,000 with the most likely estimates in the 106,000-124,000 fish range. The estimated 50% timing date of the run in Area 20 was July 5. At the time, there were concerns that relatively high discharge levels in the Fraser River would cause migration difficulties for sockeye. By July 16, the estimated run size was 130,000 fish with a peak abundance in the lower river of July 12 (July 7 in Area 20). On July 23, the run size estimate decreased to 120,000 fish.

Later in July and early August, the focus was on Early Summer-run stocks. In late July, large test fishing catches in Areas 12 and 20 and in the lower Fraser River indicated a larger return than the revised risk-averse forecast of 233,000 fish. In particular, the early timed segment of the group, including Nadina and Gates stocks, appeared to be returning well above forecast levels. By July 30, run size was estimated at 500,000 Early Summer fish (range 440,000-750,000 fish) and the 50% date in Area 20 was estimated to be July 24. With the subsequent surge in Summer-run abundance, an accounting approach (catch plus escapement at Mission) was adopted to estimate

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

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

Early Summer abundance until the end of the season. Final in-season estimates of Early Summer-run abundance and gross escapement were 720,000 and 644,000 fish, respectively.

Strong test fishing catches in Areas 12 and 20 during the last week of July indicated Summer-run returns would be larger than forecast. On August 2, the Panel provisionally increased Summer-run abundance from the pre-season risk-averse forecast of 1,069,000 fish to the pre-season point estimate (i.e., equal probability of being high or low) of 1,815,000 fish, to allow planning for limited fisheries. These plans were finalized on August 5 with the adoption of the 1,815,000 fish estimate for management purposes. However, projected escapements did not enter the river during the week of August 4-10, prompting concerns either that the high test fishing catches in Areas 12 and 20 were due to high gear efficiency or that migration delay had occurred in the Strait of Georgia. The delay hypothesis was subsequently confirmed when large numbers of Summer-run sockeye passed Mission during August 9-13. The estimated run size was increased to 2,600,000 fish on August 14, with individual estimates ranging from 2,600,000-3,500,000 fish. This estimate was subsequently increased to 2,800,000 on August 16, based on expectations of the run yet to come, but then decreased to 2,700,000 on August 23 as the run was nearing completion of its migration up-river. The 50% date for the run in Area 20 was August 6, about three days later than average. The final in-season estimate of Summer-run sockeye return was 2,654,000 fish with a gross escapement of 1,580,000 fish into the river.

Assessments of Late-run abundance began on August 11, when a test fishing based estimate of 600,000 fish was adopted. On August 14, the run size was conservatively increased to 800,000 sockeye. On August 15, using data from commercial purse seine fisheries in Areas 12, 13 and 20, estimates ranged between 760,000-880,000 Late-run sockeye. This range dropped to 725,000-840,000 on August 19. These estimates supported the 800,000 fish estimate, which remained unchanged for the balance of the season. As of August 23, there was an estimated Late-run TAC of 318,000 and catch of 289,000, leaving only 29,000 fish remaining to be caught. However, any possibility of limited fishing on Late-run sockeye in the Strait of Georgia was precluded by record early timing of the upstream migration of Weaver sockeye. Over 50% of Weaver sockeye migrated past Mission by September 7, three to four weeks earlier than usual. The last in-season estimate of total Late-run returns, including Birkenhead sockeye, was 838,000 fish with a gross escapement of 534,000. The 50% date in Area 20 for Late runs was August 8, several days earlier than usual.

Early indications were of a low Johnstone Strait diversion rate. Based on comparisons of CPUE data from Area 12 and Area 20 gillnet test fishing, the diversion rate then increased to 45% during the last week of July, and to over 50% during the first week of August. This rate moderated during the second week of August, dropping below 30%. The estimate of Johnstone Strait diversion for the season based on test fishing indices of abundance was approximately 35% compared to the forecast of 38%. Greater uncertainty in the diversion rate estimate existed in 1996 because of the dependence on test fishing catches rather than on commercial fishery data.

Cottonwood test fishing CPUE's are plotted with daily hydroacoustic estimates of sockeye passage at Mission in Figure 5. 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 datasets are similar and are consistent with patterns in previous years. Test fishing catch rates declined relative to Mission estimates after mid-August due to removal of fish from the net by seals.

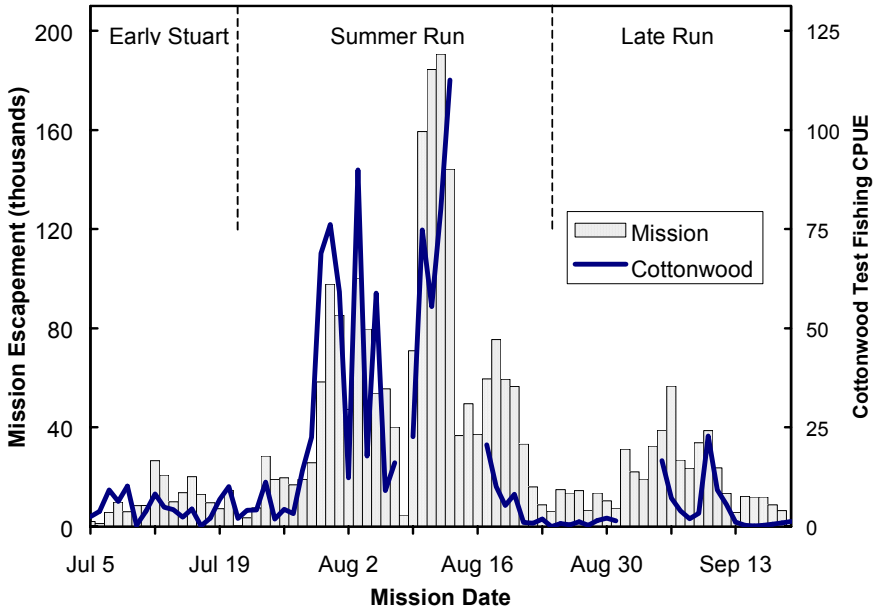

Figure 4. Daily escapements of sockeye salmon estimated at Mission by echosounding compared with prior-day test fishing CPUE at Cottonwood during 1996.

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

C. Split-Beam Hydroacoustic Study at Mission

As a result of recommendations by the Mission Hydroacoustic Facility Working Group of the Fraser River Sockeye Public Review Board in 1994, a joint PSC and DFO program that employed a side-scanning split-beam echosounder at the Mission hydroacoustic site was conducted in 1995 and 1996. The objective of the program was to examine assumptions regarding salmon behaviour and distribution that are implicit to the standard (single-beam) echosounding method used to estimate escapement past Mission[5]. 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 survey vessel transects the river; and
- Changes in salmon distribution with time-of-day and tidal stage.

Whereas the 1995 split-beam work focused on developing the tools and practices necessary to address the objectives, the 1996 work concentrated on both developing the techniques further and measuring the variables in question. Some of the advances made in 1996 include:

- Installation of Global Positioning System (GPS) equipment on the echosounding boat and digitally taping data from the standard (single-beam) program (in addition to hardcopy chart data normally collected). This allowed split-beam and standard echosounding data to be synchronized and analyzed later, which permitted: 1) comparison of fish abundances detected

[5] 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.

by the two technologies and 2) testing for fish avoidance of the transecting vessel during the standard echosounding program;
- Automated vertical split-beam echosounder scanning of the water column with a narrow-beam transducer, to quantify vertical fish distributions; and
- Twenty-four hour automated split-beam scanning, to allow full-day comparisons of split-beam and standard echosounding data.

In addition, split-beam experiments were conducted to:
- Measure detection probabilities of fish as a function of range from the transducer, which is an important aspect of estimating fish abundances at far ranges; and
- Test an ultra-narrow-beam transducer, with possible implications for estimating fish abundance across the entire river from a shore-based system.

With respect to the standard echosounding program, the GPS data allowed the actual path and speed of the boat during transects to be quantified and the specific location of fish across the river to be identified. Also, to analyze the digital data from the standard program, sophisticated software was developed to interactively select targets, automatically track targets and generate statistics on fish velocity, direction of movement and distribution.

Although analyses of the 1996 data are not complete, preliminary findings of the study are:
- More than 95% of detected fish were migrating upstream. Very few salmon-sized targets were detected moving downstream and most of these were detected near the surface, suggesting that these targets were mainly debris;
- Most upstream swimming fish followed trajectories parallel to the river bank;
- Upstream swimming speed ranged from 0.5 to 0.8 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 few fish near the river surface and bottom, making detection of individual fish possible; and
- Similar patterns of relative abundance were observed by the split-beam and standard echosounding programs.

VII. RACIAL IDENTIFICATION

PSC staff conduct programs designed to identify the stock proportions of Fraser River sockeye salmon in commercial and test fishing catches. These data provide information on the abundance and timing of these stocks as they migrate to the Fraser River. Racial data are also used to account for all catches of Fraser River sockeye salmon in coastal waters, and to apportion estimates of daily sockeye escapement past Mission into discrete stock groups. The methods used to perform racial analyses in 1996 were similar to past years[6],[7].

Analyses of scale samples from commercial and test fishing catches were performed daily, beginning in late June and continuing through mid September. Commission staff sampled commercial sockeye landings at Bellingham and Blaine, Washington, and Vancouver, Steveston and Port Renfrew, B.C.; Alaska Department of Fish and Game (ADF&G) collected samples from the District 104 net fishery at Petersburg and Ketchikan, Alaska; and DFO provided samples from commercial catches at Port Hardy and Prince Rupert, B.C., and from Fraser River First Nations

[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.

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

fisheries near Chilliwack, Yale, Lytton and Bridge River. Although requested, scales were not obtained from the Williams Lake and Prince George areas.

A. Analyses

In 1996, the dominant stocks were Early Stuart, Gates, Chilko, Stellako, Birkenhead, and Weaver. These stocks, in combination with other numerically smaller stocks, were pooled to form eight unique stock groups that had similar scale characteristics and run timing (Table 10). For most of the commercial fishing period in 1996, the eight stock groups were incorporated into two categories of in-season models: 1) models with Early Summer and Summer-run stock complexes and 2) models with Summer and Late-run stock complexes.

Table 10. Individual stocks comprising the stock groups used for age 4_2 sockeye in 1996.

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

Discriminant Function Analysis (DFA) classification matrices from standards developed pre-season predicted that most key stock groups would be well distinguished from each other by use of the (DFA) models. However, some problems were anticipated. The first problem concerned the separation of Chilko River sockeye (a Summer-run stock) from south-end Chilko Lake sockeye (an Early Summer-run stock). These stocks are assigned to different timing groups because south-end Chilko Lake (called Early Chilko) sockeye are generally one to two weeks earlier in peak timing than Chilko River sockeye. Scales from age 3_2 spawners in 1995 indicated the circuli count to the first freshwater annulus for Early Chilko sockeye averaged about one circuli less than for Chilko River sockeye. However, DFA models constructed with separate baseline standards for these stocks showed very poor classification accuracy: 60% for Early Chilko and 45% for Chilko River, with a substantial proportion of the misclassifications occurring between these stocks. Consequently, Early Chilko proportions were estimated from DFA model results only through August 1, which was the apparent peak of this stock at Mission. After this date, Early Chilko proportions were indirectly estimated by assuming the run was normally distributed about the peak migration day.

The second problem area with in-season DFA models in 1996 were misclassifications between Nadina/Gates (Early Summer-run) and Late Stuart/Stellako (Summer-run) groups (14-19%). However, because Late Stuart/Stellako sockeye average about three centimetres smaller than Gates sockeye, length data was used to help distinguish these stock groups. Matched scale and length data collected from PSC test fisheries were used to construct bivariate frequency plots of circuli count to the first freshwater annulus against post-orbital fork length. In the area of overlap between the circuli counts of Nadina/Gates and Late Stuart/Stellako stock groups, the length distribution was bimodal. Thus, during the period when Early Summer and Summer-run migrations overlapped, fish in the larger mode of the length distribution were apportioned to the Gates stock. This stock was the dominant stock in the Nadina/Gates group and was one of the largest in the Fraser watershed in 1996.

A similar technique was used to reduce misclassifications between Late Stuart/Stellako and Weaver stock groups later in the season. In this case, fish in the larger mode of the length distribution were apportioned to the Weaver group during the period of Summer and Late-run overlap.

Post-season racial analyses were performed using baseline standards derived from the 1996 spawning ground scale samples. The major component stocks in each stock group were the same as for the in-season analyses (Table 10) except: 1) Fennell/Bowron and Scotch/Seymour stock groups were combined and 2) south end Chilko Lake, Chilko River and Quesnel stock groups were combined. Post-season models had higher classification accuracies than in-season models for all stock groups during the Early Summer and Summer-run time period. During the Summer and Late-run period, however, the classification accuracies for Chilko/Quesnel and Birkenhead stock groups were lower for the post-season models. Shifts in scale characteristics between pre-season and post-season standards resulted in reduced estimates of Fennell/Bowron, Nadina/Gates, Chilko/Quesnel, and Birkenhead contributions, but increased estimates of Early Stuart, Late Stuart/Stellako and Weaver contributions.

B. Estimates of Escapement and Production by Stock

Estimates of escapement by stock group obtained in-season were compared to estimates using post-season standards (Table 11). The largest shifts in estimates were between the Chilko/Quesnel and the Late Stuart/Stellako stock groups and in the Weaver/Portage stock group. However, the largest percentage change in a major group was only 19% (Fennell/Bowron/Seymour).

Table 11. Comparison of in-season to post-season estimates of Fraser River sockeye salmon gross escapement (at Mission) by stock group, 1996.

Stock Group	In-season Estimate	Post-season Estimate
Early Stuart	114,000	131,000
Fennell/Bowron/Seymour	137,000	111,000
Nadina/Gates	346,000	330,000
Chilko/Quesnel	976,000	882,000
Late Stuart/Stellako	577,000	670,000
Birkenhead/Adams/Cultus	113,000	108,000
Weaver/Portage	390,000	432,000
Harrison/Widgeon	25,000	15,000

Returns of Early Stuart sockeye totalled approximately 94,000 adults (Table 12), compared to the pre-season risk-averse forecast of 90,000 fish. Recorded catches of this stock were 5,000 in test fisheries, while spawning escapements were 88,000 adults. The adult exploitation rate for all catch areas was 7%.

Early Summer-run returns, excluding Early Chilko sockeye, totalled 491,000 adults, almost three times the pre-season risk-averse forecast (172,000 fish). Catches totalled 131,000 adults while spawners totalled 360,000 fish. The exploitation rate on Early Summer stocks was 30%.

Total Summer-run production, including Early Chilko sockeye, was 3,028,000 adults, 2.8 times the pre-season risk-averse forecast of 1,069,000 fish. Chilko and Quesnel sockeye dominated the production of Summer-run sockeye with a combined return of 2,082,000 adults. The Late Stuart/Stellako group had a total adult return of 946,000 adults. Summer-run catches and spawning escapements were 1,615,000 and 1,413,000 adults, respectively. The total adult exploitation rate was 53%.

Table 12. Catches, escapements and exploitation rates for Fraser River sockeye salmon by stock group in 1996.

Stock Group	River & Ocean Catch *	Gross Escapement: Fraser Indian Catch	Gross Escapement: Spawning Escapement	Gross Escapement: Difference Between Estimates	Run Size: Adult	Run Size: Jacks	Portion of Run	Adult Exploitation Rate: River & Ocean	Adult Exploitation Rate: All Areas
				Sockeye Salmon					
Early Stuart	5,000	2,000	88,000	0	95,000	1,000	2%	5%	7%
Early Summer-run									
Nadina/Gates/Pitt	47,000	60,000	188,000	0	295,000	1,000	7%	16%	36%
Fennell/Bowron/Seymour	24,000	26,000	172,000	0	222,000	0	5%	11%	23%
Total	71,000	86,000	360,000	0	517,000	1,000	11%	14%	30%
Summer-run									
Chilko **/Quesnel	719,000	346,000	1,017,000	0	2,082,000	21,000	47%	35%	51%
L.Stuart/Stellako	334,000	216,000	396,000	0	946,000	4,000	21%	35%	58%
Total	1,053,000	562,000	1,413,000	0	3,028,000	25,000	68%	35%	53%
Late-run									
Birkenhead/Adams/Cultus	71,000	11,000	72,000	0	154,000	9,000	4%	46%	53%
Weaver/Portage	300,000	17,000	110,000	241,000	668,000	0	15%	45%	47%
Harrison/Widgeon	3,000	0	18,000	0	21,000	0	0%	14%	14%
Total	374,000	28,000	200,000	241,000	843,000	9,000	19%	44%	48%
Total Adults	1,503,000	678,000	2,061,000	241,000	4,483,000	36,000	100%	34%	49%
Total Jacks	7,000	0	29,000	0	36,000				
Total	1,510,000	678,000	2,090,000	241,000	4,519,000				
Portion of Total Run	33%	15%	46%	5%	100%				

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

** Early Chilko included with Chilko River

The total return of 843,000 adult Late-run sockeye was five times the pre-season risk-averse forecast abundance of 164,000 fish. The dominant Weaver/Portage group produced a total return of approximately 668,000 adults while the Birkenhead group contributed approximately 154,000 adults. Catches of Late-run sockeye totalled 402,000 adults, spawning escapements totalled 200,000 and an estimated 241,000 Weaver fish died unspawned near the mouth of Weaver Creek. The adult exploitation rate was 48%.

The total return of Fraser River sockeye in 1996 was 4,519,000 adults. Catches in all fisheries accounted for 48% of the run while 46% reached the spawning grounds (Table 12).

VIII. ESCAPEMENT

Sockeye salmon spawning escapements in the Fraser River watershed (Figure 6) are estimated annually by Fisheries and Oceans Canada. These estimates and associated biological data allow the PSC staff to revise in-season racial analyses, estimate total production for each stock or stock group, and evaluate stock assessment programs. The escapement estimates also enable the Panel to evaluate management and escapement objectives.

In 1996, preliminary estimates of sockeye escapements to the spawning grounds totalled 2,091,000 fish, including 2,062,000 adults (4- and 5-year-old fish) and 30,000 jacks (3-year-old fish) (Appendix Table 7). This was the largest escapement on the cycle since spawning ground records began in 1938 and likely the largest on the cycle since about 1900, when estimates based

on Fraser River gillnet catches and fishing times were available. The adult escapement was 93% higher than during the previous cycle year (1,069,000 fish in 1992) and 51% higher than the previous record (1,370,000 fish in 1988). Early Stuart, Early Summer and Summer-run escapements were larger than in 1992 while Late-run escapements decreased 25% (Table 13). Early Summer and Summer-run escapements were the largest recorded on the cycle. In particular, the Early Summer escapement was 3.5 times larger than in 1992 and included significant increases for several stocks.

Table 13. Adult Fraser River sockeye salmon escapements by run on the 1996 cycle for 1980-1996.

	Spawning Escapement *				
Run	1980	1984	1988	1992	1996
Early Stuart	17,000	45,000	180,000	66,000	88,000
Early Summer	77,000	125,000	217,000	102,000	360,000
Summer	571,000	643,000	745,000	635,000	1,413,000
Late	165,000	109,000	228,000	266,000	200,000
Adults	830,000	922,000	1,370,000	1,069,000	2,061,000

* Early Chilko included with Summer runs.

Early Stuart sockeye spawn in tributaries to Takla and Trembleur Lakes (A; Figure 6). Escapements in 1996 totalled 88,000 fish, an increase of 33% over the 1992 escapement but considerably below the record cycle-year escapement of 180,000 fish in 1988. Spawners were well distributed in the watershed in 1996, with 36,000 adults in Middle River tributaries (41%), 27,000 in Trembleur Lake tributaries (31%), 22,000 in Takla Lake tributaries (25%) and 2,000 in Driftwood River and it's tributaries (3%). The proportion that spawned in Middle River tributaries (41%) was the lowest observed on a non-dominant cycle year, and compares to an average of 77% in the previous four cycle years. The number of spawners in Trembleur Lake tributaries, Takla Lake tributaries and the Driftwood River area totalled 51,000 fish, the third largest escapement on a non-dominant cycle year.

Late Stuart sockeye spawn primarily in Middle and Tachie Rivers, which connect the large lakes in the Stuart watershed. The estimated escapement of 63,000 adult sockeye was the largest recorded for the cycle. The previous record was 20,000 adults in 1992. Most fish (49,000) spawned in Tachie River, while 9,000 fish spawned in Middle River. In addition, there were 2,900 jack sockeye from the 1993 dominant cycle brood.

Sockeye escapements to the Nechako River watershed (B; Figure 6) were much larger than in the brood year. Nadina River spawners totalled 39,000 adults in 1996 compared to 8,000 in 1992. Of these, 30,000 entered the spawning channel. Stellako River escapements (333,000 fish) were the second largest on record, and over three times the brood year abundance (98,000 fish).

The Bowron River supports the only sockeye stock that spawns in a Fraser River tributary upstream of Prince George. The 1996 spawning escapement increased to 8,200 fish from 2,600 in 1992. This abundance was similar to prior cycle years.

Historically, sockeye returns to the Quesnel Lake watershed (C; Figure 6) on the 1996 cycle have been the lowest of the four cycles. Usually, 3-year-olds (jacks) from the dominant cycle (1993) brood are the most abundant age group. However, in 1996, 4-year-old fish from the 1992 brood (28.5%) and 5-year-old fish from the 1991 brood (71.5%) combined to produce an escapement of 41,000 adults. This was a seven-fold increase over the 1992 escapement and was, by far, the largest recorded for the cycle. Jack sockeye returns decreased from 3,000 in 1992 to 1,300 fish in 1996. The majority of fish spawned in Horsefly River (23,000 fish) and the Horsefly River spawning channel (11,000 fish). An additional 7,000 sockeye spawned in Mitchell River, which is a tributary to the north arm of Quesnel Lake.

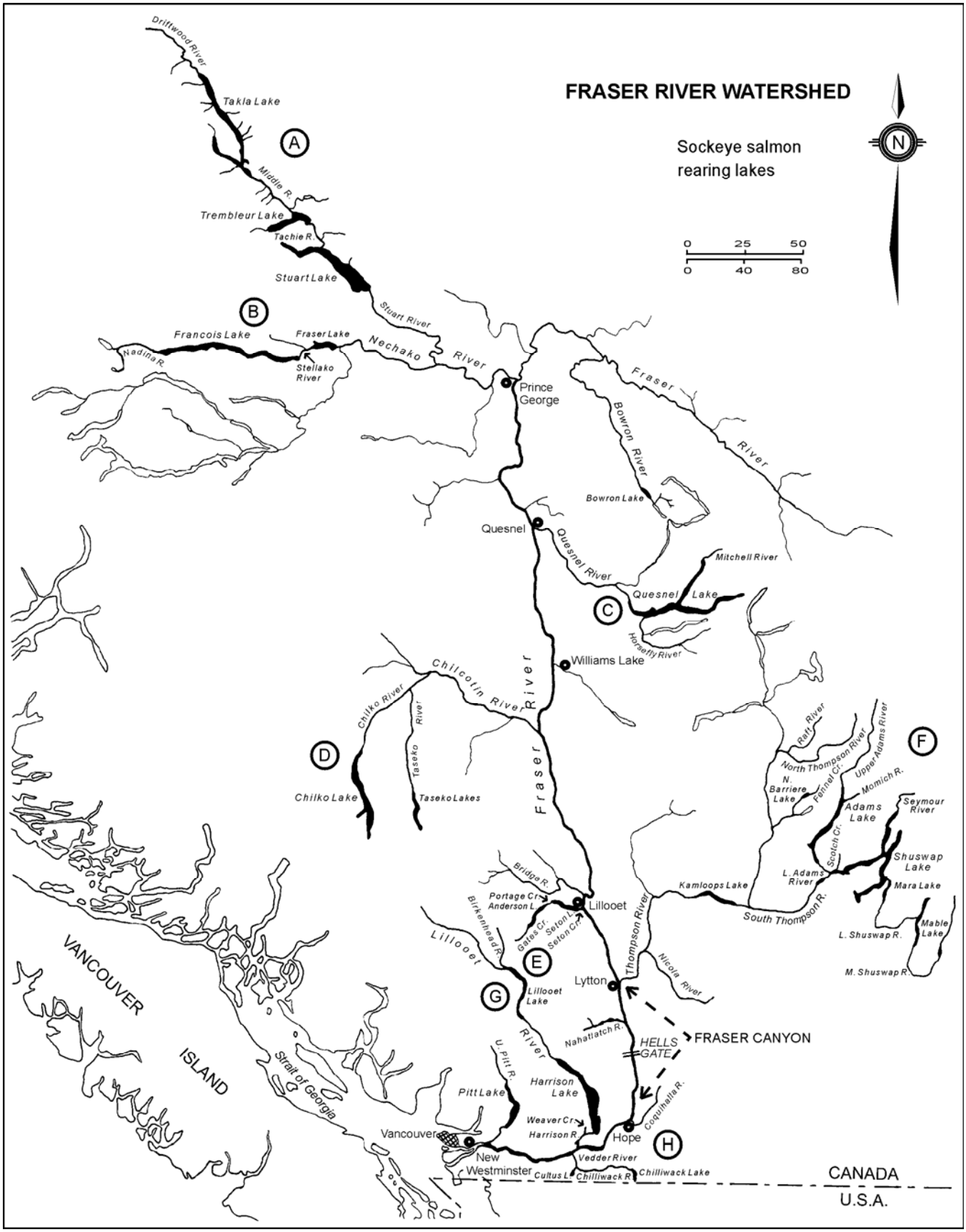

Figure 6. Sockeye salmon spawning grounds in the Fraser River watershed.

Nearly half (47%) of the total 1996 sockeye escapement in the Fraser watershed spawned in Chilko River and Lake areas (D; Figure 6). The total escapement of 974,000 Chilko adults was the third largest on record for all cycles combined. However, no breakdown of escapement between Lake and River areas was obtained. For many years, the 1996 cycle was the largest of the four cycles. This pattern was disrupted in the late 1980's when flooding in 1984 resulted in low production and escapement in 1988 and subsequently in 1992. Escapements in these dominant cycle years were smaller than in the 1990 and 1991 off years. However, the strength of the 1996 escapement may herald the resurgence of this historically dominant cycle. Escapements to the Chilko system have exceeded 440,000 fish each year since 1990, representing the highest sustained level of escapements for this stock on record.

The 1996 line has also been the dominant cycle for Gates Creek sockeye since escapements have been measured. In 1996, the spawning channel and Gates Creek spawning areas (E; Figure 6) experienced the largest escapement (100,000 fish) since about 1905. Of the total, 31,000 fish entered the spawning channel. However, only 25% of the females in the channel spawned successfully. The Late run to Portage Creek increased from 1,100 fish in 1992 to 2,700 in 1996. The 1996 cycle has been the off cycle for Portage sockeye for many years.

Sockeye stocks in the Thompson River watershed spawn in the North Thompson and South Thompson systems (F; Figure 6). South Thompson stocks are further divided by migration timing into early and late runs. The major South Thompson stocks (Lower Adams and Lower Shuswap) and many of the minor stocks in the Shuswap Lake system have large returns on the 1994 cycle and low returns on the 1996 cycle. However, the 1996 cycle is the dominant cycle for four stocks in the Thompson River watershed: Raft, Fennell, Upper Adams and Upper Momich/Cayenne.

Raft River is a tributary of North Thompson River. Fry produced here migrate approximately 137 km downstream to Kamloops Lake to rear, the longest fry migration in the Fraser River system. In 1996, Raft River escapements totalled 47,000 adults, the largest escapement on record and over five times the 1992 escapement. Fennell sockeye fry rear in North Barriere Lake, into which Fennell Creek flows. The 1996 escapement was 32,000 fish, a three-fold increase over the 1992 escapement of 9,000 fish and the largest escapement on record for this stock. Sockeye spawners were also observed in other streams in the watershed, including Barriere River and Harper Creek in the North Barriere Lake system.

In the South Thompson area, the Upper Adams and Upper Momich/Cayenne spawning areas are in the Adams Lake system, although fry from the latter stock may rear in Momich Lake. The escapement of Upper Adams sockeye was 25,000 spawners in 1996. This was the largest since about 1909, prior to when the run was destroyed by the blockage at Hells Gate in 1913 and a dam at the outlet of Adams Lake. Attempts by the IPSFC, beginning in 1949, to re-introduce sockeye into Upper Adams River began to have measurable results in the early 1980's. The population had been growing steadily since the early 1970's and reached 7,200 fish in 1988. A decline occurred in 1992 when only 3,000 fish returned. A subsequent DFO program of egg incubation and short-term fry rearing of the 1992 brood, plus nearly complete fishery closures during the 1996 Early Summer migration, led to escapements in 1996 that represent an eight-fold increase in the population compared to the brood year. Escapements of Upper Momich/Cayenne sockeye increased more than three-fold from 2,500 fish in 1992 to 9,000 in 1996.

Early Summer sockeye stocks that spawn in tributaries to Shuswap Lake also showed strong escapement gains in 1996. The largest, Seymour River sockeye, increased to 22,000 adults from 6,000 in the brood year. Scotch Creek escapements doubled to 4,600 sockeye and Eagle River escapements jumped to 5,000 fish. All three totals were the largest recorded for the cycle. Many Seymour (42.7%) and Scotch spawners (63.6%) were 5-year-olds from the 1991 brood.

Late-run sockeye escapements to the Thompson system were similar to brood year levels. Adams River and area escapements totalled 12,000 fish, compared to brood year escapements of 13,000 fish. The majority of spawners (64.1%) were 5-year-olds from the 1991 sub-dominant

cycle brood. Lower and Middle Shuswap River spawning grounds usually have only a few hundred fish on the cycle. The total in 1996 was 700 sockeye, up from 400 in the brood year. Many of these fish (39.4%) also were 5-year-olds from the 1991 brood.

Sockeye spawning escapements to the Harrison-Lillooet system (G; Figure 6) decreased substantially compared to the brood year. Returns of Birkenhead River sockeye are highly variable possibly because of periodic flooding during the fall-winter incubation period. The 1992 escapement was the fourth largest on record and discharge indices were not particularly high during the incubation period. However, the return of 4-year-old fish was poor and the abundance of 5-year-olds from the 1991 brood was low, as well. The result was a reduced escapement from 186,000 fish in 1992 to 56,000 in 1996. The age composition of Birkenhead spawners was 42.5% 4-year-olds and 57.5% 5-year-olds.

On the other hand, production of 4-year-old Weaver sockeye was strong and escapements to the creek (38,000 fish) and channel (68,000 fish) were large. The total of 106,000 spawners was double the 1992 escapement of 59,000 fish. In addition, 76,000 fish were harvested under an ESSR contract. Only 65% of females that entered the creek and channel spawned successfully.

Escapement of Harrison sockeye was also substantially larger than in the brood year. In 1996 the total was 15,000 fish, fifty times larger than the estimate of 300 spawners in 1992. The abundance of Big Silver Creek spawners was similar to the brood year at 3,500 fish.

Lower Fraser River stocks (H; Figure 6) generally had large escapements in 1996. Nahatlatch River and Lake spawning populations totalled 14,000 fish, the second largest on record. Upper Pitt River also showed a strong escapement of 50,000 fish. This was the largest recorded in the Upper Pitt River since 1948. Upper Pitt sockeye produce primarily 5-year-olds, which is unique among Fraser stocks (all other Fraser stocks produce mostly age-4 fish). However, in 1996, the 4-year-old return provided almost half (47.9%) the spawners. Sockeye escapements to the Chilliwack-Vedder system were similar to brood year levels. Chilliwack Lake spawners totalled 4,300 fish, while Cultus Lake had an escapement of 2,000 adults.

Pre-spawning mortality losses were severe at Gates Creek and Channel and at Weaver Creek and Channel, areas of large escapement in 1996. While the percentage of successful spawning of Gates sockeye in the creek and channel was very low (25%), this stock has a history of large pre-spawning mortality losses. The extremely early upstream migration of Weaver and other Late-run stocks in 1996 may have contributed to the pre-spawning losses observed. For Weaver sockeye, the spawning success rate of 65% was well below the previous record low of 76% in 1974. Spawning success rates were also below average for other Late-run stocks, including Cultus and Portage stocks, despite small spawner populations. Spawning success rates for the major Summer-run stocks were normal. For the whole watershed, pre-spawning mortality was estimated at 12.8% of the female population. The successful spawning of approximately 967,000 female sockeye was the largest on record for the 1996 cycle.

IX. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage fisheries in the Panel Area to achieve annual goals for gross escapement of Fraser River sockeye and pink salmon, for international allocation of the TAC, for domestic allocation of the catch within each country's share, and to consider conservation concerns for other stocks and species of salmon when planning and conducting the fisheries. Panel management strategies are assessed after each season to determine whether the goals were met and to improve management techniques and data collection programs.

A. Escapement

The Panel's primary objective is to achieve gross escapement targets. In 1996, assessment of the Panel's success in achieving gross escapement targets was more complex than usual. On the premise that target adjustments were necessary to compensate for potential bias between Mission (Mission escapement + Indian catch below Mission) and upriver (Fraser Indian catch + spawning escapement) estimates of gross escapement, the Panel's purpose can be stated as follows: the Panel is to achieve the adjusted gross escapement targets. Thus, one measure of the Panel's success is whether in-season gross escapement estimates met the in-season adjusted targets.

Adjusted gross escapement targets for Early Summer, Summer and Late-run stocks were exceeded by 259,000 fish (Table 14). Since Panel management commenced after the Early Stuart run was complete, the target for this run is set at the achieved gross escapement. In this table, the Early Chilko stock is included in the Early Summer group for both gross escapement target and Mission estimates.

Table 14. Comparison of in-season adjusted gross escapement targets and in-season estimates for Fraser River sockeye salmon in 1996.

	Gross Escapement *						
Run	In-season Target	+	Adjustment	=	Adjusted Target	In-season Estimate**	Difference
Early Stuart	67,000		47,000		114,000	114,000	0
Early Summer	347,000		156,000	***	503,000	644,000	141,000
Summer	1,453,000		111,000	***	1,564,000	1,580,000	16,000
Late	332,000		100,000	***	432,000	534,000	102,000
Adults	2,199,000		414,000		2,613,000	2,872,000	259,000

* Early Chilko included with Early Summer runs.

** Includes 165,000 sockeye salmon caught in Fraser River Indian fisheries below Mission, B.C.

*** Panel-agreed gross escapement adjustment.

B. International Allocation

The Panel's second priority is to achieve international catch allocations. Based on the run-size estimate of 4,519,000 sockeye and deductions totalling 2,902,000 fish, the TAC in 1996 was 1,617,000 fish (Table 15). The Washington share of the TAC was 260,000 fish and they caught 257,000 fish, 3,000 under the goal. Similarly, Canadian catches were 3,000 over their calculated share. However, during the fishing season, the TAC calculation was larger and the United States was short of their allocation by a larger amount, based on those estimates. On August 16, the United States pointed out that if Canada's decision to raise gross escapement targets to satisfy First Nations commitments resulted in additional spawning escapements, then the United States TAC should not be affected. The Alaska catch of 36,000 was excluded from the sharing formula.

Table 15. Preliminary calculations of total allowable catch and international share of Fraser River sockeye salmon in 1996.

		Sockeye
TOTAL ALLOWABLE CATCH		
Total Run Size		4,519,000
Deductions		
Escapement		2,062,000
Jack Escapement		30,000
Difference Between Estimates		241,000
ESSR Fishery Catches	*	78,000
Fraser River Indian Fishery Exemption		400,000
Test Fishing		79,000
Gear Modification Study		13,000
Total Deductions		2,902,000
Total Allowable Catch		1,617,000
UNITED STATES		
Washington Catch**		257,000
Washington Share	**	260,000
Deviation		(3,000)
Alaska Catch		36,000
Total United States Catch		293,000
CANADA		
Canadian Catch - Indian Fishery Exemption		1,324,000
Canadian Share		1,321,000
Deviation		3,000

* Terminal catch of Weaver sockeye taken under contract from Excess Salmon to Spawning Requirements (ESSR)

** Washington allocations according to agreement between the Parties:
(16.1% of TAC below 2,000,000)
+ (8% of TAC between 2,000,000 and 5,000,000)
+ (4% of TAC above 5,000,000), to a maximum of 800,000

C. Domestic Allocation

The third priority of the Panel is to achieve the domestic allocation goals of the Parties. The Panel's ability to achieve such goals is limited because the Panel manages only those fisheries in Panel Areas that are directed at Fraser River sockeye and pink salmon. In 1996, these included sockeye-directed net fisheries in Canadian Areas 20 and 29, troll fisheries in Area 18-1, 4 and -11 and Area 29, and United States net fisheries in Areas 4B, 5, 6, 6C, 7 and 7A. Fisheries in Canada other than these above were managed by DFO, including Canadian outside troll fisheries, net and troll fisheries in Johnstone Strait, and all fisheries north of Vancouver Island. Canadian First Nations fisheries in Panel and non-Panel areas in marine areas and in the Fraser River are managed by Canada in consultation with aboriginal groups.

In 1996, domestic allocation goals existed only for Washington fishers: Canadian allocations were not provided to the Panel. Within Washington in 1996, the first 183,500 sockeye of any Washington catch share was to be reserved for Treaty Indian fishers. Washington catches above 183,500 fish were to be shared equally by Treaty Indians and non-Indians. On August 19, 17,000 fish from the Treaty Indian share were transferred to the non-Indian share. At that date, there were estimated to be enough fish available for United States fishers to harvest approximately 60,000 additional fish. However, a sharp drop in abundance of fish resulted in catches of only

4,000 sockeye. Therefore, for this report the domestic allocation of catch within the United States is calculated on the original sharing formula. By this calculation, Treaty Indians caught 4,000 fish more than their allocation and Non-Indians were under by the same amount (Table 16). Among Treaty Indians, fishers in Areas 4B, 5 and 6C were 15,000 fish under their allocation while fishers in Areas 6, 7 and 7A were over by the same amount. There were no objectives for allocation by gear among Non-Indian fishers.

Table 16. Preliminary estimates of domestic overages and underages in Washington catches of Fraser River sockeye salmon in 1996.

User Category	Actual Catches Fish	Actual Catches %	Catch Goals Fish	Catch Goals %	Overage/ (Underage)
Treaty Indians: by Area					
Treaty Indian					
Areas 4B, 5 and 6C	30,000	13.4%	45,000	20.0%	(15,000)
Areas 6, 7 and 7A	194,000	86.6%	179,000	80.0%	15,000
Total:	224,000	100.0%	224,000	100.0%	0
Washington: between Treaty Indian and Non-Indian Users					
Treaty Indian	224,000	87.2%	220,000 *	85.6%	4,000
Non-Indian	33,000	12.8%	37,000 *	14.4%	(4,000)
Washington Total:	257,000	100.0%	257,000	100.0%	0

* Catch goals do not include 17,000 fish that were transferred from the Treaty Indian to Non-Indian allocation on August 19.

D. Conservation of Other Stocks

Part of the Fraser River Panel's mandate is to accommodate conservation and management needs of salmon species and stocks other than Fraser River sockeye and pink salmon during the management of Panel Area fisheries. The incidental catches during Panel Area fisheries directed at sockeye salmon are shown in Table 17.

Table 17. 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 1996. *

Area	Non-Fraser Sockeye	Non-Fraser Pink	Chinook	Coho	Chum	Steelhead
United States						
Areas 4B, 5 and 6C Net	0	0	500	800	0	0
Areas 6, 7 and 7A Net	0	0	3,800	300	0	0
Total	0	0	4,300	1,100	0	0
Canada						
Area 20 Net	0	0	500	3,900	400	0
Area 29 Net	0	0	3,500	0	0	0
Total	0	0	4,000	3,900	400	0
Total Catch	0	0	8,300	5,000	400	0

* Estimates are provided by the WDFW and DFO.

X. ALLOCATION STATUS

Because the 1996 agreement for international sharing concerned only 1996, there is no accumulated allocation status to report for Fraser River sockeye and pink salmon.

XI. APPENDICES

APPENDIX A: PRE-SEASON FORECASTS AND SPAWNING ESCAPEMENT TARGETS FOR FRASER RIVER SOCKEYE SALMON IN 1996.

Table 1. Pre-season forecasts and spawner escapement targets for Fraser River sockeye salmon. (Provided to the Panel by Fisheries and Oceans Canada on March 14, 1996.)

Stock / Run	Forecast Return	Spawning Escapement Goal
Early Stuart	90,000	90,000
Early Summer	172,000	172,000
Summer *	1,134,000	666,000
Late	164,000	164,000
Total Adult	1,560,000	1,092,000

* Early Chilko included with summer runs.

Table 2. Fraser River sockeye salmon schedule of escapement targets for ranges of returns in 1996. (Provided to the Panel by Fisheries and Oceans Canada on June 24, 1996.)

Stock Group	Range of Return	Escapement Target (a)
Early Stuart	0 - 400,000	120,000
	401,000 - 1,166,000	30%
	>1,167,000	350,000
Early Summer	0 - 933,000	280,000
	934,000 - 1,732,000	30%
	>1,733,000	520,000
Summer	0 - 2,100,000	619,000
	2,101,000 - 4,079,000	30%
	>4,080,000	1,224,000
Late	0 - 1,000,000	300,000
	1,001,000 - 2,312,000	30%
	>2,313,000	694,000

(a) 30% represents the proportion of the return designated for escapement.

APPENDIX B: 1996 REGULATIONS

The Fraser River Panel approved regulations for the management of the Fraser River sockeye 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 25, 1996.

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 the 30th day of July, 1996 to the 31st day of August, 1996, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 from the 30th day of July, 1996 to the 31st day of August, 1996, 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 the 30th day of July, 1996 to the 28th day of September, 1996, 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 the 30th day of July, 1996 to the 28th day of September, 1996 , both dates inclusive.

3. a) No person shall commercially fish for sockeye or pink salmon in Pacific Fishery Management Area 29 with nets from the 30th day of July, 1996 to the 12th day of October, 1996, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 30th day of July, 1996 to the 12th day of October, 1996, 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 1996 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the attached 1996 Management Plan adopted on July 25, 1996 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 the 30th day of July, 1996 to the 31st day of August, 1996, 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 the 30th day of July, 1996 to the 7th day of September, 1996, 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 8th day of September, 1996 to the 28th day of September, 1996, both dates inclusive.

All-Citizen Fisheries:

1. 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 the 30th day of July, 1996 to the 31st day of August, 1996, both dates inclusive.

2. 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 the 30th day of July, 1996 to the 7th day of September, 1996, both dates inclusive.

3. No person shall fish for sockeye or pink salmon with nets in that portion of Puget Sound Salmon Management and Catch Reporting Area 7A lying westerly of a straight line drawn from the low water range marker in Boundary Bay on the International Boundary through the east tip of Point Roberts in the State of Washington to the East Point Light on Saturna Island in the Province of British Columbia from the 8th day of September, 1996 to the 28th day of September, 1996, both dates inclusive.

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

Treaty Indian and All-Citizen Fisheries:

1. High Season westerly of the Bonilla Point-Tatoosh Island Light House Line.

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

During the 1996 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on the attached 1996 Management Plan adopted on July 25, 1996 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: 1996 FRASER RIVER PANEL IN-SEASON ORDERS

To provide for adequate escapement of the various stocks of Fraser River sockeye 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 1996:

July 30 United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets open from 12:00 p.m. (noon) August 1 to 12:00 p.m. (noon) August 4.

August 2 United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Close to drift gillnets 12:00 p.m. (noon) August 3.

August 5 Canada
Area 18-4:
Open to commercial trolling 12:01 a.m. to 11:59 p.m. August 7 and August 8.

Area 29 - 1 to 7 and 9 to 17:
Gillnets open 8:00 a.m. to 8:00 p.m. August 7.

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 7.

Area 6, 7 and 7A:
Open to net fishing from 5:00 a.m. to 9:00 p.m. August 7.

August 11 United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets open 5:00 p.m. August 11 to 5:00 p.m. August 13.

Areas 6, 7 and 7A:
Open to net fishing 5:00 p.m. August 12 to 9:00 p.m. August 13, southerly and easterly 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.

August 12 Canada
Area 20 - 1, 3 and 4:
Purse seines open 7:00 a.m. to 7:00 p.m. August 14.

Area 29 - 1 to 7 and 9 to 17:
Gillnets open 1:00 p.m. August 13 to 1:00 p.m. August 14.

Area 18-4:
Commercial trolling open 12:01 a.m. to 11:59 p.m. August 16.

United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets extended from 5:00 p.m. August 13 to 12:00 p.m. (noon) August 15.

August 14 Canada
Area 20 - 1, 3 and 4:
Purse seines re-open 7:00 a.m. to 7:00 p.m. August 15.

Area 29 - 1 to 7 and 9 to 17:
Gillnets open 4:00 p.m. August 15 to 12:00 p.m. (noon) August 16.

United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets extended from 12:00 p.m. (noon) August 15 to 12:00 p.m. (noon) August 17.

All-Citizen Fishery
Areas 7 and 7A:
Purse seines open 6:00 a.m. to 10:00 a.m. August 16.
Gillnets open 5:00 p.m. to 9:00 p.m. August 16, southerly and easterly 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.

August 16 Canada
Area 18-4:
Commercial trolling extended from 11:59 p.m. August 16 to 11:59 p.m. August 17.

United States
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets extended from 12:00 p.m. (noon) August 17 to 12:00 p.m. (noon) August 23.

August 19 United States
All-Citizen Fishery
Areas 7 and 7A:
Gillnets open 7:00 p.m. August 19 to 7:00 a.m. August 20.
Purse seines open 7:00 a.m. to 7:00 p.m. August 20, southerly of a straight line drawn from Iwersen's Dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

August 23 Canada
Area 20:
Relinquish regulatory control effective August 25.

United States
Treaty Indian and All-Citizen Fishery
Areas 4B, 5 and 6C:
Relinquish regulatory control effective August 25.

August 27 United States
All-Citizen Fishery
Area 7A:
Gillnets open 7:00 p.m. August 27 to 7:00 a.m. August 28.
Purse seines open 7:00 a.m. to 7:00 p.m. August 28. Non-retention of chinook salmon by purse seines.

September 11 United States
Treaty Indian and All-Citizen Fishery
Area 7A:
Relinquish regulatory control effective September 15.

Canada
Areas 17, 18 and 29-5:
Relinquish regulatory control effective September 15.

All times herein cited are Pacific Daylight Savings Time.

APPENDIX D: TABLES 1-9

Table 1. Commercial net catches of Fraser River sockeye salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1984-1996.

Date *	1984	1988	1992	1996
Jun. 23-Jun. 29	0	0	0	0
Jun. 30-Jul. 6	0	0	0	0
Jul. 7-Jul. 13	0	0	0	0
Jul. 14-Jul. 20	0	0	0	0
Jul. 21-Jul. 27	0	0	0	0
Jul. 28-Aug. 3	94,000	0	0	0
Aug. 4-Aug. 10	68,000	140,000	113,000	0
Aug. 11-Aug. 17	168,000	58,000	497,000	69,000
Aug. 18-Aug. 24	204,000	21,000	252,000	0
Aug. 25-Aug. 31	5,000	0	18,000	0
Sep. 1-Sep. 7	0	0	0	0
Sep. 8-Sep. 14	0	0	0	0
Sep. 15-Sep. 21	0	0	0	0
Sep. 22-Sep. 28	0	0	0	0
Sep. 29-Oct. 5	0	0	0	0
Total	539,000	219,000	880,000	69,000

* Dates for 1996. 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 1983-1996.

Date *	1984	1988	1992	1996
Jun. 23-Jun. 29	0	0	0	0
Jun. 30-Jul. 6	0	0	0	0
Jul. 7-Jul. 13	0	1,000	0	0
Jul. 14-Jul. 20	0	0	0	0
Jul. 21-Jul. 27	89,000	51,000	0	0
Jul. 28-Aug. 3	103,000	148,000	0	0
Aug. 4-Aug. 10	439,000	143,000	93,000	69,000
Aug. 11-Aug. 17	155,000	28,000	42,000	642,000
Aug. 18-Aug. 24	129,000	2,000	124,000	0
Aug. 25-Aug. 31	22,000	0	2,000	0
Sep. 1-Sep. 7	22,000	0	0	1,000
Sep. 8-Sep. 14	13,000	204,000	0	0
Sep. 15-Sep. 21	4,000	152,000	0	0
Sep. 22-Sep. 28	7,000	19,000	0	0
Sep. 29-Oct. 5	0	10,000	0	0
Total	983,000	758,000	261,000	712,000

* Dates for 1996. 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 1984-1996. The landing dates shown lag an average of five days behind catch dates.

Date *	1984	1988	1992	1996
Jun. 23-Jun. 29	0	0	0	0
Jun. 30-Jul. 6	0	0	0	0
Jul. 7-Jul. 13	0	5,000	0	0
Jul. 14-Jul. 20	0	32,000	2,000	0
Jul. 21-Jul. 27	1,000	5,000	25,000	0
Jul. 28-Aug. 3	3,000	1,000	65,000	0
Aug. 4-Aug. 10	10,000	0	0	0
Aug. 11-Aug. 17	10,000	1,000	77,000	1,000
Aug. 18-Aug. 24	4,000	0	0	0
Aug. 25-Aug. 31	1,000	0	0	0
Sep. 1-Sep. 7	0	0	0	0
Sep. 8-Sep. 14	0	0	0	0
Sep. 15-Sep. 21	0	0	0	0
Sep. 22-Sep. 28	0	0	0	0
Sep. 29-Oct. 5	0	0	0	0
Total	29,000	44,000	169,000	1,000

* Dates for 1996. 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 1983-1996.

Date *	1984	1988	1992	1996
Jun. 23-Jun. 29	0	0	0	0
Jun. 30-Jul. 6	0	0	0	0
Jul. 7-Jul. 13	0	1,000	0	0
Jul. 14-Jul. 20	14,000	2,000	1,000	0
Jul. 21-Jul. 27	86,000	8,000	6,000	0
Jul. 28-Aug. 3	229,000	6,000	15,000	0
Aug. 4-Aug. 10	342,000	70,000	314,000	70,000
Aug. 11-Aug. 17	264,000	45,000	1,103,000	102,000
Aug. 18-Aug. 24	195,000	17,000	565,000	1,000
Aug. 25-Aug. 31	73,000	0	43,000	0
Sep. 1-Sep. 7	0	0	2,000	0
Sep. 8-Sep. 14	1,000	5,000	0	0
Sep. 15-Sep. 21	3,000	0	0	0
Sep. 22-Sep. 28	0	0	0	0
Sep. 29-Oct. 5	0	0	0	0
Total	1,207,000	154,000	2,049,000	173,000

* Dates for 1996. 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 1984-1996. *

Fishing Area		1984	1988	1992		1996
Fraser River Mainstem						
Below Port Mann	*1*	14,300	25,400	64,100		93,700
Port Mann to Mission	*1*	4,000	11,100	16,700		71,100
Mission to Hope		76,800	86,400	110,900		77,200
Hope to Sawmill Cr.	*2*	110,400	96,300	116,900		219,400
Sawmill Cr. to Kelly Cr.	*2*	45,100	111,600	12,000		144,200
Kelly Creek to Naver Cr.	*3*	16,400	14,600	5,100		7,000
Above Naver Cr.	*3*	3,000	1,300	2,800		4,200
Total		270,000	346,700	328,500		616,800
Tributaries						
Harrison/Lillooet System		10,100	9,000	7,600		0
Thompson System		0	200	0	*4*	400
Chilcotin System		56,900	32,300	23,000		52,100
Nechako System		15,300	16,900	3,700		6,000
Stuart System		5,300	11,000	4,900		2,300
Total		87,600	69,400	39,200		60,800
Total Catch		357,600	416,100	367,700		677,600

* Data supplied by DFO.

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

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

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

4 Catches were not monitored in 1992.

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 1983-1996.

Date *	1984	1988	1992	1996
Jun. 23-Jun. 29	0	0	0	0
Jun. 30-Jul. 6	0	0	0	0
Jul. 7-Jul. 13	0	31,000	0	0
Jul. 14-Jul. 20	6,000	15,000	0	0
Jul. 21-Jul. 27	164,000	362,000	4,000	0
Jul. 28-Aug. 3	268,000	0	23,000	20,000
Aug. 4-Aug. 10	739,000	93,000	110,000	59,000
Aug. 11-Aug. 17	331,000	106,000	349,000	174,000
Aug. 18-Aug. 24	116,000	53,000	109,000	4,000
Aug. 25-Aug. 31	12,000	16,000	13,000	0
Sep. 1-Sep. 7	0	0	0	0
Sep. 8-Sep. 14	0	0	0	0
Sep. 15-Sep. 21	0	0	0	0
Sep. 22-Sep. 28	0	0	0	0
Sep. 29-Oct. 5	0	3,000	0	0
Total	1,636,000	679,000	608,000	257,000

* Dates for 1996. For other years, data from the nearest week were used.

Table 7. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1984, 1988, 1992 and 1996. *

DISTRICT	Estimated Number of Adult Sockeye *				Jacks
Stream/Lake	1984	1988	1992	1996	1996
NORTHEAST					
Upper Bowron R.	10,461	12,780	2,560	8,176	0
STUART					
Early Runs					
Takla L. Streams	4,337	23,453	11,789	24,062	210
Middle R. Streams	38,830	114,216	41,059	36,339	177
Trembleur L. Streams	2,034	42,138	12,769	27,168	455
Early Stuart Total	45,201	179,807	65,617	87,569	842
Late Runs					
Middle R.	184	1,203	1,832	9,290	273
Tachie R.	810	3,137	15,056	48,795	2,149
Miscellaneous	234	2,777	2,625	4,906	485
Late Stuart Total	1,228	7,117	19,513	62,991	2,907
NECHAKO					
Nadina R. (Late)	659	794	862	8,908	0
Nadina Channel	6,411	7,950	6,866	29,746	0
Stellako R.	60,957	367,702	97,979	333,163	9
QUESNEL					
Horsefly R. area	894	5,876	5,862	34,241	1,312
Mitchell R.	20	954	-	6,946	0
CHILCOTIN					
Chilko R.	452,618	249,989	504,236	974,349	15,159
Chilko Channel	-	4,679	7,031	- *1*	-
Chilko L.-South End	127,561	108,721	- *1*	- *1*	-
Taseko L.	2,771	11,138	970	1,470	0
SETON-ANDERSON					
Gates Cr.	2,646	17,512	2,774	69,270	315
Gates Channel	26,253	27,401	38,973	30,566	302
Portage Cr.	1,710	1,068	2,706	3,422	5
NORTH THOMPSON					
Raft R.	19,086	19,851	8,236	46,592	23
Fennell Cr.	11,021	26,927	9,139	32,279	37
SOUTH THOMPSON					
Summer Runs					
Seymour R.	17,172	16,781	5,742	21,654	0
Scotch Cr.	409	1,060	2,156	4,609	56
Eagle R.	-	31	482	4,878	0
Upper Adams R.	3,502	7,169	2,990	24,948	0
Momich / Cayenne Cr.	5,854	5,912	2,486	9,353	0
Late Runs					
Lower Adams R.	4,183	4,578	12,270	11,333	0
Lower Shuswap R.	75	194	240	635	17
HARRISON-LILLOOET					
Birkenhead R.	40,245	166,591	185,908	56,042	8,196
Big Silver	155	257	3,228	3,518	71
Harrison R.	1,267	1,544	313	15,379	0
Weaver Cr.	14,171	23,958	22,851	38,059	189
Weaver Channel	45,431	25,299	35,835	67,807	235
LOWER FRASER					
Nahatlatch R./L.	1,513	16,446	4,120	13,537	10
Cultus L.	994	861	1,203	2,022	8
Chilliwack L.	180	6,565	3,888	4,260	12
Upper Pitt R.	15,797	37,747	9,129	50,077	9
MISCELLANEOUS	1,614	5,080	2,641	3,791	1
ADULTS	922,059	1,370,339	1,068,806	2,061,591	29,715
JACKS	9,612	47,960	51,367	29,715	
TOTAL NET ESCAPEMENT	931,671	1,418,299	1,120,173	2,091,306	

* 1984 data are from the PSC. Estimates for 1988, 1992 and 1996 are from DFO.

1 Included in Chilko River estimate.

APPENDIX E: STAFF OF THE PACIFIC SALMON COMMISSION IN 1996

EXECUTIVE OFFICE

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

FINANCE AND ADMINISTRATION

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

FISHERIES MANAGEMENT DIVISION STAFF

Dr. J. Woodey, Chief

BIOMETRICS / CATCH STATISTICS GROUP

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

COMPUTER SERVICES GROUP

Ms. K. Mulholland, Computer System Manager

RACIAL IDENTIFICATION GROUP

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

STOCK MONITORING GROUP

Mr. J. Cave, Head
Mr. P. Cheng, Hydroacoustics Biologist
Dr. Y. Xie, Hydroacoustic Scientist (Term)