Review of the 2006 Fraser River Sockeye Fishery

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Highlights of the 2006 Fraser River Sockeye Season

- First application of the new Fraser River Sockeye Spawning Initiative goals;
- Significant increase in exploitation rate on Cultus Lake sockeye through an historic agreement between the Commercial Salmon Advisory Board and First Nations in the lower Fraser River;
- Significant decline in Quesnel Lake sockeye from the pre-season forecast based on recent returns on this cycle;
- Two-day test fishing results in Johnstone Strait largest on record;
- Significantly more fish on the spawning grounds past Mission than estimated, primarily Late runs, but Summer runs as well;
- Significantly fewer Summer runs returning to the mid and upper watershed than forecasted;
- Many First Nations in the mid and upper Fraser River failed to achieve food fish catch targets;
- Significant over-harvest of Summer and Late run fish, based on in-season run size estimates;
- Significant over-harvest of Summer runs, based on preliminary post-season data.

1 Overview

The 2006 Fraser sockeye fishery presented many management challenges prompted by inaccurate predictions of run sizes, and increasing pressures on the sockeye fishery. Problems have been building over the past decade that partially explain what occurred in 2006. Lower than average sockeye returns and decreased allowable catches have typified many recent Fraser River fisheries. Conservation concerns for certain stocks in the sockeye mix added to the impact on sockeye fisheries. Due to its lower priority, the commercial fishery has been impacted by conservation measures more than other fisheries. For the major commercial fisheries, concern for Cultus Lake sockeye was a potential impediment to realizing harvests from an anticipated abundance in Summer and other late Summer runs such as those returning to the Shuswap. The 2006 season was expected to be the first season in several years yielding a significant harvest for the commercial industry. The anticipation of a significant economic return coupled with conservation concerns led to forceful and potentially innovative arrangements. As the season progressed, though, it became clear that Quesnel sockeye had not returned at forecasted levels. Unfortunately, fisheries had already been conducted on the assumption abundance was high. There were at least two occasions during the season when critical decisions were made based on changing and uncertain information: the first near the end of August with the downgrading of the summer run resulting from the failure of the Quesnel stock; and the other related to the large test catches for late run fish that occurred in Johnstone Strait, and the subsequent failure of the Mission hydro-acoustic

facility to detect the large abundance. Final in-season estimates as well as preliminary post-season estimates indicated that Summer runs were over-fished by about 1.1 million fish as a result of this error. The lack of Summer run fish available to mid and upper river First Nations, combined with the earlier over-fishing of these runs, suggests that more caution should have been taken during the season in order to meet escapement levels and provide First Nations' needs. In hindsight, some of the commercial fisheries that took place in Johnstone Strait and the lower river perhaps should not have been allowed. The priority schedule places conservation followed by First Nations needs before commercial and recreational needs, but this order is not consistent with the order in which the fisheries occur in space and time. The 2006 experiences suggest the need for broader representation of voices in-season, and a new structure for the Fraser Panel.

Fraser Sockeye Spawning Initiative

In past years Fraser River sockeye spawning targets were calculated according to a "Rebuilding Strategy". Due to shortcomings in this approach the Department of Fisheries and Oceans (DFO) adopted a new escapement strategy for Fraser River sockeye in 2005. The process of developing this new approach is known as the Fraser River Sockeye Spawning Initiative (FRSSI). The FRSSI is a multi-sector group of First Nations, recreational, commercial and environmental interests[1] interacting to develop a new method for setting harvesting and spawning goals. They met several times in early 2006 to identify objectives, to consider a range of alternatives and to provide advice to DFO that was incorporated into consultations with First Nations and advisory committees.

The approach of the FRSSI uses historical records of spawning numbers and the resulting production or recruitment to prepare a large "representative" sample of potential spawner-recruit models (employing many parameters that are consistent with the historical performance of the stocks). The sample of possible biological models is then used to find an "optimal" harvesting plan that balances long-term catch objectives with short-term escapement constraints and catch expectations.

Pre-Season Forecasts

The 2006 pre-season plan was based on a sockeye run-size forecast of 17.4 million fish at the 50% probability (p) level, with a predicted diversion through Johnstone Strait of 67%. The pre-season plan incorporated provisions to protect Early Stuart and Late run stocks, in addition to Cultus and Sakinaw Lake sockeye. The U.S. share of the annual Fraser River sockeye salmon total allowable catch (TAC), harvested in the waters of Washington State, was set at 16.5% as per the PST Annex IV Chapter IV agreement.

[1] Members of the Marine Conservation Caucus have since withdrawn from the FRSSI process.

The 50% probability forecasts for the four management aggregates are as follows (Table 1): Early Stuart 84,000; Early Summer 1.3 million; mid-Summer 7.2 million; and Late 8.8 million (of which 562,000 were Birkenhead-type).

The forecast for the Early Stuart 2006 cycle was lower than the average 129,000 primarily due to low spawner abundance in the brood year (Table 2). The Early Summer forecast (1.3 million) was approximately double the historical average (586,000). The majority of Early Summer fish were destined for the Thompson/Shuswap area although above average returns were expected for upper Fraser stocks (Bowron and Nadina). The Summer run forecast (7.2 M) was considerably larger than the historical average for this cycle (3,943,000), mainly due to a record escapement to the Quesnel system in 2002. For 2006, the Quesnel forecast (4,613,000) comprised more than half of the Summer run forecast. However, there were concerns that this forecasted return would not materialize as the Quesnel fry weight was the lowest on record, and thus marine survival could be low. The larger-than-cycle-average forecast of Late run stocks reflects the unexpectedly large return in the brood year. While concerns for early entry and the associated elevated rates of pre-spawn mortality continue, conservation concerns for the Late run stocks were primarily for Cultus Lake sockeye.

Table 1 shows pre-season 2006 escapement targets, management adjustments, and harvest rates for the Early Stuart, Early Summer, Summer and Late run groupings at the 50% forecast probability level. Escapements may be exceeded where conservation measures to protect co-migrating stocks and species are applied. It should be noted that this table does not identify proposed exploitation rates for Cultus Lake sockeye for 2006 which are set at 30% at the Late run 50p level and 25% if the Late run size returns at the 25p or less level.

Late Run Sockeye and the Cultus Issue

Late Run sockeye have historically delayed in the Gulf of Georgia for 4 to 8 weeks prior to entering the Fraser River. Beginning in 1996, the delay period has become shortened and the sockeye are entering the river early. This unusual behavior has been linked with high levels of en-route and pre-spawn mortality. For example, in the Cultus and Widgeon systems, pre-spawn mortality was 90% and greater in 2000 and 2001, before dropping substantially in recent years (2002 (<20%), 2003 (23%), 2004 (<10%), 2005 (13%)). The concern that the 2006 Late run sockeye and Cultus sockeye would begin the freshwater migration early and suffer high mortality led to the inclusion of conservation objectives into the pre-season planning.

The Cultus sockeye run has been listed by COSEWIC as endangered and a recommendation was made to list it on Schedule 1 of the Species at Risk Act. The Minister of Fisheries and Oceans decided not to include Cultus Lake sockeye for the protection under the Act. However, the Minister did commit to protect and rebuild, if possible, this valuable stock. In the two years prior to 2006, DFO

planned to maintain a 10 to 12% exploitation rate on Cultus Lake sockeye. As 2006 was the first year in several years where the sockeye forecast would support substantial commercial fishing, commercial fishermen sought ways to increase their catch of more abundant sockeye stocks that were made more inaccessible due to the Cultus Lake exploitation rate constraint.

For the first time, representatives of the Commercial Salmon Advisory Board (CSAB) met with First Nations in the Fraser River to look for options to protect Cultus Lake sockeye and improve sockeye productivity, while opening opportunities for commercial fishing in mixed-stock areas. An agreement was reached between the First Nations whose territory includes Cultus Lake, and the CSAB. This agreement committed CSAB funds for hatchery expansion and habitat and predator initiatives in exchange for a higher exploitation rate than was otherwise considered.

A 30% exploitation rate, combined with a series of freshwater enhancement initiatives to be paid for from the harvest of approximately 100,000 sockeye, was agreed to by the parties. The DFO then adjusted the commercial fishery exploitation rate for Cultus sockeye to 30%.

At the time of writing this report the funds from the sale of these fish are being held up as the result of uncertainty from the Larocque case, leaving the enhancement activities in limbo. It is hoped that these funds will become available to undertake the initiatives soon.

Lower than Expected Return of Quesnel Sockeye

The pre-season forecast for Quesnel sockeye was based upon spawner abundance in 2002. Pre-season, there was concern for this run as the smolts that went to sea were much smaller than average, and so were expected to experience higher than normal mortality. As the season progressed it became clear that the Quesnel stock had not returned at forecasted levels. Unfortunately fisheries had already been conducted on the assumption the abundance was high. Final in-season estimates as well as preliminary post-season estimates indicated the Summer runs were over-fished by about 1.1 million as a result of this error.

Largest Test Fish Catch on Record

An unusually large test fish catch was recorded at the peak of the Late run migration into the outside marine areas. This purse seine test fishery in Johnstone Strait suggested a significant abundance of fish, more than the in-season estimates had shown to date. Although this large abundance did not materialize in the Mission count, preliminary post-season estimates using spawning ground numbers suggest that there was in fact a large volume of fish passing through.

Spawner counts on many of the major streams such as Adams River and lower Shuswap and Quesnel indicate that more fish arrived on the spawning ground than were estimated using the hydro-acoustic facilities at Mission. The difference between estimates has perplexed the technical staff at the Pacific Salmon Commission and as yet a formal post-season run size estimate is not available. This larger than expected abundance of spawners has reduced the known level of over-fishing in the Summer runs, as well as in the Late runs. However, a significant discrepancy remains between what was caught in the mid-summer runs and what in-river estimates predicted was available.

Impact of Low Summer Run on First Nations

The impact of fewer than expected sockeye returning in the 2006 Summer runs was felt hardest by the First Nations in the mid to upper river. In contrast to early expectations for the plentiful First Nations fishery predicted by the pre-season forecast, some First Nations ended up with fewer fish than needed. Nor were many First Nations able to reach target catches set out by DFO. The lack of Summer fish available to mid and upper river First Nations, combined with the earlier over-fishing of these runs, suggests that more caution should have been exercised during the season in order to meet escapement levels and to provide First Nations' needs. In hindsight some of the commercial fisheries that took place in Johnstone Strait and the lower river perhaps should not have been undertaken. A more precautionary approach is needed in the future to prevent a similar outcome.

The priority schedule places conservation followed by First Nations' needs before commercial and recreational needs, but this order is not consistent with the order in which fisheries occur in space and time, i.e., the latter two fisheries take place first in the marine environment. Undertaking any fisheries in the ocean entails a degree of risk that too few salmon arrive up-river to meet conservation and food fish needs. The nature and extent of that risk must be fully understood by all participants, and efforts are needed to explore options for managing that risk.

In-season decision making is made in consultation with the Fraser River Panel. Unfortunately the connection between participants on the Panel and First Nations along the river is tenuous at best. DFO is required to consult with affected First Nations when decisions are taken in-season that could potentially impact their rights. A different consultation structure is clearly required. The Fraser River Aboriginal Fisheries Secretariat does provide communication services and has technical support involved in the process. Though DFO staff tries to keep individual First Nations informed on a bilateral basis, the pace of the decision-making in 2006 made it difficult to fully communicate and consult on these important issues. The consultation process appears to have failed to adequately inform in a timely manner those First Nations who would be impacted, so that their input could be considered and their needs accommodated.

Only two First Nation individuals from the Fraser River sit on the Fraser Panel, and both are appointed by the Minister. A formal reporting mechanism for informing or receiving input between the Panel and the First Nations is lacking. Consequently, First Nations' involvement on the Panel relative to these kinds of decisions is not consultation.

2 Pre-season

Run Size Forecasts

The pre-season forecast predicted a significantly larger Fraser sockeye run than the average and greater than average run size for the cycle (Table 2). The mean run size is just under 9 million and the mean run size for the 2006 cycle was over 12 million. The 50p level expectations for 2006 were over 17 million sockeye. Most of the abundance was expected in the Summer runs, particularly Quesnel, and in the Late runs to the Adams River (4.6 and 6.6 million, respectively). Early Summer runs were also expected to be higher, at 1.3 million, than the average run size.

Environmental Conditions and Management Adjustments

Management adjustments (MAs) are added to escapement targets and correct for differences observed over all years of data between abundance estimates at Mission and upstream spawning ground estimates. It was expected that MAs would be applied for Early Stuart, Early Summer and Late runs (Table 3). Estimates of the Summer runs at Mission and upstream sites have historically been very similar and adjustments were not expected.

Early Stuart Run

The expected difference between estimates at Mission and up river for the early Stuart run was about 40%, and the prescribed management adjustment was in the order of 90% (Table 3). However, with a low forecast run size relative to the spawning target, the MA was moot: based upon the expected run size, spawning target, and environmental conditions, no directed harvest was anticipated.

Early Summer Run

The pre-season run size forecast and the spawning targets for the Early Summer run provided some room for harvest. However, the exploitation rate had to be adjusted for anticipated losses en route in the river. The expected difference between estimates for Early Summers resulted in an MA of 56% (Table 3), due to the lower than expected flows caused by low snow pack conditions and expected higher than average summer temperatures.

Summer Run

The Summer run has shown very little difference between estimates at Mission and up river over the years. There have been some years in which small discrepancies are attributed to temperature and flow in the river. However in the

pre-season of 2006 it was assumed that the difference between estimates would be negligible, therefore no management adjustment was applied for the Summer run.

Birkenhead-like Stocks

The Birkenhead and Birkenhead-like stocks are part of the Late run, and they are grouped as a separate management group as they appear not to experience the high in-river mortality of other Late run stocks. No management adjustment was applied to the stocks, as there was little or no evidence of differences between estimates.

True Late Run

The adjustment for en route mortality in the Late run is based upon the timing of the 50% migration past Mission. In 2006 this timing was projected to be the 9th of September. Based on data from recent years, 31% (the difference between estimates DBE) of the fish estimated at Mission were not expected to arrive on the spawning grounds. This resulted in the management adjustment for the Late run of 45% (Table 3).

3 In-season Management

Table 3 shows the chronology of run size adjustments and calculated allowable catches (data provided by the staff of the Pacific Salmon Commission).

There were at least two occasions during the season when critical decisions were made based on changing and uncertain information: the first near the end of August with the downgrading of the summer run resulting from the failure of the Quesnel stock; and the other related to the large test catches for late run fish that occurred in Johnstone Strait, and the subsequent failure of the Mission hydro-acoustic facility to detect the large abundance.

Summer Run

The pre-season forecast for the Summer run was for more than 7 million fish. Yet there were also concerns about the small size of the Quesnel fry and smolts going to sea. Some concern was obviously warranted; the final in-season estimate of the Summer runs was only 2 million fish. After deductions, the final TAC calculation left the fishery with zero catch (negative 152,200 pieces was the final number—Table 4). But management decisions resulted in a catch-to-date-estimate of 1.2 million.

There were signals that the Quesnel run was in trouble as early as the July 28 in-person Fraser River panel meeting. However, it was still too early to be certain, with two weeks before the peak migration was expected, even though the proportion of Quesnel stock in the Summer run was not building as expected. The Summer runs as an aggregate were tracking six days late, if they were to reach their forecast levels. Food social and ceremonial fisheries in marine areas

and the river were opened. Recreational fisheries in Canada were opened and a small Area D gillnet assessment fishery was planned. Low impact U.S. fisheries were also initiated.

At the August 4 meeting the Summer run still had not materialized in any abundance, while Early Summer stocks appeared to be near forecast abundance, although somewhat late. Late Stuart and Stellako runs would have to have been four days late to reach their forecast abundance and the Quesnel would have to have been ten days late. Further fisheries were being planned in both Canada and the United States. In Canada commercial fishing by troll and gillnet fleets in Johnstone Strait was planned. In the U.S. the larger, more effective fisheries nearer the mouth of the river were approved by the Fraser panel.

The August 11 meeting was the first time the in-season run size prediction models could be used. These models suggested a significantly lower Summer run return than forecast. The estimates ranged from less than 2 million to just over 4 million, approximately half of the pre-season forecast. The 75th percentile run size forecast of just over 4 million was adopted for planning purposes. A 3 million run size would have zeroed out the Canadian commercial TAC. Troll and gillnet fishing in Johnstone Strait continued and plans were made to open the river to commercial gillnets the following week.

At the August 18 meeting the Summer fish still had not materialized in abundance and would have to be as much as 18 days late to have met forecasts. Staff recommended staying with the 75p forecast (>4 million) for planning purposes, even though the models were producing estimates that ranged from 2.5 million to 4.7 million. The Late Summer runs were beginning to show in some abundance, and there were initial indications of their in-season run size estimates, ranging from 3.5 million to 10.5 million. This was a very uncertain time. Plans were made to open gillnet and troll fishing in Johnstone Strait and in the river as well as purse seine fishing in Johnstone Strait. The U.S. continued to fish.

On August 22 the Summer run abundance estimate was 3 million, which would have allowed no Canadian commercial TAC of Summer runs. However, attention had shifted from Summer run management to Late run management.

The August 25 meeting saw a slight increase in the estimated runs of Summer fish to 3.5 million. Four days later on August 29 it was clear to the PSC that the run was significantly smaller. The smaller run would have also meant a somewhat smaller Early Summer run. In response to this information the staff recommended an Early Summer run size of 1.4 million, down from the 1.7 million, and a Summer Run estimate of 2 million. Both of these recommendations were rejected by Canada and planning for fisheries went ahead based upon the 4 million Summer run size and a target for the estimated large abundance of Late run fish. The result was an over-fishing estimate of 1.1 million fish (Table 4).

Late Run

At the August 22 meeting it was still too early to assess Late runs with any certainty, yet it was looking like a smaller run size than forecast: around 7 million compared to the pre-season forecast of just over 8 million.

The Panel met again on August 25, just after two of the largest single day test fish catches on record in Johnstone Strait. These data suggested a much larger run of perhaps 10 million fish in the Late Run. By the August 29 meeting the 10 million estimate still looked good, but there were indications that it could be somewhat smaller.

By the September 1 meeting it was clear that the Summer runs were not showing at Mission in abundance. Therefore the expansion factors used to estimate the Late run abundance from test fishing were suspect. PSC staff provided Late run estimates based upon the measured Summer run expansion factors and suggested that the Late run may have been quite a bit smaller than 10 million. A smaller number of 7.5 million was suggested. However, some estimates were as low as 3.4 million. The main uncertainties were the expansion factors for Johnstone Strait test fisheries, the accuracy of the Mission counts, and the Gulf troll test fishery. The final in-season estimate was 4.74 million.

4 Post-season Assessments

Unlike most previous years, spawning ground assessments revealed more fish had returned than were estimated at Mission. For the Late runs this difference is significant at almost twice what was expected, based upon Mission. Spawning estimates of the Summer runs were also higher than expected.

Another complicating factor emerged from the radio tagging study that was conducted to estimate en route mortality. It suggested there was a larger than expected mortality en-route for Summer runs than had been seen previously. The final run size may end up being significantly larger than was first estimated in-season.

At the time this report was written, the final best estimate of the 2006 Fraser Sockeye Run sizes had not been confirmed. Reviews of the spawning ground estimates, the Mission hydro-acoustic estimates and the en-route mortality estimates are still underway. It is anticipated that by June 2007 the Panel will adopt a 2006 run size.

5 Discussion

Overall the 2006 Fraser River sockeye season was a disappointment. It started off with a pre-season of high expectations for some of the runs (Early Summer, Summer and Late runs), but only the Early Summers did as well as expected.

Various factors—high water temperatures and low discharge, discrepancies among assessments, effects of conservation measures on mixed stocks, and conflicting priorities—contributed to the disappointing results and ultimately revealed weaknesses in the management of sockeye and the structure of the fishery.

Uncertainty and Risk in the Fishery

The treatment of risk is at the center of Fraser Sockeye fishery management. How well the fishery is managed rests on our ability to deal with the uncertainties inherent in predicting and enumerating stocks. At no time during the 2006 season, or even post-season, do we know how many fish arrived on the coast of British Columbia to contribute to the harvest, died en-route, or ultimately spawned. Although the tools that are used to assess stocks at various points in the migration are sophisticated, modern, and as good as we can do with current technologies, they still leave huge uncertainties and potential biases that creep into the assessments and analyses.

A second factor challenging the management of the sockeye fishery is the order of the fishery, currently at odds with the order of priority. With the current structure, most of the harvest is potentially taken in outer marine areas such as Johnstone Strait, creating the potential for over-fishing, and inadequate run sizes in river. The first priority for the management system is the delivery of fish to the spawning grounds to meet conservation needs. While conservation needs are often thought to be synonymous with spawning escapement targets, they are not necessarily equivalent. The former can be set higher if a stock is threatened or at risk. The second priority as set out in a Supreme Court interpretation of the Constitution and by DFO policy is First Nations' food, social and ceremonial needs. Much of this First Nations' harvest takes place in the river past Mission, and after the bulk of the commercial fishing and other substantial harvests have occurred.

Structuring a fishery in which a large commercial fishery occurs first, given the needs of managing for certainty, is like putting the cart before the horse. Fisheries managers are asked to make choices about fisheries when there is extremely high uncertainty about the number of fish returning. The 2006 season demonstrated the pitfalls associated with making decisions in the face of such uncertainty.

A large Summer run was predicted in the pre-season, due to an abundant Quesnel stock. This created a great deal of anticipation for a large economic return by the commercial fishery, compared to recent years. Because Quesnel smolts were unusually small, the decision to base exploitation rates on the pre-season estimate was made with full awareness that the actual return could be substantially lower than expected. In hindsight in-season decision-making should have more heavily factored into the exploitation rate the higher mortality these small fish were expected to experience. As it was, the Summer run appears to

have been over-fished by 1.1 million fish (see Table 4). (The in-season TAC calculations for the runs are compared in Table 4 with post-season catches. Relative to the TAC calculations, all runs except Birkenhead were over-fished.) The majority of participants on the Fraser panel, which was an integral part of the decision-making process, represented marine commercial fishing interests. DFO staff has a responsibility to conservation, and food, social and ceremonial fisheries. When critical decisions are made there is a need for input and balance from conservation and food fish interests.

The management of the Late run was complicated by data from the largest test fish catches on record in Johnstone Strait. Although the test fish catches represented a significant volume of fish, the actual size of the run was not known, and is still not known with any degree of accuracy. If those fish were present they were likely in a single large lump making them difficult to access in the commercial fisheries in Johnstone Strait as they may have departed the Strait prior to the fishery commencing.

Although we cannot know how the outcome might be affected if decisions had been different, it is troublesome that voices for conservation and First Nations' interests were not as audible at the table. In future, when faced with these risks and trade-offs in the heat of, at times, hourly decision-making, a balance should be struck between participants whose focus is on conservation and food fish, and participants whose focus is on avoiding foregone catch.

Stock Assessment Issues

Many of the problems affecting the 2006 Fraser sockeye fisheries related to weakness in stock assessment. Our assessment tools appeared to have failed. In fact, as late as March 2007 there was still no certainty around the size of the runs for 2006; a decision is expected in June 2007. There were large discrepancies between the estimates made at Mission and the number of fish counted upstream. Unlike previous years, this discrepancy was in the positive direction: more fish were accounted for when using spawning ground estimates in catch upstream than were estimated at Mission.

The inability to get reliable numbers in-season makes it difficult to determine the run size. Another unknown is the degree of mortality that occurred en-route between Mission and the spawning grounds.

In 2006 a radio tagging study was conducted to determine en-route losses of sockeye. Unfortunately, outstanding issues remain regarding potential tag related mortality in addition to the otherwise accounted for mortality. Whether or not these can be fully resolved remains a question.

Given the problems with assessment in-season and perhaps post-season, we need to re-examine the structure of the fisheries. Fisheries management that relies on accurate and precise assessments is at substantial risk of making

inaccurate decisions when forecasts are inaccurate. A fishery structure that is more robust to the uncertainties inherent in assessment tools may be better able to reduce risks to conservation and First Nations' fisheries. The potential size and intensity of the marine fisheries, such as the purse seine fishery in Johnstone Strait, contribute to the high level of risk inherent in the current structure. A Smaller, less intense fisheries in marine areas, combined with increased harvests in the river after the fish have passed the assessment areas, will reduce risk.

This reform to the fisheries may be consistent with the shift in harvesting that is inevitable. First Nations on the Fraser and in the outside areas are actively seeking their rightful place at the table. This trend will likely mean a larger portion of the harvest taking place in-river, and smaller portions being taken along the marine migration routes.

There is a need to restructure the fishery and the Fraser Panel. A broader representation of voices is needed in-season to foster dialogue and understanding of the risks inherent in in-season management. Expansion, though, may create its own problems. The United States faced challenges when expanding its participation on the Fraser panel. The large number of participants is divided into two groups representing the interests of the United States. One group sits at the table as Fraser Panel members. The other is a larger caucus of people who vet most of the decision-making. One might think this a cumbersome arrangement; however, after several years in operation it seems to function efficiently, albeit expensively.

Whatever the future for Fraser Sockeye management, it will likely include a rearrangement of the fisheries in time and space to deal with a redistribution of the catch, and to facilitate a less risky approach to harvest. The 2006 season clearly demonstrated that a broader representation of interests in the decision-making process is urgently needed.

Table 1. Pre-season escapement targets, management adjustments and harvest rates for 2006 for each of the four Fraser River aggregates.

Stock Group	Run Size Estimate	Run Size Reference Points (a)		Total Mortality Rate Guidelines	Total Mortality Target at Run Size	Escapement Target at Run Size	Management Adjustment (b)		Exploitation Rate after MA	Cycle year adult escapement estimates 1986	1990	1994	1998	2002
Early Stuart	84	-	100	0%	0%	84	54%	45	0%	29	97	29	33	25
		100	300	0 - 60%										
		300		60%										
Early Summer		-	255	0%						205	442	248	186	458
		255	724	0 - 60%										
	1,303	724		60%	60%	521	34%	179	46%					
Summer		-	1,562	0%						581	1,597	1,325	2,382	3,804
		1,562	4,094	0 - 60%										
	7,158	4,094		60%	60%	2,863	0%	0	60%					
Birkenhead and Birkenhead-type Lates ©		-	123	0%						336	169	40	302	251
		123	321	0 - 60%										
	562	321		60%	60%	225	0%	0	60%					
true-Late (excl. Birk. Type)		-	2,422	0%						2,486	3,760	1,459	1,478	5,695
		2,422	4,441	0 - 60%										
	8,250	4,441		60%	60%	3,300	59%	1947	36%					
Sockeye Totals	17,357					6,993		2,172		3,637	6,065	3,101	4,381	10,232
	Est. Return													

a) Reference points based on exploitation rate targets

b) Management adjustments (MAs) are added to the escapement targets to correct for the actual differences between Mission and upstream abundance estimates over all years. This approach makes no prior assumption about environmental conditions because we don't yet know whether conditions will be favourable or unfavourable in 2006. We expect that the MAs will be revised to take into account an environmental conditions during the inseason management period.

c) Birkenhead type Lates include returns in the miscellaneous non-Shuswap component of the forecast returning to natal spawning areas in the Harrison-Lillooet systems (excluding Harrison and Weaver).

Table 2. Average run size for sockeye stocks or timing groups and the probabilities of achieving specified run sizes.

		Mean Run Size		Probability of Achieving Specified Run Sizes[a]				
Sockeye stock or timing group	**Forecast model[b]**	**All cycles[c]**	**2006 cycle**	**0.1**	**0.25**	**0.5**	**0.75**	**0.9**
Early Stuart	fry	**362,000**	**129,000**	**175,000**	**124,000**	**84,000**	**55,000**	**38,000**
Early Summer		**492,000**	**586,000**	**4,545,000**	**2,412,000**	**1,303,000**	**721,000**	**435,000**
Bowron	Ricker-pi	35,000	21,000	85,000	54,000	34,000	22,000	15,000
Fennell [f]	TSA	25,000	13,000	692,000	140,000	24,000	4,000	1,000
Gates [g]	power	58,000	21,000	50,000	31,000	20,000	11,000	7,000
Nadina	fry	82,000	24,000	94,000	54,000	29,000	16,000	9,000
Pitt	power	67,000	56,000	292,000	194,000	124,000	75,000	51,000
Raft	power	29,000	14,000	172,000	109,000	71,000	43,000	28,000
Scotch	R1C	49,000	119,000	567,000	319,000	168,000	89,000	50,000
Seymour	Ricker-cyc	147,000	318,000	1,039,000	656,000	393,000	253,000	166,000
Misc[d]	R/S	-	-	1,553,630	854,554	439,831	208,412	108,115
Summer		**4,669,000**	**3,943,000**	**23,240,000**	**13,052,000**	**7,158,000**	**4,020,000**	**2,484,000**
Chilko	smolt-esc	1,636,000	1,597,000	3,110,000	2,257,000	1,689,000	1,215,000	932,000
Late Stuart	R1C	686,000	305,000	2,017,000	803,000	288,000	104,000	41,000
Quesnel [h]	R1C	1,824,000	1,538,000	16,786,000	9,104,000	4,613,000	2,338,000	1,268,000
Stellako	R1C	523,000	503,000	1,327,000	888,000	568,000	363,000	243,000
Late		**3,196,000**	**8,143,000**	**28,586,000**	**16,314,000**	**8,812,000**	**4,734,000**	**2,726,000**
Cultus	smolt-jack	28,000	28,000	18,000	11,000	5,800	3,000	1,000
Harrison [i]	TSA	35,000	45,000	184,000	90,000	41,000	19,000	9,000
Late Shuswap [j]	RAC	2,206,000	6,745,000	21,605,000	12,359,000	6,644,000	3,572,000	2,043,000
Portage	Ricker	52,000	80,000	269,000	134,000	67,000	34,000	18,000
Weaver	fry	384,000	594,000	1,117,000	656,000	411,000	259,000	175,000
Birkenhead	power	491,000	651,000	1,120,000	713,000	433,000	274,000	183,000
Misc Shuswap[e]	R/S	-	-	3,819,395	2,100,807	1,081,266	512,352	265,786
Misc. non-Shuswap[e]	R/S	-	-	454,052	249,745	128,542	60,909	31,597
TOTAL		**8,719,000**	**12,801,000**	**56,546,000**	**31,902,000**	**17,357,000**	**9,530,000**	**5,683,000**

[a] probability that the actual run size will exceed the specified projection [b] see text for model descriptions
[c] 1970-2004 mean [d] unforecasted miscellaneous Early Summer stocks [e] unforecasted miscellaneous Late stocks

[f] Fennell performance measures of TSA and RAC models were nearly indistinguishable. Brood effective females (4800) were nearly double the cycle line average (2680) and 25% greater than the time series average (3861). This lends weight to the choice of the TSA model which forecasts double that of the RAC model.

[g] Gates Power model ranked third in the MAE measure, because the Fry and MRS models tied for the first rank. This influenced the average rank of the Power model. However, because the Power model is virtually the same or superior on all measures and has narrower bounds on the forecast it was the model chosen.

[h] Fry based models for Quesnel ranked third, with much greater RMSE (uncertainty) than the top two models. The fry model forecast was 6.2M (1.2M - 28M). Additionally, the top three models were all "naive", outperforming all escapement based models. While Quesnel escapement was near the historic maximum, productivity has been low relative to historic values - even during years of low escapement. Fry sizes are lower than average suggesting a conservative forecast would be appropriate.

[i] Harrison brood escapement exceeds the historical range. Use of any escapement based model would be invalid. The best ranking naïve model was chosen.

[j] The RAC model outperformed all fry models for Late Shuswap. Fry models still have great uncertainty because of their short time series (forecast 9M intervals ranging 3M to 39M). Brood escapement was 1.6x the historic maximum. Any escapement based forecast would be outside the predictive range of the model, making it invalid. Therefore only naive models were considered.

Table 3. In-season updates from July 2 to October 11, 2006 of run sizes, targets, management adjustments, deductions and allowable catches.

Updates 2006				Targets		TAC Deductions							
				Total	Exploitation	Spawning	Management Adjustment		Fraser	Test		Total	United
		Date	Run Size	Mortality Target	Rate After MA	Escapement Target	Factor	Fish	Aboriginal Exemption	Fishing Deduction	TAC Deductions	Allowable Catch	States Share
1	EStu	2-Jul-06	84,000	0%	2%	82,500	0.89	0	0	1,500	84,000	0	0
2	ESum	2-Jul-06	1,303,000	60%	40%	521,200	0.507	264,096	45,200	19,000	849,496	453,504	75,000
3	Summ	2-Jul-06	7,158,000	60%	58%	2,863,200	0.05	143,000	292,400	69,000	3,367,600	3,790,400	625,000
4	Birk	2-Jul-06	433,000	60%	48%	224,800	0.00	0	2,300	1,500	228,600	204,400	34,000
5	Late	2-Jul-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	29,000	4,874,100	3,504,900	578,000
6	Sockeye	2-Jul-06	17,357,000			6,991,700		1,892,096	400,000	120,000	9,403,796	7,953,204	1,312,000
1	EStu	14-Jul-06	84,000	0%	2%	82,500	0.89	0	0	1,500	84,000	0	0
2	ESum	14-Jul-06	1,303,000	60%	40%	521,200	0.507	264,096	45,200	19,000	849,496	453,504	75,000
3	Summ	14-Jul-06	7,158,000	60%	58%	2,863,200	0.05	143,000	292,400	69,000	3,367,600	3,790,400	625,000
4	Birk	14-Jul-06	433,000	60%	48%	224,800	0.00	0	2,300	1,500	228,600	204,400	34,000
5	Late	14-Jul-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	29,000	4,874,100	3,504,900	578,000
6	Sockeye	14-Jul-06	17,357,000			6,991,700		1,892,096	400,000	120,000	9,403,796	7,953,204	1,312,000
1	EStu	18-Jul-06	70,000	0%	2%	68,500	0.89	0	0	1,500	70,000	0	0
2	ESum	18-Jul-06	1,303,000	60%	40%	521,200	0.507	264,096	45,200	19,000	849,496	453,504	75,000
3	Summ	18-Jul-06	7,158,000	60%	58%	2,863,200	0.05	143,000	292,400	69,000	3,367,600	3,790,400	625,000
4	Birk	18-Jul-06	433,000	60%	48%	224,800	0.00	0	2,300	1,500	228,600	204,400	34,000
5	Late	18-Jul-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	29,000	4,874,100	3,504,900	578,000
6	Sockeye	18-Jul-06	17,343,000			6,977,700		1,892,096	400,000	120,000	9,389,796	7,953,204	1,312,000
1	EStu	21-Jul-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	21-Jul-06	1,303,000	60%	31%	521,200	0.715	372,564	45,200	19,000	957,964	345,036	57,000
3	Summ	21-Jul-06	7,158,000	60%	58%	2,863,200	0.05	143,000	292,400	69,000	3,367,600	3,790,400	625,000
4	Birk	21-Jul-06	433,000	60%	48%	224,800	0.00	0	2,300	1,500	228,600	204,400	34,000
5	Late	21-Jul-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	29,000	4,874,100	3,504,900	578,000
6	Sockeye	21-Jul-06	17,343,000			6,977,700		2,000,564	400,000	120,000	9,498,264	7,844,736	1,294,000
1	EStu	28-Jul-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	28-Jul-06	1,303,000	60%	31%	521,200	0.715	372,564	45,200	19,000	957,964	345,036	57,000
3	Summ	28-Jul-06	7,158,000	60%	58%	2,863,200	0.05	143,000	292,400	69,000	3,367,600	3,790,400	625,000
4	Birk	28-Jul-06	433,000	60%	48%	224,800	0.00	0	2,300	1,500	228,600	204,400	34,000
5	Late	28-Jul-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	29,000	4,874,100	3,504,900	578,000
6	Sockeye	28-Jul-06	17,343,000			6,977,700		2,000,564	400,000	120,000	9,498,264	7,844,736	1,294,000
1	EStu	11-Aug-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0

Updates 2006				Targets		TAC Deductions							
				Total Mortality	Exploitation Rate	Spawning Escapement	Management Adjustment		Fraser Aboriginal	Test Fishing	TAC	Total Allowable	United States
		Date	Run Size	Target	After MA	Target	Factor	Fish	Exemption	Deduction	Deductions	Catch	Share
2	ESum	11-Aug-06	1,303,000	60%	41%	521,200	0.487	254,000	45,200	19,000	839,400	463,600	76,000
3	Summ	11-Aug-06	4,020,000	59%	56%	1,678,000	0.05	84,000	292,400	69,000	2,123,400	1,896,600	313,000
4	Birk	11-Aug-06	433,000	60%	46%	235,000	0.00	0	2,300	1,500	238,800	194,200	32,000
5	Late	11-Aug-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	29,000	4,874,100	3,504,900	578,000
6	Sockeye	11-Aug-06	14,205,000			5,802,700		1,823,000	400,000	120,000	8,145,700	6,059,300	999,000
1	EStu	17-Aug-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	17-Aug-06	1,500,000	60%	43%	600,000	0.423	254,000	45,200	40,000	939,200	560,800	93,000
3	Summ	17-Aug-06	4,020,000	59%	56%	1,678,000	0.05	84,000	292,400	40,000	2,094,400	1,925,600	318,000
4	Birk	17-Aug-06	433,000	60%	46%	235,000	0.00	0	2,300	1,500	238,800	194,200	32,000
5	Late	17-Aug-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	40,000	4,885,100	3,493,900	576,000
6	Sockeye	17-Aug-06	14,402,000			5,881,500		1,823,000	400,000	123,000	8,227,500	6,174,500	1,019,000
1	EStu	18-Aug-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	18-Aug-06	1,700,000	60%	40%	680,000	0.488	332,000	45,200	40,000	1,097,200	602,800	99,000
3	Summ	18-Aug-06	4,020,000	59%	56%	1,678,000	0.05	84,000	292,500	40,000	2,094,500	1,925,500	318,000
4	Birk	18-Aug-06	433,000	60%	46%	235,000	0.00	0	2,200	1,500	238,700	194,300	32,000
5	Late	18-Aug-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	40,000	4,885,100	3,493,900	576,000
6	Sockeye	18-Aug-06	14,602,000			5,961,500		1,901,000	400,000	123,000	8,385,500	6,216,500	1,025,000
1	EStu	22-Aug-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	22-Aug-06	1,700,000	60%	39%	680,000	0.534	363,006	45,200	40,000	1,128,206	571,794	94,000
3	Summ	22-Aug-06	3,000,000	35%	16%	1,978,000	0.27	534,000	292,500	40,000	2,844,500	155,500	26,000
4	Birk	22-Aug-06	433,000	60%	14%	371,000	0.00	0	2,200	1,500	374,700	58,300	10,000
5	Late	22-Aug-06	8,379,000	60%	43%	3,300,000	0.45	1,485,000	60,100	40,000	4,885,100	3,493,900	576,000
6	Sockeye	22-Aug-06	13,582,000			6,397,500		2,382,006	400,000	123,000	9,302,506	4,279,494	706,000
1	EStu	25-Aug-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	25-Aug-06	1,700,000	60%	39%	680,000	0.516	350,700	45,200	40,000	1,115,900	584,100	96,000
3	Summ	25-Aug-06	3,500,000	47%	39%	1,893,000	0.12	227,000	292,500	40,000	2,452,500	1,047,500	173,000
4	Birk	25-Aug-06	433,000	60%	48%	225,000	0.00	0	2,200	1,500	228,700	204,300	34,000
5	Late	25-Aug-06	10,000,000	60%	42%	4,000,000	0.45	1,800,000	60,100	40,000	5,900,100	4,099,900	676,000
6	Sockeye	25-Aug-06	15,703,000			6,866,500		2,377,700	400,000	123,000	9,767,200	5,935,800	979,000
1	EStu	29-Aug-06	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	29-Aug-06	1,700,000	60%	39%	680,000	0.516	350,700	45,200	40,000	1,115,900	584,100	96,000
3	Summ	29-Aug-06	2,500,000	23%	19%	1,944,000	0.04	78,000	292,500	40,000	2,354,500	145,500	24,000
4	Birk	29-Aug-06	433,000	60%	48%	225,000	0.00	0	2,200	1,500	228,700	204,300	34,000

Updates 2006				Targets		TAC Deductions							
				Total Mortality	Exploitation Rate	Spawning Escapement	Management Adjustment		Fraser Aboriginal	Test Fishing	TAC	Total Allowable	United States
		Date	Run Size	Target	After MA	Target	Factor	Fish	Exemption	Deduction	Deductions	Catch	Share
5	Late	29-Aug-06	10,000,000	60%	42%	4,000,000	0.45	1,800,000	60,100	40,000	5,900,100	4,099,900	676,000
6	Sockeye	29-Aug-06	**14,703,000**			**6,917,500**		**2,228,700**	400,000	123,000	**9,669,200**	**5,033,800**	**830,000**
1	EStu	**1-Sep-06**	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	1-Sep-06	**1,700,000**	60%	39%	680,000	0.516	350,700	45,200	40,000	1,115,900	584,100	96,000
3	Summ	1-Sep-06	**2,500,000**	23%	19%	1,944,000	0.04	78,000	292,500	40,000	2,354,500	145,500	24,000
4	Birk	1-Sep-06	433,000	60%	48%	225,000	0.00	0	2,200	1,500	228,700	204,300	34,000
5	Late	1-Sep-06	10,000,000	60%	42%	4,000,000	0.45	1,800,000	60,100	40,000	5,900,100	4,099,900	676,000
6	Sockeye	1-Sep-06	14,703,000			6,917,500		2,228,700	400,000	123,000	9,669,200	5,033,800	830,000
1	EStu	**5-Sep-06**	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	5-Sep-06	**1,450,000**	60%	**40%**	**580,000**	**0.507**	**293,879**	45,200	40,000	**959,079**	**490,921**	**81,000**
3	Summ	5-Sep-06	**2,000,000**	**11%**	**17%**	**1,792,000**	**0.02**	**-124,500**	292,500	40,000	**2,000,000**	**0**	**0**
4	Birk	5-Sep-06	433,000	60%	48%	225,000	0.00	0	2,200	1,500	228,700	204,300	34,000
5	Late	5-Sep-06	**9,200,000**	60%	42%	**3,680,000**	0.45	**1,656,000**	60,100	40,000	**5,436,100**	**3,763,900**	**621,000**
6	Sockeye	5-Sep-06	**13,153,000**			**6,345,500**		**1,825,379**	400,000	123,000	**8,693,879**	**4,459,121**	**736,000**
1	EStu	**8-Sep-06**	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	8-Sep-06	1,450,000	60%	40%	580,000	0.507	293,879	45,200	**32,000**	**951,079**	**498,921**	**82,000**
3	Summ	8-Sep-06	2,000,000	11%	**9%**	1,792,000	0.02	**36,000**	292,500	**32,000**	**2,152,500**	**-152,500**	**-25,000**
4	Birk	8-Sep-06	433,000	60%	48%	225,000	0.00	0	2,200	**4,000**	**231,200**	**201,800**	**33,000**
5	Late	8-Sep-06	**7,500,000**	60%	42%	**3,000,000**	0.45	**1,350,000**	60,100	**65,000**	**4,475,100**	**3,024,900**	**499,000**
6	Sockeye	8-Sep-06	**11,453,000**			**5,665,500**		**1,679,879**	400,000	**134,500**	**7,879,879**	**3,573,121**	**589,000**
1	EStu	**29-Sep-06**	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	29-Sep-06	1,450,000	60%	40%	580,000	0.507	293,879	45,200	32,000	951,079	498,921	82,000
3	Summ	29-Sep-06	2,000,000	11%	9%	1,792,000	0.02	36,000	292,500	32,000	2,152,500	-152,500	-25,000
4	Birk	29-Sep-06	**475,000**	60%	**60%**	**190,000**	0.00	0	2,200	4,000	**196,200**	**278,800**	**46,000**
5	Late	29-Sep-06	**4,720,000**	60%	**34%**	**1,888,000**	**0.65**	**1,227,000**	60,100	65,000	**3,240,100**	**1,479,900**	**244,000**
6	Sockeye	29-Sep-06	**8,715,000**			**4,518,500**		**1,556,879**	400,000	134,500	**6,609,879**	**2,105,121**	**347,000**
1	EStu	**11-Oct-06**	70,000	0%	2%	68,500	2.47	0	0	1,500	70,000	0	0
2	ESum	11-Oct-06	1,450,000	60%	40%	580,000	0.507	293,879	45,200	32,000	951,079	498,921	82,000
3	Summ	11-Oct-06	2,000,000	11%	9%	1,792,000	0.02	36,000	292,500	32,000	2,152,500	-152,500	-25,000
4	Birk	11-Oct-06	475,000	60%	60%	190,000	0.00	0	2,200	4,000	196,200	278,800	46,000
5	Late	11-Oct-06	**4,740,000**	60%	**34%**	**1,896,000**	0.65	**1,232,000**	60,100	65,000	**3,253,100**	**1,486,900**	**245,000**
6	Sockeye	11-Oct-06	**8,735,000**			**4,526,500**		**1,561,879**	400,000	134,500	**6,622,879**	**2,112,121**	**348,000**

Table 4. Comparison of in-season TAC calculations with post-season catches for Fraser River sockeye in 2006.

2006 Fraser River Sockeye Salmon: In-season TAC Calculations

Week of: Dec. 31 - Jan. 6, 2007 — Date: Jan. 2, 2007

		Sockeye				Late Run	
	Total	Early Stuart	Early Summer	Summer	Late	Birken -head	Late -Lates
TOTAL ALLOWABLE CATCH							
Total Run Size	8,715,000	70,000	1,450,000	2,000,000	5,195,000	475,000	4,720,000
Deductions							
Adult Escapement	4,518,500	68,500	580,000	1,792,000	2,078,000	190,000	1,888,000
Management Adjustment	1,557,200	0	294,000	36,000	1,227,200	0	1,227,200
Fraser R. Aboriginal Exemptio	400,000	0	45,200	292,500	62,300	2,200	60,100
Test Fishing	134,500	1,500	32,000	32,000	69,000	4,000	65,000
Total Deductions:	6,610,200	70,000	951,200	2,152,500	3,436,500	196,200	3,240,300
Total Allowable Catch:	2,104,800	0	498,800	(152,500)	1,758,500	278,800	1,479,700
UNITED STATES (Washington)							
U.S. Share * 16.5%	347,300	0	82,300	(25,200)	290,200	46,000	244,200
% of TAC	16.5%						
Treaty Indian Share *	235,100						
% of U.S. Share	67.7%						
Non-Indian Share *	112,200						
% of U.S. Share	32.3%						
CANADA							
Canadian Allocation	1,757,500	0	416,500	(127,300)	1,468,300	232,800	1,235,500
Fraser R. Aboriginal Exemption	400,000	0	45,200	292,500	62,300	2,200	60,100
Total	2,157,500	0	461,700	165,200	1,530,600	235,000	1,295,600
Planned Non-Commercial Shares							
Fraser River Aboriginal (FSC)	449,100	0	50,700	292,500	105,900	2,500	103,400
Marine Area Aboriginal	260,100	0	29,400	121,500	109,200	1,500	107,700
Marine Recreational Fisheries	15,000	0	2,000	0	13,000	1,000	12,000
Fraser Recreational Fisheries	200,000	0	22,000	0	178,000	6,000	172,000
Total Non-commercial	924,200	0	104,100	414,000	406,100	11,000	395,100
Commercial Allocations							
Purse Seine B 47.5%	362,400						
Gillnet D 18.5%	141,200						
Gillnet E 22.0%	167,900						
Troll G 4.5%	34,300						
Troll H 7.5%	57,200						
Total 100%	763,000	0	311,800	(248,800)	700,000	212,600	487,400
Fraser River Aboriginal (EO)	470,300	0	45,800	0	424,500	11,400	413,100
Total Commercial	1,233,300	0	357,600	(248,800)	1,124,500	224,000	900,500
Gross escapement target **	7,195,100	68,500	992,500	2,120,500	4,013,600	209,900	3,803,700

* U.S. sockeye share according to Annex IV of the Pacific Salmon Treaty: 16.5% + 0 payback (maximum of 5% of share)
TI share = 67.7% of the U.S. share and payback), NI share = 32.3% of the U.S. share and payback)

** Gross escapement target = spawning escapement target, management adjustment, and catches in Fraser River aboriginal, recreational, and charter fisheries.

CATCH-TO-DATE	Total	Early Stuart	Early Summer	Summer	Late	Birken -head	Late Lates
Washington	700,800	0	129,400	181,500	389,900	14,700	375,200
Canada	4,561,000	5,800	664,900	1,080,200	2,810,100	172,300	2,637,800
Test	127,000	1,500	31,200	30,600	63,700	4,000	59,700
Total	5,388,800	7,300	825,500	1,292,300	3,263,700	191,000	3,072,700
BALANCE							
Washington	(353,500)	0	(47,100)	(206,700)	(99,700)	31,300	(131,000)
Canada	(2,403,500)	(5,800)	(203,200)	(915,000)	(1,279,500)	62,700	(1,342,200)
Total	(2,757,000)	(5,800)	(250,300)	(1,121,700)	(1,379,200)	94,000	(1,473,200)