Report of the Fraser River Panel to the Pacific Salmon Commission on the 2000 Fraser River Sockeye Salmon Fishing Season

Prepared by the

Pacific Salmon Commission

April, 2003

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REPORT OF THE

FRASER RIVER PANEL

TO THE PACIFIC SALMON COMMISSION

ON THE 2000 FRASER RIVER

SOCKEYE SALMON FISHING SEASON

2000 PANEL MEMBERS AND ALTERNATES

UNITED STATES	CANADA
L. Loomis, Chair	W. Saito, Vice-Chair
R. Lincoln	M. Chatwin
W. Robinson	M. Griswold
B. Suggs	T. Lubzinski
D. Cantillon	S. McKamey
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FISHERIES MANAGEMENT DIVISION

of the

PACIFIC SALMON COMMISSION

April, 2003

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I. EXECUTIVE SUMMARY

1. In 2000, the Fraser River Panel managed fisheries in the Panel Area that targeted Fraser River sockeye salmon, under the terms of Annex IV of the Pacific Salmon Treaty that was revised on June 30, 1999 (Appendix E). Chapter 4 of the Agreement provided catch sharing arrangements for Fraser River sockeye and pink salmon for the years 1999-2010.

2. Prior to the fishing season, the Panel recommended a fishery regime and management plan for Panel Area fisheries to the Pacific Salmon Commission. The plan was based on abundance and timing forecasts and escapement targets for Fraser River sockeye salmon provided by Fisheries and Oceans Canada, international allocation goals set in the Agreement, domestic allocation goals set by each country, management concerns for other stocks and species also identified by each country, and historic patterns in migration and fisheries dynamics.

3. The Fraser River Panel managed commercial net fisheries and the Canadian "inside" troll fishery in the Panel Area under the terms of the Agreement. The United States catch in Panel Areas (Washington) was not to exceed 20.4% of the Total Allowable Catch (TAC) of Fraser River sockeye salmon plus a payback of 26,000 fish for a catch shortfall in 1999. Panel Area fisheries in Canada were managed by the Fraser River Panel and Canadian fisheries outside the Panel Area were to be managed by Canada in a manner that anticipated and accommodated catches in United States fisheries.

4. Canada provided the Panel with run-size forecasts and rules for calculating spawning escapement targets for Fraser River sockeye salmon on May 18-19, 2000. Because unfavorable ocean conditions during the marine residency of the run increased the level of uncertainty about survival rates, Canada provided forecasts at the following probability levels: 50%, 60%, 75% and 90%.

5. On May 18-19, the Panel developed fishery plans for forecast run sizes at the 50%, 60% and 75% levels, which were 4,083,000, 3,285,000 and 2,296,000 fish, respectively. The corresponding spawning escapement targets were 1,639,000, 1,468,000 and 1,158,000 fish. The projected Total Allowable Catches (TAC) at these run sizes were 1,846,000, 1,234,000 and 613,000 fish, respectively. These TAC levels included an Aboriginal Fishery Exemption of 400,000 fish, the PSC's projections of test fishing catches (40,000-65,000 fish) and management adjustments (85,000-133,000 fish) to the gross escapement targets.

6. Domestic allocation goals in Washington were as follows: Treaty Indian fishers were allocated 54.9% of the United States TAC plus 3,000 of the 26,000 fish payback, while Non-Indian fishers were allocated the remaining 45.1% of the TAC plus 23,000 fish of the 26,000 fish payback. Among Treaty Indians, fishers in Areas 4B, 5 and 6C were allocated a maximum of 20% of the Treaty Indian share. As in recent years the allocation targets among Non-Indian fishers were 54% for purse seines, 41% for gillnets and 5% for reefnets.

7. Canada did not specify a commercial share of the Canadian TAC, but did identify sharing arrangements among commercial fishers as follows: 43% for Area B purse seines, 12% for Area D gillnets, 23% for Area E gillnets, 15% for Area G trollers and 7% for Area H trollers.

8. The Management Plan focussed on the harvest of Chilko sockeye, which was forecast to be the predominant stock group in 2000. Fishery restrictions were anticipated during the early season to protect Early Stuart sockeye and in the late season to protect Late-run stocks. Several Fraser and non-Fraser chinook, chum, and coho stocks were identified by each country as warranting conservation concerns.

9. The Panel encountered four significant challenges to their management activities in 2000. First, there was considerable uncertainty about the number of Fraser sockeye that were forecast to return. Second, high discharge levels in the Fraser River raised concerns about the migration success of early runs through the Fraser Canyon. These conditions led to en route and pre-spawning mortalities among Early Stuart sockeye. Third, it was difficult to estimate the

abundance of Chilko sockeye (the key stock in 2000) in-season, due to overlapping scale patterns and run timing with other Summer-run stocks and with Early Summer and Late-run stocks. Fourth, a very early migration of Late-run stocks into the river raised concerns that these fish would have very poor spawning success. Large en route and pre-spawning mortalities of Late-run sockeye were subsequently observed.

10. Catches of Fraser River sockeye salmon in all fisheries totalled 2,463,000 fish. Canadian catches amounted to 1,872,000 sockeye, United States fishers harvested 496,000 fish, and test fishery catches totalled 95,000 sockeye. Canadian catches included 955,000 in commercial, 877,000 in First Nations', 30,000 in recreational, 8,000 in charter fisheries and 2,000 Weaver Creek sockeye in an "excess salmon to spawning requirements" (ESSR) fishery in the Harrison River. Within the United States catch, 494,000 fish were harvested in Washington waters, including a ceremonial and subsistence catch of 3,000 fish. Commercial fishery catches in both countries summed to 1,448,000 fish.

11. The Stock Monitoring program provided in-season estimates of abundance, migration timing and diversion rate of Fraser River sockeye salmon throughout the fishing season. Peak migration timing referenced to Area 20 was June 28 for Early Stuart sockeye (five days earlier than normal for the cycle line), July 20 for Early Summer-run sockeye (five days earlier than normal), August 3 for Summer-run (normal) and August 6 for Late-run sockeye (approximately nine days earlier than normal). The overall diversion rate of Fraser sockeye through Johnstone Strait was estimated at 36%.

12. The Racial Identification program provided estimates of stock composition for catches in commercial, First Nations' and test fisheries. Scale characteristics, parasite data and length data were employed to estimate these proportions. These estimates were then used to estimate the run size and gross escapement of individual stock groups. The primary difficulties were in discriminating the: (1) Chilko stock group (Summer-run) from the Fennell/Bowron/Upper Bowron and Gates stock groups (Early Summer-run); and (2) Late Stuart/Stellako/Quesnel (Summer-run) from Nadina/Pitt (Early Summer-run) and Birkenhead and Weaver/Cultus stock groups (Late-run). A post-season re-analysis using standards developed from spawning ground scales led to revisions in the racial composition estimates.

13. Post-season estimates of total abundance by run-timing group were 378,000 Early Stuart, 1,050,000 Early Summer-run, 3,080,000 Summer-run and 708,000 Late-run adults, for a total of 5,216,000 adult Fraser sockeye. These abundances were 30%, 92%, 15% and 23% larger, respectively, than the pre-season forecasts by timing group at the 50% probability level. Overall, the actual return was 28% larger than the forecast of 4,083,000 adults at the 50% probability level. Among the Summer-run stocks, there was a slight predominance of Quesnel/Late Stuart/Stellako over the Chilko stock group. The largest Late-run return was of Weaver/Cultus sockeye, followed by Portage/Adams and Birkenhead sockeye.

14. Preliminary estimates of spawning escapements to streams in the Fraser River watershed totalled 2,353,000 adult sockeye. This escapement was 14% larger than the brood year (1996) escapement of 2,062,000 adults, and was the largest on record for the cycle. Spawning escapements were larger than the brood year for the Early Stuart (2%), Early Summer-run (59%) and Summer-run (17%) sockeye, but were drastically reduced (an 81% reduction) for Late-run sockeye, i.e., 38,000 spawners in 2000 compared to 200,000 in 1996. The success of spawning by female sockeye in the entire watershed averaged 90%.

15. The reduced number of Weaver and Cultus Late-run spawners compared to the brood year reflected probable large en route mortality of as many as 263,000 fish, or 91% of the potential spawning escapement (gross escapement minus in-river catch) in 2000. The cause of these suspected mortalities was likely the extraordinary and unprecedented early migration of these fish into the river, which made the fish susceptible to the myxosporean parasite, *Parvicapsula minibicornis*, which was the ultimate cause of death. Late-run sockeye normally delay in the Strait of Georgia for four to six weeks before migrating up the Fraser River. In 2000, there was virtually no delay. Early Stuart sockeye may have experienced substantial en route mortality in

2000. Approximately, 71,000 fish, or 44% of the potential spawning escapement was not accounted for in upstream catch or spawning escapement.

16. Adjusted gross escapement targets (target + management adjustment) for sockeye salmon were nearly achieved or exceeded for each run-timing group based on lower river estimates (in-season Mission escapement plus First Nations' catch below Mission). By this measure, gross escapements were short by 2,000 fish for Early Stuart and 29,000 fish for Late-run sockeye, and exceeded by 76,000 fish for Early Summer-run and 37,000 fish for Summer-run stocks. The total gross escapement exceeded the adjusted target by 82,000 sockeye.

17. Upriver estimates of gross escapement (catch plus spawning escapement) totalled 690,000 sockeye more than the unadjusted target. By run-timing group, gross escapements were 10,000 fish under for Early Stuart, 285,000 fish over for Early Summer-runs, 661,000 fish over for Summer-runs and 246,000 fish under for Late-run sockeye. The large shortfalls in Early Stuart and Late-run escapements were likely due to the probable en route mortalities noted previously. The difference between estimates was examined in a post-season review, which indicated that there were no apparent sources of bias originating from the Mission estimates of gross escapement.

18. In terms of the achievement of international allocation targets, Washington fishers caught 56,000 fish more than their share of 438,000 Fraser River sockeye. Interpretation of revised Annex IV (June 30, 1999), Chapter 4 (Paragraph 3 (a) led the Commission to agree that a shortfall of planned in-river catches should be considered part of the Canadian allocation.

19. Domestic allocation goals in the United States were achieved with relatively good accuracy. Treaty Indian fishers caught 3,000 fish more than their allocation and Non-Indian fishers caught 3,000 fish less. Among Treaty Indians, the catch in Areas 4B, 5 and 6C was only 2,000 fish too high. Among Non-Indian fishers, gillnets and reefnets each exceeded their respective allocation targets by 6,000 fish, while purse seines were 12,000 fish below their target allocation.

20. Domestic allocation goals in Canada were not achieved, largely because of the substantial restrictions of fisheries due to conservation concerns for Early Stuart and Late-run sockeye. Within the Canadian commercial catch of 955,000 Fraser sockeye, Area B purse seines were 137,000 fish under, Area D gillnets were 35,000 fish over, Area E gillnets were 198,000 fish over, Area G trollers were 114,000 fish under and Area H trollers were 17,000 fish over their allocations.

21. The restrained fisheries in 2000 resulted in very low by-catches of other species and stocks that were identified as conservation concerns by the Parties.

22. In terms of the allocation status for the purpose of calculating catch paybacks in future years, the United States has an overage of 56,000 sockeye and underage of 21,000 pink salmon (from 1999).

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 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 targets 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 of 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 spawning escapement target and meet international and domestic catch allocation objectives. Conservation concerns of the Parties for other species and stocks are addressed throughout the process.

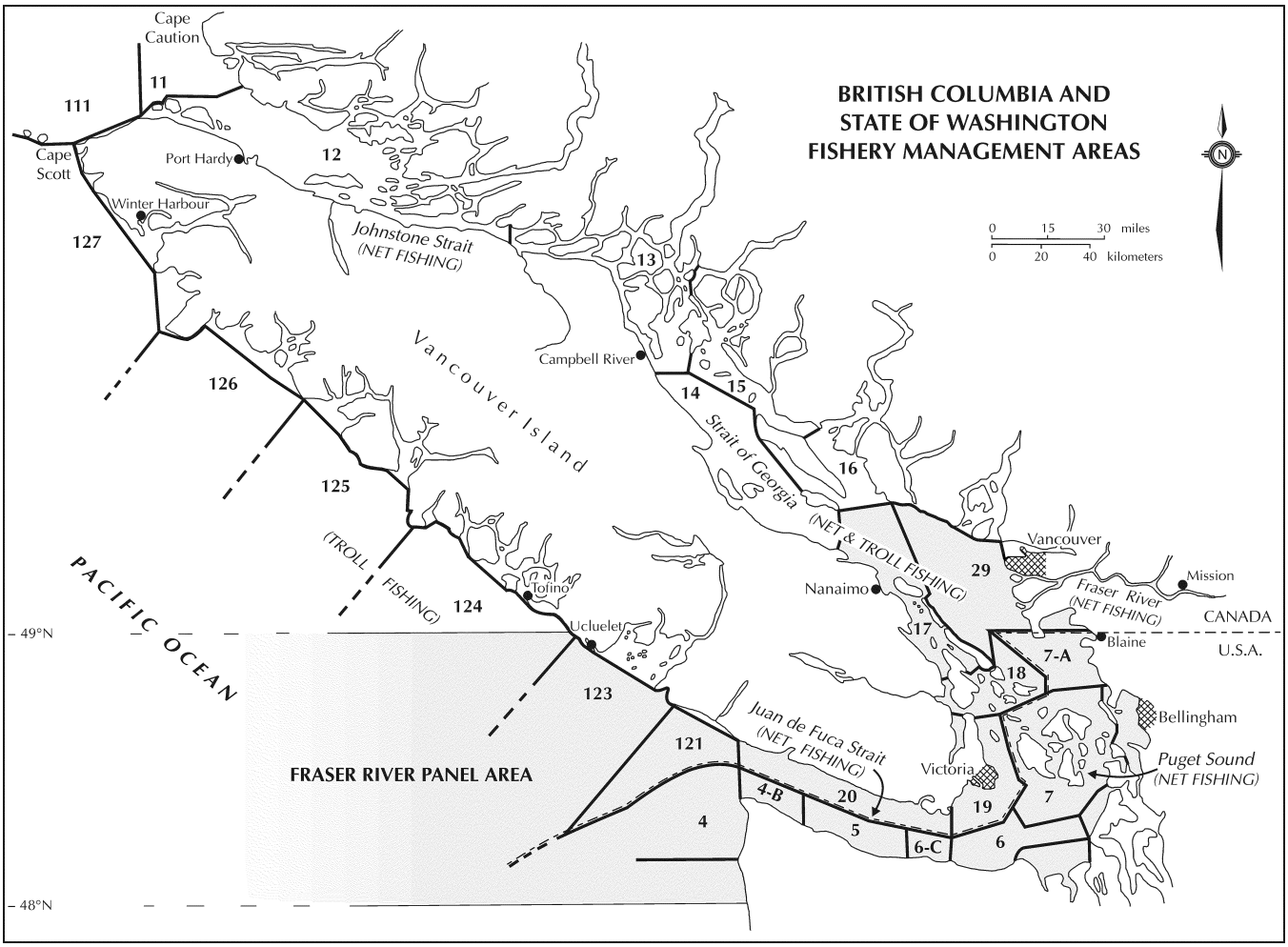

Figure 1. Fishery management areas and commercial gear used in the Fraser River Panel Area and Canadian south coast waters.

The pre-season management plan adopted by the Panel specifies a management scenario that is designed to achieve the escapement targets and catch goals, given the pre-season expectations. Using in-season commercial and test fishing data and analyses from PSC staff, the Panel modifies planned fisheries in response to in-season deviations from expectations. The activities of the Panel

are facilitated by the Fraser River Panel Technical Committee, who work in conjunction with the PSC staff and provide their respective National sections of the Panel with technical advice.

Under the terms of the revised Chapter 4 of Annex IV of the Pacific Salmon Treaty (1999) (Appendix E) between Canada and the United States, the Panel exercised its regulatory mandate in Panel Areas only for commercial net fisheries and Canadian inside (Strait of Georgia) troll fisheries that are directed at Fraser River sockeye and pink salmon. The development of management plans for other species and stocks intercepted in south coast areas are the responsibility of the Southern Panel and the Commission, and the actual management in specific areas is the responsibility of the appropriate country.

Involvement in decision-making occurs primarily through the National Sections of the Panel, where most of the user groups are represented. The Panel membership and their affiliations during the 2000 season are noted below.

UNITED STATES	CANADA
Members	
Ms. L. Loomis, Chair Treaty Indian tribes	Mr. W. Saito, Vice-Chair Fisheries and Oceans Canada
Mr. R. Lincoln Washington Department of Fish and Wildlife	Mr. M. Chatwin Salmon processing industry
Mr. W. Robinson National Marine Fisheries Service	Mr. M. Griswold Troll fisher
Mr. B. Suggs Commercial salmon fishing industry	Mr. T. Lubzinski Gillnet fisher
	Chief S. McKamey Canadian First Nations
	Mr. L. Wick Purse seine fisher
Alternates	
Mr. D. Cantillon National Marine Fisheries Service	Mr. B. Assu Purse seine fisher
Mr. R. Charles Treaty Indian tribes	Ms. L. Johnson Canadian First Nations
Mr. P. Patillo Washington Department of Fish and Wildlife	Mr. W. Otway Sport fisher
Mr. R. Zuanich Commercial salmon fishing industry	Mr. L. Rombough Gillnet fisher
	Mr. S. Watterson Troll fisher

III. INTRODUCTION

Management of Fraser River sockeye salmon stocks in 2000 was characterized by a high level of uncertainty. Consequently, the management recommendations provided to the Fraser River Panel by PSC staff often reflected these high levels of uncertainty. This led to the Panel generally adopting conservative management actions that resulted in lower catches while escapements exceeded the goals for some stocks or stock groups. Escapements of several stocks were at record levels for the period of monitoring (1938-2000). The Upper Adams sockeye spawning population had an exceptional escapement in 2000. Unexpectedly large numbers of Summer-run sockeye also arrived on their spawning grounds.

There were four main areas of uncertainty that emerged in the management of Fraser sockeye salmon in 2000. First, the pre-season forecasts of stock abundance that were provided to the Panel by Fisheries and Oceans Canada (DFO) had large confidence limits associated with them. Second, high Fraser River discharge levels during late June and early July raised concerns over the success of Early Stuart sockeye migration through the Fraser Canyon. Third, there was uncertainty in the abundance estimates for Chilko and other Summer-run sockeye stocks due to difficulty in estimating the Chilko component of the Summer-run group and variable migration timing of stocks within this group. Finally, very early migration of Late-run sockeye into the river caused concerns that very poor survival to spawning and/or spawning success of these stocks was likely to occur.

In the pre-season planning period, the Panel contended with more uncertainty than normal in the forecasts of sockeye salmon abundance for all four run-timing groups: Early Stuart, Early Summer-run, Summer and Late-runs. This uncertainty stemmed from the 1999 experience when low marine survival of the 1995 brood year sockeye led to lower adult returns (55% lower than forecast). These low returns were thought to be associated with impacts from the 1997 El Nino event. It was speculated that residual impacts of the 1997-98 El Nino also produced unfavourable conditions for juvenile sockeye survival off the British Columbia coast in 1998. Oceanographers reported that nutrient levels were low during this period. This suggested that planktonic food resources for the juvenile salmon might be poor, causing decreased survival of 1996 brood year smolts. In support of this view, the abundance of jack (age 3) sockeye in 1999 was low, which historically would have suggested that the return of age 4 adults in 2000 would also be low. Because these factors were not directly accounted for in the forecast methods, caution was applied in their interpretation.

In response to the high uncertainty surrounding the forecast of the 2000 Fraser River sockeye abundance, DFO provided a range of forecasts associated with the 50%, 60%, 75% and 90% probability levels that the return would exceed the predicted abundance. The Panel was faced with the choice of planning fisheries based on the forecasts at a particular level of probability that the run would be exceeded, or planning fisheries at several possible levels of abundance. The Panel considered the high uncertainty in the forecast and provided only general guidelines for fisheries in the form of conditions (e.g., level of abundance) for initiating fisheries in the two countries.

The second major source of uncertainty in 2000 began in late June, as Early Stuart sockeye began arriving in the Fraser River. High river flows increased the potential of a second consecutive year of difficult passage conditions for early-timed sockeye. Discharges of 8,000 cms were reached in early July. These discharge levels have been previously observed to impede adult migration through the Fraser Canyon. The high discharge level in the Fraser River during the Early Stuart sockeye migration likely slowed the passage of fish upstream and made them vulnerable to in-river First Nations' fisheries for a longer period than usual. This resulted in larger catches and lower escapements than anticipated. Later arriving stocks were relatively unaffected by discharge levels. Water temperatures in the Fraser River watershed were favourable for sockeye migration throughout most of the season.

The third major uncertainty in 2000 was abundance estimation of Chilko River sockeye, which was key for triggering many of the fisheries. The uncertainty in estimating Chilko run size was compounded by the early migration of Early Summer-run and some Summer-run stocks and

variable migration timing of stocks within the Summer-run group. Early indicators of the Summer-run sockeye returns suggested that these stocks would be less abundant than the run-size models were estimating; particularly because the estimated contribution of Chilko sockeye to fisheries early in the season was lower than expected. The Panel took a conservative approach to the harvest of Summer-run stocks because achieving the Chilko escapement goal had been given high priority. Later in the season, it became apparent that the timing of the Chilko migration was near average while the other Summer-run stocks, particularly the Late Stuart stock, were earlier than normal. However, by this time in the season, the earlier components of the Summer-run migration had passed through commercial fishing areas and only the escapement of the Chilko stock could be controlled by decisions on fishery openings. By the end of the season, it was apparent that the gross escapement targets for Early Stuart, Early Summer and most Summer-run stocks had been exceeded, at the expense of additional harvest in marine fishing areas.

The last major uncertainty characterizing the 2000 management season was the potential of high en route mortality of Late-run sockeye (Weaver, Portage, Adams, Cultus, etc.) resulting from their extremely early entry into the Fraser River. Typically, Late-run sockeye arrive in the Strait of Georgia from mid August to early September and delay there for four to six weeks before proceeding upstream to their spawning grounds. They usually enter the lower Fraser River in mid September to early October in an advanced state of sexual maturity. However, in recent years (e.g., 1996, 1998 and 1999) the upstream migration of many Late-run sockeye has occurred after only one to two weeks of delay when the fish were not sexually mature. High en route and pre-spawning mortality have been associated with the early entry timing. For example, approximately 88% of the Weaver, and 66% of the Adams sockeye died unspawned in 1999, based on the differences between Mission and upstream estimates of abundance.

Fishery managers hoped that Late-run sockeye would migrate according to historical behavior patterns in 2000 and delay in the Strait of Georgia until mid to late September. By August 1, Weaver sockeye were identified in the lower Fraser River test fishery catches. Subsequently, virtually all Late-run sockeye salmon entered the river almost immediately upon arriving in the Strait of Georgia. The 50% date of upstream abundance of Weaver sockeye at Mission was August 13. This was an astonishing six to seven weeks earlier than the average 50% date, and three weeks earlier than the earliest recorded migration date. Troll test fishing in the Strait of Georgia confirmed that few sockeye remained off the mouth of the Fraser River after September 1.

The extremely early migratory behavior of Late-run sockeye in August caused the Panel to increase the gross escapement target by 300,000 Late-run sockeye (later adjusted to 200,000 Late-run sockeye) in an attempt to compensate for expected mortalities. The harvest of Late-run sockeye was greatly reduced to provide this increased escapement. These harvest restrictions also reduced catches of Summer-run stocks that co-migrate with Late-run sockeye through marine areas and the lower Fraser River.

Post-season evaluation of the en route mortality of Late-run sockeye suggests that approximately 90% of these fish died before reaching their spawning grounds (many of which were silver-bright, sexually immature fish). In addition, of those Late-run sockeye that reached their spawning grounds, 24% died unspawned . Similar to 1999, the suspected primary causative agent in the mortality of Late-runs was the myxosporean parasite, *Parvicapsula minibicornis*. However, the factor leading to the mortality problem for Late-run stocks is thought to be their very early migration into freshwater, not the parasites or diseases that subsequently cause mortality. It is suspected that their early migration into freshwater induces physiological stress on the fish, which compromises their immune system, thus making them highly susceptible to diseases or parasites.

The early river entry of Late-run stocks is one of the most severe problems to affect the management of Fraser River sockeye in over 50 years of international and Canadian fisheries management efforts. It is a major conservation and management dilemma. The productivity of Late-run stocks will be greatly decreased, reducing the total abundance of Fraser sockeye. In addition, conservation requirements necessary to maintain and rebuild these stocks may dramatically reduce the harvest of the productive Summer-run stocks that co-migrate with Late-run stocks.

The Panel held a workshop at the Pacific Salmon Commission in February 2001 to help identify and plan potential areas of research to determine causes(s) of the early river-entry timing of Late-run sockeye. Approximately 40 scientists and biologists from agencies and universities in Canada and the United States attended the workshop. The participants divided into five groups, including: oceanographic factors, contaminants, predators, parasites and diseases, and physiological factors. Each group developed hypotheses and action plans for examining the potential causes of the early entry behavior. The groups identified potential hypotheses and ranked them in order of priority. The hypotheses that received the highest ranking were: (1) oceanographic factors (i.e. biological, chemical, and physical oceanographic characteristics) in the Strait of Georgia during the period of "normal" Late-run residency; (2) "biological clocks" in adult sockeye e.g., maturation, temporal, metabolic energy reserves, and osmotic triggers; and (3) parasites or contaminants (e.g., sewage, neurotoxins) that may be triggering the early entry. Participants also estimated the approximate costs and timelines for investigating the various hypotheses and identified potential sources of funding for the studies.

Planning will be initiated to determine what types of management actions are necessary to protect Late-run Fraser sockeye stocks from excessive harvest assuming that abnormal migration behaviour continues. Enhancement and mitigation efforts should also be considered to maximize the productivity of those Late-run sockeye that are surviving to spawn.

While Late-run sockeye escapements were small, the escapement of Upper Adams River sockeye increased considerably. This stock has been the focus of intense recovery efforts for over 50 years since it's extirpation in the early 1900's by the Hells Gate disaster of 1913 and a splash dam at the outlet of Adams Lake. Rebuilding efforts by DFO in 1996 resulted in the largest production and escapement (Figure 2) since before 1913.

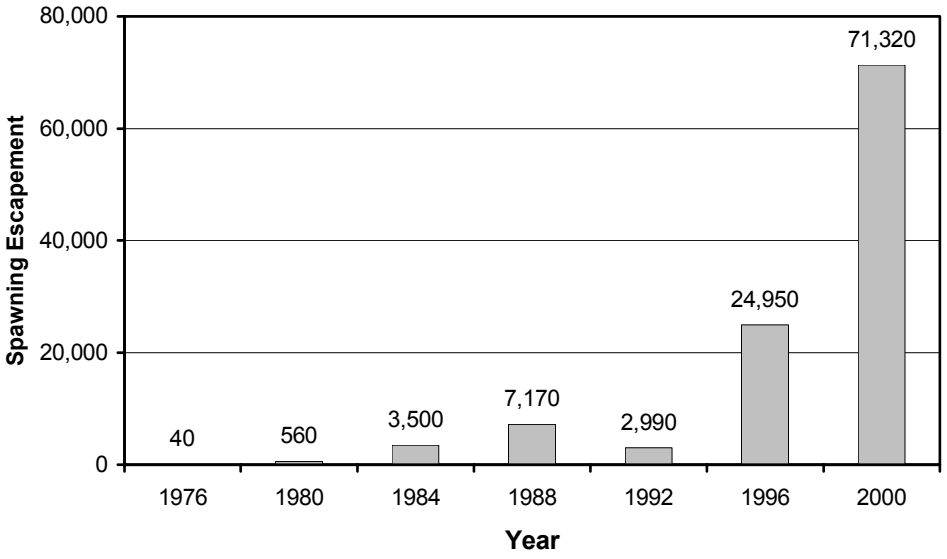

Figure 2. Spawning escapements to the Upper Adams River on the dominant cycle line since 1976, showing the substantial increase in escapements primarily due to re-building efforts.

As a result of lowered harvest rates and an apparent bias in the escapement estimates at Mission, Summer-run spawning populations greatly exceeded the anticipated number. A total of 1,650,000 adult sockeye were estimated to have reached their spawning grounds compared to an in-season expectation of 1,043,000 fish. Review of hydroacoustic programs failed to identify an apparent source of bias.

The 2000 season was difficult for Fraser River sockeye stocks, the fishers, and the fisheries managers. The uncertainties described above affected the numbers of fish harvested and the

numbers that successfully spawned. Compared to the normal situation, in 2000, the fisheries were focussed more on inside and in-river areas due to the uncertainties regarding the abundance and timing of key stocks. Escapement targets were exceeded for several stock groups. The most serious event in 2000, however, was the severe en route mortality of Late-run sockeye that will likely reduce the abundance of these stocks on future cycles.

IV. MANAGEMENT ACTIONS

A. Forecasts of Returns, Escapement Targets, and Potential TAC

Canada presented the Panel with run-size forecasts and spawning escapement targets for the 2000 return of Fraser River sockeye stocks at the Fraser River Panel meeting held from May 18-19, 2000. The methods and data used to develop the forecasts were unable to directly incorporate indicators of ocean conditions that were considered potentially unfavorable for salmonids. These adverse oceanographic conditions existed during the spring and summer of 1998, which was during the period of initial marine residency for Fraser sockeye that returned in 2000. DFO incorporated this uncertainty in their estimates and provided the Panel with a range of total run-size forecasts. This range (7,437,000, 4,083,000, 3,285,000, 2,296,000 and 1,380,000 fish) corresponded to the 25%, 50%, 60%, 75% and 90% probability levels at which the forecast would be exceeded (Appendix A, Table 1).

Canada provided a method of calculating spawning escapement targets by sockeye stock group as a function of returning run size (Appendix A, Table 2). Based on this calculation method, Canada established spawning escapement targets for the range of forecast run-sizes presented to the Panel. The spawning escapement targets relating to the forecast run-sizes noted above were 2,493,000, 1,639,000, 1,468,000, 1,158,000 and 886,000 fish, respectively.

Forecasts of peak (50%) arrival timing, with associated prediction intervals, for the Early Stuart and Chilko stocks were provided to the Panel on July 7. The stocks were forecast to have near normal peak arrivals in Area 20 of July 3 (Early Stuart) and August 4 (Chilko). On July 10, DFO provided a Johnstone Strait diversion rate forecast of 30%, which was based on sea surface temperatures.

At the meetings on May 18-19, the Fraser River Panel developed the fishery management plans in 2000 for Fraser River sockeye salmon in Panel Area waters. In response to the uncertainty surrounding the 2000 sockeye forecasts, the Panel developed gross escapement targets and TAC for international sharing at 50%, 60% and 75% forecast probability levels. The Panel used DFO's spawning escapement targets, PSC staff's projected test fishery catches, Canada's proposed management adjustments and an Aboriginal Fisheries Exemption of 400,000 fish as specified in Annex IV of the Pacific Salmon Treaty to facilitate the TAC calculations (Table 1).

Management adjustments for the Early Stuart and Early Summer-run timing groups were included in the gross escapement targets. The management adjustments were employed to compensate for the historical trend toward lower numbers of fish of these run-timing groups being accounted for upstream than at Mission. Fish were added to the gross escapement targets for these run-timing groups to help ensure that escapement targets were achieved. The United States accepted the management adjustments proposed by Canada, but requested a review of the methodology used to calculate the adjustments prior to the 2001 pre-season planning meetings.

PSC staff provided the Panel with daily abundance curves (Figure 3) for the arrival of Fraser River sockeye in Juan de Fuca Strait. This figure shows the expected timing and abundance of major stocks in 2000, at the 50% probability level forecast (4,083,000 fish).

Table 1. Pre-season forecasts of total run, spawning escapement target and other deductions, total allowable catch and Washington share at the 50%, 60% and 75% probability levels for 2000.

	Probability of Achieving Specified Run Size		
	50%	60%	75%
Total Run Size	4,083,000	3,285,000	2,296,000
Deductions			
Spawning Escapement Target	1,639,000	1,468,000	1,158,000
Management Adjustment	133,000	133,000	85,000
Fraser River Aboriginal Fishery Exemption	400,000	400,000	400,000
Test Fishing	65,000	50,000	40,000
Total Deductions:	2,237,000	2,051,000	1,683,000
Total Allowable Catch:	1,846,000	1,234,000	613,000
Washington Share of TAC			
Calculated Share (20.4% of TAC)	377,000	252,000	125,000
U.S. Payback	26,000	26,000	24,000
Share + Payback:	403,000	278,000	149,000

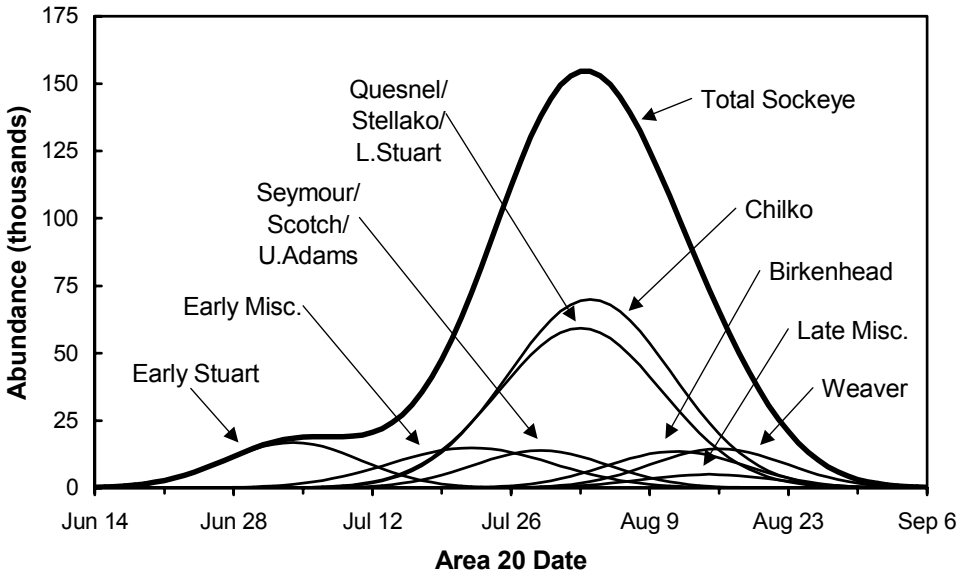

Figure 3. Expected daily abundance curves for migrating Fraser River sockeye salmon in 2000 (Area 20 date), based on forecast abundances (50% probability estimates) and timing patterns.

Based upon the pre-season forecasts, escapement targets and test fishing catch estimates, the TACs available for international sharing at the 50%, 60% and 75% probability levels were: 1,846,000 fish, 1,234,000 fish, and 613,000 fish, respectively (Table 1). The corresponding pre-season catch goals for Washington State fishers (20.4% of the TAC plus a 26,000 fish payback due to a catch shortfall in 1999) were 403,000, 278,000 and 149,000 sockeye, respectively. Goals for the domestic allocation of Fraser sockeye among Washington fishers were as follows:

1. Treaty Indian fishers were to receive 54.9% of the United States TAC, plus 3,000 of the 26,000 fish payback, while Non-Indian fishers were to receive 45.1% of the TAC, plus the remaining payback of 23,000 fish;
2. Treaty Indian fishers in Areas 4B, 5 and 6C were allocated a maximum of 20% of the Treaty Indian share; and
3. Among the Non-Indian commercial gear sectors, allocation targets were 54% for purse seines, 41% for gillnets and 5% for reefnets.

Canada did not identify a specific commercial TAC due to on-going negotiations with First Nations' regarding catch objectives in excess of the 400,000 fish Aboriginal exemption. However, DFO identified proportional sharing arrangements for the commercial sector: 43% for Area B purse seines, 12% for Area D gillnets, 23% for Area E gillnets, 15% for Area G trollers, and 7% for Area H trollers.

B. Pre-season Regulations

The 2000 Regulations and Management Plan for the Panel Area were developed using the run-size forecasts, gross escapement targets, and the international and domestic allocation goals outlined above. When the Management Plan was developed, DFO's forecasts of the diversion rate through Johnstone Strait (Figure 4), and 50% timing dates for Early Stuart and Chilko runs to the lower Fraser River were not available. Thus, a 50% diversion rate and average timing for all stocks was assumed. The Management Plan was developed using the Fishery Simulation Model, which the PSC staff used in formulating fishery recommendations to harvest available TAC. The 2000 fishery plans focussed on the harvest of Summer-run Chilko sockeye. Restrictions on fishing were anticipated early in the season to protect Early Stuart and Early Summer-run sockeye stocks and later in the season to protect Late-run sockeye. DFO also gave high priority to attaining the spawning escapement targets for Early Stuart and Chilko sockeye.

During the pre-season planning process, the Parties identified a number of conservation and management concerns. Species and stocks identified as being of concern to Canada included Skeena and Thompson River coho salmon, Lower and Upper Georgia Strait coho salmon, Johnstone Strait coho salmon, summer-run chum salmon, Thompson River steelhead, and Harrison River chinook salmon. The species and stocks identified by the United States included Hood Canal summer-run chum salmon, and Puget Sound chinook salmon.

On May 19, 2000, the Panel adopted regulations (Appendix B) for regulatory control of Panel Areas. The Commission accepted the regulations and submitted them to the Parties. As per the revised (1999) Annex IV, Chapter 4 of the Pacific Salmon Treaty (Appendix E), all sockeye and pink salmon fisheries regulated by the Panel were to be "closed unless opened" for fishing by in-season orders of the Panel.

In the pre-season Management Plan, fisheries in United States Panel Areas were anticipated to start during the week of July 22-29 in Areas 4B, 5 and 6C, and the week of July 30-August 5 in Areas 6, 7 and 7A. These tentative starting dates were contingent upon in-season run-sizes ranging from 2,300,000 to 4,100,000 fish, with consideration of stock proportions and daily abundance levels in Area 20, and cumulative escapement past Mission. Fisheries in Canadian Panel Areas were scheduled to open during the week of July 30-August 5 (for Area H trollers), and during the week of August 13-19 in Area 29 (for Area E gillnetters), subject to TAC availability.

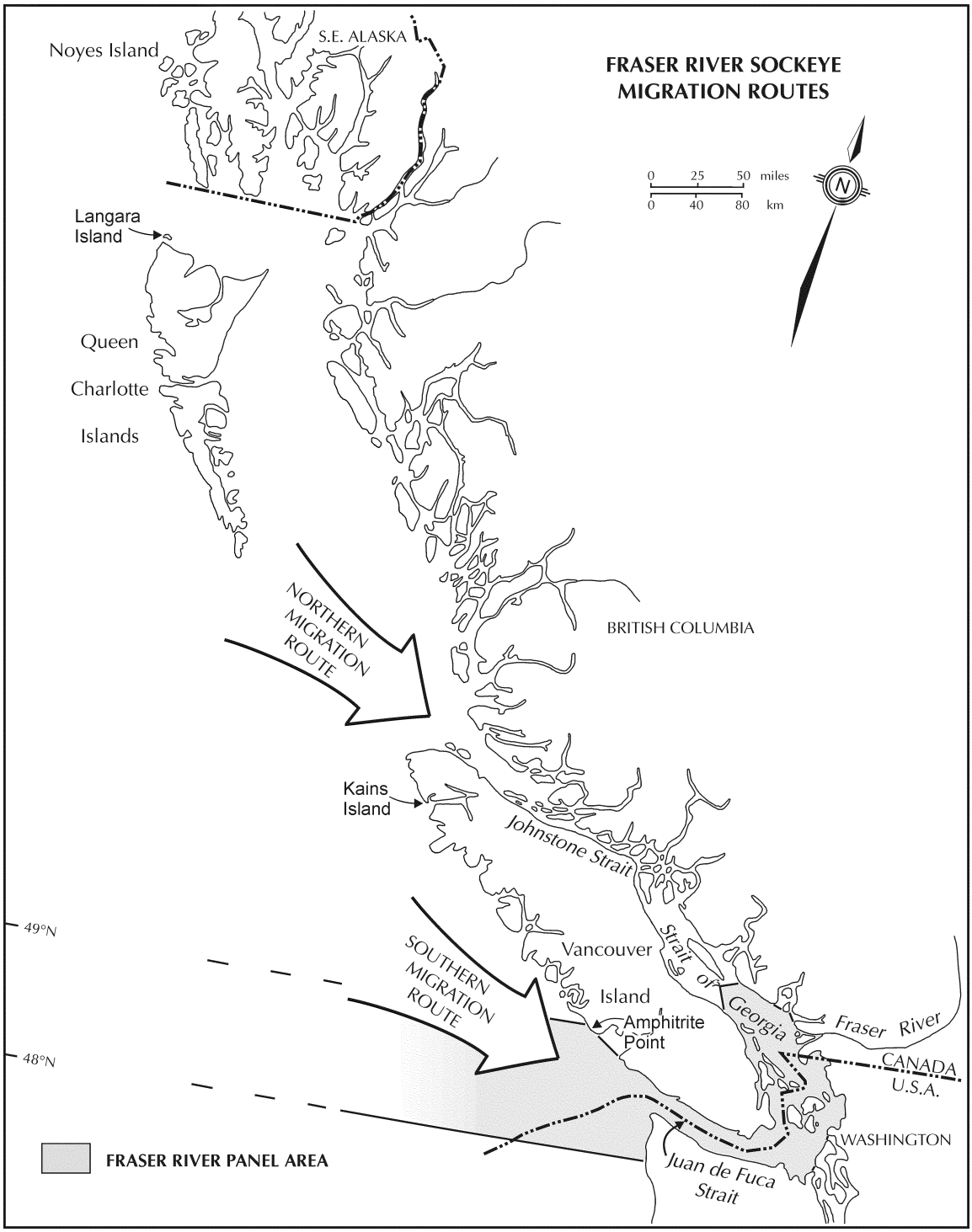

Figure 4. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migrating to the Fraser River.

C. In-season Regulations

Between June 28 and August 22, the Fraser River Panel conferred 21 times (by telephone or in-person) to discuss sockeye salmon run status and enact in-season orders (Appendix C) to regulate fisheries directed at the harvest of Fraser River sockeye salmon in Panel Areas

The main events of the season are summarized on a weekly basis below. This synopsis focuses on analyses and recommendations by PSC staff, and on Panel decisions.

The Panel met on June 28 to discuss the apparent early arrival of Early Stuart sockeye. At the time, staff analyses could not differentiate between early timing and larger than expected abundance, consequently no change was recommended to the pre-season abundance forecast and management actions were not considered. However, the Panel was informed that a departure from the pre-season fishing schedule might be required if early arrival timing was confirmed with subsequent information. On June 30, analyses presented to the Panel supported both early arrival timing and larger than forecast abundance. There was insufficient data to generate an accurate in-season run size update, however the Bayesian model (see Stock Monitoring section) indicated a 91% probability that the Early Stuart run would equal or be greater than the 50% pre-season forecast of 291,000 fish. The Panel consequently approved 291,000 fish as a minimum run size for the Early Stuart timing group. On July 3, the Panel approved an interim run-size estimate of 300,000 fish. This generated a commercial TAC of 37,000 fish and a United States share of 8,000 fish. Commercial fisheries were not recommended because of the small size of the TACs. The Panel recognized that any uncaught portion of the United States share that were expected to be composed of Early Stuart sockeye would be taken in the Summer-run group.

By July 7 staff and the Panel were becoming concerned about the migration conditions for sockeye in the Fraser River. The discharge at Hope was 8,000 cms, which was a level where en route losses had occurred in past years. PSC staff informed the Panel that migration delays were likely in the Fraser Canyon. The arrival of Early Stuart sockeye in the lower Fraser River was estimated to be four to five days early, and their abundance was consistent with the interim run-size estimate of 300,000 fish. Consequently, the Panel formally adopted an Early Stuart run-size estimate of 300,000 fish. In response to the early arrival timing of some Fraser sockeye stocks, the Panel also decided to advance the start-up date for the Area 20 purse seine test fishery, and advised DFO that the Area 12 and 13 purse seine test fisheries should be started earlier than previously scheduled.

On July 11, the Panel approved an Early Stuart run-size increase to 350,000 fish in response to estimates of larger than expected numbers of fish escaping past Mission, and stable proportions of Early Stuart sockeye in outside migratory areas. A fishery was not recommended for United States Panel Areas because the proportions of Early Stuart sockeye had declined to 50% in United States waters, and no TAC existed for the co-migrating Early Summer stocks. In outside migratory areas, Early Summer and Summer-run fish were identified in scale samples from the test fisheries. However, there was a high degree of uncertainty in the identification of fish from these timing groups.

Planning meetings held on July 13-14 included discussion of decision criteria to help provide guidance for recommendations on potential fisheries in United States Panel waters in 2000. The Panel approved general decision criteria incorporating stock proportions and daily abundances in Area 20 and cumulative Mission escapement. Based on these criteria, the Panel did not open Treaty Indian fisheries at Panel meetings on July 14 and 18. This was the first Panel Area fishery to proceed according to the preseason plan and was therefore of particular concern to the Panel. However, all of the decision criteria required to initiate this fishery had not been met. The abundance of Summer-run fish in Area 20 was not building strongly (it was below 50% of the total Fraser stock complex) and the escapement of Summer-run sockeye past Mission was insignificant.

Early Summer-run sockeye were tracking above the pre-season 50% forecast level by July 21, and appeared to be returning four to five days early. In contrast, the abundance of Summer-run sockeye were either arriving early at lower run sizes than forecast, or were normally timed and at

abundance levels close to the 50% forecast. In particular, racial analyses suggested that Chilko sockeye were present in much lower proportions than was expected for the date. The Panel adopted an interim Early Summer run size of 547,000 fish, which was the 50% probability forecast. At this run size, the United States TAC was 21,000 Early Summer sockeye. The staff advised the Panel that Summer-run sockeye TAC was available. Based on this information, the Panel approved a Treaty Indian fishery in Areas 4B, 5 and 6C.

On July 24, staff reported that estimated migration past Mission over recent days had exceeded expectations. Due to problems in the interpretation of data from marine test fisheries, PSC staff was having difficulty projecting escapements and the abundance of stocks. Run-size projections for Early Summer sockeye ranged from 575,000 to 700,000 fish, with arrival timing estimated to be six to eight days early. The Panel approved a run size estimate of 600,000 fish. At this run size the TAC was 144,000 fish and the United States share was 33,000 fish. With the arrival timing, and larger than forecast abundance of Early Summer sockeye, the staff suggested to the Panel that management actions outside of those identified in the pre-season fishing plan should be considered. One problem was that the gross escapement target for the Early Summer sockeye would likely be reached in the near future. A second problem was that Canada had not specified an allocation plan for their share of the TAC. The Panel approved Treaty Indian fisheries in Areas 4B, 5 and 6C, and Treaty Indian and Non-Indian fisheries in Area 7 and 7A based on the need to control Early Summer-run escapements, and because the by-catch of Chilko sockeye was expected to be small. Canada could not approve a recommended Area 29 gillnet fishery due to the absence of a gross escapement goal (for Canadian allocation purposes).

An unexpected surge of fish migrating into the Fraser River on July 25 warranted an increase in the Early Summer run-size estimate to 800,000 fish. In contrast, the abundance of Summer-run sockeye appeared to be either below forecast (if the run was early), or close to forecast (if the run timing was normal). Regardless of the total Summer-run return strength, weakness was identified in the Chilko stock, which was estimated to comprise only 20 to 33% of Summer-run sockeye. The Panel approved a gillnet fishery in Area 29 because of the larger TACs due to the increased run size, and to pace the escapement of Early Summer-run sockeye. Extensions were also approved for both the Treaty Indian and Non-Indian fisheries in the United States.

The Panel was informed on July 28 that Early Stuart sockeye were late in arriving to their natal streams. There were also reports of Early Stuart sockeye in poor condition from Williams Lake to the lower Nechako River. The Panel was informed that some of the Early Stuart sockeye, which had been delayed in the Fraser Canyon due to high river flows, would likely succumb en route to their spawning grounds.

During the period from July 25 to July 31, there was a high degree of uncertainty in the assessment of Fraser River sockeye in marine areas, and PSC staff were cautious in their interpretation of abundance data. The migration of Early Summer-run sockeye continued at a level consistent with a total run of 800,000 fish. However, the run was now estimated to be only three to four days early. Staff speculated that the timing profile of the Summer-run migration could be similar to that of the Early Summers. On July 31 the Panel adopted an interim Summer-run estimate of 2,400,000 fish (for planning purposes). The Panel also agreed to use 27% (650,000 fish) as the Chilko component of the Summer-run group. Canada informed the Panel that the spawning escapement target for Chilko sockeye would remain at 350,000 fish. The Panel approved a troll fishery in Canadian Panel waters (Area H) for Canadian domestic allocation needs on July 31 that was expected to have a low harvest of sockeye.

By August 2, it was apparent that the sockeye migration through United States waters over the previous few days, while small, was stronger than suggested by Area 20 test fishing indices. Run size estimates remained unchanged from July 31, as did the United States allocation which if distributed proportionally would be composed of 34,000 Early Summers and 142,000 Summer-run sockeye. Staff suggested that viable fishing opportunities existed for United States fishers and that there was an opportunity to harvest both Early Summer-run and Summer-run sockeye before the proportion of Chilko sockeye increased. There was concern that if the fishery was delayed, then the Early Summer-run component would decrease, while the Chilko component would increase. The Panel approved a Non-Indian fishery in Areas 7 and 7A and the Canadian Area H troll fishery continued under prior regulation.

By August 4 the abundance of Early Summer-run sockeye was declining in marine-area test fishing samples, while the Summer-run migration was building. The protracted migration pattern exhibited by the Early Summer-runs resulted in an upgraded run size estimate to 900,000 fish. The run size estimate for Summer-runs remained at 2,400,000 fish. The Panel also adopted an interim estimate of Late-runs at the 50% forecast level (577,000 fish) as a working number to remove artificial obstacles to the harvest of surplus Early Summer and Summer-run fish. This was considered appropriate because all earlier timed stocks, with the exception of Chilko, were returning at 50% forecast abundance levels, or larger. The United States Treaty Indian fishers had 132,000 fish remaining in their allocation at these run sizes and therefore the Panel approved Treaty Indian fisheries in Areas 4B, 5 and 6C as well as in Areas 6, 7 and 7A. Canadian Area E gillnet fishers had exceeded their allocation and their fishery remained closed. The Panel approved an extension to the Area H troll fishery, which had 110,000 fish remaining in its allocation.

The gross escapement of Early Summer-run sockeye was 4% over the goal, while the Summer-run escapement was 37% complete by August 7. The estimates of run size for Early Summer-run and Summer-run sockeye remained at 900,000 fish and 2,400,000 fish, respectively. The Chilko proportion of Summer-runs was now estimated at 40%, or 960,000 fish. This resulted in an increased TAC. It was determined that until the catches from the ongoing Treaty Indian fishery were assessed, no fisheries could be recommended for United States Panel waters. The Panel approved a Canadian Area H troll fishery, and discussed the need for an Area E gillnet fishery to minimize excess escapement of Early Summer-run and Summer-run stocks.

Escapements into the Fraser River continued to be difficult to project because of continued uncertainties in assessing marine test fishing indices. By August 8 the gross escapement goal for Early Summers (620,000 fish) had been exceeded (105% complete), the Summer-run escapement (664,000 fish) was 49% complete and the Late-run escapement (61,000 fish), comprised primarily of Birkenhead sockeye, was 19% complete. Staff could not identify the surplus of Early Summer sockeye early enough to recommend fisheries for their harvest and therefore, the Panel discussed the possibility of approving a deduction to the TAC based on a management imprecision of 50,000 for the Early Summer stock group. Agreement was not reached on this issue. The Panel approved a run size increase to 2,600,000 Summer-run sockeye. They also approved a Canadian Area E gillnet fishery to pace the escapement of Summer-run sockeye, and a Non-Indian fishery in Areas 7 and 7A to help achieve international allocation objectives.

On August 11, the Panel approved run size increases for Early Summer-runs (950,000 fish) and Late-run sockeye (700,000 fish). Based on the increase in the Early Summer estimate, the Panel agreed to a management imprecision deduction to the TAC of 70,000 fish for this run timing group. Analysis of data from scale analyses identified early entry of Late-run sockeye into the Fraser River. It was noted that a similar early migration of Late-run stocks in 1999 resulted in significant en route and pre-spawning mortality. The Panel approved an extension of the Canadian Area H troll fishery for Canadian domestic allocation purposes.

The United States had 21,000 fish remaining in its allocation of 461,000 sockeye, including 17,000 in the Non-Indian allocation and 4,000 in the Treaty Indian allocation on August 14. Canada had 656,000 fish remaining in its allocation, including outstanding balances in First Nations, commercial and selective fishery allocations. Staff did not make fishery recommendations for Canadian Panel Areas. The Area H troll fishery remained open until further notice, and no allocation remained for Area E gillnets. The Panel approved a Non-Indian fishery in Areas 7 and 7A (southerly and easterly of the Iwersen's Dock Line). The purpose of the fishery was to catch the remaining United States allocation of sockeye, and recognized that the by-catch of coho salmon would likely increase if fisheries occurred later in the month. Late-run sockeye continued to migrate directly into the Fraser River without delaying in the Strait of Georgia. PSC staff advised the Panel that this behavior pattern was anticipated to result in high en route and pre-spawning mortalities in these stocks.

On August 18, PSC staff informed the Panel that because of anticipated strong Summer-run escapements over the next several days, the gross escapement goal (1,406,000 fish) would be exceeded by August 20. Therefore, the Panel approved an Area E gillnet fishery to harvest some of the surplus. The fishery was restricted to sub-areas 11 to 17 in Area 29 to prevent the harvest of

Late-run sockeye that might be delaying in the Strait of Georgia. The Panel also increased the estimate of Late-run sockeye return to 1,000,000 fish. A management adjustment of 300,000 sockeye was adopted to compensate for the expected en route and pre-spawning moralities of Late-run sockeye. To help protect Late-run sockeye delaying in the Strait of Georgia, the Panel also closed the Area H troll fishery on August 20.

At the August 22 Panel meeting, DFO reported that the myxosporean parasite, *Parvicapsula minibicornis,* had been identified in kidney samples recently taken from Late-run sockeye in the Harrison River. DFO expressed concerns about potential en route and pre-spawning losses of these delaying fish. By August 22, the terminal abundance of Summer-run and Late-run sockeye in the Strait of Georgia was declining rapidly. The troll test fishery in the Strait of Georgia indicated few fish remaining there. The Panel consequently approved a staff recommendation to reduce the run-size estimates of both Summer-run (2,500,000 fish) and Late-run (800,000 fish). Because of the reduced Late-run run-size, the Panel also decreased the management adjustment of Late-run sockeye to 200,000 fish. At these levels, no TAC remained on Late-run stocks. Accounting estimates at the end of the season prompted the Panel to reduce the run size estimate of Early Summer-run sockeye to 925,000 fish. The Panel relinquished regulatory control of Canadian Area 20 and United States Areas 4B, 5 and 6C, and Areas 6, 7 and 7A (southerly and easterly of the Iwersen's Dock Line) effective August 27.

At the final in-season meeting on September 18, the Panel was provided with a final in-season estimate for Fraser River sockeye in 2000 of 4,541,000 fish. Final in-season run-size estimates by run-timing group were 366,000 Early Stuart, 923,000 Early Summer-run, 2,455,000 Summer-run, and 796,000 Late-run sockeye. Virtually all Late-run sockeye migrated into the Fraser River with minimal delay in the Strait of Georgia. The upstream migration of Late-run sockeye was approximately three weeks earlier than any past year on record. Based on data from recent years and observations in terminal areas, PSC and DFO staff predicted that large en route losses and pre-spawning mortalities were likely.

Net fishing times in Canadian Panel Areas are shown in Table 2. Fisheries were not scheduled in Area 20 due to coho conservation concerns expressed by Canada. Three gillnet fisheries were scheduled in Area 29. These fisheries were designed to help meet domestic allocation objectives and to pace the escapement of Early Summer and Summer-run stocks. Area H troll fisheries were scheduled in Areas 29 and 18, for periods of one day (July 28), three days (August 4-6) and twelve days (August 10-21) for domestic allocation purposes.

Table 2. Actual fishing times (days) in major Canadian fisheries in the Fraser River Panel Area in 2000.

	Area 20		Area 29 *	Areas 17,18,29
Date	Purse Seine	Gillnet	Gillnet	Troll
Jun.25-Jul.15	Closed	Closed	Closed	Closed
Jul.16-Jul.22	Closed	Closed	Closed	Closed
Jul.23-Jul.29	Closed	Closed	1	1
Jul.30-Aug.5	Closed	Closed	Closed	2
Aug.6-Aug.12	Closed	Closed	1	4
Aug.13-Aug.19	Closed	Closed	Closed	7
Aug.20-Aug.26	Closed	Closed	1	2
Aug.27-Sep.2	Relinq.	Relinq.	Closed	Closed
Sep.3-Sep.23			Closed	Closed
Sep.24-Sep.30			Closed	Relinq.
Oct.1-Oct.7			Closed	
Oct.8-Oct.14			Relinq.	
Total	0	0	3	16

* Area 29 fishing times are measured in 20-30 hour days.

Net fishing times in United States Panel Areas are shown in Table 3. These fisheries were conducted to meet international and domestic allocation obligations of the Panel. The Treaty Indian fishery in Areas 4B, 5 and 6C was open for a total of 234 hours spanning the period from July 21 to August 7. The Treaty Indian fishery in Areas 6, 7 and 7A was open twice, for a total of 58 hours. The Non-Indian fishery in Areas 7 and 7A was open on four separate occasions. The purse seines had 72 hours of fishing, the gillnets had 74 hours and the reefnet fishery had 44 hours.

Table 3. Actual fishing times (hours) in major United States net fisheries in the Fraser River Panel Area in 2000.

	Treaty Indian		Non-Indian		
	Areas	Areas	Areas 7 and 7A		
Date	4B, 5, 6C	6, 7, 7A	Purse Seine	Gillnet	Reefnet
Jun.25-Jul.15	Closed	Closed	Closed	Closed	Closed
Jul.16-Jul.22	30	28	Closed	Closed	Closed
Jul.23-Jul.29	156	Closed	16	16	16
Jul.30-Aug.5	6	30	32	34	16
Aug.6-Aug.12	42	Closed	12	12	12
Aug.13-Aug.19	Closed	Closed	12	12	Closed
Aug.20-Aug.26	Closed	Closed	Closed	Closed	Closed
Aug.27-Sep.2	Relinq.	Relinq.	Relinq.	Relinq.	Relinq.
Sep.3-Sep.23					
Total	234	58	72	74	44

* Times recorded to the nearest hour.

V. CATCH SUMMARY

A. Sockeye Salmon

The post-season estimate of the total return in 2000 was 5,217,000 Fraser River sockeye salmon (Table 4), which exceeded the pre-season run-size forecast of 4,083,000 fish (50% probability level) by 28%. This return was the third largest on the 2000 cycle (Figure 5), exceeding both the long-term average for the cycle of 3,806,000 fish and the average return on the cycle from recent years (1972-1996; 4,549,000) (Table 5). The commercial exploitation rate (27.8%) was the second lowest on record; 1996 was marginally lower at 27.6%. Exploitation rates in the other cycle years (1972-92) ranged from 50% to 77%. The total harvest rate (47%) was the lowest on record, for the cycle years spanning 1972-1996, while the spawning escapement comprised the second highest proportion (45%) of the run on record. The remainder of these fish (8%) were those fish that were estimated to have migrated upstream but died en route to their spawning grounds.

Table 4. Preliminary estimates of fishery catches, spawning escapement and total run of Fraser River sockeye salmon during the 2000 fishing season, by country and area.

	Number of Fish	% of Run
CANADA		
COMMERCIAL CATCH		
Fraser River Panel Area		
Areas 121-124 Troll	0	
Area 20 Net	0	
Areas 17-18 and 29 Troll	4,000	
Area 29 Net	418,000	
Total	422,000	8.1%
Non-Panel Areas		
Areas 1-10 Troll and Net	0	
Areas 11-16 Troll and Net	532,000	
Areas 124-127 Troll	1,000	
Total	533,000	10.2%
Commercial Total	955,000	18.3%
FIRST NATIONS CATCH		
Marine Areas		
Areas 12-16, 18, 20, and 123-126	89,000	
Area 29-1 to 7	2,000	
Total	91,000	1.7%
Fraser River		
Below Sawmill Creek	462,000	
Above Sawmill Creek	324,000	
Total	786,000	15.1%
First Nations Total	877,000	16.8%
NON-COMMERCIAL CATCH		
ESSR Fishery *	2,000	
Charter	8,000	
Recreational Fishery - Marine	6,000	
Recreational Fishery - Above Mission	24,000	
Non-Commercial Total	40,000	0.8%
CANADIAN TOTAL	1,872,000	35.9%
UNITED STATES		
COMMERCIAL CATCH		
Fraser River Panel Area		
Areas 4B, 5 and 6C Net	53,000	
Areas 6 and 7 Net	138,000	
Area 7A Net	300,000	
Total	491,000	9.4%
Non-Panel Areas		
Alaska Net	2,000	0.0%
Commercial Total	493,000	9.4%
NON-COMMERCIAL CATCH		
Ceremonial and Subsistence	3,000	0.1%
UNITED STATES TOTAL	496,000	9.5%
TEST FISHING		
COMMISSION		
Areas 20 and 29 Test Fishing	73,000	
Area 7 Test Fishing	0	
Commission Total	73,000	1.4%
CANADA		
Areas 12 and 13 Test Fishing	22,000	0.4%
TEST FISHING TOTAL	95,000	1.8%
TOTAL CATCH	2,463,000	47.2%
SPAWNING ESCAPEMENT	2,354,000	45.1%
DIFFERENCE BETWEEN ESTIMATES **	400,000	7.7%
TOTAL RUN	5,217,000	100.0%

* Harvest of Weaver Creek sockeye in the terminal area that were Excess Salmon to Spawning Requirements (ESSR).

** Gross escapement (Mission escapement + FN catch below Mission) minus spawning escapement and in-river catches in First Nations, recreational and ESSR fisheries.

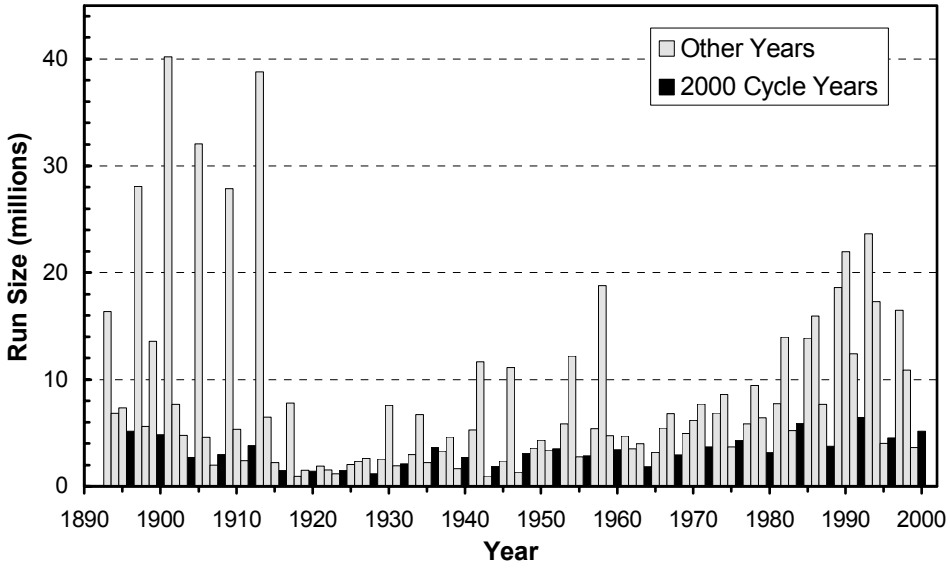

Figure 5. Total run sizes of Fraser River sockeye salmon between 1893-2000. Returns on the 2000 cycle are emphasized.

Catches of Fraser River sockeye salmon in all fisheries totalled 2,463,000 fish (Table 4). Canadian catches of 1,872,000 sockeye included a commercial harvest of 955,000 fish, a First Nation's catch of 877,000 fish and miscellaneous non-commercial catches of 40,000. United States fishers caught 496,000 fish, including a commercial harvest of 493,000 and a ceremonial and subsistence catch of 3,000 fish. In addition to the catches outlined above, test fisheries authorized by the Fraser River Panel landed 95,000 sockeye.

Estimates of spawning escapements totalled 2,354,000 sockeye, while an estimated 400,000 fish died between Mission and the spawning grounds due to environmental and disease factors (see Introduction).

The average weight of age 4 Fraser sockeye caught in purse seine test fisheries in Area 20 was 2.78 kg (6.1 lbs.).

Table 5. Comparison of recent run sizes, harvests and spawning escapements for Fraser River sockeye salmon on the 2000 cycle.

		Commercial Catch		Total Catch		Spawning Escapement	
Year	Run Size	Fish	%	Fish	%	Fish	%
1972	3,708,000	2,743,000	74%	2,878,000	78%	830,000	22%
1976	4,341,000	3,284,000	76%	3,517,000	81%	823,000	19%
1980	3,133,000	2,069,000	66%	2,285,000	73%	848,000	27%
1984	5,919,000	4,572,000	77%	4,988,000	84%	932,000	16%
1988	3,774,000	1,917,000	51%	2,355,000	62%	1,418,000	38%
1992	6,442,000	4,165,000	65%	4,925,000	76%	1,120,000	17%
1996	4,523,000	1,247,000	28%	2,187,000	48%	2,091,000	46%
2000	5,217,000	1,448,000	28%	2,463,000	47%	2,354,000	45%

* Differences between estimates and en route mortalities account for remaining fish.

i. Canada

A total of 1,872,000 Fraser River sockeye salmon were harvested in commercial, First Nation's and non-commercial fisheries in Canada (Table 4). The commercial catch was 955,000 fish, including 422,000 fish caught in Panel Areas and 533,000 fish harvested in non-Panel Areas. Non-commercial catches included DFO charter catches of 8,000 fish, an ESSR catch of 2,000 fish and recreational catches of 6,000 fish and 24,000 fish in marine and Fraser River areas, respectively.

Estimates of Canadian commercial catches of Fraser River sockeye salmon by gear type and area are presented in Table 6. Area B (southern) purse seines caught 274,000 sockeye (28% of the Canadian commercial catch), Area D (Johnstone Strait) gillnets caught 150,000 sockeye (16% of the commercial harvest) and Area E (Fraser River) gillnets caught 418,000 (44% of the commercial share). Within the troll sector, Area G (outside) trollers caught 29,000 sockeye (3% of the commercial harvest), and Area H (inside) trollers caught 84,000 sockeye (9% of the commercial share). Weekly catches in Canadian fishing areas are shown in Appendix D (Tables 1-4).

First Nation's fishers caught 877,000 sockeye, including 91,000 fish harvested in marine fisheries and 786,000 in the Fraser River (Table 4). The catch distribution in the Fraser River was 161,000 fish caught in the Fraser River below Mission, 301,000 harvested in the mainstem of the Fraser River between Mission and Sawmill Creek, and 324,000 caught in the mainstem of the Fraser River and in tributaries upstream of Sawmill Creek (Appendix D: Table 5).

Table 6. Preliminary estimates of Canadian commercial catches of Fraser River sockeye salmon by gear type, license designation and statistical area during the 2000 fishing season.

	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
1-10	0		0			0			0
11-16		274,000		150,000	0		28,000	80,000	532,000
121-127		0		0			1,000		1,000
20		0			0		0		0
17, 18, 29		0			418,000			4,000	422,000
Total Catch	0	274,000	0	150,000	418,000	0	29,000	84,000	955,000
% of Catch	0.0%	28.7%	0.0%	15.7%	43.8%	0.0%	3.0%	8.8%	100.0%

* DFO preliminary post-season catch estimates.

ii. United States

Catches of Fraser River sockeye in the United States totalled 496,000 fish, 491,000 fish in Panel Area commercial fisheries, 2,000 fish in Non-Panel Area commercial fisheries and 3,000 fish in ceremonial and subsistence fisheries (Table 4). Treaty Indian fishers harvested 263,000 fish, including a catch of 55,000 fish in Areas 4B, 5 and 6C, and 208,000 fish in Areas 6, 7 and 7A (Table 7). Non-Indian catches totalled 231,000 sockeye, including 112,000 fish caught by purse seines, 101,000 fish by gillnets and 18,000 fish by reefnets. Weekly catches of Fraser River sockeye salmon in United States Panel Areas are shown in Appendix D (Table 6).

Table 7. Preliminary estimates of United States catches of Fraser River sockeye salmon by user group, gear type and statistical area during the 2000 fishing season.

Areas	Test and Ceremonial	Purse Seine	Gillnet	Reefnet	Total
Treaty Indian					
4B, 5 and 6C	2,000	0	53,000	0	55,000
6 and 7	0	29,000	15,000	0	44,000
7A	1,000	59,000	104,000	0	164,000
6, 7 and 7A Total	1,000	88,000	119,000	0	208,000
% of Catch	0.5%	42.3%	57.2%	0.0%	100.0%
Total Catch	3,000	88,000	172,000	0	263,000
% of Catch	1.1%	33.5%	65.4%	0.0%	100.0%
Non-Indian					
7	0	32,000	44,000	18,000	94,000
7A	0	80,000	57,000	0	137,000
Total Catch	0	112,000	101,000	18,000	231,000
% of Catch	0.0%	48.5%	43.7%	7.8%	100.0%
United States					
Panel Area Total	3,000	200,000	273,000	18,000	494,000
Alaska (District 104) Catch					2,000
Total Catch					496,000

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

VI. STOCK MONITORING

The goal 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. This information is required for developing fishing plans that aid in meeting escapement and catch allocation objectives. Commercial catches usually provide much of the data used in the analyses. In addition, test fisheries (Table 8) conducted by the Commission or by DFO (at the Commission's request) provide important data before and after the commercial fishing season and between fishing periods. Information about upstream migration in the Fraser River is primarily obtained by echosounding at Mission, B.C., visual observations at Hells Gate and analysis of catches in Fraser River First Nations' fisheries.

The upstream passage of sockeye in 2000 was monitored at Mission from June 23 to September 3. Estimates of daily sockeye escapements were calculated by applying species composition data collected from gillnet test fishing at Whonnock to hydroacoustic estimates collected at Mission. In addition, the PSC and DFO jointly conducted the sixth year of an experimental split-beam hydroacoustic program.

Daily observations at Hells Gate between June 29 and August 25 provided qualitative information on the success of upstream fish passage and abundance. The observations also provided a rough index for projecting the relative abundance of sockeye migrating through Hells Gate.

Table 8. Test fishing operations that were approved by the Fraser River Panel for the 2000 fishing season.

Area	Gear	Dates of Operation	Operated by
Canadian Panel Areas			
20	Purse Seine	July 18 - August 17	PSC
20	Gillnet	June 20 - August 16	PSC
29-13	Gillnet	July 4 - August 25	PSC
29-16	Gillnet	June 23 - September 7	PSC
29-1 to 6	Troll	August 22 - September 6	PSC
Canadian Non-Panel Areas			
12	Gillnet	July 11 - August 14	DFO
12	Purse Seine	July 18 - August 20	DFO
13	Purse Seine	July 18 - August 20	DFO
United States Panel Areas			
7	Reefnet	July 20 - July 20	PSC

A. Sockeye Salmon

Run-size estimation for Fraser River sockeye by stock group is based primarily on catch, effort, escapement, racial composition and diversion rate data. These data are analysed using purse seine catch, catch-per-unit-effort (CPUE), cumulative-normal and cumulative-passage-to-date models, which are described in the Pacific Salmon Commission's Technical Report No. 6[1] and in the Fraser River Panel's 1995 Annual Report[2]. Much of the data used in these models are obtained from commercial fisheries, however, in 2000, commercial fishing was very restricted. Therefore, test fishing catch and CPUE data were used more extensively than normal in assessing stock group abundances.

Early Stuart sockeye are the first Fraser River sockeye run arriving in coastal waters off British Columbia. Larger than expected numbers of Early Stuart sockeye migrating in the lower Fraser River in late June suggested that the run was earlier than the forecast return timing in Area 20 of July 3. An estimated 12,000 Early Stuart sockeye passed Mission prior to the start of the in-river monitoring programs (test fisheries and echosounding). Analyses on June 25 indicated the run size was equal to or slightly higher than the 50% pre-season forecast (291,000 fish). However, by June 30 estimates of abundance ranged from 340,000-414,000 fish with peak Area 20 timing of June 28, which was five days earlier than forecast. This resulted in the 50% pre-season forecast of 291,000 fish being adopted for in-season management. On July 3, the variability in the estimates decreased and they ranged from 351,000-385,000 fish and an interim run-size estimate of 300,000 Early Stuart sockeye was adopted. By July 7, a decrease in the test fishing CPUE in Area 20 indicated that the run might be contracted and much earlier than forecast and the estimates of run size ranged from 275,000-295,000 fish. Staff also raised concerns that the adverse effect of high water levels (8000 m^3/s at Hope) in the Fraser River would likely cause en route loss and pre-spawning mortalities. By July 7, there was evidence that the migration of Early Stuart sockeye was not as contracted as previously estimated and the Panel approved a run-size increase to 350,000 fish. The estimated 50% point of the migration through Area 20 was June 28, which was five days earlier than the long-term average date. The final in-season estimates of Early Stuart abundance and gross escapement were 366,000, and 354,000 fish, respectively.

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

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

Later in July and in early August, management efforts focussed on Early Summer-run sockeye. Assessment of the abundance of this timing group was complicated by the relatively high abundance of co-migrating Summer-run sockeye. By July 11, 43,000 Early Summer-run sockeye were accounted for in catch and escapement. This was a large abundance for the date, which indicated that the return timing and distribution might be similar to the early timing and broad distribution of the Early Stuart run. On July 21, estimates of run size ranged from 650,000-800,000 Early Summer-run sockeye. The Panel approved an estimate of 547,000 fish (the 50% point forecast) as a working estimate. The run-size estimates ranged between 575,000 to 700,000 fish on July 24 with timing assumptions that the run was 6-8 days earlier than normal and the Panel approved a run-size upgrade to 600,000 fish. Because of continued large abundances of Early-Summer-run sockeye in marine areas and the Fraser River, the run size was increased to 800,000, 900,000, then 950,000 fish on July 25, August 4, and August 11, respectively. The 50% point of the migration through Area 20 was estimated to have occurred on July 20, which was about five days earlier than normal. The final in-season estimates of Early Summer-run abundance and gross escapement were 924,000 and 650,000 fish, respectively.

As in the two previous years, assessment of Summer-run sockeye abundance in 2000 was based primarily on reconstruction of catches and escapements past Mission (cumulative-normal and cumulative-passage models) rather than on commercial catch and effort models. The early timing of the Early Stuart and Early Summer runs indicated that Summer-run fish might also be early. By July 28, the strong abundance of the Late Stuart and Stellako stocks indicated early timing of the Summer-runs, however, there was apparent weakness in the Chilko component of the run. Early assessments indicated that Chilko sockeye were less abundant and earlier than forecast (50% date of August 3 through Area 20). On July 31, the Panel approved an interim estimate of 2,400,000 Summer-run sockeye, including an estimated 650,000 Chilko sockeye. Estimates of Summer-run abundance ranged between 2,400,000 and 2,600,000 sockeye on August 4. Because of more optimistic model estimates, the run size was upgraded on August 8 to 2,600,000 fish. On August 22, when the expected abundance of Summer-run sockeye was not evident, the Panel approved a run-size downgrade to 2,500,000. By the end of the season, Summer-run sockeye abundance was estimated at 2,454,000 fish with a gross escapement of 1,390,000 fish. The 50% migration date of Summer-run sockeye through Area 20 was August 3, which was approximately the same as the long-term average as well as near the forecast timing for Chilko sockeye (August 4).

The assessment of Late-run sockeye abundance was complicated by the higher abundance of co-migrating Summer-run sockeye, the closure of Area 20 commercial fisheries, and their very early upstream migration. The Panel adopted a provisional run-size estimate of 577,000 Late-run sockeye (the 50% point forecast) on August 4 because the other run timing groups were generally returning at or greater than forecast abundance levels. On August 11, the estimate was increased to 700,000 fish and on August 18, to 1,000,000 fish based on model run assessments. The run size estimate was decreased to 800,000 sockeye on August 22, due to weakness of the latter part of the migration. Because the typical delay of Late-run sockeye in the Strait of Georgia during August and September did not occur in 2000, the low catches in the Area 29 troll test fishery gave early indications that the run was not delaying. However, overall, the information was not useful for assessing the run-size of Late-run sockeye. At the end of the season, Late-run abundance was estimated at 800,000 fish with a gross escapement of 498,000 fish. The 50% migration date of Late-runs through Area 20 was estimated to be August 6, which was approximately 9 days earlier than the recent cycle average.

Early in the 2000 sockeye migration, the estimated proportion of fish migrating via Johnstone Strait was less than 10%. The diversion rate increased to 50% by the beginning of August then decreased to 30% by the middle of August. The average diversion rate for the season was estimated at 36%, which was slightly higher than Canada's forecast of 30%.

Cottonwood test fishing CPUE's are plotted against the daily hydroacoustic estimates of sockeye passage at Mission in Figure 6. Cottonwood data are lagged one day, which is the estimated travel time for sockeye between Cottonwood and Mission sites. Daily abundance changes at Cottonwood normally align closely with the abundance at Mission the following day.

Observations at Hells Gate indicated that the migration speed of sockeye from Mission to Hells Gate was slower than normal during the first 10 days of July. This was due primarily to the high discharge rates in the Fraser River during this period. Later in the season, as discharge rates declined to near normal levels, observations at Hells Gate confirmed that delay behaviour was no longer a problem.

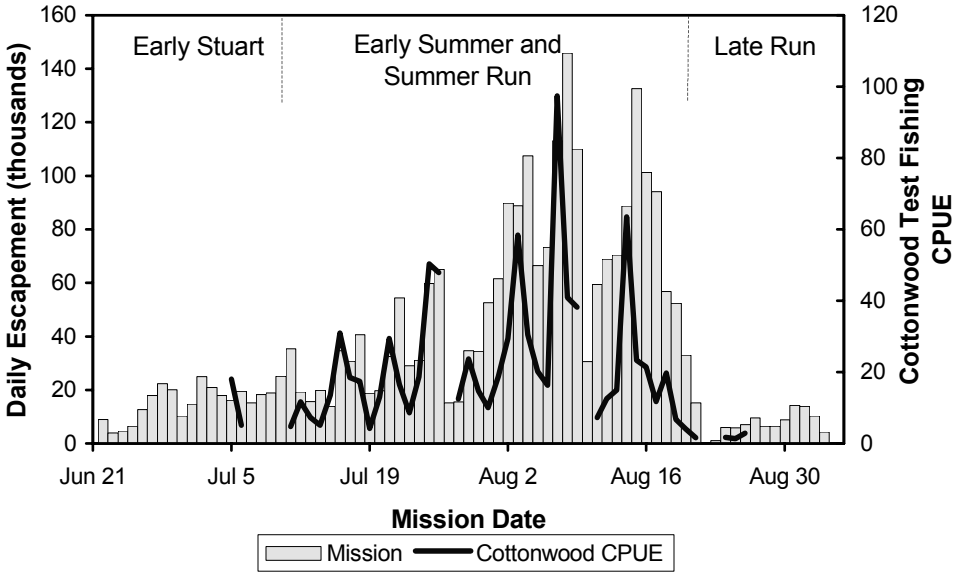

Figure 6. Daily escapements of sockeye salmon estimated by echosounding at Mission, compared with test fishing CPUE's at Cottonwood one to two days earlier. The primary migratory periods of the four run-timing groups are also indicated.

B. Split-Beam Hydroacoustic Study at Mission

PSC and DFO staff conducted a joint hydroacoustic study from 1995-1998[1,3] to examine assumptions regarding salmon behaviour and distribution that are implicit in the standard echo-sounding method, which is used to estimate the daily escapement of salmon passing Mission. This method is based on mobile and stationary, downward-looking, single-beam echo sounding. In 1999, joint studies commenced to evaluate the potential for using split-beam hydroacoustic technology for the escapement estimation program. These studies continued in 2000 and focused on examining the three following Mission hydroacoustic systems:

1. shore-based, side-looking, split-beam system on the south shore of the Fraser River;
2. shore-based, side-looking, split-beam system on the north shore of the Fraser River; and
3. downward-looking, split-beam system operated on the vessel along with the single-beam system.

The main objective of these studies was to test the effectiveness of operating an integrated split-beam system with computer processing of the hydroacoustic data on a near real-time basis for daily escapement estimation of salmon. Narrow-beam, side-looking transducers positioned on the south and north shores provided data that indicated salmon (mainly sockeye) exhibited normal upstream migratory behavior in 2000 corresponding well to data collected from 1995 to 1999, which included fish distribution, speed of travel and direction of travel. Analysis of the split-beam transecting/stationary data indicated that a wide-beam transducer could be used to track individual fish from a moving vessel.

[3] Pacific Salmon Commission. 2000. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1998 Fraser River sockeye salmon fishing season. Vancouver, B.C., 66 p.

While additional studies are required to develop strategies for operating split-beam hydroacoustic systems in the Fraser River, it is probable that the new system will be implemented by 2002 or 2003. Unlike the single-beam system, this new hydroacoustic strategy can be used to examine whether boat avoidance by the migrating salmon is an important source of bias in the data that is collected.

VII. RACIAL IDENTIFICATION

A. Sockeye Salmon

PSC staff conduct programs designed to identify the stock proportions of Fraser River sockeye in commercial, test and First Nations' catches. These data provide information on the abundance and timing of sockeye stocks as they migrate to their natal rivers in the Fraser River watershed. Racial data are also used to account for Fraser River sockeye salmon wherever they may be caught, and to apportion the daily estimates of sockeye escapement past Mission into discrete stock groups. Except where noted below, racial analysis methods in 2000 were similar to past years.[4,5]

Analyses of scale samples from catches in commercial and test fisheries were conducted daily, beginning in late June and continuing through late August. Commission staff sampled test fishing catches and commercial sockeye landings at sites in Vancouver, Steveston, Port Renfrew, and Port Hardy, British Columbia. Alaska Department of Fish and Game (ADF&G) collected samples from the District 104 purse seine fishery at landing sites in Petersburg and Ketchikan, Alaska. DFO provided samples from Johnstone Strait purse seine test fisheries. In addition, DFO and First Nations' personnel coordinated weekly scale sampling from Fraser River First Nations' fisheries located near Chilliwack, Yale, Lytton, Bridge River and Sheep Creek.

i. Analyses

In 2000, the pre-season expectations of the most abundant stocks and/or stock groups were Chilko, Stellako, Quesnel, and Late Stuart. These stocks, in combination with other numerically smaller stocks, were pooled to form nine stock groups: Early Stuart, Fennell/Bowron/Upper Adams, Nadina/Pitt, Gates, Chilko, Late Stuart/Stellako/Quesnel, Birkenhead, Weaver/Cultus and Portage/Adams/Lower Shuswap. For most stock identification analyses in 2000, the nine stock groups were incorporated into one of two categories of in-season models: (1) those with Early Summer and Summer-run stock complexes, or (2) those with Summer-run and Late-run stock complexes.

Stock-specific baseline standards used for in-season racial analyses are developed from two sources. The preferred source relies on scales from siblings of current year age 4 and 5 fish because they have reared together in the same nursery lake and thus have similar freshwater scale patterns. The second and less preferable source is used when sibling data from the previous year are unavailable. Baseline standards are developed using data from the same age class from prior years. Because of the low return of age 3 fish in 1999, only three stocks provided sufficient returns of jacks for scale samples to develop age 4 standards for 2000: Gates (n=107), Birkenhead (n=59) and Weaver (n=58). Although small jack samples were also available for Chilko (n=9), Stellako (n=25), and Portage stocks (n=22), the majority of scales for age 4 standards for these stocks and all others stocks came from prior years' age 4 returns. Reliance on age 4 standards created from past years' age 4 scales reduces the accuracy of in-season baseline standards compared to years when many jacks are available for sampling.

Discriminant Function Analysis (DFA) of scale patterns from standards that were developed pre-season, identified similarities within the following two groups: (1) Chilko,

[4] Gable, J.H. and S.F. Cox-Rogers. 1993. Stock identification of Fraser River sockeye salmon: methodology and management application. Pacific Salmon Comm. Tech. Rep. No. 5: 36 p.
[5] Pacific Salmon Commission. 1999. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1997 Fraser River sockeye and pink salmon fishing season. Vancouver, B.C., 47 p.

Fennell/Bowron/Upper Adams, Gates, and Portage/Adams/Lower Shuswap; and (2) Stuart/Stellako/Quesnel, Nadina/Pitt, Birkenhead, and Weaver/Cultus. These similarities in the scale patterns caused the most difficulty for stock discrimination models during periods when the timing-abundance curves of the less abundant Early Summer-run and Late- run stocks overlapped with the more abundant Summer-run stocks (Figure 3). Usually, the timing-abundance overlaps have been divided into two distinct periods: (1) the transition from Early Summer-runs to Summer-runs, and (2) the transition from Summer-runs to Late-runs. However, in 2000, the problem was exacerbated by the extremely early upstream migration of Late-run stocks combined with the relatively strong returns of Early Summer-run stocks. Consequently, Early Summer-run, Summer-run and Late-run stocks were all present in significant proportions in samples collected from both river and marine areas for about a two-week period between late July and early August. When stocks with similar scale characters differ greatly in abundance, stock discrimination models tend to overestimate stocks present in low proportions and underestimate stocks present in high proportions. The methods used to minimize this bias were similar to past years.[6]

Post-season racial analyses were performed using baseline standards derived from spawning ground scale samples collected in 2000. The major stocks included in each stock group were the same in the post-season and in-season DFA models, with two exceptions. In the post-season analyses, the proportion of Quesnel fish was estimated from the prevalence of the brain parasite, *Myxobolus articus*, and the Nadina stock was estimated individually rather than as part of the Nadina/Pitt stock group.

In 2000, PSC staff continued their collaboration with DFO to assess the potential use of microsatellite DNA markers to distinguish among Fraser River sockeye stocks. Baseline samples from fish collected from spawning areas by PSC staff with assistance from DFO in 1998 and 1999 were scored at 14 microsatellite loci on an automated sequencer. The initial tests of the accuracy of this microsatellite DNA method are encouraging but further work is needed to test the method under a wider range of stock composition scenarios. In addition to these analyses, PSC staff collected spawning ground samples from 19 Fraser River sockeye populations to expand the existing baseline. Early Summer-run and Late-run stocks were the focus of spawning ground sampling in 2000, because the existing baseline was inadequate. In-season DNA samples were also obtained from test fisheries in marine areas and the Fraser River for post-season analysis.

Future work in 2001 will include the analysis of two additional major histocompatability (mhc) loci to improve stock discrimination capability (16 loci in total). A subset of the 2000 in-season and spawning ground collections were analyzed. In 2001, PSC staff plan to collect and analyze in-season and spawning ground samples.

ii. Estimates of Escapement and Production by Stock Group

In-season estimates of gross escapement (Mission escapement plus First Nations' catch below Mission) by stock group (Table 9) based on in-season racial data, were compared to estimates where post-season racial standards were applied. This enabled the effect of changes between in-season and post-season estimates of racial composition to be determined. The post-season racial analysis resulted in relatively small changes from the in-season estimates for most stock groups. The largest changes in the estimated gross escapement occurred among the less abundant stock groups from the Early Summer-runs and the Late-runs, which displayed freshwater scale characteristics that were similar to the Summer-run stock-groups, including: Fennell/Bowron/Upper Adams (53% increase), Birkenhead (66% decrease) and Portage/Adams/Lower Shuswap (39% decrease). The estimate of the gross escapement of Birkenhead sockeye decreased because the post-season scale standard was more distinct, whereas the in-season standard was more similar to the Late Stuart/Stellako/Quesnel stock group. Because in-season scale models could not adequately distinguish the Fennell/Bowron/Upper Adams stock group from Chilko, the Fennell/Bowron/Upper Adams stock group was removed from the in-season models in early August to minimize estimation bias. Therefore, the in-season migration of the Fennell/Bowron/Upper Adams stock group was artificially truncated and the resulting total gross escapement estimate was low. The post-season gross escapement estimate was larger

[6] Pacific Salmon Commission. 2000. Report of the Fraser River Panel to the Pacific Salmon Commission on the 1998 Fraser River Sockeye fishing season. Vancouver. B.C., 66 p.

because the later-timed part of the Fennell/Bowron/Upper Adams stock group was estimated using spawning ground timing data obtained from fences (weirs) at Fennell and Scotch Creeks and bridge counts which indexed the Upper Adams River migration.

Table 9. Comparison of in-season and post-season estimates of gross escapement of Fraser River sockeye salmon stocks in 2000.

Run	Gross Escapement *		Difference	
	In-season	Post-season	Fish	%
Early Stuart	354,000	367,000	13,000	4%
Early Summer				
Bowr./Fenn./U.Adams	133,000	204,000	71,000	53%
Nadi./Raft/Gates/Pitt	517,000	508,000	(9,000)	-2%
Total	650,000	712,000	62,000	10%
Summer				
Chilko	612,000	527,000	(85,000)	-14%
Ques./L.Stuart/Stel.	778,000	878,000	100,000	13%
Total	1,390,000	1,405,000	15,000	1%
Late				
Birkenhead	106,000	36,000	(70,000)	-66%
Weaver/Cultus	256,000	290,000	34,000	13%
Portage/Adams/Misc.	136,000	83,000	(53,000)	-39%
Total	498,000	409,000	(89,000)	-18%
Total	2,892,000	2,893,000	1,000	0%

* Escapement past Mission plus First Nations catches below Mission.

The scale patterns for the Portage/Adams/Lower Shuswap stock group were overlapped with Chilko. During the in-season period, Portage/Adams/Lower Shuswap were estimated by identifying groups of fish with length and/or scale patterns that were distinct from the Chilko (and Late Stuart/Stellako/Quesnel) standard. In the post-season analysis, the early and middle timed components of the Portage/Adams/Lower Shuswap profile were estimated using the Weaver profile. This indirect method was used because: (1) Weaver stock proportions were accurately estimated by the DFA model due to its distinct scale patterns; (2) the DFA model likely over-estimated the Portage/Adams/Lower Shuswap proportions relative to the Weaver proportions during the peak migration of Summer-runs; and (3) Portage/Adams/Lower Shuswap and Weaver sockeye have shown similar entry patterns into the Fraser River in past years.

The total return of Early Stuart sockeye (378,000 fish, Table 10) was 30% greater that the pre-season forecast (291,000 fish). Recorded catches for this stock consisted of 11,000 fish in test and miscellaneous non-commercial fisheries and 206,000 fish in Fraser River First Nations' fisheries. The exploitation rate for all catch areas was 57%. An estimated 71,000 Early Stuart sockeye died en route to their spawning grounds.

The total return of Early Summer-run stocks was 1,050,000 fish (Table 10), which was almost double the pre-season forecast of 547,000 fish. Catches of Early Summer-run sockeye from commercial, test, and marine First Nations' fisheries totalled 274,000 fish. In addition, in-river recreational and Fraser River First Nations' fisheries caught 202,000 fish. The exploitation rate on Early Summer-run stocks was 45%. Spawning escapements were approximately 116,000 fish larger than expected during the in-season period, based on Mission hydroacoustic estimates.

The total return of Summer-run stocks was 3,080,000 fish (Table 10), which was about 15% greater than the pre-season forecast (2,668,000 fish). Commercial, test and marine First Nations' catches totalled 1,066,000 fish, while in-river recreational and Fraser River First Nations' catches totalled 364,000 fish. The exploitation rate for Summer-run stocks in all fisheries was 46%. The upstream estimates of Summer-run migration (catch plus spawning escapement) exceeded estimates

at Mission by 578,000 fish. This difference was the amount that spawning escapements exceeded anticipated levels based on Mission estimates of fish passage.

Table 10. Catches, escapements, differences between estimates, run sizes and exploitation rates for Fraser River sockeye salmon (by stock group) in 2000.

Stock Group	River & Ocean Catch *	Gross Escapement: In-river Indian & Sport 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	11,000	206,000	90,000	71,000	378,000	0	7%	3%	57%
Early Summer-run									
Bowr./Fenn./U.Adams	52,000	50,000	177,000	0	279,000	0	5%	19%	37%
Nadi./Raft/Gates/Pitt	222,000	152,000	397,000	0	771,000	800	15%	29%	49%
Total	274,000	202,000	574,000	0	1,050,000	800	20%	26%	45%
Summer-run									
Chilko	521,000	144,000	759,000	0	1,424,000	200	27%	37%	47%
Ques./L.Stuart/Stel.	545,000	220,000	891,000	0	1,656,000	200	32%	33%	46%
Total	1,066,000	364,000	1,650,000	0	3,080,000	400	59%	35%	46%
Late-run									
Birkenhead	68,000	3,000	24,000	9,000	104,000	0	2%	65%	68%
Weaver/Cultus	161,000	19,000	8,000	263,000	451,000	0	9%	36%	40%
Portage/Adams/Misc.	70,000	20,000	7,000	56,000	153,000	0	3%	46%	59%
Total	299,000	42,000	39,000	328,000	708,000	0	14%	42%	48%
Total Adults	1,650,000	814,000	2,353,000	399,000	5,216,000	1,200	100%	32%	47%
Total Jacks	0	0	1,200	0	1,200				
Total	1,650,000	814,000	2,354,200	399,000	5,217,200				
Portion of Total Run	32%	16%	45%	8%	100%				

* Includes catches in all fisheries, excluding Fraser River First Nations and recreational fisheries above Mission.

** Gross escapement (Mission escapement + FN catch below Mission) minus spawning escapement and in-river catches in First Nations, recreational and ESSR fisheries.

The pre-season forecast for Late-run stocks was a return of 577,000 fish. The estimated return was 708,000 fish, which was approximately 23% greater than forecast. Weaver sockeye dominated the Late-run production with an estimate of 451,000 fish. The remainder of Late-run production was split between the Birkenhead (104,000 fish) and Portage/Adams/Lower Shuswap (153,000 fish) stock groups. Catches of Late-run sockeye in commercial, test and marine First Nations' totalled 299,000 fish. Catches in Fraser River First Nation's and in-river recreational fisheries totalled 42,000 fish. The exploitation rate on Late-run stocks was 48%. En route mortalities, including losses of fish that migrated to a point just short of the spawning grounds but then held there until dying, were estimated at 328,000 fish.

The total return of adult Fraser River sockeye in 2000 was estimated to be 5,216,000 adults (Table 10). Catches in all fisheries accounted for 47% of the fish. Therefore, 53% of the fish were available for spawning escapement. However, estimated spawning escapements totalled 2,353,000 adults, or 45% of the total return. The remaining 399,000 fish (8%) were not accounted for in upstream catch and escapement, likely due to en route mortalities caused by difficult migration conditions (Early Stuart sockeye) and disease (Late-run sockeye). Of the 47% harvest component, commercial fisheries harvested 28%, miscellaneous non-commercial fisheries (including test fisheries) harvested 3%, marine First Nations' fisheries took 2% and Fraser River First Nations' fisheries accounted for approximately 15% (Table 4).

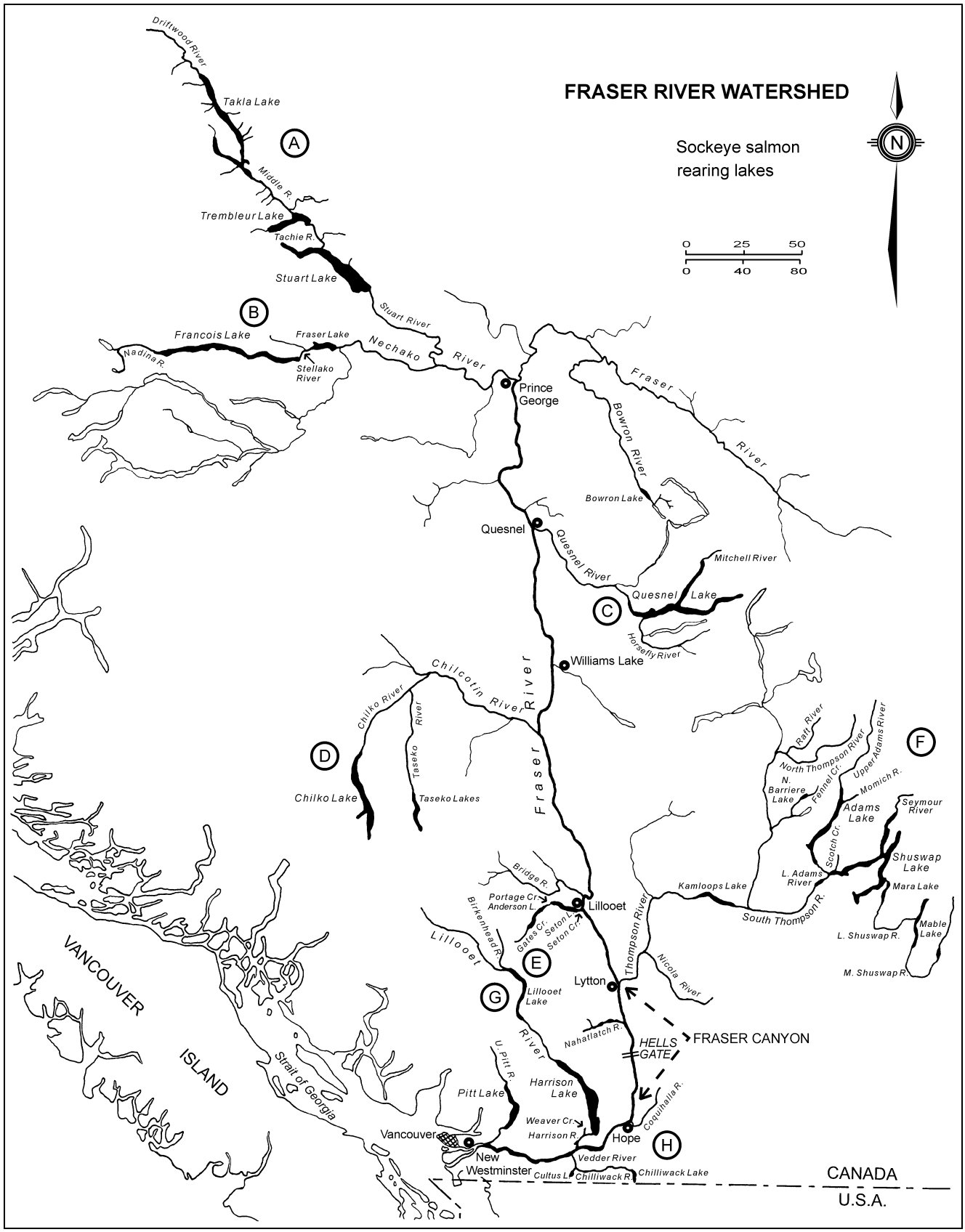

Figure 7. Sockeye salmon spawning grounds in the Fraser River watershed.

VIII. ESCAPEMENT

A. Sockeye Salmon

The enumeration of sockeye salmon escapements in the Fraser River watershed (Figure 7) is conducted annually by DFO. Data collected in this program is used to generate estimates of the total production of sockeye on a stock and run-timing group basis. Escapements are also required for forecasting sockeye returns four years hence. The Fraser River Panel relies on the spawning ground estimates to determine if escapement goals have been met, which is the highest priority objective of the Panel's in-season management. Further, the escapement estimates provided by DFO help in the post-season evaluation of stock identification and stock monitoring programs conducted by PSC staff.

In 2000, the preliminary escapement estimate of adult (4 and 5-year-old) sockeye totalled 2,353,000 fish (Appendix D: Table 7). Only 1,200 jacks (3-year-old fish) were estimated in 2000, which was a major decrease from the average of 43,000 jacks over the previous three cycle years (1988, 1992, 1996). The total escapement of 2,354,000 sockeye was the largest escapement on this cycle since records of spawning escapements began in 1938, and 14% higher than the previous record for this cycle of 2,061,000 fish in 1996 (Table 11). The Early Stuart escapement of 90,000 sockeye was slightly higher than the brood year (1996) when the escapement was 88,000 fish. Escapements of Early Summer-run stocks increased to 574,000 fish, which was a record for the cycle and an increase of 58% over the 1996 return. Summer-run escapements were 15% higher than 1996, and resulted in 1,650,000 sockeye reaching their spawning grounds. However, extremely low escapements of Late-run stocks were recorded in 2000. Late-run sockeye escapements declined to only 39,000 fish in 2000, which was 19% of the brood year escapement of 200,000 fish and 19% of the long-term average for this cycle. The problem for Late-run fish was not in the number of fish migrating into the lower Fraser River (409,000 fish), which should have been sufficient to attain the required return to the spawning grounds of 300,000 fish, but rather in the extremely high en route and pre-spawning mortalities of Late-run sockeye in 2000. The very high en route mortality in 2000 was associated with the abnormally early entry time of Late-run sockeye into the Fraser River.

Table 11. Adult sockeye salmon escapements by run-timing group on the 2000 cycle for years 1984-2000.

	Spawning Escapement				
Run	1984	1988	1992	1996	2000
Early Stuart	45,000	180,000	66,000	88,000	90,000
Early Summer	125,000	217,000	102,000	360,000	574,000
Summer	643,000	745,000	635,000	1,413,000	1,650,000
Late	109,000	228,000	266,000	200,000	39,000
Adults	922,000	1,370,000	1,069,000	2,061,000	2,353,000

Of the 90,000 Early Stuart sockeye that reached their natal areas, the distribution of spawning was fairly even with 31,000 fish to tributaries of Takla Lake (34%), 30,000 fish to the Middle River (33%) and 26,000 fish to tributaries of Trembleur Lake (29%) (A; Figure 7). The Driftwood River, which flows into the north end of Takla Lake, was the destination of 4,000 fish or approximately 4% of the Early Stuart run. The period of peak spawning activity (August 2 - 10) was normal. The spawning escapement of 90,000 fish was the second highest on the cycle since 1940. Although the escapement was relatively large for the cycle, it was only 60% of the potential spawning escapement, i.e., the number of fish estimated to have passed Mission less reported catches upstream. Fraser River discharge during Early Stuart migration through the lower Fraser River was very high for a short period near the peak of their migration at Hells Gate. It is likely that the high water levels prevented some Early Stuart fish from migrating through the Fraser Canyon, and others that were successful were unable to reach their spawning grounds.

At least three factors suggest that many Early Stuart sockeye experienced unusually harsh migration conditions that reduced the number and viability of those that reached the spawning grounds. First, the number of days between when Early Stuart sockeye were first observed at Mission on June 17 and when they were observed at Kynock Creek on July 27 was 41 days, which was approximately three weeks longer than the average transit time. Second, approximately 56% of the Early Stuart spawning escapement was comprised of males, which tend to be larger than females and thus are generally more able to negotiate higher river flow conditions. Finally, the spawning success of fish that arrived on the spawning grounds was 88.7%, which is slightly below the long-term average of 91.4%, suggesting a stressful migration.

Returns of Late Stuart sockeye to the Tachie and Middle Rivers and Kazchek, Kuzkwa, and Pinchi Creeks increased more than seven-fold from their brood year return of 63,000 fish to 454,000 fish. The main component of this increase was the return of 369,000 sockeye to the Tachie River in 2000, compared to the brood year return of 49,000 fish. The 97% spawning success of the 233,000 Late Stuart female spawners were near average.

Sockeye returns to the Nadina River (B; Figure 7), increased about five-fold from the 1996 brood year escapement of 39,000 fish to 200,000 fish. The large escapements to Nadina River and spawning channel is significant because Francois Lake, the rearing lake used by Nadina fry is highly productive but under-utilized for sockeye rearing. The spawning success of Nadina River sockeye was only 58%. The other major stock in the Nechako River watershed is the Stellako River, where the escapement of 372,000 fish was slightly higher than the brood year spawning of 333,000 sockeye. The spawning success of Stellako River sockeye was also higher at 93%.

The escapement of 64,000 sockeye to the Quesnel Lake watershed (C; Figure 7) was an increase of over 50% relative to the brood year return of 41,000 fish in 1996. The Mitchell River escapement of 27,000 sockeye was almost four times higher than in the brood year. A high proportion of the escapement to the Horsefly and Mitchell Rivers were age 5 fish from the 1995 brood year. The overall spawning success of Quesnel sockeye was excellent (99%).

The Bowron River also experienced elevated returns of spawning sockeye in 2000. Escapements rose from about 8,000 fish in 1996 to 13,000 fish. The 7,200 female spawners achieved a spawning success rate of 93%.

Although Chilko escapements (D; Figure 7) were large in 2000 (759,000 fish), they represented a decline of 22% from the brood year return of 974,000 fish. However, this was still substantially over the escapement target for this stock. The escapement in 2000 is the eleventh consecutive year of escapements over 452,000 fish and escapements over this period have averaged 769,000 fish. The success of female spawning was estimated at 96%.

Early Summer-run escapements to Gates Creek (E; Figure 7) declined about 11%, from 100,000 fish in 1996 to 89,000 fish in 2000. Spawning success was low in both the spawning channel and creek with only 42% of females spawning successfully. The return of Late-run sockeye to Portage Creek also dropped from 3,400 fish in the brood year to only 1,300 fish in 2000. Portage sockeye were one of the Late-run stocks that suffered high en route and pre-spawning mortality.

Sockeye stocks in the Thompson River watershed spawn in the North Thompson and South Thompson River systems (F; Figure 7). In the South Thompson River, the Early Summer, Upper Adams River sockeye run has been the focus of long-term rebuilding efforts that began in 1945 with the removal of a splash dam that was located at the outlet of Adams Lake. In 2000, this stock experienced its largest return since about 1909 with an escapement of 71,000 sockeye (Figure 2). This was almost three times the 1996 record escapement (since rebuilding efforts were initiated) of 25,000 fish. Spawning success was also very high, at 97%. In other Early Summer stocks, Eagle River (13,000 fish) and Seymour River (25,000 fish) spawners both attained a 99% spawning success rate. Late-run escapements to the South Thompson area (primarily the Lower Adams and the Lower Shuswap Rivers) declined greatly from 12,000 fish in the brood year to only 900 fish. These latter stocks appear to have suffered high en route mortality, similar to other Late-run sockeye.

Good returns of sockeye were observed in the North Thompson River watershed. Raft River had an escapement of 66,000 fish, which was about 32% higher than the brood year return of 50,000 fish and was the largest escapement on record (1938 to present). About 87% of these fish spawned successfully, while the 10,000 Fennel Creek spawners achieved a slightly higher spawning success rate (91%).

Very low spawning escapements of sockeye were observed in the Harrison-Lillooet area (G; Figure 7) with only 35,000 spawners, compared to the brood year escapements that totalled 181,000 fish. The spawning success of those sockeye that arrived at their natal areas was 90%. Specific returns to several stocks within this area were very low; Weaver Creek and the spawning channel had only 7,000 spawners compared to the brood year escapement of 106,000 fish. The Weaver escapement was the smallest since 1974, soon after the spawning channel was constructed. Birkenhead River had 14,000 fish compared to 56,000 in 1996. Harrison River sockeye also returned in numbers (4,000 fish) much lower than in 1996 (15,000 fish). The escapement of sockeye to Big Silver Creek, a tributary to Harrison Lake, was estimated at 9,000 fish, the largest on record for this stock. The low escapement to Weaver Creek and other Late-run stocks in the watershed was associated with abnormally early migration into the Fraser River and subsequent infestation by the myxosporean parasite *Parvicapsula minibicornis*.

Escapements of sockeye to Lower Fraser River tributaries (H, Figure 7), including Chilliwack Lake, Cultus Lake, Nahatlatch River and Upper Pitt River, totalled 57,000 fish in 2000. The spawning success averaged 87%. Upper Pitt River and Chilliwack returns (43,000 fish and 7,000 fish respectively) both achieved a 99% success rate. Nahatlatch River escapements totalled 5,000 fish, with a 95% spawning success rate. An estimated 1,200 sockeye escaped to Cultus Lake.

The overall success of spawning for female sockeye in the Fraser River watershed in 2000 was 90%. In total, approximately 1,113,000 female sockeye spawned successfully, which was the largest on record for the 2000 cycle.

IX. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage commercial fisheries in Panel Area waters to achieve a hierarchy of annual goals. In order of importance, these goals are to: (a) achieve escapement targets for Fraser River sockeye and pink salmon that are set by Canada or modified by Panel agreement; (b) achieve targets for international sharing of the TAC as defined in the Treaty or by agreement of the Parties; and (c) achieve domestic catch allocation goals within each country. In the process of achieving these objectives, the Panel must consider the 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. Gross Escapement

The Panel's first task is to achieve Canada's gross escapement targets by run timing group (Early Stuart, Early Summer, Summer and Late). Gross escapement targets include fish for spawning and for First Nation's harvest in the Fraser River. A third category, "Management Adjustments", has been added to gross escapement targets in recent years to help ensure spawning escapement targets are reached. Calculation of these adjustments comes from either: (a) bias in the relationship between gross escapement estimates in the lower river (Mission escapement estimate + Fraser First Nations' catches below Mission) and estimates made upstream (First Nations' catches + spawning escapement), or (b) in-season predictions of en route or pre-spawning mortality rates. On May 18, the Panel agreed to a Management Adjustment of 50,000 Early Stuart and 83,000 Early Summer fish to compensate for the tendency for in-season gross escapement estimates to be greater than upriver estimates for these run-timing groups. Later in the season on August 10, the Panel agreed to an additional management adjustment of 300,000 Late-run fish (adjusted on August 22 to 200,000 fish) when it became apparent that Late-run sockeye were

entering the river much earlier than normal and would likely experience high en route and pre-spawn mortalities as a consequence.

The success of Panel management can be assessed by: (a) whether in-season lower-river estimates of gross escapement met the adjusted gross escapement targets, and (b) whether upriver gross escapement estimates met the unadjusted targets. By the first measure, the adjusted gross escapement target was achieved for Early Stuart sockeye (2,000 fish under), exceeded for Early Summer-run (76,000 fish over) and Summer-run stocks (37,000 fish over), and not achieved for Late-run stocks (29,000 fish under) (Table 12). The summed gross escapements exceeded the target by a total of 82,000 fish. These differences represent relatively small percentage deviations from the in-season targets: 1% under for Early Stuart, 13% over for Early Summer-run, 3% over for Summer-run and 6% under for Late-run stocks, for an aggregate deviation of 3% over.

By the second measure, upriver estimates of gross escapement were near the target for Early Stuart sockeye (10,000 fish under), considerably higher than the target for Early Summer-runs (285,000 fish over) and Summer-runs (661,000 fish over) runs, and substantially less than the target for Late-run stocks (246,000 fish under) (Table 13). In total, the cumulative upriver estimate of gross escapement was 690,000 fish more than the in-season target. The shortfalls in the Early Stuart and Late-run escapements were likely due to en route mortalities, as discussed in the Introduction section. The overages in the Early Summer-run and Summer-run escapements were at least partly due to the protective measures that were applied to maximize the escapement of Early Stuart and Late-run fish. However, upstream total gross escapements for these run timing groups exceeded in-season estimates by 946,000 fish, suggesting that a large estimation bias was also present. The cause of this bias was not apparent in the post-season review of the Mission hydroacoustic program. However, this error adversely impacted in-season management of the fisheries by the Panel.

Table 12. Comparison of in-season adjusted targets and in-season lower-river gross escapement estimates for Fraser River sockeye salmon in 2000.

	Gross Escapement				
Run	In-season Target	Adjustment *	Adjusted Target	In-season Estimate**	Difference
Early Stuart	306,000	50,000	356,000	354,000	(2,000)
Early Summer	491,000	83,000	574,000	650,000	76,000
Summer	1,353,000	0	1,353,000	1,390,000	37,000
Late	327,000	200,000	527,000	498,000	(29,000)
Adults	2,477,000	333,000	2,810,000	2,892,000	82,000

* Panel-agreed gross escapement adjustment.

** Includes 164,000 sockeye caught in Fraser River First Nations' fisheries below Mission, B.C.

Table 13. Comparison of in-season unadjusted targets and upriver gross escapement estimates for Fraser River sockeye salmon in 2000.

	Gross Escapement		
Run	In-season Target	Upriver Estimate*	Difference
Early Stuart	306,000	296,000	(10,000)
Early Summer	491,000	776,000	285,000
Summer	1,353,000	2,014,000	661,000
Late	327,000	81,000	(246,000)
Adults	2,477,000	3,167,000	690,000

* Reported spawning escapements plus Fraser River First Nations and recreational fishery catches, and excluding differences between estimates.

Table 14. Preliminary calculations of total allowable catch and international shares of Fraser River sockeye salmon in 2000.

		Sockeye
TOTAL ALLOWABLE CATCH		
Total Run Size		5,217,000
Deductions		
Spawning Escapement		2,354,000
Difference Between Estimates	*1*	400,000
ESSR Fishery Catches	*2*	2,000
Fraser River Aboriginal Fishery Exemption		400,000
Shortfall in Fraser R. Non-commercial Catch	*3*	(53,000)
Test Fishing		95,000
Total Deductions:		3,198,000
Total Allowable Catch:		2,019,000
UNITED STATES		
Washington Catch		494,000
Washington Share		
Washington Share	*4*	412,000
Payback	*5*	26,000
Total Share:		438,000
Deviation:		56,000
Alaska Catch		2,000
Total United States Catch:		496,000
CANADA		
Canadian Catch - (AF Exemption + ESSR catch)		1,470,000
Shortfall in Fraser R. Non-commercial Catch	*3*	53,000
Total Catch for Share Calculation:		1,523,000
Canadian Share		1,579,000
Deviation:		(56,000)

1 Gross escapement (Mission escapement + FN catch below Mission) minus spawning escapement and in-river catches in First Nations, recreational and ESSR fisheries.

2 Harvest of Weaver Creek sockeye in the terminal area that were Excess Salmon to Spawning Requirements (ESSR).

3 Fraser River First Nations, pilot sales and recreational catches minus additional escapement requested by Canada (863,000), according to June 12, 2002, Commission agreement.

4 Washington share of Fraser River sockeye salmon was not to exceed 20.4% of the TAC in 2000, according to revised (1999) Annex IV of the Pacific Salmon Treaty.

5 Payback for a catch shortfall of 26,000 in 1999.

B. International Allocation

The Panel's second priority is to achieve the goal for international allocation of the TAC, which is based on in-season estimates of run abundance. The final estimate of Washington catch was 494,000 sockeye compared to an allocation target of 412,000 sockeye (20.4% of TAC + 26,000 fish payback) out of a total international TAC of 2,019,000 fish (Table 14). This represents an overage of 56,000 fish in the United States catch. Canadian fishers caught 1,470,000

sockeye, excluding the Fraser River Aboriginal exemption of 400,000 sockeye and the ESSR fishery catch of 2,000 fish.

The TAC calculation for 2000 takes into account fish that inadvertently reached their spawning grounds rather than being caught by in-river fisheries. When sharing arrangements were in place between 1991 and 1998, all fish which escaped to their natal spawning areas were exempt in the calculation of the TAC of Fraser sockeye and pink salmon. Under the 1999, revised Annex IV, Chapter 4 (Para. 3 (a)), the TAC for international sharing was redefined such that "The spawning escapement is that escapement which is a direct result of Fraser River Panel management actions, …". The view of the United States was that in 2000, domestic allocation decisions within Canada affected the escapement and, thus, the United States share. Canada had requested that the Panel regulate the fisheries in such a manner to allow 863,000 fish to escape upstream over and above the spawning escapement requirement and the 400,000 Aboriginal fishery exemption. Of these fish, 810,000 fish were caught leaving a deficit of 53,000 fish, which, presumably, reached their spawning grounds in excess of the number doing so as a result of Panel action.

Discussions by the Panel in 2001 and early 2002 failed to resolve the handling of this issue for the 2000 TAC calculation. On June 12, 2002, the Commission determined that the TAC of Fraser River sockeye in 2000 would be calculated as if the fish that Canada had requested to meet catch expectations in the non-commercial fishery be considered part of the Canadian allocation. In order to show the appropriate calculation, the TAC table (Table 14) reflects this as a shortfall of in-river fishery catches.

Much of the overage in the United States catch was due to late-season reductions in the TAC after the United States had caught their share. A Non-Indian fishery on August 16 caught the remaining United States allocation (482,000 fish) that was in effect at the time. However, the United States share subsequently dropped 37,000 fish to 445,000 on August 22, due to lower run-size estimates and spawning escapement targets and higher management adjustments. The remaining overage was largely due to post-season revisions to run-size and gross escapement estimates that resulted in a lower TAC and United States share.

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. Canada regulated Canadian net and troll fisheries in non-Panel areas such as Johnstone Strait.

In 2000, allocation goals existed between and within Treaty Indian and Non-Indian user groups in Washington. The allocation of catch between Treaty Indian and Non-Indian fishers was close to the goal, with Treaty Indian fishers catching only 3,000 fish more than their allocation of 260,000 fish while Non-Indian fishers were 3,000 fish short of their allocation of 234,000 fish (Table 15). Within the Treaty Indian group the achieved allocations were also close, with fishers in Areas 4B, 5 and 6C catching 2,000 fish more and fishers in Areas 6, 7 and 7A catching 2,000 fish less than the targets. There were larger but still modest deviations from the allocation targets within the Non-Indian group, with gillnets and reefnets each catching 6,000 fish more than their allocation targets while purse seines caught 12,000 fish less.

The achievement of domestic allocation goals in Canada was not as successful, because of several reasons: (1) there was high uncertainty in regard to the potential abundance during the pre-season period; (2) accurate estimates of the abundances of Early Summer-run and Chilko sockeye were delayed during the in-season period; and (3) the imposition of substantial fishery restrictions due to the anticipated en route mortality of Late-run stocks. Within the Canadian commercial catch of 955,000 Fraser River sockeye, Area B purse seines were 137,000 fish under, Area D gillnets were 35,000 fish over, Area E gillnets were 198,000 fish over, Area G trollers were 114,000 fish under and Area H trollers were 17,000 fish over their allocations (Table 16).

Table 15. Preliminary estimates of domestic overages and underages in Washington catches of Fraser River sockeye salmon in 2000.

User Category	Actual Catches Fish	%	Catch Goals Fish	%	Overage/ (Underage)
Treaty Indians: by Area					
Treaty Indian					
Areas 4B, 5 and 6C	55,000	20.9%	53,000	20.0% *	2,000
Areas 6, 7 and 7A	208,000	79.1%	210,000	80.0%	(2,000)
Total:	263,000	100.0%	263,000	100.0%	0
Non-Indians: by Gear					
Purse Seine	112,000	48.5%	124,000	54.0%	(12,000)
Gillnet	101,000	43.7%	95,000	41.0%	6,000
Reefnet	18,000	7.8%	12,000	5.0%	6,000
Total:	231,000	100.0%	231,000	100.0%	0
Washington: between Treaty Indian and Non-Indian Users					
Treaty Indian	263,000	53.2%	260,000 *	54.9%	3,000
Non-Indian	231,000	46.8%	234,000 *	45.1%	(3,000)
Washington Total:	494,000	100.0%	494,000	100.0%	0

* TI share = 54.9% + 3,000 of the 26,000 U.S. payback.
NI share = 45.1% + 23,000 of the 26,000 U.S. payback.

Table 16. Preliminary estimates of domestic overages and underages in Canadian catches of Fraser River sockeye salmon in 2000.

Gear License Area	Actual Catches Fish	%	Catch Goals Fish	%	Overage/ (Underage)
Purse Seine					
A Northern	0	0.0%	0	0.0%	0
B Southern	274,000	28.7%	411,000	43.0%	(137,000)
Total	274,000	28.7%	411,000	43.0%	(137,000)
Gillnet					
D Johnstone Strait	150,000	15.7%	115,000	12.0%	35,000
E Fraser River	418,000	43.8%	220,000	23.0%	198,000
Total	568,000	59.5%	335,000	35.0%	233,000
Troll					
F Northern	0	0.0%	0	0.0%	0
G Southern	29,000	3.0%	143,000	15.0%	(114,000)
H Inside	84,000	8.8%	67,000	7.0%	17,000
Total	113,000	11.8%	210,000	22.0%	(97,000)
Total	955,000	100.0%	956,000	100.0%	

D. Conservation of Other Stocks

Due to the closure of fishing in Canadian Area 20 and restricted fishing in other areas, catches of non-target species and stocks in Panel Area fisheries directed at Fraser River sockeye were very low (Table 17). The recorded by-catches totalled 4,700 chinook and 2,100 coho salmon.

Table 17. Preliminary estimates of catches of non-Fraser sockeye and pink salmon and of other salmon species in commercial fisheries regulated by the Fraser River Panel in 2000.*

	Non-Fraser		Fraser and Non-Fraser			
Area and Gear	Sockeye	Pink	Chinook	Coho	Chum	Steelhead
Areas 4B, 5 and 6C Net	0	0	400	2,000	0	-
Areas 6, 7 and 7A Net	0	0	900	100	0	-
Total	0	0	1,300	2,100	0	0
Area 20 Net	0	0	0	0	0	-
Area 29 Net	0	0	3,400	0	0	-
Total	0	0	3,400	0	0	0
Total	0	0	4,700	2,100	0	0

* Estimates are provided by the WDFW and DFO.

X. ALLOCATION STATUS

In accordance with the payback policy in the revised (1999) Annex IV of the Treaty, catch overages and underages will be used to adjust United States allocations in subsequent years. After the 2000 fishing season, the United States has a catch overage of 56,000 Fraser sockeye and a catch underage of 21,000 pink salmon (Table 18).

Table 18. Allocation status of Fraser River sockeye and pink salmon for 1999-2000.

	Sockeye		Pink
	1999	**2000**	**1999**
TOTAL ALLOWABLE CATCH			
Total Run Size	3,644,000	5,217,000	3,593,000
Escapement and other deductions	3,437,000	3,198,000	3,445,000
Total Allowable Catch:	207,000	2,019,000	148,000
UNITED STATES			
Washington Catch	20,000	494,000	17,000
Washington Share *	46,000	412,000	38,000
Deviation:	(26,000)	82,000	(21,000)
Cumulative Allocation Status:	(26,000)	56,000	(21,000)

* Washington share of the TAC according to Annex IV of the Pacific Salmon Treaty:
1999: Shall not exceed 22.4% for Fraser sockeye and 25.7% for Fraser pinks.
2000: Shall not exceed 20.4% for Fraser sockeye.

XI. APPENDICES

APPENDIX A: PRE-SEASON FORECASTS AND SPAWNING ESCAPEMENT TARGETS FOR FRASER RIVER SOCKEYE SALMON IN 2000.

Table 1. Pre-season forecasts for Fraser River sockeye salmon in 2000. (Provided to the Panel by Fisheries and Oceans Canada on May 18, 2000).

	Probability of Achieving Specified Run Sizes [a]				
Stock/Timing	**25%**	**50%**	**60%**	**75%**	**90%**
Early Stuart	**540,000**	**291,000**	**231,000**	**157,000**	**89,000**
Early Summer	**1,046,000**	**547,000**	**428,000**	**289,000**	**161,000**
Fennell	87,000	47,000	37,000	25,000	14,000
Bowron	58,000	33,000	26,000	18,000	11,000
Raft	217,000	115,000	91,000	61,000	34,000
Gates	96,000	43,000	32,000	19,000	9,000
Nadina	74,000	41,000	33,000	22,000	13,000
Pitt	63,000	29,000	22,000	14,000	7,000
Seymour	154,000	82,000	65,000	44,000	25,000
Scotch	77,000	29,000	20,000	11,000	4,000
Upper Adams *b*	220,000	128,000	102,000	75,000	44,000
Mid Summer	**4,680,000**	**2,668,000**	**2,181,000**	**1,564,000**	**977,000**
Chilko	2,240,000	1,444,000	1,226,000	931,000	623,000
Quesnel	735,000	311,000	227,000	132,000	59,000
Stellako	1,078,000	645,000	533,000	386,000	242,000
Late Stuart	627,000	268,000	195,000	115,000	53,000
Late Summer	**1,171,000**	**577,000**	**445,000**	**286,000**	**153,000**
Birkenhead	427,000	240,000	193,000	134,000	79,000
Late Shuswap	98,000	51,000	40,000	26,000	14,000
Cultus	9,000	5,000	4,000	2,000	1,000
Portage	68,000	31,000	23,000	14,000	7,000
Weaver	569,000	250,000	185,000	110,000	52,000
Total	**7,437,000**	**4,083,000**	**3,285,000**	**2,296,000**	**1,380,000**

a Probability that the actual run size will exceed the specified forecast. Note that forecasts for timing groups are the sum of individual stock components.

b The Upper Adams forecast is based on recruits-per-spawner data for all stocks combined.

Table 2. Preliminary Fraser River sockeye salmon escapement target plan (in thousands of fish) for 2000 (provided to the Panel by Fisheries and Oceans Canada on May 18, 2000).

Run Stock group	Forecast Return (*a*)	Range of returns	Escapement target	Harvest rate plan	Harvest rate at forecast
Early Stuart		0 - 75	0 - 75	0%	
	157	76 - 192	-	0 to 35%	35%
	291	193 - 357	125	35 to 65%	57%
		358 - 743	-	65-70%	
		>743	260	>65-70%	
Early Summer	289	0 - 329	-	Max 15%	
	547	330 - 800	280	15 to 65%	49%
		801 - 1,486	-	65-70%	
		>1,486	520	>65-70%	
Summer					
Chilko		0 - 350	0-350	0%	
		351 - 412	-	0 to 15%	
	931	413 - 1,000	350	15 to 65%	62%
	1,444	1,001 - 2,354	-	65-70%	65%
		>2,354	824	>65-70%	
Stellako,	633		238		62%
Late Stuart,	1,224		428		65%
Quesnel					
Late	286	0 - 353	-	Max 15%	
	577	354 - 857	300	15 to 65%	48%
		858 - 2,503	-	65-70%	
		>2,503	876	>65-70%	
Totals	2,296		1,179		49%
	4,083		1,639		60%

a At the 75% and 50% probability levels that the actual run size will exceed the specified forecast.

APPENDIX B: 2000 REGULATIONS

The Fraser River Panel approved regulations for the management of the Fraser River sockeye and pink salmon fishery in Panel Area waters and submitted these to the Pacific Salmon Commission. The Commission approved the Fishery Regime and Regulations and submitted these to the respective national governments for approval on May 23, 2000.

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, 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 25th day of June, 2000, to the 2nd day of September, 2000, 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 25th day of June, 2000, to the 2nd day of September, 2000, 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 25th day of June, 2000, to the 30th day of September, 2000, 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 25th day of June, 2000, to the 30th day of September, 2000, both dates inclusive.

3. a) No person shall commercially fish for sockeye or pink salmon with nets in Pacific Fishery Management Area 29 from the 25th day of June, 2000, to the 14th day of October, 2000, both dates inclusive.

   b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 25th day of June, 2000, to the 14th day of October, 2000, 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 2000 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 2000 Management Plan adopted by the Panel. This Plan will be 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, 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 25th day of June, 2000 to the 2nd day of September, 2000, 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 25th day of June, 2000, to the 9th day of September, 2000, 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 10th day of September, 2000, to the 30th day of September, 2000, 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 25th day of June, 2000, to the 2nd day of September, 2000, 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 25th day of June, 2000, to the 9th day of September, 2000, 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 10th day of September, 2000, to the 30th day of September, 2000, both dates inclusive.

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

Treaty Indian and All-Citizen Fisheries:

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

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

During the 2000 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 2000 Management Plan adopted by the Panel. This Plan will be designed to achieve Pacific Salmon Treaty-mandated international allocations of the catch and domestic goals of the Parties.

APPENDIX C: 2000 FRASER RIVER PANEL IN-SEASON ORDERS

To provide for adequate escapement of the various stocks of Fraser River sockeye and pink salmon and for the prescribed allocation of catch: (a) internationally, between the United States and Canada, and (b) domestically, among the commercial user groups in Canada and the United States, the Fraser River Panel formulated the following orders to regulate Panel Area fisheries in 2000.

July 21 United States:
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gillnets open 6:00 p.m., July 21, to 12:00 p.m. (noon), July 26.

July 24 United States:
Treaty Indian Fishery
Areas 4B, 5 and 6C:
Drift gill nets extended from 12:00 p.m. (noon), July 26, to 12:00 p.m. (noon), July 29.

Areas 6, 7 and 7A:
Open to net fishing from 4:00 a.m. to 8:00 p.m., July 26.

All-Citizen Fishery
Areas 7 and 7A:
Purse seines open 6:00 a.m. to 3:00 p.m., July 27.
Gillnets open 3:00 p.m. to 11:59 p.m., July 27.
Reef nets open 5:00 a.m. to 9:00 p.m., July 29.

July 25 Canada:
Area 29 - 1 to 7 and 9 to 17:
Gillnets open 12:00 p.m. (noon), July 26, to 12:00 p.m. (noon), July 27.

Area 29 - 1 to 6 and Area 18 - 1, 4 and 11:
Commercial trolling open 12:01 a.m. to 11:59 p.m., July 28.

United States:
Treaty Indian Fishery
Areas 6, 7 and 7A:
Fishing times revised (from July 24 order): open to net fishing from 4:00 a.m., July 26, to 8:00 a.m., July 27.

All-Citizen Fishery
Areas 7 and 7A:
Fishing times revised (from July 24 order): Gillnets open 8:00 a.m. to 11:59 p.m., July 27.
Purse seines open 5:00 a.m. to 9:00 p.m., July 28.
Reef nets open 5:00 a.m. to 9:00 p.m., July 29, and, July 30.

July 31 Canada:
Area 29 - 1 to 6 and Area 18 - 1, 4, and 11:
Commercial trolling open 12:01 a.m., August 4, until further notice.

August 2 United States:
All-Citizen Fishery
Areas 7 and 7A:
Gillnets open 7:15 a.m. to 11:59 p.m., August 3 and August 4.
Purse seines open 5:00 a.m. to 9:00 p.m., August 3 and August 4.

August 4 Canada:

Area 29 - 1 to 6 and Area 18 - 1, 4 and 11:

Commercial trolling extended to 11:59 p.m., August 6.

United States:

Treaty Indian Fishery

Areas 4B, 5 and 6C:

Drift gillnets open 6:00 p.m., August 5, to 6:00 p.m., August 7.

Areas 6, 7 and 7A:

Open to net fishing 12:00 p.m. (noon), August 6, to 6:00 p.m., August 7.

August 7 Canada:

Area 29 - 1 to 6 and Area 18 - 1, 4 and 11:

Commercial trolling open 12:01 a.m., August 10, until further notice.

August 8 Canada:

Area 29 - 1 to 7 and 9 to 17: Gillnets open 6:00 p.m., August 9, to 12:00 p.m. (noon), August 10.

United States:

All-Citizen Fishery

Areas 7 and 7A:

Reef nets open 6:00 a.m. to 6:00 p.m., August 9.

Purse seines open 6:00 a.m. to 6:00 p.m., August 10.

Gillnets open 8:00 a.m. to 8:00 p.m., August 10.

August 14 United States:

All-Citizen Fishery

Areas 7 and 7A:

Purse seines open 6:00 a.m. to 6:00 p.m., August 16.

Gillnets open 8:00 a.m. to 8:00 p.m., August 16, 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 18 Canada:

Area 29 - 1 to 6 and Area 18 - 1, 4 and 11:

Commercial trolling closes 11:59 p.m., August 21.

Area 29 - 11 to 17:

Gillnets open 8:00 a.m., August 21, to 8:00 a.m., August 22.

August 22 Canada:

Area 20:

Relinquish regulatory control effective, August 27.

United States:

Treaty Indian and All-Citizen Fishery

Areas 4B, 5, 6, 6C and 7:

Relinquish regulatory control effective, August 27.

Area 7A:

Relinquish regulatory control of those waters 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 effective, August 27.

APPENDIX D: TABLES 1-7

Table 1. Commercial net catches of Fraser River sockeye salmon in Canadian Area 20 (Juan de Fuca Strait) by week for cycle years 1988-2000.

Date *	1988	1992	1996	2000
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	0	0	0	0
Jul. 16-Jul. 22	0	0	0	0
Jul. 23-Jul. 29	0	0	0	0
Jul. 30-Aug. 5	0	0	0	0
Aug. 6-Aug. 12	140,000	113,000	0	0
Aug. 13-Aug. 19	58,000	497,000	69,000	0
Aug. 20-Aug. 26	21,000	252,000	0	0
Aug. 27-Sep. 2	0	18,000	0	0
Sep. 3-Sep. 9	0	0	0	0
Sep. 10-Sep. 16	0	0	0	0
Sep. 17-Sep. 23	0	0	0	0
Sep. 24-Sep. 30	0	0	0	0
Oct. 1-Oct. 7	0	0	0	0
Total	219,000	880,000	69,000	0

* Dates for 2000. 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 1988-2000.

Date *	1988	1992	1996	2000
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	1,000	0	0	0
Jul. 16-Jul. 22	0	0	0	0
Jul. 23-Jul. 29	51,000	0	0	177,000
Jul. 30-Aug. 5	148,000	0	0	1,000
Aug. 6-Aug. 12	143,000	93,000	69,000	225,000
Aug. 13-Aug. 19	28,000	42,000	642,000	3,000
Aug. 20-Aug. 26	2,000	124,000	0	14,000
Aug. 27-Sep. 2	0	2,000	0	0
Sep. 3-Sep. 9	0	0	1,000	0
Sep. 10-Sep. 16	204,000	0	0	0
Sep. 17-Sep. 23	152,000	0	0	0
Sep. 24-Sep. 30	19,000	0	0	0
Oct. 1-Oct. 7	10,000	0	0	0
Total	758,000	261,000	712,000	420,000

* Dates for 2000. 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 1988-2000.

Date *	1988	1992	1996	2000
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	5,000	0	0	0
Jul. 16-Jul. 22	32,000	2,000	0	0
Jul. 23-Jul. 29	5,000	25,000	0	0
Jul. 30-Aug. 5	1,000	65,000	0	0
Aug. 6-Aug. 12	0	0	0	0
Aug. 13-Aug. 19	1,000	77,000	1,000	0
Aug. 20-Aug. 26	0	0	0	0
Aug. 27-Sep. 2	0	0	0	0
Sep. 3-Sep. 9	0	0	0	0
Sep. 10-Sep. 16	0	0	0	0
Sep. 17-Sep. 23	0	0	0	0
Sep. 24-Sep. 30	0	0	0	0
Oct. 1-Oct. 7	0	0	0	0
Total	44,000	169,000	1,000	0

* Dates for 2000. 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 1988-2000.

Date *	1988	1992	1996	2000
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	1,000	0	0	0
Jul. 16-Jul. 22	2,000	1,000	0	0
Jul. 23-Jul. 29	8,000	6,000	0	0
Jul. 30-Aug. 5	6,000	15,000	0	112,000
Aug. 6-Aug. 12	70,000	314,000	70,000	391,000
Aug. 13-Aug. 19	45,000	1,103,000	102,000	33,000
Aug. 20-Aug. 26	17,000	565,000	1,000	12,000
Aug. 27-Sep. 2	0	43,000	0	0
Sep. 3-Sep. 9	0	2,000	0	0
Sep. 10-Sep. 16	5,000	0	0	0
Sep. 17-Sep. 23	0	0	0	0
Sep. 24-Sep. 30	0	0	0	0
Oct. 1-Oct. 7	0	0	0	0
Total	154,000	2,049,000	173,000	548,000

* Dates for 2000. 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 1988-2000.*

Fishing Area		1988	1992	1996	2000
Fraser River Mainstem					
Below Port Mann	*1*	25,400	64,100	93,700	100,400
Port Mann to Mission	*1*	11,100	16,700	71,100	61,000
Mission to Hope		86,400	110,900	77,200	135,300
Hope to Sawmill Cr.	*2*	96,300	116,900	219,400	165,300
Sawmill Cr. to Kelly Cr.	*2*	111,600	12,000	144,200	252,700
Kelly Creek to Naver Cr.	*3*	14,600	5,100	7,000	13,700
Above Naver Cr.	*3*	1,300	2,800	4,200	5,000
Total		346,700	328,500	616,800	733,400
Tributaries					
Harrison/Lillooet System		9,000	7,562	0	0
Thompson System		200	0	400	1,100
Chilcotin System		32,300	23,000	52,100	38,000
Nechako System		16,900	3,700	6,000	6,000
Stuart System		11,000	4,900	2,300	7,300
Total		69,400	39,162	60,800	52,400
Total Catch		416,100	367,662	677,600	785,800

* Data supplied by DFO.

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

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

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

Table 6. Commercial net catches of Fraser River sockeye salmon in United States Areas 4B, 5, 6, 6C, 7, and 7A (Juan de Fuca Strait and northern Puget Sound) by week for cycle years 1988-2000.

Date *	1988	1992	1996	2000
Jun. 25-Jul. 1	0	0	0	0
Jul. 2-Jul. 8	0	0	0	0
Jul. 9-Jul. 15	31,000	0	0	0
Jul. 16-Jul. 22	15,000	0	0	1,000
Jul. 23-Jul. 29	362,000	4,000	0	110,000
Jul. 30-Aug. 5	0	23,000	20,000	108,000
Aug. 6-Aug. 12	93,000	110,000	59,000	260,000
Aug. 13-Aug. 19	106,000	349,000	174,000	11,000
Aug. 20-Aug. 26	53,000	109,000	4,000	0
Aug. 27-Sep. 2	16,000	13,000	0	0
Sep. 3-Sep. 9	0	0	0	0
Sep. 10-Sep. 16	0	0	0	0
Sep. 17-Sep. 23	0	0	0	0
Sep. 24-Sep. 30	0	0	0	0
Oct. 1-Oct. 7	3,000	0	0	0
Total	679,000	608,000	257,000	490,000

* Dates for 2000. For other years, data from the nearest week were used.

Table 7. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 1984-2000.

DISTRICT	Estimated Number of Adult Sockeye *					Jacks
Stream/Lake	1984	1988	1992	1996	2000	2000
NORTHEAST						
Upper Bowron R.	10,461	12,780	2,560	8,176	13,440	0
STUART						
Early Runs						
Takla L. Streams	4,337	23,453	11,789	24,062	34,075	1
Middle R. Streams	38,830	114,216	41,059	36,339	29,988	0
Trembleur L. Streams	2,034	42,138	12,769	27,168	25,684	0
Early Stuart Total	45,201	179,807	65,617	87,569	89,747	1
Late Runs						
Middle R.	184	1,203	1,832	9,290	51,426	0
Tachie R.	810	3,137	15,056	48,795	368,834	81
Miscellaneous	234	2,777	2,625	4,906	34,137	0
Late Stuart Total	1,228	7,117	19,513	62,991	454,397	81
NECHAKO						
Nadina R. (Late)	659	794	862	8,908	165,442	0
Nadina Channel	6,411	7,950	6,866	29,746	34,852	0
Stellako R.	60,957	367,702	97,979	333,163	371,564	3
QUESNEL						
Horsefly R. area	894	5,876	5,862	34,241	36,634	79
Mitchell R.	20	954	-	6,946	27,069	0
CHILCOTIN						
Chilko R.	452,618	254,668	511,267	974,349	758,941	222
Chilko L.-South End	127,561	108,721	- *1*	- *1*	- *1*	-
Taseko L.	2,771	11,138	970	1,470	3,000	0
SETON-ANDERSON						
Gates Cr.	2,646	17,512	2,774	69,270	56,226	544
Gates Channel	26,253	27,401	38,973	30,566	32,421	198
Portage Cr.	1,710	1,068	2,706	3,422	1,269	0
NORTH THOMPSON						
Raft R.	19,086	19,851	8,236	46,592	66,292	0
Fennell Cr.	11,021	26,927	9,139	32,279	10,155	14
SOUTH THOMPSON						
Summer Runs						
Seymour R.	17,172	16,781	5,742	21,654	25,465	0
Scotch Cr.	409	1,060	2,156	4,609	3,765	4
Eagle R.	-	31	482	4,878	14,166	0
Upper Adams R.	3,502	7,169	2,990	24,948	71,332	0
Momich / Cayenne Cr.	5,854	5,912	2,486	9,353	8,334	0
Late Runs						
Lower Adams R.	4,183	4,578	12,270	11,333	754	0
Lower Shuswap R.	75	194	240	635	50	0
HARRISON-LILLOOET						
Birkenhead R.	40,245	166,591	185,908	56,042	13,842	0
Big Silver Cr.	155	257	3,228	3,518	8,956	0
Harrison R.	1,267	1,544	313	15,379	4,343	12
Weaver Cr.	14,171	23,958	22,851	38,059	1,237	8
Weaver Channel	45,431	25,299	35,835	67,807	5,376	2
LOWER FRASER						
Nahatlatch R. & L.	1,513	16,446	4,120	13,537	5,165	0
Cultus L.	994	861	1,203	2,022	1,227	0
Upper Pitt R.	15,797	37,747	9,129	50,077	42,638	11
Chilliwack L.	180	6,565	3,888	4,260	8,160	0
MISCELLANEOUS	1,614	5,080	2,641	3,792	16,671	0
ADULTS	922,059	1,370,339	1,068,806	2,061,591	2,352,930	
JACKS	9,612	47,960	51,367	29,715	1,179	1,179
TOTAL NET ESCAPEMENT	931,671	1,418,299	1,120,173	2,091,306	2,354,109	

* 1984 data are from the PSC. Estimates for subsequent years are from DFO.

1 Included in Chilko River estimate.

APPENDIX E: Revised (1999) Chapter 4 of Annex IV of the Pacific Salmon Treaty

Chapter 4. Fraser River Sockeye and Pink Salmon

1. The provisions of this Chapter shall apply for the period 1999 through 2010.

2. The U.S. share of the annual Fraser River sockeye and pink salmon Total Allowable Catch (the "TAC"), as defined in paragraph 3 to be harvested in the waters of Washington State is as follows:

   (a) for sockeye salmon in 1999, the U.S. catch in the Fraser Panel Area shall not exceed 22.4 percent of the TAC;

   (b) for sockeye salmon in 2000, the U.S. catch in the Fraser Panel Area shall not exceed 20.4 percent of the TAC;

   (c) for sockeye salmon in 2001, the U.S. catch in the Fraser Panel Area shall not exceed 18.4 percent of the TAC;

   (d) for sockeye salmon in 2002 through 2010, the U.S. catch in the Fraser Panel Area shall not exceed 16.5 percent of the TAC;

   (e) for pink salmon, the U.S. catch in the Fraser Panel Area shall not exceed 25.7 percent of the TAC.

3. For the purpose of this Chapter, the TAC shall be defined as the remaining portion of the annual aggregate Fraser River sockeye and pink runs (including any catch of Fraser River sockeye identified in Alaskan waters) after the spawning escapements, the agreed Fraser River Aboriginal Exemption, and the catch in Panel authorized test fisheries have been deducted. TAC shall be computed separately for Fraser River sockeye and pink salmon. The following definitions apply to TAC calculations:

   (a) The spawning escapement is that escapement which is a direct result of Fraser River Panel management actions, and, therefore, will reflect the results of inadvertent management error by the Fraser River Panel.

   (b) For the purposes of in-season management by the Fraser River Panel, the spawning escapement objective is the target set by Canada including any extra requirements that may be determined by Canada and agreed to by the Fraser River Panel, for natural, environmental, or stock assessment factors, to ensure the fish reach the spawning grounds at target levels. Any additional escapement amounts believed necessary by Canada for reasons other than the foregoing will not affect the U.S. catch.

   (c) The agreed Fraser River Aboriginal Fishery Exemption is that number of sockeye which is subtracted from the total run size in determining the TAC upon which the U.S. shares specified in paragraph 2 are calculated. Any Canadian harvests in excess of these amounts count against the TAC, and do not affect the U.S. share. The agreed Fraser River Aboriginal Fishery Exemption for 1999 is the actual catch of Fraser River sockeye harvested in the in-river Fraser River Aboriginal Fishery. For each year from 2000 until the expiration of this Chapter, the agreed Fraser River Aboriginal Fishery Exemption is the actual catch of Fraser River sockeye harvested in both the in-river and marine area Aboriginal Fisheries, up to 400,000 sockeye annually.

   (d) For computing TAC by stock management groupings, the Fraser River Aboriginal Fishery Exemption shall be allocated to management groups as follows: The Early Stuart sockeye exemption shall be up to 20% of the Fraser River Aboriginal Fishery Exemption, and the remaining balance of the latter exemption shall be based on the average

proportional distribution for the most recent three cycles and modified annually as required to address concerns for Fraser River sockeye stocks and other species. For the duration of this Chapter, the harvest distribution of Early Stuart sockeye is expected to remain similar to that of recent years.

(e) The Fraser River Panel shall manage the United States fishery to spread the United States harvest proportionately to the TACs across all Fraser River sockeye stock management groupings (Early Stuart, Early Summer, Mid-Summer, and Late Run), except as otherwise may be agreed.

4. Pursuant to Article IV, paragraph 3, Canada shall annually establish the Fraser River sockeye and pink salmon spawning escapement targets for the purpose of calculating the annual TAC. For the purposes of pre-season planning, where possible, Canada shall provide forecasts of run size and spawning escapement requirements by stock management groupings to the Fraser River Panel no later than the annual meeting of the Commission. Forecasts of migration patterns, gross escapement needs, and any in-season adjustments in escapement requirements shall be provided to the Fraser River Panel by Canada as they become available in order to accommodate the management needs of the Panel in a timely manner. In addition, on a timely basis, the United States shall provide forecasts of sockeye and pink salmon run size returns affected by Panel management.

5. The Fraser River Panel will develop fishing plans and in-season decision rules as may be necessary to implement the intent of this Chapter. The Parties shall establish and maintain data sharing principles and processes which ensure that the Parties, the Commission, and the Fraser River Panel are able to manage their fisheries in a timely manner consistent with this Chapter. With respect to management responsibilities, all activities of the Parties and the Fraser River Panel shall be consistent with the August 13, 1985, Memorandum of Understanding between the Parties.

6. Fraser River Panel pre-season planning meetings that do not occur simultaneously with Commission meetings shall be held alternately in Canada and the United States. Scheduled in-season management meetings shall be held at Richmond, B.C. unless the Panel agrees otherwise. As agreed, Panel meetings may be held by telephone conference call.

7. The Parties may agree to adjust the definition of the Fraser Panel Area as necessary to simplify domestic fishery management and ensure adequate consideration of the effect on other stocks and species harvested in the Area.

8. The shares of both countries shall be adjusted each year in the amount of any harvest overage or underage of that annual share of the same species from the previous year or years. In making this adjustment, the share(s) will be reduced by no more than 5 percent because of the adjustment, unless otherwise agreed. The Fraser River Panel shall attempt to balance the shares of the Parties by the expiration of this Chapter. Any remaining balance from the harvest overage or underage shall be incorporated in the subsequent year's allocation. Any residual overage or underage remaining at the last year of this Chapter shall be carried forward into the next Chapter period.

9. The Parties shall establish a Technical Committee for the Fraser River Panel:

(a) the members shall coordinate the technical aspects of Fraser River Panel activities with and between the Commission staff and the national sections of the Fraser River Panel, and shall report, unless otherwise agreed, to their respective National Sections of the Panel. The Committee may receive assignments of a technical nature from the Fraser River Panel and will report results directly to the Panel.

(b) membership of the Technical Committee shall consist of up to five such technical representatives as may be designated by each National Section of the Commission.

(c) members of the Technical Committee shall analyze proposed management regimes, provide technical assistance in the development of proposals for management plans,

explain technical reports and provide information and technical advice to their respective National Sections of the Panel.

(d) the Technical Committee shall work with the Commission staff during pre-season development of the fishery regime and management plan and during in-season consideration of regulatory options for the sockeye and pink salmon fisheries of Fraser Panel Area waters and during post-season evaluations of the season to ensure that:

(i) domestic allocation objectives of both Parties are given full consideration;

(ii) conservation requirements and management objectives of the Parties for species and stocks other than Fraser River sockeye and pink salmon in the Fraser Panel Area during periods of Panel regulatory control are given full consideration; and

(iii) the Commission staff is informed in a timely manner of management actions being taken by the Parties in fisheries outside of the Fraser Panel Area that may harvest sockeye and pink salmon of Fraser River origin.

(e) the staff of the Commission shall consult regularly in-season with the Technical Committee to ensure that its members are fully informed in a timely manner on the status of Fraser River sockeye and pink salmon stocks, and the expectations of abundance, migration routes and proposed regulatory options, so the members of the Technical Committee can brief their respective National Sections prior to each in-season Panel meeting.

10. The Parties agree that Panel management actions should meet the following objectives, listed in order of priority:

(a) obtain spawning escapement goals by stock or stock grouping;

(b) meet Treaty defined international allocation; and

(c) achieve domestic objectives.

11. The Fraser River Panel shall manage its fisheries consistent with the provisions of the other chapters of Annex IV to ensure that the conservation needs and management requirements for other salmon species and other sockeye and pink salmon stocks are taken into account.

12. The Parties agree to develop regulations to give effect to the provisions of the preceding paragraphs. Upon approval of the pre-season plan and during the period of Panel regulatory control, all sockeye and pink fisheries under the Panel's jurisdiction are closed unless opened for fishing by in-season order of the Panel.

APPENDIX F: STAFF OF THE PACIFIC SALMON COMMISSION IN 2000

EXECUTIVE OFFICE

Mr. D. Kowal, Executive Secretary
Ms. J. Bakas, 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
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Mr. M. Lapointe, Sockeye Racial Analysis Biologist
Ms. M. Reichardt, Scale Analyst
Ms. J. Volk, Scale Analyst
Mr. B. White, Pink Racial Analysis Biologist

STOCK MONITORING GROUP

Mr. J. Cave, Head
Mr. P. Cheng, Hydroacoustics Biologist
Mr. A. Gray, Hydroacoustics Biologist (Term)
Mr. P. Van Will, Test Fishing Biologist (Term)
Dr. Y. Xie, Hydroacoustic Scientist