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**Report of the  
Fraser River Panel  
to the  
Pacific Salmon Commission  
on the  
2014 Fraser River Sockeye  
Salmon Fishing Season**



*Prepared by the*

**Pacific Salmon Commission  
May 2018**

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**REPORT OF THE  
FRASER RIVER PANEL  
TO THE PACIFIC SALMON COMMISSION  
ON THE 2014 FRASER RIVER SOCKEYE  
SALMON FISHING SEASON**

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**May 2018**

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# I. EXECUTIVE SUMMARY

## Pre-season Planning

1. Management of Fraser River sockeye salmon fisheries in 2014 was conducted under the provisions contained in the May 16, 2014 revised Annex 4, Chapter 4 of the Pacific Salmon Treaty (Appendix B).
2. Pre-season expectations were for a median run size (p50 level, Appendix C) of 22,854,000 Fraser River sockeye salmon and a one in two chance that the run size would be between 12,788,000 and 41,121,000.
3. Forecasted abundances by management group were 299,000 Early Stuart, 4,126,000 Early Summer, 5,699,000 Summer and 12,730,000 Late-run sockeye (Table 1).
4. Expectations of migration parameters included a 66% diversion rate for Fraser River sockeye salmon through Johnstone Strait, except for Harrison sockeye for which a 36% diversion rate was assumed based on historical information. Expected Area 20 50% migration dates used for pre-season planning were July 4 for Early Stuart, August 4 for Early Summer, August 10 for Summer-run and August 18 for Late-run sockeye. On July 10, Canada provided the Panel with revised predictions of diversion rate (57%) and migration timing (July 7 for Early Stuart, August 9 for Early Summer, August 14 for Summer and August 22 for Late-run sockeye).
5. Pre-season spawning escapement goals were approximately 120,000 Early Stuart, 1,444,000 Early Summer-run, 1,995,000 Summer-run and 4,456,000 Late-run sockeye for a total of 8,014,000 adult spawners (Table 1). The goals for each sockeye management group were established by applying Canada's Spawning Escapement Plan (Appendix C) to the forecasted run sizes. For pre-season planning purposes, Early Stuart was constrained by a 10% Low Abundance Exploitation Rate (LAER).
6. Management Adjustments (MAs) of 103,000 Early Stuart, 607,000 Early Summer and 219,000 Summer-run sockeye were added to the spawning escapement targets to increase the likelihood of achieving the targets. The Early Stuart MA was based on a relationship between river conditions (discharge and temperature) and historical differences between lower and upriver escapement estimates. The Early Summer MA was based on the weighted average (by p50 forecast abundances) of the median historical pMA for the Early Summer group, excluding Pitt and Chilliwack, an assumed pMA of zero for Pitt, and a pMA of 0.70 for Chilliwack (derived from subset of the historical data). The Summer-run MA was based on the weighted average (by p50 forecast abundances) of the median historical pMAs for Harrison sockeye and non-Harrison Summer-run sockeye.
7. For Late-run sockeye, the Panel assumed a continuation of early upstream migration behavior and associated high mortality that has occurred since 1996. For pre-season planning, the Panel adopted a Late-run MA of 1,248,000 fish based on a weighted average of the historical median pMA for Birkenhead sockeye and the historical mean of the 1998, 2002 and 2010 pMAs for non-Birkenhead Late-run sockeye.
8. The projected Total Allowable Catch (TAC) of Fraser River sockeye salmon for International sharing purposes (Table 1) based on the median forecasted abundances and agreed deductions was 12,106,000 sockeye, of which 16.5% (1,997,000 sockeye) were allocated to the United States (U.S.). The United States share was reduced by 6,600 sockeye to account for a small payback resulting from the 2013 season (Table 17).
9. Domestic objectives within the U.S. included an allocation to Treaty Indian fishers of 67.7% of the U.S. share of the TAC, with the remaining balance allocated to All Citizen fishers. In Canada, pre-season catch expectations for sockeye included 1,010,000 fish for First Nations FSC, 280,000 fish for recreational and 9,226,000 fish for commercial (including First Nations economic opportunity ("EO") and demonstration ("Demo")) fishers.
10. Pre-season model runs indicated it was unlikely the Summer-run TAC could be fully harvested due to fisheries constraints required to achieve spawning escapement targets for co-migrating Early Summer and Late-run stocks.
11. The Panel adopted the 2014 Principles and Constraints (Appendix D) and the 2014 Regulations (Appendix E).



## In-season Management Considerations

12. Compared to pre-season expectations used for planning, the observed marine migration timing (Figure 3) was 5 days later for Early Stuart sockeye, 4 days earlier for Early Summer stocks, 7 days later for Summer and Late-run stocks.
13. The overall Johnstone Strait diversion rate (Figure 4) for Fraser sockeye was 96%, compared to the revised pre-season forecast of 57%.
14. The total return of Fraser sockeye was about 12% less than the median pre-season forecast (Table 9).
15. Fraser River temperatures (Figure 5) were warmer than average throughout July and August and flow levels were lower than average. These high temperatures and low flows changed the models' predictions for the difference between estimates (DBE). As a result, the Fraser River Panel adopted the model predicted Management Adjustment (MA) of 212,000 (pMA=1.96) for Early Stuart which was larger than what was predicted pre-season. For Early Summer and Summer run, the Fraser River Panel did not make any in-season updates to difference between estimates (DBEs) given favorable in-season observations of fish condition. In-season estimates of Late-run sockeye delay in the Strait of Georgia were substantially longer than expected, resulting in a smaller DBE than predicted pre-season which led the Panel to reduce the Late-run MA to 416,000 sockeye (pMA=0.11).

## Run Size, Catch and Escapement

16. The final in-season estimate of 19,883,500 adult Fraser sockeye was revised post-season to 20,148,000 fish (Tables 8 and 9), 29% lower than the brood year abundance of 28,253,000 adults in 2010 (Figure 6). Divided into management groups, adult returns totalled 233,000 Early Stuart, 1,862,000 Early Summer-run, 8,280,000 Summer-run and 9,767,000 Late-run sockeye. The Early Summer-run return was less than half of the median pre-season forecast while Summer-run return exceeded the median pre-season forecast by almost 50%.
17. Catches of Fraser River sockeye salmon in all fisheries totalled 11,159,000 fish, including 10,123,000 fish caught by Canada, 887,000 fish caught by the U.S. and 149,000 fish caught by test fisheries (Table 8). Most of the Canadian catch occurred in commercial fisheries (8,829,000 fish, including First Nations Economic Opportunity catch), followed by First Nations FSC (937,000 fish) and recreational fisheries (353,000). In Washington, commercial catches totalled 698,000 Fraser sockeye, mostly caught in Treaty Indian fisheries (470,000 fish). In 2014, 21% (186,000 fish) of the U.S. catch of Fraser sockeye was estimated to be caught in Alaska. The overall exploitation rate was 55% of the run, which is the largest harvest rate observed since 2004 (Figure 7).
18. DFO's near-final estimates of spawning escapement to streams in the Fraser River watershed totalled 5,877,000 adult sockeye (Tables 8 and 9). This was about 55% lower than the brood year escapement of 13,131,000 adults which was the maximum estimated escapement on this cycle since 1938 (Figure 9). Spawning escapements for all management groups (Figure 9) except the Late run were above average for this cycle, while the Late-run escapement was 12% below the cycle average. There were 3,067,000 effective female spawners in the Fraser watershed, representing an overall spawning success of 96%.

## Achievement of Objectives

19. In order of descending priority, the goals of the Panel are to achieve the targets for spawning escapement, international sharing of the TAC and domestic catch allocation.
20. In-season management decisions are based on targets for spawning escapement, which are represented in-season by potential spawning escapement targets (i.e., spawning escapement targets plus MAs). In-season estimates of potential escapement (i.e., Mission escapement minus catch above Mission, Table 12) were within 15% of the targets for Early Stuart (11% under), Early Summer-run (9% over), Summer-run (11% over) and Late-run sockeye (12% over).
21. Post-season spawning ground estimates of Fraser sockeye abundance (Table 13) totalled 5,877,000 adults, which is 17% below the post-season target. Spawner abundance was below the target for Early Stuart (36% under) and Late-run sockeye (33% under), and on target for

- Early Summer and Summer-run stocks. The preliminary estimate of the Early Stuart exploitation rate was 11%, slightly above the Low Abundance Exploitation Rate of 10%.
22. The International TAC (Total Allowable Catch) of Fraser sockeye (Table 14) was 11,235,000 fish, based on the calculation method set out in Annex IV, Chapter 4 of the Pacific Salmon Treaty. The Washington catch of 702,000 Fraser sockeye (excluding the Alaska catch of 186,000 Fraser sockeye) was 1,145,500 fish less than their 16.5% share. This was mainly due to the extremely high northern diversion rate (96%) which made most of the Fraser sockeye run inaccessible to U.S. fisheries. The total Canadian catch of 10,123,000 Fraser sockeye (excluding the ESSR catch of 600 sockeye) exceeded the Canadian in-season catch goal (83.5% of TAC + 400,000 fish AFE) by 342,000 fish due to the inability of the US to catch their share. In these calculations, the TAC is fixed on the date that Panel control of the last U.S. Panel Area was relinquished (October 4 in 2014), while catches are post-season estimates.
  23. In terms of domestic allocation objectives for Fraser sockeye, Treaty Indian fishers and All Citizen fishers were respectively 781,000 and 371,000 fish under their shares of the U.S. TAC (Table 15).
  24. By-catch of non-Fraser sockeye and pink salmon in commercial net fisheries regulated by the Fraser River Panel totalled 670 sockeye and 720 pink salmon (Table 16). Catches of other Fraser and non-Fraser salmon species include 14,400 chinook, 3,100 coho, 2,800 chum and 10 steelhead.

### **Allocation Status**

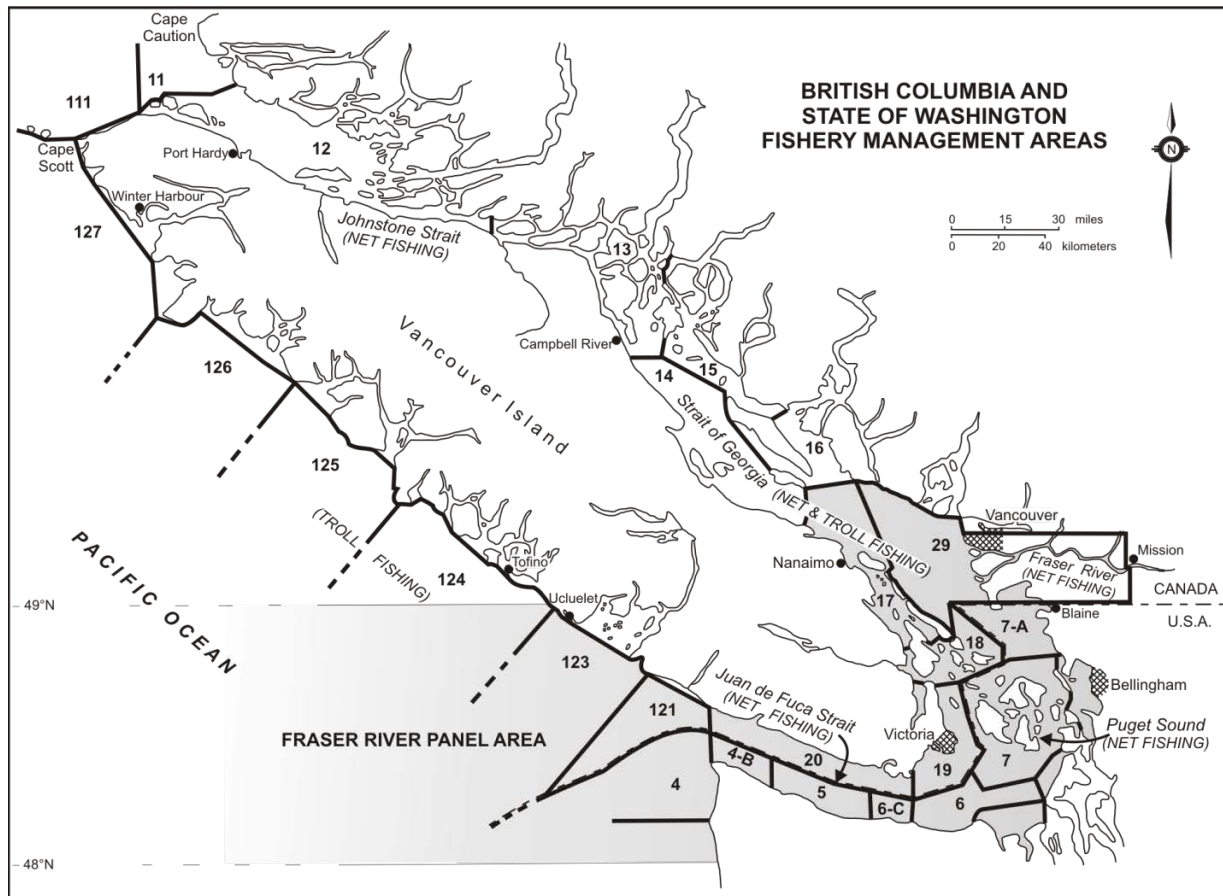
25. There is no payback of Fraser River sockeye to carry forward to 2015 (Table 17) because the U.S. caught less than their share in 2014.

## **II. FRASER RIVER PANEL**

In 2014, the Panel operated under the terms of the May 16, 2014 revision of Annex IV, Chapter 4 of the Pacific Salmon Treaty between Canada and the United States (U.S.) (Appendix B). The Fraser River Panel is responsible for in-season management of fisheries that target Fraser River sockeye and pink salmon within the Panel Area (Figure 1), including net fisheries in both countries and the Canadian troll fishery in the Strait of Georgia. Fisheries directed at Fraser River sockeye and pink salmon that occur outside of the Panel Area are coordinated with those in the Panel area, but are the responsibility of the appropriate agencies (largely Canada's Department of Fisheries and Oceans (DFO)). Coordination of directed harvest of other salmon species and stocks intercepted in south coast areas is the responsibility of the Southern Panel and the Pacific Salmon Commission (PSC). Regulation of Southern Panel related fisheries is the responsibility of the appropriate agencies in each country.

Prior to the fishing season, the Fraser River Panel recommends a fishery regime for Panel Area fisheries to the Pacific Salmon Commission (PSC). The recommendation is based on: (1) abundance, timing and migration route forecasts and escapement targets for Fraser River sockeye salmon provided by Canada's Department of Fisheries and Oceans (DFO); (2) international catch allocation goals set by the Treaty; (3) domestic catch allocation goals established by each country; (4) management concerns for other stocks and species also identified by each country; and (5) historical patterns in migration and fisheries dynamics. In descending priority, the objectives that guide the Panel's decision-making are to: (1) achieve the spawning escapement targets, (2) meet international catch allocation goals, and (3) meet domestic catch allocation objectives. Conservation concerns for other species and stocks that may occur as by-catch in fisheries directed at Fraser sockeye salmon are generally addressed domestically with some international coordination.

Implicit to the proposed regime is the principle that all Panel-regulated fisheries are to remain closed (Appendix E) unless opened by specific order (Appendix F). The pre-season plan identifies the approximate pattern of fishery openings required to achieve Panel objectives given pre-season expectations. However, the Panel determines the actual pattern of fishery openings based on in-season assessments by PSC staff (Staff, Appendix J) of sockeye and pink salmon run size, migration timing and route, in-river migration abundance (i.e., Mission escapement) and management adjustments. Thus, the Panel responds to deviations from pre-season expectations in their weekly fishing plans and most substantive fishery decisions are based on in-season rather than pre-season assessments. The Fraser River Panel Technical Committee (Appendix I) works in conjunction with Staff to facilitate Panel activities by providing their respective National sections with technical advice and ensuring timely exchange of data between Staff and the Parties.



**Figure 1.** Fishery management areas in the Fraser River Panel Area and south coast waters.

### III. PANEL MANAGEMENT ACTIVITIES

Information used for Panel management can be divided into three general categories: (1) pre-season forecasts and expectations, on which planning activities such as the pre-season management plan are based; (2) in-season estimates that develop over the course of the season, on which in-season fishery decisions are based; and (3) post-season estimates derived from information that was unavailable during the season, such as spawning ground estimates of escapement, more complete catch estimates, and adjustments to estimates that with hindsight appear to have been biased or incorrect. Post-season estimates impact Panel management in two ways: (a) they can affect the data used to inform pre-season assumptions (e.g. abundance, timing and management adjustments) in future years and (b) some elements (e.g. catches) impact post-season evaluation of the achievement of management objective (see Section VI below for more details). Key information in the first two categories is discussed in the following sections.

## A. Pre-season Planning

Pre-season fisheries management plans for Panel Area fisheries were developed by the Panel using the Fishery Simulation Model<sup>1</sup>, which helps to evaluate the impacts of alternative fishery options on the achievement of management objectives. Model inputs include forecasts of run size, migration timing, diversion rate and Management Adjustments (MAs), plus objectives for spawning escapement and catch allocation. Inputs to the “base case” planning model are summarized in the “Pre-season” rows in Table 1.

In 2014, the Panel used the median (i.e., 50% probability level) forecast of 22,854,000 Fraser River sockeye from a long-term productivity model as a “base case” scenario for planning purposes. Fishing plans that included directed harvest of Early Summer, Summer and Late-run sockeye were evaluated. Fishing opportunities were constrained by the need to achieve spawning escapement objectives for Early Summer sockeye as well as a Low Abundance Exploitation Rate (LAER) limit of 10% for Early Stuart (Appendix C, Table C2). Alternative model runs explored the sensitivity of fishing plans to alternative assumptions for run size, MAs, diversion rates, allowable exploitation rates for Cultus sockeye, and the options being considered by Canada for the spawning escapement plan.

Preliminary run-size forecasts for Fraser River sockeye salmon were produced by Canada using a variety of stock-recruit models assuming long-term average productivity<sup>2</sup>. Canada presented the Panel with preliminary sockeye run-size forecasts corresponding to five probability levels (10%, 25%, 50%, 75% and 90%) that the return will be below, or at, the specified abundance (Appendix C, Table C1). Forecasts for some stocks (e.g. Late Shuswap) were particularly uncertain because they were based on spawning escapements that exceeded the maximums of the previously observed ranges, in part as a consequence of the very large return in the brood year (2010; the largest return in almost 100 years). The Panel used the median (i.e., 50% probability level) forecast of 22,854,000 Fraser River sockeye as the “base case” scenario for planning purposes. Fishing opportunities on Summer-run stocks were constrained by a very small Early Stuart TAC and 10% LAER (i.e., small, but acceptable amounts of by-catch), and by spawning objectives for the Early Summer run.

Canada used the “Fraser River Sockeye Spawning Initiative” (FRSSI) model and the Integrated Fisheries Management Process (IFMP) to establish escapement goals for the 2014 management season. The spawning escapement plan released by Canada to the Panel (Appendix C, Table C2) was based on FRSSI guidelines with input from a domestic consultation process (IFMP). Pre-season escapement targets for sockeye (Table 1) at the 50% probability run-size levels by management group were: Early Stuart – 299,000; Early Summer run – 4,126,000; Summer run – 5,699,000; and Late run – 12,730,000<sup>3</sup>.

Pre-season fisheries management planning was based on assumptions about marine timing (i.e., Juan de Fuca or Area 20 50% migration dates) and Mission timing. Area 20 dates are indices of marine migration timing and represent the date when 50% of the total run would have entered Juan de Fuca Strait (Canadian Area 20) if the entire run had migrated via that route. Beginning with forecasts of Early Stuart and Chilko timing provided by Canada (obtained from an ensemble of predictions generated from linear regressions fit to historic timing and a suite of oceanographic variables), timing forecasts for other Fraser stock groups were calculated from relationships between historical Early Stuart and Chilko timing and historical timing for the other stock groups. The Panel adopted Area 20 migration dates (Figure 3) of July 4 for Early Stuart, August 4 for Early Summer, August 10 for Summer and August 18 for Late-run sockeye (Table 1). These dates are close to historical cycle-line median dates. To model the effect of Late-run delay on upstream migration timing, the model assumed a delay portion of the Late run (89% of the forecasted run

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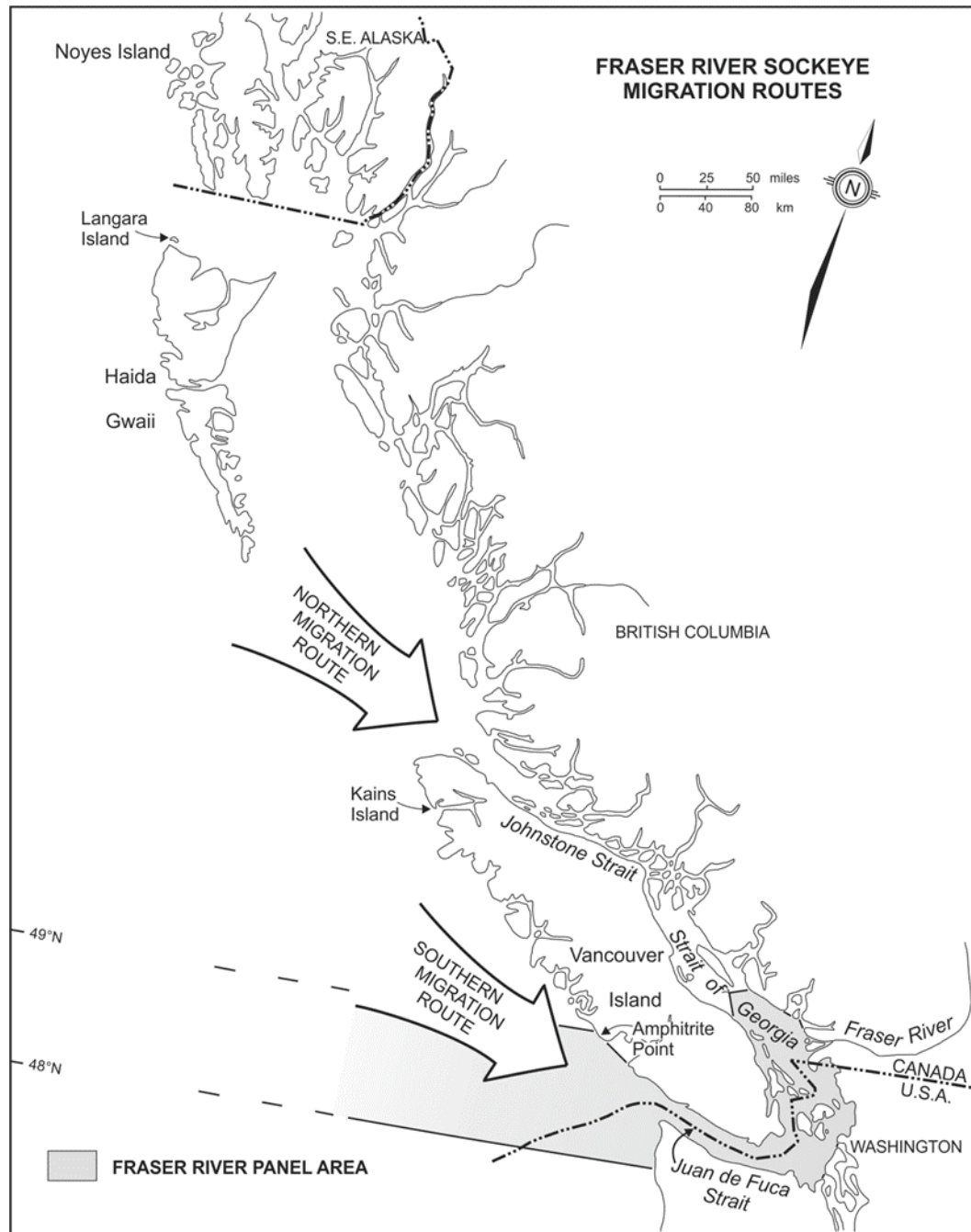
<sup>1</sup> Cave, J.D. and W.J. Gazey. 1994. A pre-season simulation model for fisheries on Fraser River sockeye salmon (*Oncorhynchus nerka*). Can. J. Fish. Aquat. Sci. 51(7): 1535-1549.

<sup>2</sup> DFO. 2014. Pre-season run size forecasts for Fraser River Sockeye (*Oncorhynchus nerka*) salmon in 2014. DFO Can. Sci. Advis. Sec. Sci. Resp. 2014/040. 46 pp.

<sup>3</sup> 2014/2015 Southern British Columbia Salmon Integrated Fishery Management Plan. Fisheries and Oceans Canada.

sizes, with a September 13 Mission date) and a non-delay portion of the Late run (remaining 11%).

Modelling the migration of Fraser sockeye also involved assumptions about the proportion of Fraser sockeye that would migrate through Juan de Fuca Strait versus Johnstone Strait (i.e. Johnstone Strait diversion rate, Figure 2). Canada provided the Panel with a Johnstone Strait diversion rate forecast of 66% (Figure 4) for the aggregate Fraser sockeye return that was based on a relationship between sea surface temperatures at Kains Island and historical diversion rates.



**Figure 2.** The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migration to the Fraser River.



Because Harrison sockeye migrate predominantly through the southern approach (PSC, unpublished data) and have a “delay” component, the planning model included a separate diversion rate and delay proportion for the Harrison component. A Johnstone Strait diversion of 36% was used in the model based on a historic regression between total Fraser sockeye and Harrison sockeye diversion (2005-2013; M. Hague, PSC pers. comm.). In addition, Harrison was modelled with a 31% “delay” component, and an assumed September 9 upstream timing for delaying fish (using the median of 2006 and 2010).

DFO’s Environmental Watch Program provided the Panel with long-range projections of Fraser River temperature and discharge conditions. Forecasts projected average discharge and above average water temperatures in the Fraser River during the sockeye migration. Staff used the environmental forecasts in a Management Adjustment (MA) model developed jointly between DFO and the PSC to predict how many additional fish from the Early Stuart management group should be allowed to escape to increase the probability of achieving spawning escapement objectives. The Early Summer MA was based on the weighted average (by p50 forecast abundances) of the median historical pMA for the Early Summer group, excluding Pitt and Chilliwack, and an assumed pMA of zero for Pitt, and a pMA of 0.70 for Chilliwack (derived from subset of the historical data). For the Summer run, the pMA was the weighted (by p50 forecasts) mean of the historical median Harrison pMA and historical median non-Harrison Summer-run pMA. The Late-run pMA was similarly calculated as the weighted (by p50 forecasts) mean of the historical median Birkenhead pMA and historical (1998, 2002, 2010) mean non-Birkenhead Late-run pMA. The MA values adopted for pre-season planning (Table 1) were: Early Stuart - 103,000 fish (pMA=0.86); Early Summer – 607,000 fish (pMA=0.42); Summer – 219,000 fish (pMA=0.11); and Late – 1,248,000 fish (pMA=0.28). For more details about how the MAs were obtained see the “Management Adjustment and DBE” section in Appendix G.

Given the “base-case” conditions using the biological parameters described above, Canada and the U.S. developed plans with fishing beginning the weeks of June 22 (Canada; First Nations in-river only) and July 27 (commercial fisheries in the U.S. and Canada). This plan included the “Management Plan Principles and Constraints” and “2014 Regulations” (Appendices D and E). If in-season assessments indicated that return abundances of sockeye salmon were lower or higher than forecast, that return timing of sockeye stocks was significantly different than forecast, or that in-season forecasts of MAs deviated from the pre-season forecasts, then the commencement and duration of fisheries could deviate from the proposed plan.

TACs and international harvest shares for Fraser sockeye were calculated according to the 2014 revised Annex IV, Chapter 4 of the Pacific Salmon Treaty (Appendix B). The U.S. (Washington) share was 16.5% of the sockeye salmon TAC. With a pre-season TAC projection of 12,106,000 sockeye for international sharing (Table 1), the corresponding U.S. share was 1,997,000 fish minus the payback of 6,600 sockeye. In terms of domestic U.S. goals, Treaty Indian fishers were allocated 67.7% and All-Citizen fishers the remaining 32.3% of the U.S. TAC. The Canadian share including the 400,000 Aboriginal Fishery Exemption (AFE) included pre-season catch projections of 9,226,000 fish for commercial, 1,010,000 fish for First Nations FSC and 280,000 fish for recreational fisheries.

During the pre-season planning process, both countries identified salmon stocks for which they had conservation concerns that would influence management decisions for fisheries directed at Fraser sockeye. Canada identified southern B.C. Chinook salmon (Fraser 4<sub>2</sub> and 5<sub>2</sub> fish, lower Strait of Georgia Chinook salmon, west coast Vancouver Island Chinook salmon, lower Fraser fall Chinook, interior Fraser coho salmon, Cultus and Sakinaw sockeye salmon, summer Fraser steelhead, rockfish, Fraser sturgeon and killer whales. The U.S. highlighted concerns for Puget Sound Chinook and steelhead, Hood Canal summer-run chum, Puget Sound rockfish and southern resident killer whales.

## **B. In-season Management**

The Panel convened 26 times in-season between July 3 and October 1 to discuss run status and enact in-season orders (Appendix F) to regulate fisheries directed at Fraser River sockeye

salmon in Panel Areas. Table 1 summarizes pre-season and in-season data by meeting date, including estimates of run size and the various components that result in the calculated TAC by management group (i.e., spawning escapement target, MA, projected test fishery catch and Aboriginal Fishery Exemption). Also shown are estimates of available harvest (run size minus spawning escapement target and MA), catch to date, Mission escapement to date and 50% migration dates. The main events transpiring during each week are summarized below, with a focus on Staff assessments and Panel decisions. The Fraser River discharge and temperature data referred to below are shown in Figure 5. DFO's Environmental Watch Program provides 10-day forecasts of river temperature and flow each Monday and Thursday in-season.

**Table 1.** Pre-season and in-season updates of run size, spawning escapement targets and other TAC-related values for Fraser River sockeye salmon in 2014. The available harvest (run size minus spawning escapement target and management adjustment), catch to date, Mission escapement to date and migration timing are also shown.

			TAC										50%
			Spawning Escapement		Manage- ment	Test	Aboriginal Fishery	Total Allowable	Available Harvest	Catch	Mission Passage	Migration	
Date	Management Group	Total Abundance	Target	pMA	Adjust.	Fishing	Exemption	Catch	**	to date	to date	Date	
June 19	Pre-season	Early Stuart	299,000	119,600	0.86	102,900	7,100	80,000	0	76,500		4-Jul	
		Early Summer	4,126,000	1,444,100	0.42	606,500	62,400	47,400	1,965,600	2,075,400		4-Aug	
		Summer	5,699,000	1,994,700	0.11	219,400	52,800	133,500	3,298,600	3,484,900		10-Aug	
		Late	12,730,000	4,455,500	0.28	1,247,500	46,100	139,100	6,841,800	7,027,000		18-Aug	
		Sockeye	22,854,000	8,013,900		2,176,300	168,400	400,000	12,106,000	12,663,800			
July 3	In-season	Early Stuart	299,000	119,600	0.86	102,900	6,700	69,700	100	76,500	200	5,500	4-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	70,000	48,900	1,956,500	2,075,400	0	100	4-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	53,900	137,800	3,293,200	3,484,900	0	200	10-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	37,700	143,600	6,845,700	7,027,000	0	0	18-Aug
		Sockeye	22,854,000	8,013,900		2,176,300	168,300	400,000	12,095,500	12,663,800	200	5,800	
July 8	In-season	Early Stuart	299,000	119,600	0.86	102,900	6,700	69,700	100	76,500	800	29,800	4-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	70,000	48,900	1,956,500	2,075,400	100	1,100	4-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	53,900	137,800	3,293,200	3,484,900	100	1,800	10-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	37,700	143,600	6,845,700	7,027,000	0	0	18-Aug
		Sockeye	22,854,000	8,013,900		2,176,300	168,300	400,000	12,095,500	12,663,800	1,000	32,700	
July 11	In-season	Early Stuart	189,000	108,000	0.86	92,900	6,700	13,900	0	0	1,500	49,900	7-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	57,100	1,953,400	2,075,400	100	3,800	4-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	54,500	161,100	3,269,300	3,484,900	300	1,800	10-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	42,300	167,900	6,816,800	7,027,000	0	0	18-Aug
		Sockeye	22,744,000	8,002,300		2,166,300	168,400	400,000	12,039,500	12,587,300	1,900	55,500	
July 15	In-season	Early Stuart	189,000	108,000	2.12	229,000	6,700	12,200	0	0	2,300	111,500	7-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	57,400	1,953,100	2,075,400	400	14,300	4-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	54,500	161,800	3,268,600	3,484,900	500	9,700	10-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	42,300	168,600	6,816,100	7,027,000	0	0	18-Aug
		Sockeye	22,744,000	8,002,300		2,302,400	168,400	400,000	12,037,800	12,587,300	3,200	135,500	
July 18	In-season	Early Stuart	240,000	108,000	2.12	229,000	6,700	17,300	0	0	3,800	159,800	9-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	56,600	1,953,900	2,075,400	700	32,000	4-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	54,500	159,700	3,270,700	3,484,900	700	18,600	10-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	42,300	166,400	6,818,300	7,027,000	0	0	18-Aug
		Sockeye	22,795,000	8,002,300		2,302,400	168,400	400,000	12,042,900	12,587,300	5,200	210,400	
July 22	In-season	Early Stuart	240,000	108,000	2.12	229,000	3,500	20,500	0	0	4,300	197,000	9-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	56,200	1,954,300	2,075,400	1,500	57,800	7-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	57,700	158,300	3,268,900	3,484,900	1,600	55,200	15-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	42,300	165,000	6,819,700	7,027,000	100	2,300	22-Aug
		Sockeye	22,795,000	8,002,300		2,302,400	168,400	400,000	12,042,900	12,587,300	7,500	312,300	
July 25	In-season	Early Stuart	240,000	108,000	1.96	211,700	3,500	20,500	0	0	5,400	205,300	9-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	56,200	1,954,300	2,075,400	2,400	97,300	7-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	57,700	158,300	3,268,900	3,484,900	2,400	93,700	15-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	42,300	165,000	6,819,700	7,027,000	100	2,100	22-Aug
		Sockeye	22,795,000	8,002,300		2,285,100	168,400	400,000	12,042,900	12,587,300	10,300	398,400	
July 29	In-season	Early Stuart	240,000	108,000	1.96	211,700	3,500	20,500	0	0	6,000	211,400	9-Jul
		Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	56,200	1,954,300	2,075,400	5,800	131,600	7-Aug
		Summer	5,699,000	1,994,700	0.11	219,400	57,700	158,300	3,268,900	3,484,900	6,100	134,100	15-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	42,300	165,000	6,819,700	7,027,000	500	5,000	22-Aug
		Sockeye	22,795,000	8,002,300		2,285,100	168,400	400,000	12,042,900	12,587,300	18,400	482,100	

Table 1, continued on next page

Table 1, continued

			TAC										50%
			Spawning		Manage-		Aboriginal		Total	Available		Mission	Migration
Date	Management	Total	Escapement	pMA	Adjust.	Test	Fishery	Allowable	Harvest	Catch	Passage	Date	
	Group	Abundance	Target			Fishing	Exemption	Catch	**	to date	to date	Area 20	
August 1	Early Stuart	240,000	108,000	1.96	211,700	3,500	20,500	0	0	8,600	218,000	9-Jul	
	Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	56,200	1,954,300	2,075,400	31,700	176,200	7-Aug	
	Summer	5,699,000	1,994,700	0.11	219,400	57,700	158,300	3,268,900	3,484,900	51,100	214,800	15-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	42,300	165,000	6,819,700	7,027,000	12,300	5,500	22-Aug	
	Sockeye	22,795,000	8,002,300	2,285,100	168,400	400,000	12,042,900	12,587,300	103,700	614,500			
August 5	Early Stuart	240,000	108,000	1.96	211,700	3,500	20,500	0	0	8,600	231,100	9-Jul	
	Early Summer	4,126,000	1,444,100	0.42	606,500	64,900	56,200	1,954,300	2,075,400	36,700	290,600	7-Aug	
	Summer	5,699,000	1,994,700	0.11	219,400	57,700	158,300	3,268,900	3,484,900	83,400	313,200	15-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	42,300	165,000	6,819,700	7,027,000	19,800	13,900	22-Aug	
	Sockeye	22,795,000	8,002,300	2,285,100	168,400	400,000	12,042,900	12,587,300	148,500	848,800			
August 8	Early Stuart	240,000	108,000	1.96	211,700	3,000	20,500	0	0	18,400	227,900	9-Jul	
	Early Summer	4,126,000	1,444,100	0.42	606,500	30,000	56,200	1,989,200	2,075,400	175,700	428,400	7-Aug	
	Summer	5,699,000	1,994,700	0.11	219,400	95,000	158,300	3,231,600	3,484,900	363,400	514,600	15-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	90,700	44,200	22-Aug	
	Sockeye	22,795,000	8,002,300	2,285,100	168,400	400,000	12,042,400	12,587,300	648,200	1,215,100			
August 12	Early Stuart	240,000	108,000	1.96	211,700	3,000	20,500	0	0	18,400	227,900	9-Jul	
	Early Summer	1,800,000	630,000	0.42	264,600	30,000	56,200	819,200	905,400	292,200	532,200	8-Aug	
	Summer	5,699,000	1,994,700	0.11	219,400	95,000	158,300	3,231,600	3,484,900	705,900	668,400	15-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	253,200	62,600	22-Aug	
	Sockeye	20,469,000	7,188,200	1,943,200	168,400	400,000	10,872,400	11,417,300	1,269,700	1,491,100			
August 15	Early Stuart	233,500	108,000	1.96	211,700	3,000	20,500	0	0	23,900	227,900	9-Jul	
	Early Summer	1,800,000	630,000	0.42	264,600	30,000	56,200	819,200	905,400	379,800	685,100	8-Aug	
	Summer	5,699,000	1,994,700	0.11	219,400	95,000	158,300	3,231,600	3,484,900	1,091,100	1,061,300	15-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	459,500	103,200	22-Aug	
	Sockeye	20,462,500	7,188,200	1,943,200	168,400	400,000	10,872,400	11,417,300	1,954,300	2,077,500			
August 19	Early Stuart	233,500	108,000	1.96	211,700	3,000	20,500	0	0	24,000	227,900	9-Jul	
	Early Summer	2,200,000	770,000	0.42	323,400	30,000	56,200	1,020,400	1,106,600	568,400	949,500	10-Aug	
	Summer	6,300,000	2,205,000	0.11	242,600	95,000	158,300	3,599,100	3,852,400	1,676,400	1,517,500	15-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	815,700	261,400	22-Aug	
	Sockeye	21,463,500	7,538,500	2,025,200	168,400	400,000	11,441,100	11,986,000	3,084,500	2,956,300			
August 22	Early Stuart	233,500	108,000	1.96	211,700	3,000	20,500	0	0	24,700	227,900	9-Jul	
	Early Summer	2,200,000	770,000	0.42	323,400	30,000	56,200	1,020,400	1,106,600	611,700	1,015,100	10-Aug	
	Summer	7,000,000	2,450,000	0.11	269,500	95,000	158,300	4,027,200	4,280,500	2,008,200	1,835,000	16-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	1,024,000	351,000	22-Aug	
	Sockeye	22,163,500	7,783,500	2,052,100	168,400	400,000	11,869,200	12,414,100	3,668,600	3,429,000			
August 26	Early Stuart	233,500	108,000	1.96	211,700	3,000	20,500	0	0	24,700	227,900	9-Jul	
	Early Summer	2,000,000	700,000	0.42	294,000	30,000	56,200	919,800	1,006,000	697,200	1,102,500	8-Aug	
	Summer	6,000,000	2,100,000	0.11	231,000	95,000	158,300	3,415,700	3,669,000	2,526,700	2,171,300	14-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	1,601,700	448,300	22-Aug	
	Sockeye	20,963,500	7,363,500	1,984,200	168,400	400,000	11,157,100	11,702,000	4,850,300	3,950,000			
August 29	Early Stuart	233,500	108,000	1.96	211,700	3,000	20,500	0	0	25,500	227,900	9-Jul	
	Early Summer	1,900,000	665,000	0.42	279,300	30,000	56,200	869,500	955,700	719,100	1,129,600	8-Aug	
	Summer	7,000,000	2,450,000	0.11	269,500	95,000	158,300	4,027,200	4,280,500	2,992,400	2,428,400	16-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	1,758,800	462,500	22-Aug	
	Sockeye	21,863,500	7,678,500	2,008,000	168,400	400,000	11,718,300	12,263,200	5,495,800	4,248,400			
September 2	Early Stuart	233,500	108,000	1.96	211,700	3,000	20,500	0	0	25,500	227,900	9-Jul	
	Early Summer	1,900,000	665,000	0.42	279,300	30,000	56,200	869,500	955,700	754,800	1,176,500	8-Aug	
	Summer	8,200,000	2,870,000	0.12	344,400	95,000	158,300	4,732,300	4,985,600	3,252,600	2,995,400	18-Aug	
	Late	12,730,000	4,455,500	0.28	1,247,500	40,400	165,000	6,821,600	7,027,000	2,106,600	873,900	22-Aug	
	Sockeye	23,063,500	8,098,500	2,082,900	168,400	400,000	12,423,400	12,968,300	6,139,500	5,273,700			

Table 1, continued on next page



Table 1, continued.

			TAC									50%	
			Spawning		Manage-	Aboriginal		Total	Available		Mission	Migration	
Date	Management	Total	Escapement	pMA	ment	Test	Fishery	Allowable	Harvest	Catch	Passage	Date	
	Group	Abundance	Target		Adjust.	Fishing	Exemption	Catch	**	to date	to date	Area 20	
September 5	In-season	Early Stuart	233,500	108,000	1.96	211,700	3,000	22,800	0	0	25,500	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	30,000	55,800	869,900	955,700	785,400	1,199,200	8-Aug
		Summer	8,200,000	2,870,000	0.12	344,400	95,000	157,400	4,733,200	4,985,600	3,723,000	3,203,600	18-Aug
		Late	12,730,000	4,455,500	0.28	1,247,500	40,400	164,000	6,822,600	7,027,000	2,761,600	1,114,300	22-Aug
		Sockeye	23,063,500	8,098,500	2,082,900	168,400	400,000	12,425,700	12,968,300	7,295,500	5,745,000		
September 9	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,500	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	788,000	1,200,300	8-Aug
		Summer	7,800,000	2,730,000	0.12	327,600	85,000	157,400	4,500,000	4,742,400	4,058,400	3,518,800	18-Aug
		Late	10,800,000	3,780,000	0.28	1,058,400	40,000	164,000	5,757,600	5,961,600	3,314,300	1,375,100	26-Aug
		Sockeye	20,733,500	7,283,000	1,877,000	155,800	400,000	11,129,500	11,659,700	8,186,200	6,322,100		
Sep. 12	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	792,300	1,205,200	8-Aug
		Summer	7,800,000	2,730,000	0.12	327,600	85,000	157,400	4,500,000	4,742,400	4,167,200	3,648,200	18-Aug
		Late	10,800,000	3,780,000	0.28	1,058,400	40,000	164,000	5,757,600	5,961,600	3,499,300	1,369,400	26-Aug
		Sockeye	20,733,500	7,283,000	1,877,000	155,800	400,000	11,129,500	11,659,700	8,484,400	6,450,700		
Sep. 15	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	791,700	1,204,500	8-Aug
		Summer	7,800,000	2,730,000	0.12	327,600	85,000	157,400	4,500,000	4,742,400	4,249,900	3,676,900	18-Aug
		Late	10,800,000	3,780,000	0.28	1,058,400	40,000	164,000	5,757,600	5,961,600	3,736,300	1,404,400	26-Aug
		Sockeye	20,733,500	7,283,000	1,877,000	155,800	400,000	11,129,500	11,659,700	8,803,500	6,513,700		
Sep. 17	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	792,300	1,205,300	8-Aug
		Summer	7,800,000	2,730,000	0.12	327,600	85,000	157,400	4,500,000	4,742,400	4,326,000	3,701,700	18-Aug
		Late	10,800,000	3,780,000	0.17	642,600	40,000	164,000	6,173,400	6,377,400	4,394,300	1,603,100	26-Aug
		Sockeye	20,733,500	7,283,000	1,461,200	155,800	400,000	11,545,300	12,075,500	9,538,200	6,738,000		
Sep. 18	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	792,300	1,205,300	8-Aug
		Summer	7,800,000	2,730,000	0.12	327,600	85,000	157,400	4,500,000	4,742,400	4,326,000	3,701,700	18-Aug
		Late	10,800,000	3,780,000	0.11	415,800	40,000	164,000	6,400,200	6,604,200	4,394,300	1,603,100	26-Aug
		Sockeye	20,733,500	7,283,000	1,234,400	155,800	400,000	11,772,100	12,302,300	9,538,200	6,738,000		
Sep. 22	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	808,700	1,204,500	8-Aug
		Summer	7,900,000	2,765,000	0.12	331,800	85,000	157,400	4,560,800	4,803,200	4,435,300	3,867,300	18-Aug
		Late	10,800,000	3,780,000	0.11	415,800	40,000	164,000	6,400,200	6,604,200	4,971,700	3,120,500	26-Aug
		Sockeye	20,833,500	7,318,000	1,238,600	155,800	400,000	11,832,900	12,363,100	10,241,300	8,420,200		
Sep. 25	In-season	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,800	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	808,700	1,204,500	8-Aug
		Summer	8,100,000	2,835,000	0.12	340,200	85,000	157,400	4,682,400	4,924,800	4,467,100	4,029,800	18-Aug
		Late	10,800,000	3,780,000	0.11	415,800	40,000	164,000	6,400,200	6,604,200	5,239,300	4,030,200	26-Aug
		Sockeye	21,033,500	7,388,000	1,247,000	155,800	400,000	11,954,500	12,484,700	10,540,700	9,492,400		
October 1	End-of-season*	Early Stuart	233,500	108,000	1.96	211,700	2,800	22,600	0	0	25,600	227,900	9-Jul
		Early Summer	1,900,000	665,000	0.42	279,300	28,000	55,800	871,900	955,700	810,500	1,204,500	8-Aug
		Summer	8,150,000	2,852,500	0.14	399,400	85,000	157,500	4,655,600	4,898,100	4,500,500	4,199,600	18-Aug
		Late	9,600,000	3,360,000	0.10	336,000	40,000	164,100	5,699,900	5,904,000	5,393,700	4,510,700	26-Aug
		Sockeye	19,883,500	6,985,500	1,226,400	155,800	400,000	11,227,400	11,757,800	10,730,300	10,142,700		

\* The TAC is determined by the run sizes and TAC deductions (spawning escapement targets, management adjustments, projected test fishing catches and AF Exemptions) that were in effect when Panel control of the last U.S. fishery area was relinquished.

\*\* Available Harvest = Total abundance minus spawning escapement target and Management Adjustment.

**June 29 – July 5:** The first in-season Panel meeting took place on Thursday, July 3. Test fishing programs in Juan de Fuca Strait (Area 20) had started on June 21, and in the Fraser River at Whonnock on June 23. The Mission acoustics program generated its first official estimate on June 29. Based on initial test fishing catches in Area 20 and at Whonnock, as well as hydroacoustics estimates, the Early Stuart run appeared to be smaller and/or later than forecasted (p50 forecast of 299,000, Area 20 date of July 4). In addition to Early Stuart sockeye, test fishing catches in Area 20 included non-Fraser sockeye, as well as Chilliwack and Harrison sockeye. The few fish caught at Whonnock all appeared to be Early Stuart Fish. The Fraser River peak freshet that occurred in late May had since declined and discharge levels at Hope were in the 6500 m<sup>3</sup>•s<sup>-1</sup> range. Marine observers reported that a large algae bloom in Area 20 that had caused brown murky water was beginning to clear.

**July 6 – 12:** DFO updated the pre-season forecast of sockeye diversion rate to 57%, and Area 20 timing forecasts to July 7 for Early Stuart and August 15 for Chilko sockeye. Early Stuart sockeye continued to track below the pre-season abundance forecast, and the Panel adopted a reduced Early Stuart run size of 189,000 fish (the p25 forecast) with Area 20 timing of July 7. The discharge at Mission was 8% below average at  $5,500 \text{ m}^3\cdot\text{s}^{-1}$  on July 10, while the river temperature was  $1.7^\circ\text{C}$  above average at  $17^\circ\text{C}$ . With temperatures in the river forecasted to rise to a record  $19^\circ\text{C}$  by July 16, Early Stuart sockeye were expected to experience challenging conditions during their migration to the spawning grounds, potentially leading to increased en-route mortality. The MA for Early Stuart was therefore expected to increase, but because too few days of forecasted and observed river temperature and discharge data were available to run the MA prediction model, the Panel did not update the MA.

**July 13 – 19:** Approximately 32,000 Early Summer-run sockeye had passed by Mission to date and the majority of Summer-run fish detected in test fisheries and migrating past Mission were Harrison sockeye. Fraser discharge at Hope was 20% below average, declining to about  $4,500 \text{ m}^3\cdot\text{s}^{-1}$ , while the temperature reached  $18.8^\circ\text{C}$ , which is  $2.8^\circ\text{C}$  higher than the average for the date. The Panel adopted an increased Early Stuart run size of 240,000 fish, with Area 20 timing of July 9, and increased the pMA from the pre-season value of 0.86 to 2.12 due to the high river temperatures. The Panel delayed the start of the Areas 12 and 20 purse seine test fisheries from July 21 to no earlier than July 23, due to the later than expected migration timing of Fraser sockeye.

**July 20 – 26:** Low test fishery catches of Early Summer sockeye suggested that this management group was late and/or smaller than expected. Summer-run sockeye were present and continued to be dominated by Harrison fish. The 5-day average diversion rate increased from 29% to 38% by the week's end. Fraser River discharge at Hope had increased to  $4,900 \text{ m}^3\cdot\text{s}^{-1}$  and the temperature had declined to  $17.1^\circ\text{C}$ , both values were near the historical averages for the date. Updated projections of Early Stuart test fishery catch resulted in a reduced deduction for the TAC calculation - from 6,700 to 3,500, with the difference of 3,200 fish moved to the Summer-run deduction. Based on these updated deductions, Canada provided revised AFEs. The Panel adopted updated Area 20 timings for Early Summer (August 7), Summer (August 15), and Late-run sockeye (August 22) based on the July 9 Area 20 date for Early Stuart and the forecasted August 15 Area 20 date for Chilko. The timing of the other stocks was based on using the historical relationship between Early Stuart timing, Chilko timing, and the timing of the other management groups. Slightly cooler river temperatures led the FRP to approve a decreased Early Stuart pMA of 1.96. Purse seine test fisheries in Areas 12 and 20 began on July 25, and the Area 13 purse seine test fishery began on July 27.

**July 27 – August 2:** The 5-day average diversion rate for Fraser sockeye rose from 54% to 72% by the end of the week. Summer-run stocks other than Harrison began to dominate Summer-run abundances in marine areas. Summer-run stocks were more abundant in marine areas and the river than expected, suggesting that the run might be larger and/or earlier than forecasted. The Fraser River discharge at Hope had decreased to  $4,100 \text{ m}^3\cdot\text{s}^{-1}$ , 11% below average, while the temperature had increased above the historical average to  $18.4^\circ\text{C}$ . Mission passage estimates for Early Stuart, Early Summer and Summer-run groups were, respectively, 218,000, 176,000, and 215,000 fish. The Early Summer passage at Mission was lower than modelled pre-season and suggested that components of this management group may be later and/or lower in abundance than expected. The Panel opened a Treaty Indian gillnet fishery in Areas 4B, 5 and 6C.

**August 3 – 9:** The 5-day average diversion rate for Fraser sockeye dropped from 87% to 83%. The Fraser River discharge at Hope was 17% below average at  $3,400 \text{ m}^3\cdot\text{s}^{-1}$  and the temperature was  $20.0^\circ\text{C}$ , which was  $2.2^\circ\text{C}$  or about 2 standard deviations above normal and it matched the previous record high for the date in the 1971-2000 time period. Mission passage estimates for Early Stuart, Early Summer and Summer-run groups were 228,000, 428,000, and 515,000 fish, respectively. This Early Summer-passage was lower than modelled pre-season and suggested the group may be later and/or lower than forecasted, with a run size closer to the p25 forecast. Daily abundance estimates for the Summer-run were consistent with the pre-season forecast of 5,699,000 fish with August 15 Area 20 timing. The Panel opened Area E gillnet fishery in Area 29 and Area H Individual Transferable Quota (ITQ) troll fishery in Areas 18 and 29 (the

troll fishery was open until further notice) in Canada, and opened Treaty Indian and All Citizen fishers in Areas 6, 7 and 7A, and extended the Treaty Indian fishery in Areas 4b, 5 and 6C in the U.S. On August 4<sup>th</sup> the tailings pond at the Mount Polley copper and gold mine breached its dam releasing 10 million cubic meters of waste water and 4.5 million cubic metres of slurry into the west arm of Quesnel Lake.

**August 10 – 16:** The 5-day average diversion rate for Fraser sockeye remained very high and increased to 98%, which was unprecedented for the time of year. The Fraser River discharge at Hope was 25% below average and had declined to  $2,800 \text{ m}^3 \cdot \text{s}^{-1}$ , while the temperature of  $19.7^\circ\text{C}$  was  $1.9^\circ\text{C}$  above normal and set a new record for the time of year. The Panel adopted reduced run sizes of 233,500 Early Stuart and 1,800,000 Early Summer sockeye (August 8 Area 20 timing). The Panel scheduled an Area E gillnet fishery in Area 29 and an Area G ITQ troll fishery in Areas 123 and 124. In the U.S., a suite of Treaty Indian and All Citizen fisheries were opened or extended.

**August 17 – 23:** The 5-day average diversion rate for Fraser River sockeye remained very high (97%). Fraser River discharge at Hope was  $2,900 \text{ m}^3 \cdot \text{s}^{-1}$ , 10% below average, while temperatures in the  $20.1^\circ\text{C}$  range were tracking  $2.8^\circ\text{C}$  above average and just below the record temperatures for the date. The Early Summer run appeared to be tracking the p25 forecast level, although recent marine test fishery catches indicated the possibility of a larger and/or later-timed run. Summer-run sockeye continued to track the p50 forecast level. The Panel adopted an Early Summer-run abundance of 2,200,000 fish with August 10 Area 20 timing, and a Summer-run abundance of 6,300,000 and then 7,000,000 fish with August 16 Area 20 timing. The Panel scheduled an Area E gillnet fishery in Area 29 and in the U.S., a suite of Treaty Indian and All Citizen fisheries in Areas 4B, 5 and 6C, and in Areas 6, 7 and 7A were opened or extended.

**August 24 – 30:** The 5-day average diversion rate for Fraser sockeye remained very high, ranging from 94% to 99%. Fraser River discharge at Hope was  $2,100 \text{ m}^3 \cdot \text{s}^{-1}$ , 24% below normal, while the temperature of  $18.9^\circ\text{C}$  was  $2.1^\circ\text{C}$  above average and continued to match or fall just below previous record temperatures for the time of year. The Early Summer run continued to track near the p25 forecast level. The Panel therefore reduced the adopted run size slightly to 2,000,000 and then 1,900,000 fish, with August 8 marine timing. The Panel adopted a reduced Summer-run abundance of 6,000,000 fish, then increased it again to 7,000,000 fish based on continued strength in marine test fishing catches. The Panel scheduled an Area E gillnet fishery in Area 29 and in the U.S., a suite of Treaty Indian and All Citizen fisheries in Areas 4B, 5 and 6C, and in Areas 6, 7 and 7A were opened or extended.

**August 31 – September 6:** The last 5-day average diversion rate estimate for the season was very high at almost 100%. The test fishery in Area 20 ended on September 3, thereby ending Staff's ability to provide any further diversion rate estimates. Fraser River water discharge at Hope increased to  $2,400 \text{ m}^3 \cdot \text{s}^{-1}$ , approaching the average for the date, while river temperatures fell to  $17.0^\circ\text{C}$ , also approaching the seasonal norm. The Panel adopted an increased Summer-run abundance of 8,200,000 fish with August 18 Area 20 timing, based on continued strength in marine test fishing catches. The Late run appeared to be tracking below the pre-season forecast. The Panel scheduled an Area E gillnet fishery in Area 29 and in the U.S., a suite of Treaty Indian and All Citizen fisheries in Areas 4B, 5 and 6C, and in Areas 6, 7 and 7A were opened or extended.

**September 7 – 13:** Fraser River conditions approached normal values for the time of year, with a discharge at Hope of  $2,000 \text{ m}^3 \cdot \text{s}^{-1}$  and temperature of  $15.0^\circ\text{C}$ . The Panel adopted a decreased Summer-run abundance of 7,800,000 fish with August 18 Area 20 timing, based on lower than expected passage at Mission, and reduced the Late-run abundance from the pre-season forecast of 12,730,000 to 10,800,000 fish with August 26 timing. The Panel scheduled an Area E gillnet fishery in Area 29 and in the U.S., a suite of Treaty Indian and All Citizen fisheries in Areas 4B, 5 and 6C, and in Areas 6, 7 and 7A were opened or extended.

**September 14 – 20:** A lower Late-run pMA of 0.17 was adopted during a Small Group meeting on September 17, based on later than expected upstream migration. The Panel

subsequently adopted a pMA of 0.11, which corresponded to a Mission 50% date of September 21 for the Late-run group. The Panel scheduled an Area B ITQ fishery in Area 29, and in U.S. waters scheduled Treaty Indian and All Citizen fisheries in Areas 6, 7 and 7A. The Panel extended their regulatory control of U.S. Area 7A to September 27, which was 1 week later than specified in the pre-season regulations (Appendix E).

**September 21 – 27:** The continued abundance of Harrison sockeye passing Mission prompted the Panel to increase Summer-run abundance to 7,900,000 and then 8,100,000 fish, with Area 20 timing unchanged at August 18. The Panel scheduled an Area B ITQ fishery in Area 29, and in U.S. waters scheduled Treaty Indian and All Citizen fisheries in Area 7A. The Panel also scheduled the closure of the Area H ITQ troll fishery that had operated since August 6.

**September 28 – October 4:** At the Panel's end-of-season meeting on October 1, the Panel adopted a Summer-run abundance of 8,150,000 sockeye, and because the Mission passage of Late-run fish had stopped faster than expected, a reduced Late-run abundance of 9,600,000 sockeye. With these updates the adopted abundances of Fraser sockeye totalled 19,883,500 fish (Table 1). The Panel also adopted a slightly higher Summer-run pMA of 0.14, based on the relative abundance of Harrison sockeye compared to the total Summer run, and a slightly lower Late-run pMA of 0.10, based on the relative abundance of Birkenhead compared to the total Late run. The final in-season TAC was 11,227,000 fish, accounted catch to date was 10,730,000 fish and Mission passage was 10,143,000 fish.

Panel control of the last U.S. Panel Area was relinquished on October 4 in accordance with pre-season regulations (Appendix E). The inputs used to calculate the TAC and international shares were frozen on this date, except for post-season updates to the test fishery catch deduction. The achievement of in-season catch objectives will be assessed by comparison with post-season catch estimates in the Achievement of Objectives section of this report (see Section VI below for more details).

Tables 2 and 3 summarize the extent of commercial fishery openings in Canada and the U.S. in 2014.

**Table 2.** Number of days when Canadian commercial fisheries were open for directed harvest of Fraser River sockeye salmon in 2014. Regulatory control of Canadian Panel Areas was relinquished by the Panel on September 13 for Area 20, September 27 for Areas 17 and 18, and October 18 for Area 29, in accordance with pre-season regulations (Appendix F).

Date	Panel Areas					Non-Panel Areas			
	20		29		18, 29	11-16			
	Purse Seine	Gillnet	Purse Seine	Gillnet	Troll	Purse Seine	Gillnet	Troll H	Troll G
Jun.8-Jul.26									
Jul.27-Aug.2							1		
Aug.3-Aug.9					4	4	6	4	
Aug.10-Aug.16				1	7	7	6	7	
Aug.17-Aug.23				1	7	7	6	7	3
Aug.24-Aug.30				3	7	7	6	7	
Aug.31-Sep.6				2	7	7	6	7	
Sep.7-Sep.13				5	7	6	5	6	
Sep.14-Sep.20			5	1	7				
Sep.21-Sep.27			7		7				
Sep.28-Oct.4									
Total	0	0	12	13	53	38	36	38	3

**Table 3.** Number of days when major U.S. net fisheries in the Fraser River Panel Area were open for directed harvest of Fraser River sockeye salmon in 2014. Regulatory control of U.S. Panel Areas was relinquished by the Panel on September 13 for Areas 4B, 5 and 6C, September 20 for Areas 6, 6A and 7 and October 4 for portions of Area 7A in accordance with pre-season regulations (Appendix F). Regulatory control of portions of Area 7A was relinquished on September 27 by in-season order.

Date	Treaty Indian		All Citizen		
	Areas	Areas	Areas 7 and 7A		
	4B, 5, 6C	6, 7, 7A	Purse Seine	Gillnet	Reefnet
Jun.8-Jul.26					
Jul.27-Aug.2	3				
Aug.3-Aug.9	7	3	1	1	
Aug.10-Aug.16	7	7	2	2	3
Aug.17-Aug.23	7	6	3	3	5
Aug.24-Aug.30	7	6	2	2	7
Aug.31-Sep.6	7	5	3	3	7
Sep.7-Sep.13	7	7	1	1	7
Sep.14-Sep.20		7	1	1	7
Sep.21-Sep.27		6	2	2	
Sep.28-Oct.4					
Total	45	47	15	15	36

**Table 4.** Panel-approved stock monitoring operations (test fishery, hydroacoustic and observer) conducted during the 2014 fishing season.

Area	Location	Gear	Dates	Operated by
<b>Canadian Panel Areas</b>				
20	Juan de Fuca Str.	Gillnet	June 21 - August 15	PSC
20	Juan de Fuca Str.	Purse Seine	July 25 - September 2	PSC
29-1 to 6	Str. of Georgia	Troll	August 17 - September 9	PSC
29-14	Fraser R. (Cottonwood)	Gillnet	July 14 - September 29	PSC
29-16	Fraser R. (Whonnock)	Gillnet	June 23 - October 3	PSC
29-16	Fraser R. (Mission)	Hydroacoustic	June 29 - October 1	PSC
	Fraser R. (Qualark)	Gillnet	July 3 - October 4	PSC
	Fraser R. (Hells Gate)	Observer	July 2 - September 30	PSC
<b>Canadian non-Panel Areas</b>				
12	Queen Charlotte Str. (Round Is.)	Gillnet	July 10 - August 15	DFO
12	Johnstone Str. (Naka Cr.)	Gillnet	July 18 - July 29	DFO
12	Johnstone Str. (Blinkhorn)	Purse Seine	July 25 - September 8	DFO
13	Lower Johnstone Str.	Purse Seine	July 27 - September 8	DFO
<b>United States Panel Areas</b>				
5	Juan de Fuca Str.	Gillnet	July 17 - July 26	PSC
7	San Juan Islands	Reefnet	July 21 - August 6	PSC

## IV. MANAGEMENT INFORMATION

To facilitate decision making, the Panel requires information about the abundance, timing, migration route and catch levels of Fraser sockeye salmon by management group. Pre-season, these quantities are provided by DFO in the form of forecasts and by PSC Staff through analysis of historical data. Staff update these estimates in-season through various assessment programs (Appendix G). Stock monitoring programs collect information about abundance at various points along the migration route using test fisheries, hydroacoustic facilities (Mission) and observers (Hells Gate). The locations and schedule for these Staff and DFO programs are listed in Table 4. Stock identification programs collect and analyze biological samples (e.g., DNA, scales) from various fisheries. The resulting information is used to apportion the total abundance of sockeye into component stock groups. These data are augmented with catch information from commercial, First Nations, recreational and other fisheries that are provided by the two counties. Table 5 shows the stock resolution that was reported in 2014.

**Table 5.** Individual stocks included in Fraser River sockeye stock groups used in 2014.

Stock Group	Component Stocks
<b>Early Stuart</b>	
Early Stuart	Early Stuart stocks
<b>Early Summer</b>	
Pitt	Pitt, Alouette, Coquitlam
Chilliwack	Chilliwack Lake, Chilliwack River (Upper)
Early Miscellaneous	Nadina, Bowron, Gates, Nahatlatch, Taseko
Early Thompson	North Barriere Lake and tributaries (formerly labeled Fennell), Shuswap Lake (Scotch, Seymour, early Eagle), Adams Lake (Cayenne, Upper Adams River)
<b>Summer</b>	
Chilko	Chilko River, south end Chilko Lake
Horsefly/McKinley	Horsefly, McKinley
Mitchell/Lake Tributaries	Mitchell, Roaring, Wasko, Blue Lead, Deception Point
Late Stuart/Stellako	Stellako, Tachie, Middle, Pinchi, Kuzkwa
North Thompson	Raft, North Thompson main stem
Harrison	Harrison Rapids, Widgeon
<b>Late</b>	
Birkenhead	Birkenhead, Big Silver
Late Shuswap/Portage	{ Portage, Shuswap Lake (Lower Adams, Lower Shuswap, Middle Shuswap, Shuswap Lake, late Eagle)
Weaver/Cultus	Weaver, Cultus

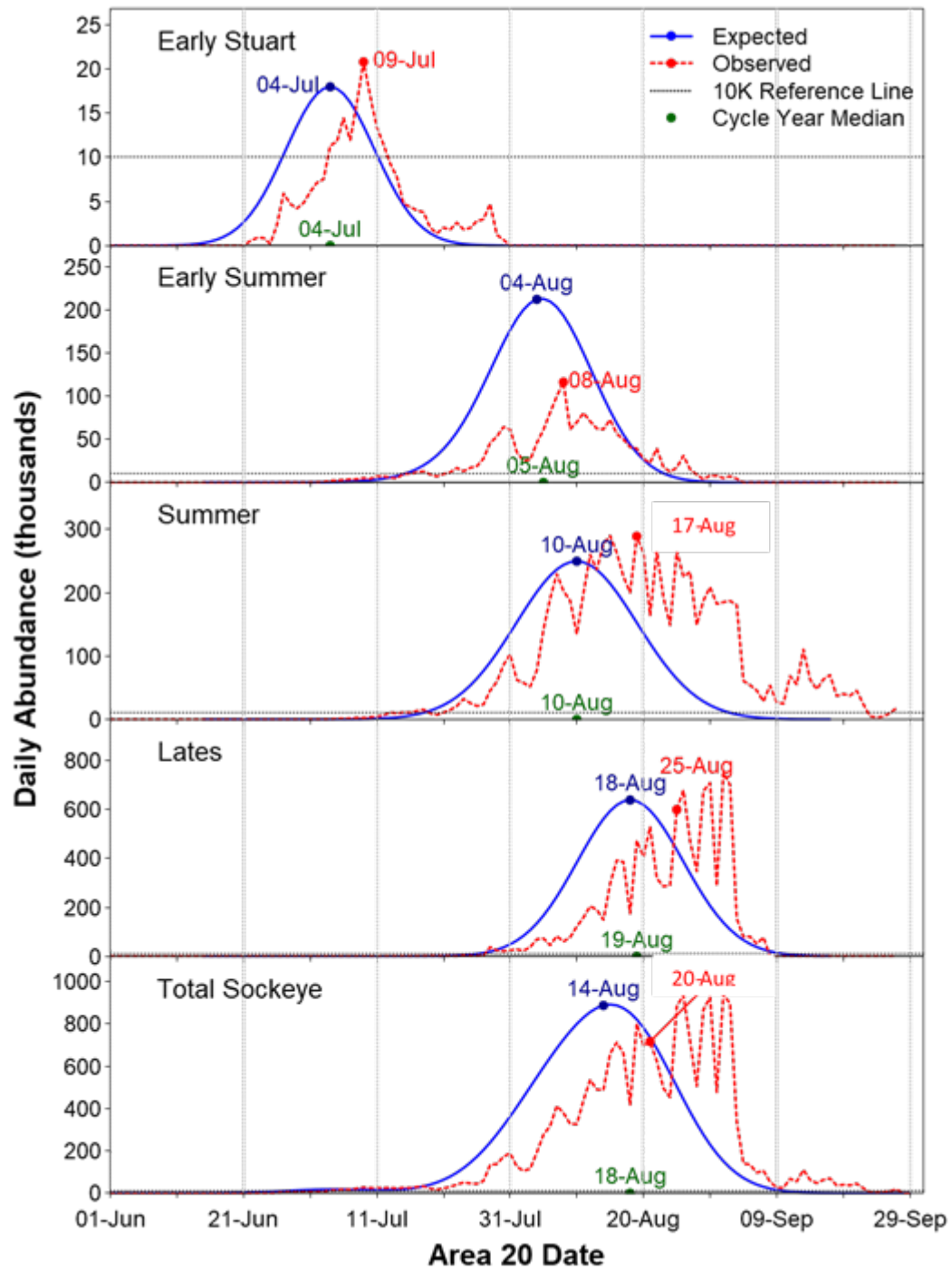
Stock assessment activities conducted by Staff use the data described above to provide estimates of daily catch, daily abundance, Mission escapement, migration timing and diversion rate, which are the basis for estimating total abundances, escapement targets and catch allocations for the different sockeye management groups. Staff also provide estimates of Management Adjustments (MAs), which are a measure of how many additional fish should be allowed to escape past Mission to increase the likelihood of achieving spawning escapement targets, given historical discrepancies and current year migration timing and river conditions. These data are compiled and analysed by Staff and the results provided to the Panel. The following sections provide a summary of these results.

### A. Abundance

End-of-season estimates of run size adopted by the Panel totalled 19,884,000 Fraser sockeye (Table 1). This large abundance resulted in substantial fishing opportunities in both countries. The post-season abundance estimate (20,148,000 fish, Tables 8 and 9) based on accounted catches,



spawning ground enumerations and difference between estimates (DBEs) is close to both the median pre-season forecast (22,854,000 fish) and final in-season estimate.

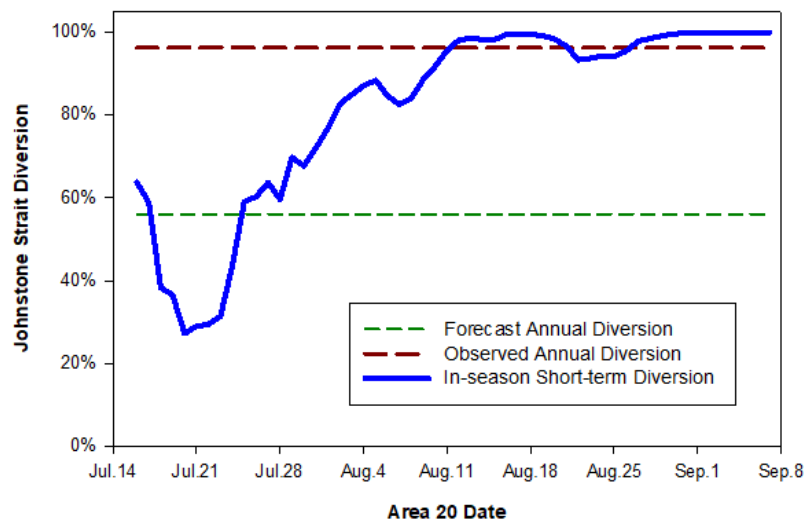


**Figure 3.** Pre-season projections (Expected) and post-season reconstructions (Observed) of daily Fraser River sockeye salmon abundance in 2014 (Area 20 date), including the 50% dates. Cycle-year median dates are also shown in green.

## B. Migration Timing and Diversion Rate

Pre-season expectations of migration timing (Table 1) are re-assessed during and after the fishing season (Figure 3) using run reconstruction methods. End-of-season estimates of marine migration timing in 2014 were later than expected pre-season for Early Stuart (5 days later), Early Summer-run (4 days later), Summer-run (8 days later) and Late-run sockeye (8 days later) (Table 1). Post-season estimates (Figure 3) were unchanged for Early Stuart and Early Summer-run sockeye, but a day earlier for both Summer and Late-run sockeye (7 days later). The migration dates for all these groups were later than historical cycle-year averages, with the largest deviation being 7 days later than average for the Summer and Late-run sockeye.

Diversion rates in 2014 were the highest on record. The observed annual diversion through Johnstone Strait was 96% of the Fraser sockeye return, compared to the initial forecast of 66% used for pre-season planning (Figure 4) and the revised forecast of 57%.



**Figure 4.** Pre-season forecasts of annual Johnstone Strait diversion rate for Fraser sockeye salmon, compared to observed short-term and annual rates for 2014.

## C. Management Adjustments and DBEs

Management adjustments or MAs are based on statistical models<sup>4,5,6,7</sup> that consider the historical differences between projections of spawning escapement (i.e., Mission escapement minus catch upstream of Mission) and spawning ground estimates of abundance. For Early Stuart, Early Summer and Summer-run stocks, the models relate historical escapement differences (difference between estimates, or DBEs) to river conditions measured near Hells Gate in the

<sup>4</sup> Hague, M.J., and Patterson, D.A. 2007. Quantifying the sensitivity of Fraser River sockeye salmon (*Oncorhynchus nerka*) management adjustment models to uncertainties in run timing, run shape and run profile. Can. Tech. Rep. Fish. Aquat. Sci. 2776 : vii + 55p.

<sup>5</sup> Macdonald, J.S., Patterson, D.A., Guthrie, I., Lapointe, M. 2008. Improvements to environmental management adjustment models: SEF final report.

<sup>6</sup> Macdonald, J.S., Patterson, D.A., Hague, M.J., Guthrie, I.C. 2010. Modeling the Influence of Environmental Factors on Spawning Migration Mortality for Sockeye Salmon Fisheries Management in the Fraser River, British Columbia. Transactions of the American Fisheries Society 139:768-782.

<sup>7</sup> Cummings, J.W., Hague, M.J., Patterson, D.A., and Peterman, R.M. 2011. The impact of different performance measures on model selection for Fraser River sockeye salmon. N. Am. J. Fish. Aquat. Sci. 31: 323-334.



Fraser River. When discharge levels or temperatures are above average, DBEs tend to be high. In addition, for Early Stuart and Early Summer runs, in-season estimates are consistently higher than spawning ground estimates even when migration conditions are within normal ranges, and this tendency is also captured by the MA models. For Late-run sockeye, historical DBEs relate to the date when half the run has migrated past Mission (i.e., 50% date), which captures the negative impact of the early migration behaviour on the migration success of these stocks that has been observed since the mid 1990's.

Pre-season MAs and DBEs are based on median values from historical datasets for each management group, or are projected from long-range forecasts of river conditions and in-river migration timing. In-season values are predicted using updated migration timing estimates and the combination of observed and short-range forecasts of river discharge and temperature. DFO's Environmental Watch Program provides both the long-range forecast used pre-season and 10-day forecasts of river temperatures and discharge each Monday and Thursday in-season. In contrast, post-season values are calculated independently of any environmental data as the difference between potential and spawning ground estimates of escapement. Potential spawning escapement (PSE) is defined as Mission passage minus in-river catch that occurs upstream of Mission between the hydroacoustic site and the spawning areas.

A summary of the pre-season and in-season MA models adopted in 2014 are provided in the "Management Adjustment and DBE" section in Appendix G. Comparisons of %DBE and pMA estimates for the pre-season, in-season and post-season periods are shown in Table 6. The magnitude of observed post-season values was larger than both the pre-season and in-season adopted values for all four timing groups. The in-season pMA forecasted for Early Stuart was larger than the pre-season forecast due to higher temperatures and lower discharge than predicted. Based on up-river temperatures and observations of migrating fish being in good condition the Panel did not adopt in-season MA model predictions for Early Summers and Summers during the migration period, and remained with pre-season adopted values until the last Panel meeting. Although substantial delay (approximately 16 days) was observed for Late-run sockeye, which was expected to reduce the DBE, the observed post-season value was much higher than both the pre-season and in-season adopted values.

**Table 6.** Pre-season, in-season and post-season estimates of DBEs (differences between estimates) and pMAs (proportional management adjustments). Pre-season predictions are based on long-range forecasts of migration timing and of 31-day mean Fraser River temperature and discharge. In-season estimates reflect the end of season values adopted by the Panel (Table 1) and are based on in-season estimates of migration timing and 19-day mean river conditions. Observed DBEs are calculated from final in-season estimates of potential spawning escapement and post-season estimates of spawning populations based on field enumeration programs conducted by DFO. (See Appendix A: Glossary of terms and abbreviations for DBE definition)

Description	Early							
	Early Stuart		Summer <sup>1</sup> Aggregate		Summer <sup>2</sup> Aggregate		Late <sup>3</sup> Aggregate	
	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA
Pre-season prediction	-46%	0.86	-30%	0.42	-10%	0.11	-22%	0.28
In-season prediction	-66%	1.96	-30%	0.42	-12%	0.14	-9%	0.10
Observed <sup>4</sup>	-67%	2.02	-37%	0.58	-21%	0.26	-44%	0.79

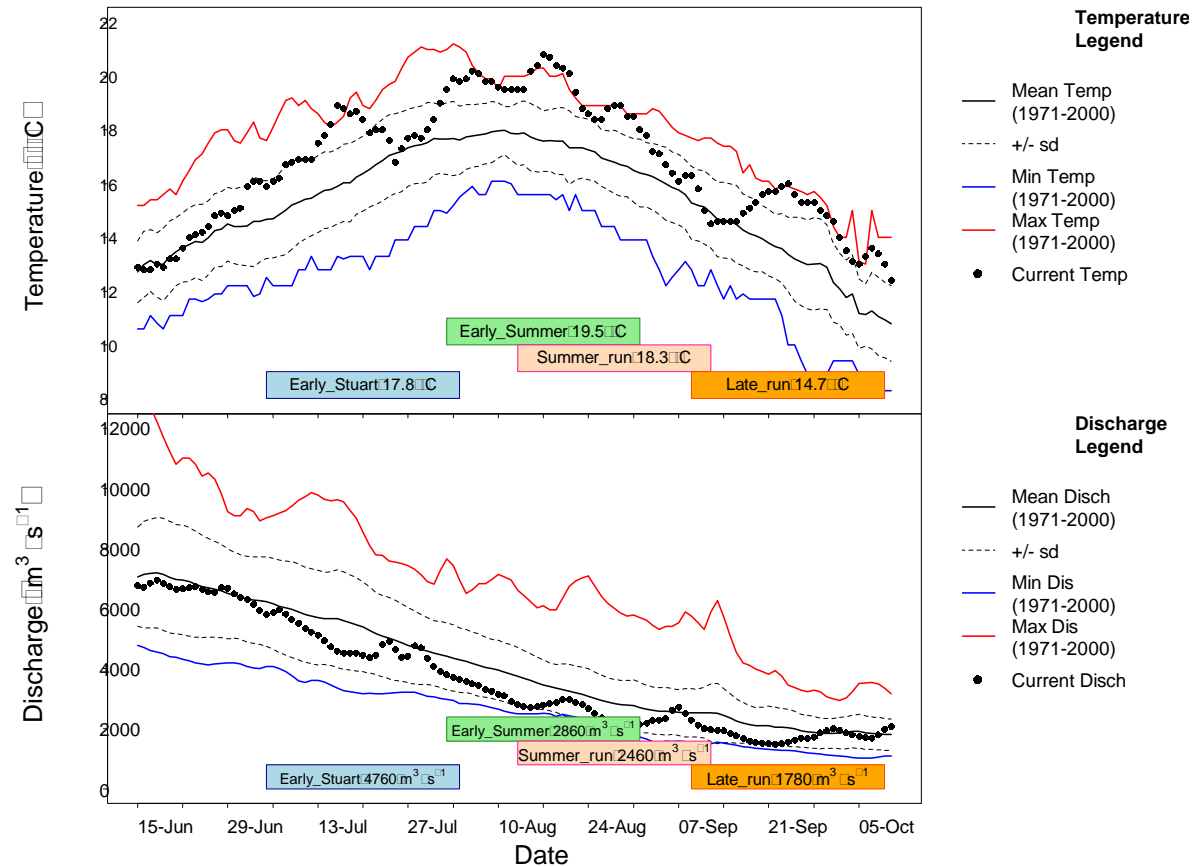
1 The Early Summer aggregate is a weighted average of the pMA for the non-Pitt, non-Chilliwack Early Summer component, the pMA for Chilliwack and the pMA for Pitt based on the p50 level of abundances.

2 The Summer aggregate pMA is a weighted average of the pMA for the non-Harrison Summer component and the pMA for Harrison, based on the p50 level of abundances.

3 The Late aggregate pMA was a weighted average of the pMA for the non-Birkenhead Late component and the pMA for Birkenhead, based on the p50 level of abundances.

4 Derived from Near Final escapement estimates

In the spring of 2014, snowpack values were high in the upper Fraser, but with early freshet and higher than normal air temperatures, discharge levels were low and water temperatures remained well above average for most of the July-September period (Figure 5). Observed temperatures exceeded the optimum temperature for aerobic swimming<sup>8</sup> for all four management groups during much of their migrations and were near or exceeded the upper temperature ranges for aerobic swimming for the Early Summer and Summer-run groups during much of their migrations. These exposures to high river temperatures were likely major contributors to the high observed DBEs for all management groups (Table 6).



**Figure 5.** Fraser River temperature and discharge measured near Hope in 2014. Also shown are the run timing bars that represent a 31-day spread of the run centred around the Hells Gate date and the mean temperature and discharge for the 31-day spread.

#### D. Mission Escapement

Estimates of Mission escapement totalled 10,143,000 sockeye, including 228,000 Early Stuart, 1,204,000 Early Summer, 4,173,000 Summer and 4,538,000 Late-run sockeye (Table 7; see Appendix G for program details).

<sup>8</sup> Elliason, E.J., Clark, T.D., Hague, M.J., Hanson, L.M., Gallagher, Z.S., Jeffries, K.M., Gale, M.K., Patterson, D.A., Hinch, S.G., and Farrell, A.P. 2011. Differences in Thermal Tolerance Among Sockeye Salmon Populations. *Science* 332:109-112.

**Table 7.** Fraser River sockeye salmon passage at Mission in 2014.

Management Group Stock Group	Mission Passage	
	fish	%
<b>Early Stuart</b>	<b>227,900</b>	<b>2%</b>
<b>Early Summer</b>	<b>1,204,100</b>	<b>12%</b>
Chilliwack	23,500	0%
Early Miscellaneous	158,000	2%
Early South Thompson	950,800	9%
Barriere River/Taseko	22,000	0%
Pitt <sup>1</sup>	49,800	0%
<b>Summer</b>	<b>4,172,700</b>	<b>41%</b>
Raft/N.Thompson	55,300	1%
Chilko	1,257,600	12%
Quesnel	1,133,800	11%
Late Stuart/Stellako	725,000	7%
Harrison	1,000,900	10%
<b>Late</b>	<b>4,537,800</b>	<b>45%</b>
Birkenhead	43,000	0%
Late Shuswap/Portage	4,412,000	44%
Weaver/Cultus	82,800	1%
<b>Total Sockeye</b>	<b>10,142,500</b>	<b>100%</b>

<sup>1</sup> Pitt River sockeye do not migrate past Mission, but are shown here as if they did to provide a complete accounting of Fraser sockeye

## V. RUN SIZE, CATCH AND ESCAPEMENT

Table 8 provides an overview of run size by management group for Fraser sockeye salmon. Included are estimates of catches, spawning escapements and difference between estimates (DBEs) <sup>9</sup>. Table 9 provides similar information, but with more detail on individual sockeye stock groups. Figure 6 shows total sockeye abundance by year, while Figure 7 shows catch, escapement and exploitation rate by year for a historical perspective. Details of commercial catch distributions by area and gear in Canada and the U.S. are provided in Tables 10 and 11. Table H1 in Appendix H shows catch by user group, spawning escapement, DBE and total abundance over the last four

<sup>9</sup> In estimates of total return, Difference Between Estimates (DBEs) will eventually be replaced by Run-size Adjustments (RSAs) which are revisions to the total run size in cases when there is evidence that more fish returned than were accounted for in catch and escapement, e.g., evidence of en route mortality, evidence of biased or incomplete estimates of catch, Mission escapement or spawning escapement. The focus of RSAs is on providing the best assessments of total returns, i.e., recruitment. Models that relate recruitment and spawning stock are used to develop both pre-season abundance forecasts and escapement policy. Staff work with the Fraser Technical Committee to provide recommendations to the Fraser Panel about how RSAs are assigned and corresponding best estimates of total return. PSC staff, Technical Committee members and DFO staff collaborate in a formal process for determining RSAs.

cycle years. Sockeye salmon escapements since 1938 are summarized for total Fraser sockeye and by management group in Figure 9, and by stock for the last four cycle years in Table H2.

**Table 8.** Catch, escapement, difference between estimates and run size for Fraser River sockeye salmon by management group in 2014.

	Fraser Sockeye				Total	% of Run
	Early Stuart	Early Summer	Summer	Late		
<b>CANADIAN CATCH</b>	<b>23,100</b>	<b>774,100</b>	<b>4,273,900</b>	<b>5,052,300</b>	<b>10,123,400</b>	<b>50%</b>
<b>Commercial Catch</b>	<b>30</b>	<b>457,100</b>	<b>3,243,700</b>	<b>4,288,600</b>	<b>7,989,400</b>	<b>40%</b>
Panel Area	0	100,500	1,057,300	1,864,400	3,022,200	15%
Non-Panel Areas	30	356,600	2,186,400	2,424,200	4,967,300	25%
<b>First Nations Catch</b>	<b>22,900</b>	<b>273,100</b>	<b>852,300</b>	<b>628,100</b>	<b>1,776,600</b>	<b>9%</b>
Marine FSC	20	47,700	165,100	108,200	321,100	2%
Fraser River FSC	22,900	176,400	345,400	71,100	615,800	3%
Economic Opportunity	0	49,100	341,800	448,800	839,600	4%
<b>Non-commercial Catch</b>	<b>90</b>	<b>43,900</b>	<b>177,800</b>	<b>135,600</b>	<b>357,400</b>	<b>2%</b>
Marine Recreational	40	7,500	47,100	55,700	110,300	1%
Fraser Recreational	0	35,900	128,800	77,700	242,400	1%
Charter (Albion + Qualark)	60	500	1,900	1,600	4,100	0%
ESSR	0	0	0	600	600	0%
<b>UNITED STATES CATCH</b>	<b>10</b>	<b>36,200</b>	<b>313,000</b>	<b>537,900</b>	<b>887,200</b>	<b>4%</b>
<b>Washington Total</b>	<b>10</b>	<b>18,900</b>	<b>195,500</b>	<b>487,200</b>	<b>701,600</b>	<b>3%</b>
<b>Commercial catch</b>	<b>0</b>	<b>18,300</b>	<b>193,600</b>	<b>486,200</b>	<b>698,200</b>	<b>3%</b>
Treaty Indian	0	12,400	128,500	329,400	470,300	2%
All Citizen	0	6,000	65,100	156,800	227,900	1%
<b>Non-commercial Catch</b>	<b>10</b>	<b>500</b>	<b>1,900</b>	<b>1,000</b>	<b>3,400</b>	<b>0%</b>
Ceremonial	10	500	1,900	1,000	3,400	0%
Recreational	0	0	0	0	0	0%
<b>Alaska</b>	<b>0</b>	<b>17,400</b>	<b>117,400</b>	<b>50,700</b>	<b>185,500</b>	<b>1%</b>
<b>TEST FISHING CATCH</b>	<b>2,800</b>	<b>26,600</b>	<b>78,800</b>	<b>40,500</b>	<b>148,700</b>	<b>1%</b>
<b>PSC (Panel Areas)</b>	<b>2,700</b>	<b>7,200</b>	<b>18,300</b>	<b>12,800</b>	<b>41,000</b>	<b>0%</b>
Canada	2,600	5,600	15,100	11,800	35,100	0%
United States	100	1,500	3,200	1,000	5,800	0%
<b>Canada (non-Panel Areas)</b>	<b>100</b>	<b>19,500</b>	<b>60,500</b>	<b>27,700</b>	<b>107,800</b>	<b>1%</b>
<b>TOTAL RUN</b>	<b>233,400</b>	<b>1,862,900</b>	<b>8,284,100</b>	<b>9,767,700</b>	<b>20,148,100</b>	<b>100%</b>
Total Catch in All Fisheries	25,900	837,000	4,665,700	5,630,700	11,159,300	55%
Adult Spawning Escapement *	68,600	646,500	2,859,000	2,303,200	5,877,300	29%
Jack Spawning Escapement	0	1,300	3,900	400	5,600	0%
Difference Between Estimates **	138,900	378,000	755,600	1,833,400	3,105,900	15%
<b>Percentage of Total Run</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	
Total Catch in All Fisheries	11%	45%	56%	58%	55%	
Spawning Escapement	29%	35%	35%	24%	29%	
Difference Between Estimates	60%	20%	9%	19%	15%	

\* Spawning escapement estimate for Cultus sockeye includes 225 individuals captured as brood stock.

\*\* Difference between estimates as at the time of the final spawning ground estimates.

## A. Sockeye Salmon

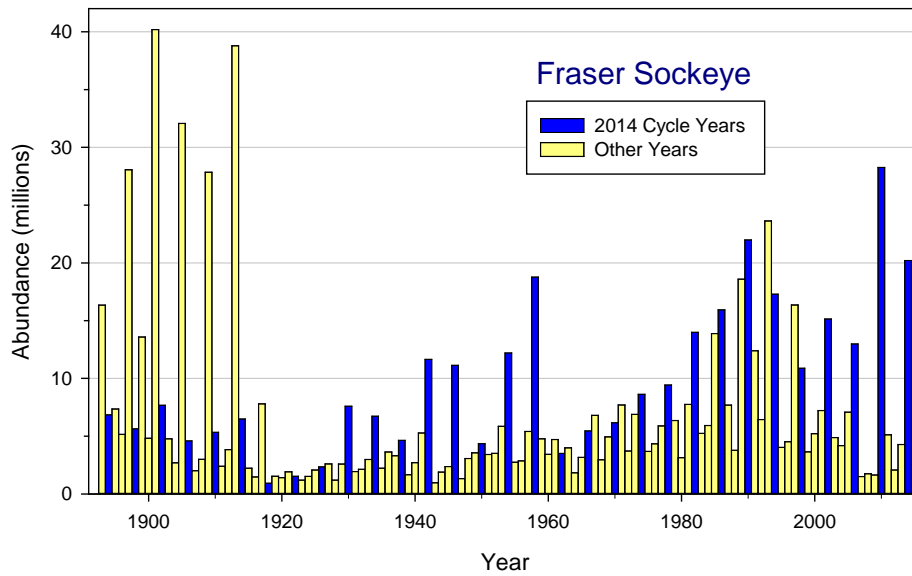
The total abundance of adult sockeye salmon in 2014 was 20,143,000 fish (Tables 8 and 9), which is 12% lower than the median forecast of 22,854,000 fish and about 29% lower than the brood year abundance of 28,253,000 fish in 2010 (Appendix H, Table H1). This was the third highest return on the cycle on record (Figure 6).

**Table 9.** Catch, escapement, difference between estimates, run size and exploitation rate for Fraser River sockeye salmon by stock group in 2014.

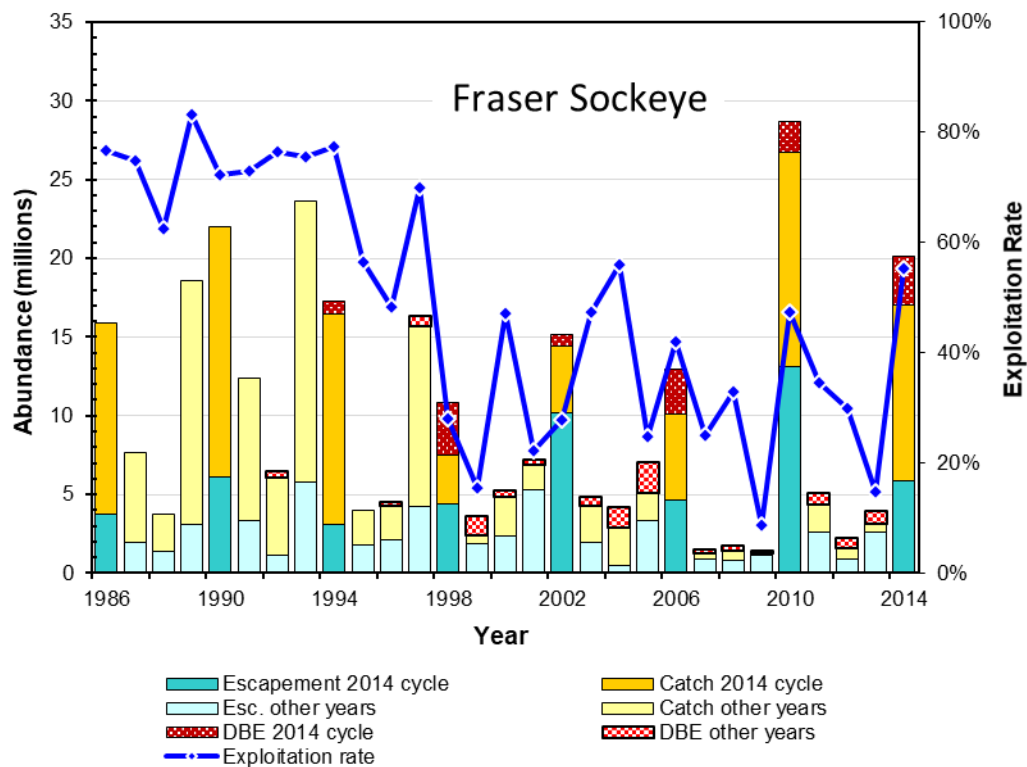
Management Group Stock Group	Catch	Adult Spawning	Difference Between	Abundance			Portion of Run	Adult Exploitation Rate
		Escapement	Estimates	Adult	Jack <sup>1</sup>	Total		
Fraser Sockeye Salmon								
Early Stuart	25,900	68,600	138,900	233,400	0	233,400	1%	11%
Early Summer-run	837,000	646,500	378,000	1,861,500	1,300	1,862,900	9%	45%
Chilliwack	1,700	3,500	19,500	24,700	0	24,700	0%	7%
Early Miscellaneous	88,900	93,200	28,900	211,000	1,200	212,200	1%	42%
Early South Thompson	717,900	501,800	309,900	1,529,600	100	1,529,700	8%	47%
Barriere River/Taseko	8,600	11,600	6,400	26,600	20	26,600	0%	32%
Pitt	19,800	36,500	13,300	69,700	10	69,700	0%	28%
Summer-run	4,665,700	2,859,000	755,600	8,280,300	3,900	8,284,100	41%	56%
Raft/N.Thompson	80,400	39,800	8,800	129,000	60	129,100	1%	62%
Chilko	1,577,300	1,025,600	14,200	2,617,100	3,700	2,620,800	13%	60%
Quesnel	1,434,300	835,200	152,600	2,422,100	80	2,422,200	12%	59%
Late Stuart/Stellako	1,050,200	558,500	36,500	1,645,200	0	1,645,200	8%	64%
Harrison/Widgeon	523,400	399,900	543,500	1,466,800	30	1,466,800	7%	36%
Late-run	5,630,700	2,303,200	1,833,400	9,767,300	400	9,767,700	48%	58%
Birkenhead/Big Silver	67,300	41,600	0	108,900	200	109,100	1%	62%
Late Shuswap/Portage	5,448,800	2,232,400	1,783,300	9,464,500	100	9,464,600	47%	58%
Weaver/Cultus	114,600	29,200 <sup>2</sup>	50,000	193,900	30	193,900	1%	59%
Total	11,159,300	5,877,300	3,105,900	20,142,500	5,600	20,148,100	100%	55%
Portion of Total Run	55%	29%	15%	100%	0%	100%		

<sup>1</sup> Jack ratios were not estimated for fisheries; estimates include only those jacks that were actually sampled and are therefore underestimates.

<sup>2</sup> Spawning escapement estimate of Cultus sockeye includes 225 individuals captured as brood stock.



**Figure 6.** Total run size of Fraser River sockeye salmon in 1893-2014. Returns on the 2014 cycle are emphasized.



**Figure 7.** Total catch, escapement, difference between estimates, run size and exploitation rate for Fraser River sockeye salmon in 1986-2014, with returns on the 2014 cycle emphasized.

All management groups returned abundances that were lower than their median pre-season forecast with the exception of Summer-run sockeye which returned at levels that exceeded its median forecast. The return for each management group was much higher than their cycle line averages (4 year intervals beginning with 1954). The total return of Early Stuart sockeye was 233,000 adults (Tables 8 and 9), which was 22% smaller than the median forecast but 75% larger than the cycle line average. Early Summer-run returns totalled 1,862,000 adult sockeye, less than half (45%) of the median forecast but just over double the cycle line average. The largest Early Summer-run stock component by a wide margin was the Early South Thompson group. The abundance of Summer-run sockeye was 8,280,000 adults, 45% larger than the median forecast and 1.3 times larger than the cycle line average. Most Summer-run fish were from the Chilko and Quesnel groups. The abundance of Late-run sockeye was 9,767,000 adults, 23% less than forecasted but 9% above the cycle line average. Late Shuswap stocks dominated the Late-run return.

**Table 10.** Canadian commercial catches of Fraser River sockeye salmon by gear type, license designation and statistical area in 2014. Grey areas indicate fishery areas are not part of the license-area designation.

Fishery Areas	Purse Seine		Gillnet			Troll			Total
	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	
<b>Commercial</b>	<b>0</b>	<b>4,805,000</b>	<b>0</b>	<b>1,174,100</b>	<b>1,624,100</b>	<b>39,900</b>	<b>35,300</b>	<b>310,900</b>	<b>7,989,400</b>
<b>Panel Areas</b>	<b>0</b>	<b>1,285,100</b>	<b>0</b>	<b>0</b>	<b>1,624,100</b>	<b>0</b>	<b>0</b>	<b>112,900</b>	<b>3,022,200</b>
20		0			0		0		0
17, 18, 29		1,285,100			1,624,100			112,900	3,022,200
121-124 *		0			0		0		0
<b>Non-Panel Areas</b>	<b>0</b>	<b>3,519,900</b>	<b>0</b>	<b>1,174,100</b>	<b>0</b>	<b>39,900</b>	<b>35,300</b>	<b>198,000</b>	<b>4,967,300</b>
1-10	0		0			39,900			39,900
11-16		3,519,900		1,174,100	0		35,300	198,000	4,927,300
124-127 *		0			0		0		0
<b>First Nations Economic Opportunity and Demo Fisheries</b>									<b>839,600</b>
<b>Total Catch</b>									<b>8,829,000</b>

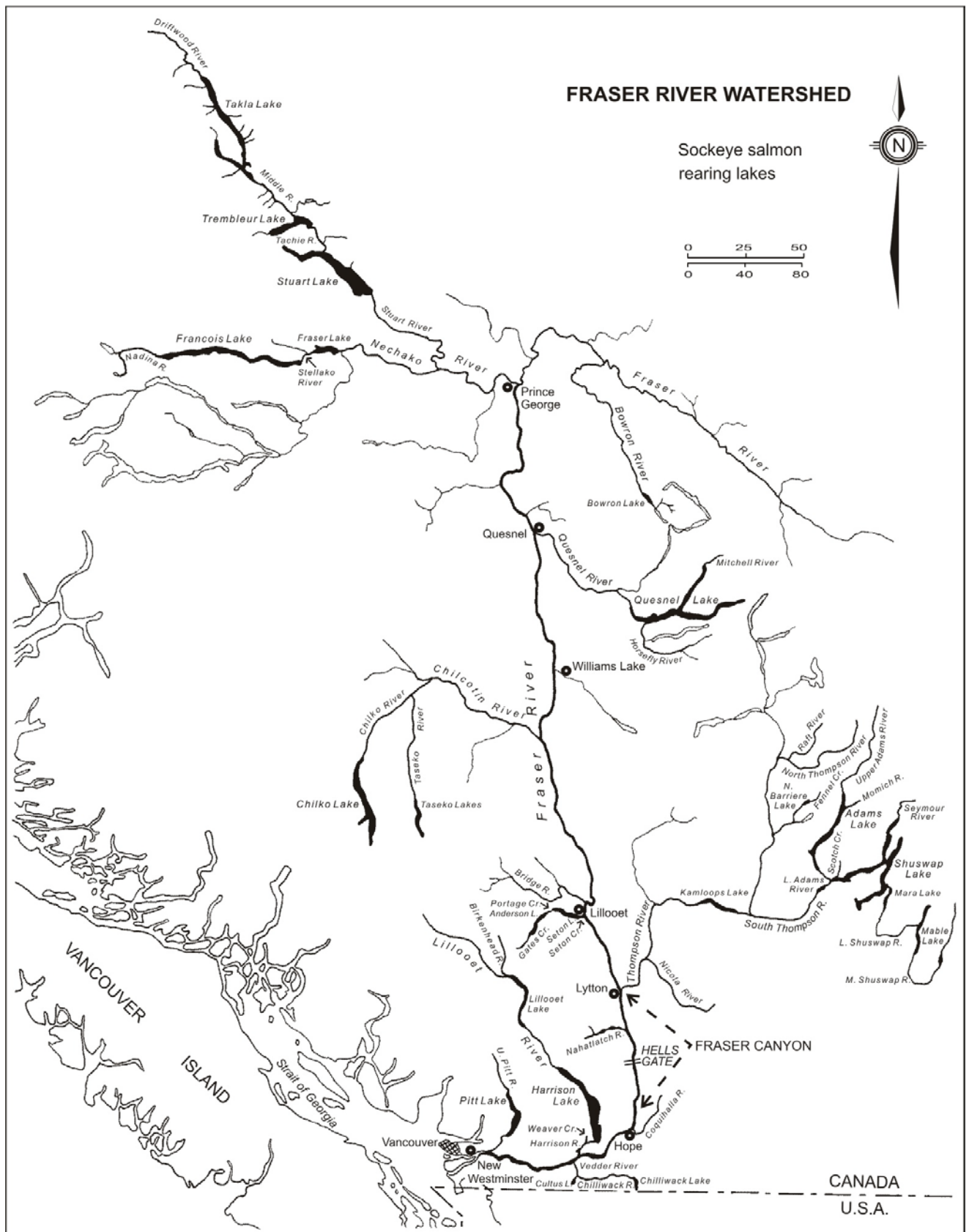
\* Catch in Area 124 is divided between Panel and Non-Panel Areas.

**Table 11.** U.S. commercial catches of Fraser River sockeye salmon by user group, gear type and statistical area in 2014.

Areas	Purse				Total
	Troll	Seine	Gillnet	Reefnet	
<b>Panel Area (Washington)</b>	<b>0</b>	<b>485,200</b>	<b>199,400</b>	<b>13,600</b>	<b>698,200</b>
<b>Treaty Indian *</b>	<b>0</b>	<b>308,600</b>	<b>161,700</b>	<b>0</b>	<b>470,300</b>
4B, 5 and 6C	0	0	3,250	0	3,250
6 and 7	0	60,100	24,500	0	84,700
7A	0	248,500	133,900	0	382,400
<b>All Citizen **</b>	<b>0</b>	<b>176,600</b>	<b>37,700</b>	<b>13,600</b>	<b>227,900</b>
7	0	43,500	9,480	13,600	66,600
7A	0	133,100	28,200	0	161,300
<b>Alaska (District 104) Catch</b>					<b>185,500</b>
<b>United States Total</b>					<b>883,700</b>

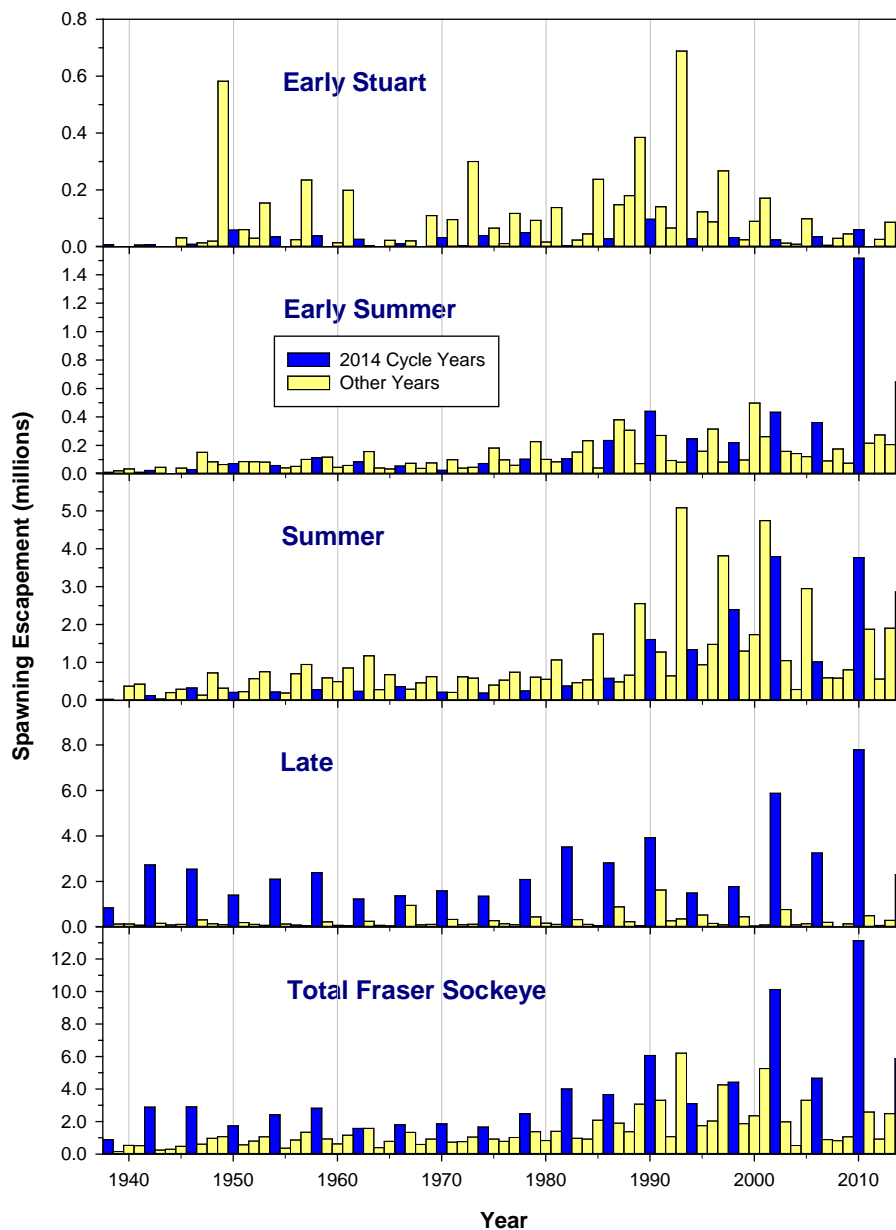
\* Estimates for Treaty-Indian fisheries are from the "TOCAS" database.

\*\* Estimates for All Citizen fisheries are from the WDFW "LIFT" database.



**Figure 8.** Sockeye salmon spawning areas in the Fraser River watershed.





**Figure 9.** Annual adult spawning escapement of Fraser River sockeye salmon for each management group and for total sockeye in 1938-2014, with escapements on the 2014 cycle emphasized.

The total catch of 11,159,000 fish was about 55% of the run (Tables 8 and 9). This exploitation rate is the highest since 2004 and the second highest since 1997 (Figure 7). Of the total catch, 10,123,000 fish were caught in Canada, 702,000 in Washington State, 149,000 fish in test fisheries and 186,000 in Alaska (Table 8).

Most of the Canadian catch was taken in commercial fisheries (including First Nations Economic Opportunity fisheries), followed by First Nations FSC fisheries (Table 8). Within the commercial sector, most of the catch was taken in purse seines fisheries, followed by gillnet and then troll fisheries (Table 10).

In Washington State approximately two thirds of the commercial catch (Table 8) was taken in Treaty Indian fisheries and the remainder in All Citizen fisheries. Most fish were caught by purse seines, followed by gillnets and reefnets (Table 11).

DFO annually assesses the spawning ground abundance of sockeye populations in the Fraser watershed (Figure 8). In 2014, the near-final estimate of adult spawners (primarily age 4 and age 5 fish) totalled 5,877,000 fish, or 29% of the total run. This escapement was less than half of the record (since 1938) brood year (2010) escapement of 13,131,000 adults.

Spawner abundances for Early Stuart (14% higher) slightly exceeded those observed in the brood year (2010, Figure 9), while the Early Summer-run escapement was 57% lower, the Summer-run escapement was 24% lower and Late-run escapement was 70% lower. In a historical cycle-line context, spawning escapements in 2014 represent the: (1) extension of the relatively high brood year escapement to the Early Stuart system, compared to the previous four cycles (1994-2006); (2) much smaller than the brood year escapement of the Early Summer run but higher than all other years and cycle years on record; (3) continuation of relatively high Summer-run escapements observed for three of the last four cycles; (4) smaller than most recent brood year escapements of Late-run stocks but close to the long-term average escapement on the cycle.

The overall spawning success of adult female sockeye in the Fraser watershed was 96%; 3,067,000 effective female spawners out of 3,206,000 total female spawners. These values represent a lower number of effective females but a much higher spawning success rate compared to the brood year (2010: 5,832,000 effective females, 80% success rate). In a historical cycle-line context, the number of effective females spawners in 2014 was: (1) Early Stuart (23,000 fish, 67% spawning success) – 68% of the brood year abundance and lowest spawning success rate since 1998; (2) Early Summer (314,000 fish, 92% spawning success) – less than half the brood year abundance but the 2<sup>nd</sup> highest on record; (3) Summer (1,628,000 fish, 97% spawning success) – similar to the brood year and the 2<sup>nd</sup> highest abundance on record; and (4) Late (1,200,000 fish, 95% spawning success) – only 34% of the brood year abundance but near the long-term average.

The difference between estimates (DBEs)<sup>10</sup> was 3,106,000 fish, or 15% of the total return. As a percentage of run size for each management group, Early Stuart had the largest DBE (60%) and the Summer group the lowest (9%), with the remaining groups in the 19-20% range (Tables 8 and 9).

## **VI. ACHIEVEMENT OF OBJECTIVES**

The mandate of the Fraser River Panel is to manage commercial fisheries in Panel Area waters to achieve a hierarchy of objectives. In order of importance, the objectives are to: (1) achieve spawning escapement targets for Fraser River sockeye and pink salmon as determined by the schedule provided by Canada; (2) achieve targets for international sharing of the TAC as defined in the Treaty; and (3) achieve domestic catch allocation goals within each country. In addition, the Panel must consider conservation concerns for other stocks and species of salmon when planning and conducting fisheries. Panel management is evaluated after each season to determine whether the goals were achieved and to identify potential improvements in data collection programs, assessment methods and management techniques. While not formally under Panel control, management of Canadian non-Panel fisheries directed at Fraser River sockeye and pink salmon is based on the same in-season information and hierarchy of objectives, with priority given to First Nations FSC (Food, Social and Ceremonial) harvest within Canada's allocation.

### **A. Escapement**

The Panel's first task is to achieve spawning escapement targets. Spawning escapement targets were determined by applying Canada's spawning escapement plan (Appendix C, Table C2) to abundance estimates for each management group, which resulted in the calculation of TAM

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<sup>10</sup> In estimates of total return, Difference Between Estimates (DBEs) will eventually be replaced by Run-size Adjustments (RSAs) which are revisions to the total run size in cases when there is evidence that more fish returned than were accounted for in catch and escapement, e.g., evidence of en-route mortality, evidence of biased or incomplete estimates of catch, Mission escapement or spawning escapement.

rules (Total Allowable Mortality as a percentage of the total return) and corresponding escapement targets.

In-season monitoring of the progress toward spawning escapement targets is not directly measureable because in most cases spawner abundance cannot be assessed on the spawning grounds until well after the fishing season has ended. In-season management is therefore based on targets for potential spawning escapement (i.e., PSE target = in-season spawning escapement target + MA). Progress towards these targets is monitored by comparison with in-season PSE estimates (i.e., Mission passage to date - catch above Mission).

Based on final in-season PSE estimates, in-season PSE targets were nearly achieved for all management groups: Early Stuart - 11% under, Early Summer – 9% over, Summer – 11% over and Lates – 12% over (Table 12). Figure 10 shows the available harvest and catch-to-date of total Fraser sockeye through the fishing season.

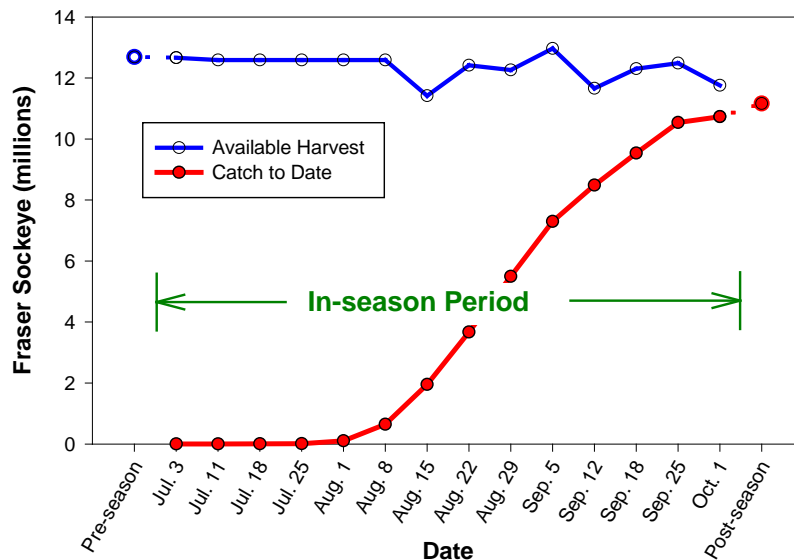
**Table 12.** Comparison of in-season targets and in-season estimates of potential spawning escapement (PSE) for adult Fraser River sockeye salmon in 2014.

Management Group	Final In-season Abundance Estimate	Potential Spawning Escapement (PSE)					
		Spawning Escapement Target	Management Adjustment *	In-season		PSE *** Estimate	Difference Fish %
				PSE ** Target			
<b>Adult sockeye</b>	<b>19,883,500</b>	<b>6,985,500</b>	<b>1,226,400</b>	<b>8,125,700</b>		<b>8,978,000</b>	<b>854,300 11%</b>
Early Stuart	233,500	108,000	211,700	233,500		208,000	-25,500 -11%
Early Summer	1,900,000	665,000	279,300	944,300		1,025,000	80,700 9%
Summer	8,150,000	2,852,500	399,400	3,251,900		3,615,000	363,100 11%
Late	9,600,000	3,360,000	336,000	3,696,000		4,132,000	436,000 12%

\* Adjustment of spawning escapement targets to achieve spawning escapement goals. If the spawning escapement target + MA exceeds the total abundance, then the target equals the total abundance.

\*\* Spawning escapement target + MA.

\*\*\* Mission passage minus all catch above Mission.



**Figure 10.** Available harvest of Fraser sockeye compared to catch to date in all fisheries in 2014. The available harvest is calculated as run size minus spawning escapement target and management adjustment, and represents fish that are available for catch in all commercial, recreational, First Nations and test fisheries.

To assess the achievement of post-season objectives, post-season spawning escapement targets were determined by applying Canada's spawning escapement plan to post-season run-size estimates, and these were compared to observed abundances on the spawning grounds. The total spawning escapement of Fraser sockeye was 17% less than the post-season target (Table 13). Spawning escapements of Early Stuart (36% below) and Late-run (33% below) sockeye were substantially below the targets, while Early Summer and Summer-run escapements were very close (within 2%). For Early Stuart, the shortfall is mainly due to the large DBE (Table 6, -67%) in combination with the catch of 26,000 fish. With DBEs of this magnitude, the run size would have to be much larger than observed to achieve the escapement target, even in the absence of catch. The catch represents 11% of the Early Stuart run, slightly above the 10% allowed under the LAER provisions. For the Late run, the shortfall is mainly due to the much larger than predicted DBE (Table 6, -9% in-season versus -44% observed), which means that in-season management objectives did not account for the observed loss of fish.

**Table 13.** Comparison of post-season spawning escapement targets and escapement estimates for adult Fraser River sockeye salmon in 2014. Post-season estimates of sockeye escapement are from spawning ground enumeration programs (DFO).

Management Group	Post-season Run-size Estimate	Spawning Escapement			
		Post-season Target	Adult Estimate	Difference	
				Fish	%
<b>Sockeye salmon</b>	<b>20,215,000</b>	<b>7,101,600</b>	<b>5,877,300</b>	<b>-1,224,300</b>	<b>-17%</b>
Early Stuart	233,400	108,000	68,600	-39,400	-36%
Early Summer	1,862,900	652,000	646,500	-5,500	-1%
Summer	8,351,100	2,922,900	2,859,000	-63,900	-2%
Late	9,767,700	3,418,700	2,303,200 *	-1,115,500	-33%

\* Late-run escapement estimate include 225 Cultus fish kept for broodstock.

## B. International Allocation

The Panel's second priority is to achieve the goals for international allocation of the TACs for Fraser sockeye salmon. In accordance with Annex IV, Chapter 4 of the Pacific Salmon Treaty (Appendix B), TAC calculations are based on the run sizes, spawning escapement targets and MAs in effect when the Panel relinquished control of the last U.S. Panel Area (October 4). The test fishing catch deduction is the post-season estimate, however.

With the total in-season abundance estimate of 19,884,000 Fraser sockeye, minus deductions for spawning escapement, MA, test fishing catch and AFE, the TAC in 2014 was 11,235,000 sockeye (Table 14). The Washington share of the TAC (16.5%) was 1,854,000 fish and their catch was 702,000 fish, resulting in a catch underage of 1,152,000 Fraser sockeye. Canada's catch of 10,123,000 Fraser sockeye (excluding the ESSR catch of 600 fish) was 342,000 fish higher than their share of the TAC plus the AFE. A detailed version of the TAC calculations by management group is presented in Table H3 in Appendix H.

**Table 14.** Total allowable catch (TAC) and achievement of international catch shares for Fraser River sockeye salmon in 2014. TAC calculations use the in-season estimates of run size, spawning escapement target and management adjustment at the time the Panel relinquished control of the last U.S. Panel Area (October 4), in accordance with Annex IV of the Treaty.

	<u>Sockeye</u>	
<b>TOTAL ALLOWABLE CATCH</b>		
In-season Total Run Size		<b>19,883,500</b>
Deductions		<b>8,760,600</b>
In-season Spawning Escapement Target		6,985,500
In-season Management Adjustment		1,226,300
Aboriginal Fishery Exemption (AFE)		400,000
Post-season Test Fishing Catch		148,700
Total Allowable Catch	1, 2	<b>11,234,500</b>
<b>UNITED STATES</b>		
Washington Share		<b>1,847,100</b>
Washington Share of TAC	1, 3	1,853,700 16.5%
Payback		-6,600
Washington Catch		<b>701,600</b>
Deviation		<b>1,145,500</b>
In-season Alaska Catch Estimate		0
<b>CANADA</b>		
Canadian Share of TAC + U.S. Payback + AFE		<b>9,787,400</b>
Canadian Catch excluding ESSR Catch		<b>10,122,800</b>
Deviation		<b>-335,400</b>
1	TAC and Washington sockeye share according to the revised (May 16, 2014) Annex IV of the Pacific Salmon Treaty.	
2	TAC may not equal the total run minus total deductions shown due to adjustments required when the run size of individual management groups is less than the nominal deductions. A more detailed TAC calculation showing these intermediate calculations is shown in Table 7 in Appendix I.	
3	United States share according to revised Annex IV of the Pacific Salmon Treaty: Sockeye: 16.5% of the TAC - payback (maximum 5% of share).	

### C. Domestic Allocation

The third priority of the Panel is to achieve domestic allocation goals as specified by the Parties. While the Panel manages all commercial fisheries directed at Fraser River sockeye salmon in Panel Area waters (Figure 1), Canada has sole responsibility for regulating fisheries including commercial net and troll fisheries in non-Panel areas such as Johnstone Strait, and First Nations and recreational fisheries in all fishing areas. Thus, achievement of Canadian domestic allocation goals requires coordination between Panel and non-Panel regulatory actions.

With respect to domestic allocations of Fraser sockeye salmon, Treaty Indian fishers in the U.S. caught 781,000 fish less than their share of the TAC and All Citizen fishers caught 371,000 fish less (Table 15). There is no domestic allocation to report for Canadian commercial fisheries.

**Table 15.** Achievement of domestic catch goals in Washington for Fraser River sockeye salmon in 2014.

User Category	Actual Catch		Share of TAC		Deviation
	Fish	%	Fish	%	
<b>Washington Total</b>	<b>701,600</b>	<b>100.0%</b>	<b>1,853,700</b>	<b>100.0%</b>	<b>-1,152,100</b>
Treaty Indian *	473,700	67.5%	1,255,000	67.7%	-781,300
All Citizen **	227,900	32.5%	598,700	32.3%	-370,800

\* Treaty Indian catch includes commercial and ceremonial catches.

\*\* All Citizen catch includes commercial and recreational catches.

#### D. Conservation of Other Stocks and Species

Non-target stocks and species are caught in Panel Area fisheries directed at Fraser River sockeye salmon. By-catches of non-Fraser sockeye and pink salmon in commercial net fisheries regulated by the Fraser River Panel totalled 670 sockeye and 720 pink salmon (Table 16). Catches of other Fraser and non-Fraser salmon species included 14,400 chinook, 3,100 coho, 2,800 chum and 10 steelhead.

**Table 16.** Catches of non-Fraser sockeye and pink salmon and catches of other salmon species in commercial fisheries regulated by the Fraser River Panel in 2014.

Area and Gear	Non-Fraser		Fraser and Non-Fraser			
	Sockeye	Pink	Chinook	Coho	Chum	Steelhead
<b>United States *</b>	<b>630</b>	<b>650</b>	<b>7,910</b>	<b>3,130</b>	<b>1,130</b>	<b>10</b>
Areas 4B, 5 and 6C Net	70	20	1,060	1,220	60	10
Areas 6, 7 and 7A Net	560	630	6,850	1,900	1,070	0
<b>Canada **</b>	<b>40</b>	<b>70</b>	<b>6,510</b>	<b>20</b>	<b>1,650</b>	<b>0</b>
Area 20 Net	0	0	0	0	0	0
Area 29 Net	40	70	6,510	20	1,650	0
<b>Total</b>	<b>670</b>	<b>720</b>	<b>14,420</b>	<b>3,140</b>	<b>2,780</b>	<b>10</b>

\* Estimates for All Citizen fisheries are from the WDFW "LIFT" database, while estimates for Treaty-Indian fisheries are from the "TOCAS" database.

\*\* Estimates are from DFO in-season hail program.

## VII. ALLOCATION STATUS

The U.S. caught less than their share of the TAC in 2014 and so there was no payback of Fraser sockeye salmon to carry forward to the 2015 fishing season (Table 17).

**Table 17.** Allocation status for Fraser River sockeye salmon in 2010-2014. No paybacks were owed by the U.S. after the 2014 fishing season.

	2010	2011	2012	2013	2014
<b>TOTAL ALLOWABLE CATCH</b>					
Total Run Size	34,546,000	5,077,000	2,515,000	3,732,000	19,883,500
Escapement and other deductions	18,769,100	2,999,200	1,796,000	3,649,400	8,688,600
Total Allowable Catch:	15,776,900	2,077,800	719,000	82,600	11,194,900
<b>UNITED STATES</b>					
Washington Catch	1,959,600	278,800	111,300	20,200	701,600
Washington Share (exclds payback) *	2,603,200	342,800	118,600	13,600	1,847,100
Deviation:	-643,600	-64,000	-7,300	6,600	-1,145,500
<b>Cumulative Allocation Status:</b>	<b>0 **</b>	<b>0 **</b>	<b>0 **</b>	<b>6,600</b>	<b>0 **</b>
<b>CANADA</b>					
Catch	11,558,700	1,405,200	510,400	410,100	8,981,100
Share + Aboriginal Exemption	13,573,700	2,135,000	1,000,400	469,000	9,747,800
Deviation:	-2,015,000	-729,800	-490,000	-58,900	-766,700

\* Washington share of the TAC according to Annex IV of the Pacific Salmon Treaty:  
2010: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks.  
2011: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks.  
2012: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks. Allocation status based on TAC when Panel made it's last decision about U.S. fisheries in 2012 (Aug. 10), because TAC decreased between date of last U.S. fishery decision (Aug. 10) and when Panel control of last U.S. fishery area was relinquished (Sep. 2).  
2013: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks.  
2014: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks.

\*\* By Panel agreement, no paybacks are to be carried forward.

## VIII. APPENDICES

### APPENDIX A: Glossary of Terms and Abbreviations

**Bayesian Methods and Models:** Statistical models which allow pre-season forecasts of run size, diversion rate, and migration timing to be used as priors and then combined with in-season observations as data accumulates over the course of the season. Early in the season, estimates are heavily dependent on these pre-season priors, but this dependence shifts to the collected data as the season progresses. Uncertainty in the in-season estimates of run size, migration timing and diversion rate decreases as more data become available. The name “Bayesian” comes from the frequent use of Bayes’ theorem in the inference process which specifies how the prior and in-season data interact in the generation of estimates.

**Commercial Communal (CC) fishery:** Commercial Fraser River First Nations fishery in the BC Interior area.

**CPUE:** Catch per unit of effort. Typically associated with data obtained from test fisheries (e.g. number of fish caught per 100 fathom minutes ( a measure of net size and soak time)).

**Cycle line:** A series of years associated with a cohort of Fraser sockeye assuming spawners are 4 years old. A cycle line of a particular year includes every 4<sup>th</sup> year starting from that year (e.g., 2003, 2007, 2011).

**Difference between estimates (DBE):** Difference between estimates of potential spawning escapement (PSE) and spawning escapement (SE) ( $DBE = SE - PSE$ ,  $\%DBE = 100 * DBE / PSE$ ). The potential spawning escapement is defined as Mission escapement minus any in-river catch that occurs between Mission and the spawning areas. Sources for DBEs include en route mortality and errors (bias and imprecision) introduced through the estimates of Mission escapement, spawning ground escapement, First Nations and recreational catches above Mission, and stock composition. Historical DBE values are used to generate Management Adjustment (MA) models, which use estimates of migration timing and river conditions to predict the DBEs likely to be observed in the current year. DBEs may be represented as a number of fish or a percentage of the potential spawning escapement, and are related to pMAs through the formula:  $pDBE = (1 / (1 + pMA)) - 1$ . The proportional DBE is usually shown as a percentage, such that  $\%DBE = 100 * pDBE$ .

**Diversion rate:** Proportion of the salmon run that migrates through Johnstone Strait (northern approach) as opposed to Juan de Fuca Strait (southern approach). Estimates may be in time steps of a week or a few days, or a value for the entire migration on an annual basis.

**Economic Opportunity (EO) fishery:** Commercial Fraser River First Nations fishery in the Lower Fraser area.

**ESSR:** Terminal harvest of sockeye that are “Excess Salmon to Spawning Requirements”(e.g. Weaver Creek sockeye).

**Fishery-induced Mortality (FIM) or Release Mortality:** In fisheries where some component of the catch is released (e.g., non-retention), some proportion of the released fish are expected to die due to the stress of capture and handling. These mortalities are referred to as fishery-induced mortality or release mortality.

**Fishery Planning Model:** A pre-season model that allows the Panel to evaluate the impacts of various fishery options on the achievement of management objectives, given pre-season expectations such as abundance, stock composition, migration timing, diversion rate, spawning escapement targets, management adjustments and catch objectives.

**Food, Social and Ceremonial (FSC) fishery:** Non-commercial Fraser River First Nations fishery.



**Low Abundance Exploitation Rate (LAER):** The purpose of managing a sockeye management group in a LAER situation is to permit by-catch of that stock group in fisheries directed at other management groups or species with available surpluses (e.g., pink salmon). The application of a LAER for a management group has the effect of limiting the exploitation rate (ER) of that group to a small amount (e.g. 10% or 20% of a run timing group). The need to implement a LAER for a particular sockeye management group can be caused by one of the following:

- When the run size is below the lower fisheries reference point as defined by Canada's Spawning Escapement Plan.
- When the escapement goal plus the management adjustment (MA) is greater than the run size.
- When the escapement goal plus the MA is less than the run size but the resulting ER is less than the % LAER.

**Management Adjustment (MA):** Additional fish added to an escapement target for the purpose of increasing the likelihood of achieving the escapement target. Pre-season, MAs are typically calculated based on historical discrepancies or long range forecasts of river conditions. In-season the MAs for Early Stuart, Early Summer-run and Summer-run sockeye stocks, are calculated using models that relate historical discrepancies to river conditions. Estimates of migration timing and river conditions in the current year are then used to predict the proportional management adjustments (pMA) that are applied to spawning escapement targets. For Late-run stocks, MAs are often calculated based on models that relate historical discrepancies to upstream timing. The pMAs are multiplied by the spawning escapement targets to calculate numerical MAs. MAs are calculated pre-season as inputs for pre-season planning, and at regular intervals during the fishing season based on in-season estimates of migration timing, and observed and forecasted river conditions.

**Management group or Run-timing group:** Aggregates of sockeye salmon stocks that are used in Fraser Panel management, i.e., Early Stuart, Early Summer, Summer and Late-run groups.

**Migration date or 50% date:** Dates when half (50%) of the total run would have passed a certain geographical location if it is assumed that all fish migrated via that route.

**Area 20 date:** An index of marine migration timing, assuming the entire run migrated through Canadian fishery management Area 20 in Juan de Fuca Strait.

**Mission date:** An index of in-river migration timing, it is the date when 50% of a stock or management group is estimated to have passed the Mission hydroacoustic site.

**Reconstructed Mission date:** An index of in-river migration timing based on the reconstructed run to Mission (Mission escapements plus catches seaward of Mission). Reconstructed Mission dates are generally not available for Late-run stocks for which a portion of the run is expected to delay prior to entering the Fraser River.

**Mission Passage:** PSC estimates of the daily number of fish that migrate upstream past the hydroacoustic field station at Mission, B.C. Mission passage is primarily estimated by hydroacoustic methods, but at times (usually early and late in the season) is supplemented by expanded CPUE estimates derived from in-river test fisheries.

**Non-retention:** In fisheries where one species is targeted but by-catch of a second species is expected, regulations may specify that the fish of the second species be released. For example, sockeye salmon were expected to be caught in some pink-directed fisheries in 2011 but there was minimal TAC for Late-run Fraser sockeye remaining, so some fisheries were opened for pink salmon harvest but under conditions of either mandatory or voluntary non-retention for sockeye.

#### **Potential Spawning Escapement (PSE)**

**Potential spawning escapement target:** In-season target for PSE by management group, where the PSE is the sum of the spawning escapement target plus the management adjustment (MA). May also be called the "Adjusted Spawning Escapement target". The management objective is to achieve the PSE target in-season as measured by the potential spawning escapement.

**Potential spawning escapement:** Mission passage estimate minus in-river catch upstream of Mission. If there were no en-route mortalities or estimation errors in Mission passage, up-river catch, spawning escapement or stock identification, the potential spawning escapement would in theory equal the number of fish estimated to have reached the spawning areas.

**Run size:** Total abundance or total return of a stock, management group or entire population of Fraser River sockeye or pink salmon.

**Run-size Adjustment (RSA):** Additions to the total return in cases when there is evidence that more fish returned than were accounted for in catch and escapement, e.g., evidence of en route mortality, spawning grounds that did not have enumeration programs.

### Spawning Escapement

**Spawning escapement or Net escapement:** Spawning escapement of adult male and female spawners and jack spawners (precocious age 3 males) as estimated through enumeration programs conducted on the spawning grounds, or projected from other data when such programs are not conducted in all areas (e.g., Quesnel spawners in 2002). Such escapement numbers do not include losses from pre-spawn mortality on the spawning grounds, however, pre-spawn mortality is accounted for in estimates of effective female spawners.

**Spawning escapement target:** Target for total adult spawning escapement for each spawning population as defined each year by Canada's Spawning Escapement Plan.

**Total Allowable Mortality rule (TAM rule):** For each Fraser sockeye management group at different run sizes, Canada's Spawning Escapement Plan specifies the total allowable mortality from all sources, including fishery removals (catch) and en route mortality (represented by the Management Adjustment).

### List of abbreviations

ADFG: Alaska Department of Fish and Game	JS: Johnstone Strait
AFE: Aboriginal Fishery Exemption	LAER: Low Abundance Exploitation Rate
BC: Province of British Columbia	LGL: A biological consulting company
DBE: Difference between estimates	MA: Management Adjustment
CPUE: Catch per Unit of Effort	MLP: Mandatory Landing Program
DFO: Fisheries and Oceans Canada	M-R: Mark-recapture
DIDSON: Dual-frequency IDentification SONar	pMA: Proportional Management Adjustment
EO: Economic Opportunity	PSC: Pacific Salmon Commission
ESSR: Excess Salmon to Spawning Requirements	PSE: Potential spawning escapement
FRP: Fraser River Panel	RSA: Run Size Adjustment
FRPTC: Fraser River Panel Technical Committee	SE: Spawning Escapement
FSC: "Food, social and ceremonial"	SET: Spawning Escapement Target
	TAC: Total Allowable Catch
	TAM: Total Allowable Mortality
	WDFW: Washington Department of Fish and Wildlife

**APPENDIX B: 2014 Revised Annex IV Chapter 4 of the Pacific Salmon Treaty  
(revised May 16, 2014)**

**Chapter 4: Fraser River Sockeye and Pink Salmon**

1. The provisions of this Chapter shall apply for the period 2014 through 2019.
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, the U.S. catch in the Fraser Panel Area shall not exceed 16.5 percent of the TAC;
  - (b) 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 (excluding any catch of Fraser River sockeye identified in Alaskan waters) after the spawning escapement targets established, unless otherwise agreed, by application of Canada’s pre-season escapement plan (subject to any adjustments made pursuant to paragraph 3(b), below), 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 and procedures apply to TAC calculations:
  - (a) The annual U.S. share shall be computed based on the inseason run size estimates in effect at the time the Panel relinquishes control of the U.S. Panel waters, using the escapement targets established by application of Canada’s preseason escapement plan as may be adjusted pursuant to paragraph 3(b), below, and taking into account any adjustments as provided in paragraph 8, below.
  - (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 identified 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. In the event the Fraser River Panel does not agree to additional escapement amounts, the PSC staff will make a recommendation which shall become effective upon agreement by at least one national section of the Panel. Any additional escapement amounts believed necessary by Canada above those determined pursuant to the foregoing will not affect the U.S. share.
  - (c) The agreed Fraser River Aboriginal Fishery Exemption (AFE) 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 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 group, the AFE 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 (AFE), 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 and as otherwise agreed by the Fraser River Panel. If either pre-season or in-season, there is insufficient harvestable surplus (defined as run size minus escapement goal, minus management adjustments made pursuant to paragraph 3(b), minus test fishing catches) in any stock management group to allow for the total AFE distribution to that stock management group as described above, the AFE for that stock management group will be the greater of: a) the catch, b) the projected catch by aboriginal fisheries or c) the available harvestable surplus. The remaining balance of

AFE not distributed to that stock management group will be re-distributed to the other stock management groups in the same proportions as specified above, unless otherwise agreed by the Fraser River Panel. The Fraser River Panel shall develop agreed procedures for implementing potential AFE redistributions as part of its preseason planning process. The harvest distribution of Early Stuart sockeye is expected to remain similar to that of recent years.

- (e) Each Fraser River sockeye stock is assigned to one of four stock management groups. The stock management groups are Early Stuart, Early Summer, Mid-Summer and Late Run. The annual U.S. share of sockeye available for harvest in the Panel Area is computed by applying the percentage share provided in paragraph 2(a) to the aggregate TAC, defined as the sum of the TACs computed for each of the four stock management groups. To the extent practicable, the Fraser River Panel shall develop and implement a fishing plan that provides the U.S. fishery with the opportunity to harvest its 16.5% aggregate share of the TAC of Fraser River sockeye. To accomplish this, the Panel to the extent practical, shall strive to concentrate the U.S. sockeye fishery on the most abundant management group (or groups), i.e., those that provide the largest percentage of the available TAC. It is understood that, despite concentrating the U.S. harvest in this manner, the overlapping of management groups may result in greater than 16.5% of the TAC for one or more of the less abundant management groups being taken by the U.S. fishery. A small but acceptable rate of incidental harvest may occur on one or more overlapping management groups that have little or no TAC as defined in this Chapter.
  - (f) Notwithstanding paragraph 3(e), in order to address specific conservation and harvest objectives in any given year the Panel may by agreement assign Fraser River sockeye stocks to five or more management groups. In the event the Panel adopts more than four Fraser River sockeye stock management groups, the TAC calculation, overlapping stock harvest approach, and incidental harvest provisions would apply in a similar fashion as per the four stock management groupings as in paragraph 3(e). As part of the decision to adopt more than four stock management groups the Panel will agree on how the AFE would be apportioned amongst the stock management groups.
  - (g) To the extent practicable, the Fraser River Panel shall develop and implement a fishing plan that provides the U.S. fishery with the opportunity to harvest its 25.7% share of the Fraser River pink salmon TAC. To accomplish this, the Panel shall take into consideration the availability of both the sockeye salmon TAC and pink salmon TAC, through the entire fishing season, while to the extent practical, minimizing the impacts on overlapping sockeye management groups with little or no TAC. It is understood that the overlapping of sockeye and pink salmon migrations may result in a small but acceptable rate of incidental harvest on one or more overlapping sockeye management groups that have little or no TAC as defined in this Chapter.
- 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 run size forecasts of U.S. origin sockeye and pink salmon stocks affected by Panel management.
  - 5. The Fraser River Panel shall 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. Annually, the U.S. share shall be adjusted for harvest overages and underages based on post-season catch estimates as follows:
  - (a) The U.S. share shall be adjusted in the amount of any harvest overage or underage of the same species from the previous year or years as provided in subparagraphs (b) and (c), below. In making such adjustment, the U.S. current year share will not be reduced by more than 5 percent nor increased by more than 15 percent because of the adjustment, unless otherwise agreed. The Fraser River Panel shall attempt to fully implement any adjustments to the U.S. share 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.
  - (b) The U.S. share will be adjusted to account for management imprecision in U.S. fisheries subject to the limitations prescribed in subparagraph (c). Additionally, the U.S. share will be adjusted for underages which occur as a result of Canada directly impeding the U.S. from pursuing its in-season share of the TAC. This latter circumstance will be noted in-season by the Panel including the effect Canada's catch had on impeding the U.S. pursuit of its in-season share, and will be compensated for as an underage pursuant to paragraph (a).
  - (c) The U.S. share will not be adjusted:
    - (i) for underages which occur because the U.S. fishery failed to deploy sufficient effort;
    - (ii) for underages which occur because too few fish were available to the U.S. fishery due to migration patterns (e.g., diversion rates) or harvesting constraints for intermingled stocks or species; or
    - (iii) for that portion of an underage resulting from an increase in the estimated TAC identified after the year's fishery has ended but which would not have been available due to harvest constraints for intermingled stocks or species.
    - (iv) for an overage resulting from TAC reductions after the scheduling of the last Fraser River Panel approved U.S. fishery of the season.
    - (v) for any harvest of Fraser River sockeye that occurs in Alaska.
  - (d) Fisheries that occur after the last U.S. Fraser River Panel approved fishery are expected to remain similar to those of recent years.
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.
13. Pursuant to the Parties' obligations under Article VI the Panel will use the following in-season decision process:
- (a) The mid-point forecast provided by Canada shall be used for management purposes until in-season updates of run size become available. Based upon advice from the Fraser River Panel Technical Committee and PSC staff, the Panel may adopt a more precautionary or optimistic applications of the forecast information until in-season updates of run size are available. PSC staff shall provide the Fraser River Panel with recommendations for in-season run size and other factors relevant to sound fisheries management decisions. Based on information such as, but not limited to, in-season estimates of run timing and diversion rate, the PSC staff shall make recommendations to the Fraser River Panel regarding in-season decision making.
  - (b) PSC staff shall provide the Fraser River Panel with projected harvestable surpluses and status of harvest from fisheries under Panel management. These projections will incorporate any Fraser River Panel agreement on management adjustments that deal with environmental conditions during in-river migration that could significantly impact the Fraser River Panel's ability to achieve spawning escapement objectives and other considerations agreed to by the Panel.
  - (c) Any changes from PSC staff recommendations for points 13(a) and 13(b) above shall be based on bilateral agreement between the National Sections of the Fraser Panel. Acceptance of the PSC staff recommendation requires approval of at least one of the National Sections.

- (d) The respective National Sections of the Panel will develop proposed regulations for their domestic Panel Area fisheries consistent with recommendations and projections provided by the PSC staff as described in 13(a) and 13(b) as may be modified pursuant to 13(c). Either National Section may ask PSC staff for advice in designing its fisheries proposals. PSC staff shall assess and provide advice as to whether proposed fishery regulations for Panel Area fisheries are consistent with recommendations and projections described in 13(a) and 13(b) and Panel objectives. Subsequently, after full discussion of a Panel Area fishery proposal, the following may occur: (i) the Panel may adopt the proposal based on bilateral agreement or; (ii) the proposing National Section may modify and re-submit its proposal in response to advice from staff and/or concern(s) raised by the other National Section; or (iii) while acknowledging objection(s) of the other National Section, the Panel shall approve the fishery proposal. In the event that the Panel approves a fishery under the provisions of the latter circumstance (13(d)(iii)), prior to the commencement of the proposed fishery, the proposing National Section must provide a written rationale for the fishery as submitted.
- (e) If post-season a Party believes that it has been adversely affected by a fishery that had been objected to pursuant to paragraph 13(d)(iii) above or paragraph 13 (f) below; the PSC staff shall prepare an objective report on the circumstances of the fishery and its consequences for the January PSC meeting following the season in question. The Panel shall review the staff report and determine what action is required. If the Panel cannot come to agreement on the appropriate action, the issue shall be referred to the Commission for resolution during its February annual meeting.
- (f) Pursuant with Article VI, paragraph 7 of the treaty, the Parties shall communicate and consult with one another in a timely manner regarding their fishing plans for Fraser River sockeye outside of the Panel's regulatory control. In the event that a party has an objection to the other party's fishing plans as they relate to achievement of Panel objective, the implementing party will provide the rational for such plans.

14. The Parties agree that:

- (a) Fraser River sockeye are caught incidental to fisheries in Alaska District 104 directed at pink salmon;
- (b) Fraser River sockeye comprise a minor portion of the catch in that fishery and are not the target stock in that fishery;
- (c) the extent of these incidental catches is unpredictable from year to year; and paragraph 8(c)(v) is premised along with other considerations between the Parties, on these circumstances continuing.



## APPENDIX C: 2014 Pre-Season Forecasts and Spawning Escapement Targets for Fraser River Sockeye Salmon

**Table C1.** Pre-season forecasts for Fraser River sockeye salmon in 2014, provided to the Panel by Fisheries and Oceans Canada.

Run timing group	Forecast Model <sup>b</sup>	C D E			F G		H I J K L				
		BY (10)	BY (09)	Ret	Mean Run Size		Probability that Return will be at/or Below Specified Run Size <sup>a</sup>				
		(EFS)	(EFS)	2014	all cycles <sup>c</sup>	2014 cycle <sup>d</sup>	10%	25%	50%	75%	90%
Stocks											
<sup>xx</sup> Early Stuart	Ricker (Ei)	34,200	21,900		308,000	126,000	132,000	189,000	299,000	476,000	709,000
Early Summer (total excluding miscellaneous)					--	--	730,000	1,741,000	4,126,000	8,470,000	16,805,000
Bowron	MRS	4,400	1,000		527,000	897,000	523,000	1,279,000	3,111,000	6,845,000	13,898,000
Fennell	power	5,500	700		39,000	26,000	8,000	15,000	30,000	60,000	113,000
Gates	Larkin	5,900	5,300		25,000	20,000	9,000	13,000	24,000	41,000	68,000
Nadina	MRJ	11,900	3,700		53,000	18,000	31,000	47,000	79,000	131,000	228,000
Pitt	Larkin	8,800	18,800		79,000	26,000	26,000	51,000	109,000	233,000	460,000
**Scotch	Ricker	273,900	2,700		71,000	59,000	31,000	46,000	73,000	127,000	208,000
**Seymour	Ricker	287,500	3,100		113,000	390,000	264,000	678,000	1,542,000	3,328,000	6,993,000
Misc (EShu & Taseko) <sup>e</sup>	RS (Sc/Se)+RS(Chilko)	119,500	1,600		147,000	358,000	154,000	429,000	1,254,000	2,925,000	5,828,000
Misc (Chilliwack) <sup>f</sup>	RS (Esum)	1,500	2,400		--	--	198,000	444,000	982,000	1,565,000	2,795,000
Misc (Nahatlatch) <sup>f</sup>	RS (Esum)	2,900	700		--	--	4,000	8,000	14,000	26,000	48,000
Summer (total excluding miscellaneous)					--	--	5,000	10,000	19,000	34,000	64,000
Chilko <sup>g</sup>	power (juv) (Pi)	54.9 M	34.4 M		3,879,000	3,483,000	2,127,000	3,393,000	5,699,000	10,116,000	17,781,000
Late Stuart	power	43,500	43,300		2,118,000	2,118,000	2,118,000	3,377,000	5,670,000	10,058,000	17,667,000
Quesnel	Ricker-cyc	133,000	82,800		1,405,000	1,484,000	1,121,000	1,670,000	2,615,000	4,274,000	6,790,000
Stellako	Larkin	110,300	15,900		554,000	232,000	92,000	172,000	329,000	672,000	1,308,000
Raft <sup>h</sup>	Ricker (PDO)	2,400	6,000		1,345,000	1,050,000	467,000	845,000	1,524,000	2,950,000	5,864,000
**Harrison <sup>h &amp; i</sup>	Adjusted RIC	399,700	387,100		461,000	548,000	303,000	437,000	690,000	1,119,000	1,719,000
Misc (N. Thomp. Tribs) <sup>h &amp; j</sup>	R/S (Ra/Fe)	600	1,000		31,000	22,000	17,000	25,000	39,000	63,000	98,000
Misc (N. Thomp River) <sup>h &amp; j</sup>	R/S (Ra/Fe)	3,200	1,700		83,000	147,000	118,000	228,000	473,000	980,000	1,888,000
Late (total excluding miscellaneous)					--	--	2,000	3,000	6,000	12,000	23,000
Cultus <sup>g</sup>	MRJ	318,400	174,000		--	--	7,000	13,000	23,000	46,000	91,000
**Late Shuswap	Ricker-cyc	3.1 M	20,200		3,222,000	8,967,000	4,248,000	7,465,000	12,730,000	22,059,000	36,719,000
Portage	Larkin	26,700	800		4,230,000	7,432,000	4,230,000	7,432,000	12,670,000	21,955,000	36,534,000
Weaver	MRS	25,300	12,900		39,000	36,000	3,000	6,000	13,000	28,000	56,000
<sup>xx</sup> Birkenhead	Ricker (Ei)	67,800	34,500		2,414,000	7,791,000	3,900,000	6,894,000	11,730,000	20,240,000	33,503,000
Misc. non-Shuswap <sup>k</sup>	R/S (Lillooet-Harrison)	7,400	5,100		43,000	76,000	20,000	45,000	111,000	265,000	657,000
TOTAL SOCKEYE SALMON					361,000	576,000	102,000	176,000	323,000	591,000	1,019,000
(TOTAL excluding miscellaneous)					365,000	488,000	205,000	311,000	493,000	831,000	1,299,000
					--	--	18,000	33,000	60,000	104,000	185,000
					7,936,000	13,473,000	7,237,000	12,788,000	22,854,000	41,121,000	72,014,000
							7,003,000	12,277,000	21,750,000	39,334,000	68,808,000

**\*\*Note that for Scotch, Seymour, Harrison, Late Shuswap and Portage Creek, these stocks were forecast using record brood year EFS, as a result, these forecasts are particularly uncertain given the forecast models are extrapolating beyond the observed data range.**

**xxNote that Early Stuart and Birkenhead, for different reasons, have biased brood year escapement estimates in 2010, which adds additional uncertainty to the 2014 forecasts.**

- Probability that return will be at, or below, specified projection.
- See Table 5 for model descriptions
- Sockeye: 1953-2010 (depending on start of time series)
- Sockeye: 1954-2010 (depending on start of time series)
- Misc. Early Shuswap stocks use Scotch and Seymour R/EFS in forecast; Misc. Taseko uses Chilko R/EFS in forecast
- Misc. Chilliwack & Nahatlatch use Early Summer Run stocks R/EFS in forecast
- Brood year smolts in columns C & D (not effective females)
- Raft, Harrison, Miscellaneous North Thompson stocks moved in current forecast to Summer Run timing group due to changes in run timing of these stocks
- Harrison are age-4 (column C) and age-3 (column D).
- Misc. North Thompson stocks use Raft & Fennel R/EFS in forecast
- Misc. Late Run stocks (Harrison Lake down stream migrants including Big Silver, Cogburn, etc.) use Birkenhead R/EFS in forecast

**\*\* Harrison forecasts are extremely uncertain due to age-proportion variations and brood year escapements (2010/2011) that are out of the historical data range**

Definitions: BY: Brood year; BY9: brood year 2009; BY10: brood year 2010; EFS: effective female spawners; Ei (Entrance Island sea-surface-temperature); PDO (Pacific Decadal Oscillation).

**Table C2.** Spawning escapement plan for Fraser River sockeye salmon in 2014, provided to the Panel by Fisheries and Oceans Canada.

**Raft North Thompson & Harrison in Summer Run. Adjusted Early Stuart TAM & variable Late Run LAER.**

		Harvest Rule Parameters				
		Low		Lower Fishery	Upper Fishery	
		Abundance ER		Reference	Reference	Pre-season
Management Unit		(LAER)	TAM Cap	Point	Point	pMA
Early Stuart		10%	60%	108,000	270,000	0.66
Early Summer (w/o misc)		10%	65%	180,000	514,000	0.42
Summer (w/o misc)		10%	65%	1,020,000	2,914,000	0.08
Late (w/o misc)		20-30%	65%	1,100,000	3,143,000	0.39

Management Unit	Pre-season Forecast Return				
	p10	p25	p50	p75	p90
Early Stuart forecast	132,000	189,000	299,000	476,000	709,000
TAM Rule (%)	18%	43%	60%	60%	60%
Escapement Target	108,000	108,000	119,600	190,400	283,600
MA	71,300	71,300	78,900	125,700	187,200
Esc. Target + MA	179,300	179,300	198,500	316,100	470,800
LAER	10%	10%	10%	10%	10%
ER at Return	0%	5%	34%	34%	34%
Allowable ER	10%	10%	34%	34%	34%
available harvest	13,200	18,900	100,500	159,900	238,200
<u>2014 Performance</u>					
Projected S (after MA)	72,000	102,000	120,000	190,000	284,000
BY Spawners	60,300	60,300	60,300	60,300	60,300
Proj. S as % BY S	119%	169%	199%	315%	471%
cycle avg S	36,500	36,500	36,500	36,500	36,500
Proj. S as % cycle S	197%	279%	329%	521%	778%

Management Unit	Pre-season Forecast Return				
	p10	p25	p50	p75	p90
Early Summer (w/o RNT) lower ref. pt. (w misc)	251,000	245,000	239,000	223,000	218,000
upper ref. pt. (w misc)	717,000	700,000	682,000	636,000	622,000
forecast (incl. misc)	730,000	1,741,000	4,126,000	8,470,000	16,805,000
TAM Rule (%)	65%	65%	65%	65%	65%
Escapement Target	255,500	609,350	1,444,100	2,964,500	5,881,750
MA	107,300	255,900	606,500	1,245,100	2,470,300
Esc. Target + MA	362,800	865,250	2,050,600	4,209,600	8,352,050
LAER	10%	10%	10%	10%	10%
ER at Return	50%	50%	50%	50%	50%
Allowable ER	50%	50%	50%	50%	50%
available harvest	367,200	875,750	2,075,400	4,260,400	8,452,950
<u>2014 Performance</u>					
Projected S (after MA)	255,000	609,000	1,444,000	2,965,000	5,882,000
BY Spawners	1,524,700	1,524,700	1,524,700	1,524,700	1,524,700
Proj. S as % BY S	17%	40%	95%	194%	386%
cycle avg S	291,400	291,400	291,400	291,400	291,400
Proj. S as % cycle S	88%	209%	496%	1018%	2019%

Table C2, continued on next page

Table C2, continued.

Management Unit		Pre-season Forecast Return				
		p10	p25	p50	p75	p90
<b>Summer</b> <b>(w. RNT &amp; Har)</b>	lower ref. pt. (w misc)	1,119,000	1,119,000	<b>1,119,000</b>	1,119,000	1,119,000
	upper ref. pt. (w misc)	3,195,000	3,195,000	<b>3,195,000</b>	3,195,000	3,195,000
	forecast	2,127,000	3,393,000	<b>5,699,000</b>	10,116,000	17,781,000
TAM Rule (%)		47%	65%	<b>65%</b>	65%	65%
Escapement Target		1,119,000	1,187,550	<b>1,994,650</b>	3,540,600	6,223,350
MA		89,500	95,000	<b>159,600</b>	283,200	497,900
Esc. Target + MA		1,208,500	1,282,550	<b>2,154,250</b>	3,823,800	6,721,250
LAER		10%	10%	<b>10%</b>	10%	10%
ER at Return		43%	62%	<b>62%</b>	62%	62%
Allowable ER		43%	62%	<b>62%</b>	62%	62%
available harvest		918,500	2,110,450	<b>3,544,750</b>	6,292,200	11,059,750
2014 Performance						
Projected S (after MA)		1,119,000	1,188,000	<b>1,995,000</b>	3,541,000	6,223,000
BY Spawners		3,757,100	3,757,100	<b>3,757,100</b>	3,757,100	3,757,100
Proj. S as % BY S		30%	32%	<b>53%</b>	94%	166%
cycle avg S		1,113,200	1,113,200	<b>1,113,200</b>	1,113,200	1,113,200
Proj. S as % cycle S		101%	107%	<b>179%</b>	318%	559%
Management Unit		Pre-season Forecast Return				
		p10	p25	p50	p75	p90
<b>Late</b> <b>(w/o Har)</b>	lower ref. pt. (w misc)	1,105,000	1,105,000	<b>1,105,000</b>	1,105,000	1,105,000
	upper ref. pt. (w misc)	3,158,000	3,158,000	<b>3,158,000</b>	3,158,000	3,158,000
	forecast	4,248,000	7,465,000	<b>12,730,000</b>	22,059,000	36,719,000
TAM Rule (%)		65%	65%	<b>65%</b>	65%	65%
Escapement Target		1,486,800	2,612,750	<b>4,455,500</b>	7,720,650	12,851,650
MA		579,900	1,019,000	<b>1,737,600</b>	3,011,100	5,012,100
Esc. Target + MA		2,066,700	3,631,750	<b>6,193,100</b>	10,731,750	17,863,750
LAER		20%	20%	<b>20%</b>	30%	30%
ER at Return		51%	51%	<b>51%</b>	51%	51%
Allowable ER		51%	51%	<b>51%</b>	51%	51%
available harvest		2,181,300	3,833,250	<b>6,536,900</b>	11,327,250	18,855,250
2014 Performance						
Projected S (after MA)		1,487,000	2,613,000	<b>4,455,000</b>	7,721,000	12,852,000
BY Spawners		7,788,900	7,788,900	<b>7,788,900</b>	7,788,900	7,788,900
Proj. S as % BY S		19%	34%	<b>57%</b>	99%	165%
cycle avg S		2,902,000	2,902,000	<b>2,902,000</b>	2,902,000	2,902,000
Proj. S as % cycle S		51%	90%	<b>154%</b>	266%	443%
Available Harvest (TF, US, CDN)		3,480,200	6,838,350	<b>12,257,550</b>	22,039,750	38,606,150
<b>Total projected spawners</b>		<b>2,933,000</b>	<b>4,512,000</b>	<b>8,014,000</b>	<b>14,417,000</b>	<b>25,241,000</b>

## **APPENDIX D: 2014 Fraser River Panel Management Plan Principles and Constraints (agreed July 15, 2014)**

1. Fisheries and Oceans Canada (DFO) has provided the Panel with run-size forecasts for Fraser River sockeye salmon. It is broadly understood that the Fraser River sockeye run-size forecasts are associated with relatively high uncertainty due to high variability in annual salmon productivity (recruits/spawner) and observation error in the stock-recruitment data. For pre-season planning purposes, the Panel used the 50% probability levels of abundance for the forecasted sockeye stocks (22,854,000 fish). To put the sockeye run size forecast uncertainty into context, there is a one in four chance that the actual number of returning sockeye will be at or below 12,788,000 fish and there is a three in four chance that the actual number of returning sockeye will be at or below 41,121,000 fish. By stock grouping, the 50% probability forecasts are 299,000 Early Stuart, 4,126,000 Early Summer-run, 5,699,000 Summer-run, and 12,730,000 Late-run sockeye<sup>11</sup>. When sufficient information is available in-season, the Panel will update run size estimates of Fraser River sockeye salmon, as appropriate.
2. The Panel's first priority in 2014 is to achieve spawning escapement goals by stock or stock grouping. A coordinated approach to management has been developed that reflects both Parties sharing the burden of conservation.
3. TAC and international shares will be calculated according to the 2014 revised Annex IV, Chapter 4, of the Pacific Salmon Treaty, which limits the United States harvest (in Washington State) to 16.5% of the total allowable catch (TAC) of Fraser River sockeye salmon. Based upon the 50% probability levels of abundance, for the purposes of computing TAC by stock management grouping in 2014, the Panel agreed to pre-season Fraser River Aboriginal Exemptions as follows: Early Stuart sockeye, 80,000 fish; Early Summer-run sockeye, 47,400 fish; Summer-run sockeye, 133,500 fish; and Late-run sockeye, 139,100 fish. In situations where the allowable harvest of a management group, according to Total Allowable Mortality rules as defined in Canada's escapement plan, is less than the harvest allowed under the low abundance exploitation rates (LAERs), the Panel will implement LAERs in order to allow access to available TAC in other management groups. At the 50% probability forecasts, the LAERs set at 10% for Early Stuart, Early Summer and Summer-run sockeye, and at 20% for Late-run sockeye, are not intended to create directed harvest opportunities in mixed stock areas and do not contribute to International TACs. Calculated International TACs that fall below the LAER amount will contribute to the International share.
4. The Panel has adopted a management approach for Late-run sockeye that presumes that similar to recent years, Late-run sockeye will enter the Fraser River earlier than the long-term average, and some proportion will not survive to spawn.
5. Given pre-season assumptions about Late-run sockeye marine timing and recent delay behavior, the Fraser Panel has agreed to use the mean Management Adjustment (pMA) for the 2014 cycle (including 1998, 2002 and 2010, but excluding 2006) of 0.28. The Panel will review alternate methods for predicting the pMA should upstream migration occur earlier than expected in 2014. That review, and adoption of any alternate approach for predicting the pMA in-season, will be completed by July 29.

### **Regulations**

- i) If the abundance of Early Summer-run sockeye salmon is tracking at approximately the 50% probability level (4,126,000 fish) and the abundance of Summer-run sockeye salmon is tracking at approximately the 50% probability level (5,699,000 fish) and the runs arrive at or near expected dates, low impact fisheries would be expected to commence during late July in Panel Waters. The actual start dates and duration of fisheries will depend on in-season estimates of timing and abundance.
- ii) The Parties' conservation concerns for other species and stocks will be taken into account throughout the 2014 management season.

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<sup>11</sup> Similar to the 2013 management season, Raft, North Thompson, and Harrison sockeye will again be managed as part of the Summer-run group in 2014.

## **APPENDIX E: 2014 Regulations**

The Fraser River Panel approved regulations for the management of the Fraser River sockeye salmon fishery in Panel Area waters and submitted these to the Pacific Salmon Commission. The Commission approved the Fishery Regime and Regulations and submitted these to the respective national governments for approval on June 19, 2014.

### **Canadian Fraser River Panel Area**

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends to the Canadian Government 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 29th day of June, 2014, to the 13th day of September, 2014, 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 29th day of June, 2014, to the 13th day of September, 2014, 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 29th day of June, 2014 to the 27th day of September, 2014, 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 29th day of June, 2014, to the 27th day of September, 2014, 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 29th day of June, 2014, to the 18th day of October, 2014, both dates inclusive.
  - b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 29th day of June, 2014, to the 18th day of October, 2014, 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 2014 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 2014 Management Plan adopted by the Panel. This Plan will be designed to achieve Pacific Salmon Treaty-mandated conservation objectives, 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 29th day of June, 2014 to the 13th day of September, 2014, 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 29th day of June, 2014, to the 20th day of September, 2014, 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 21st day of September, 2014, to the 4th day of October, 2014, 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 29th day of June, 2014, to the 13th day of September, 2014, 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 29th day of June, 2014, to the 20th day of September, 2014, 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 21st day of September, 2014, to the 4th day of October, 2014, both dates inclusive.

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

### Treaty Indian and All-Citizen Fisheries:

4. High Seas westerly of the Bonilla Point-Tatoosh Island Lighthouse Line.
5. Puget Sound Salmon Management and Catch Reporting Areas 6B, 6D, 7B, 7C, 7D and 7E.

During the 2014 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 2014 Management Plan adopted by the Panel. This Plan will be designed to achieve Pacific Salmon Treaty-mandated conservation objectives, international allocations of the catch, and domestic goals of the Parties.

## APPENDIX F: 2014 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.

July 29, 2014

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Open to drift gillnets 12:00 p.m. (noon), Thursday, July 31, 2014, to 12:00 p.m. (noon) Saturday, August 2, 2014.

August 1, 2014

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon), Saturday, August 2, 2014, to 12:00 p.m. (noon) Wednesday, August 6, 2014.

August 5, 2014

Canada

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

Open to Area H troll ITQ fishery from 12:01 a.m. Wednesday August 6, 2014 until further notice.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Wednesday, August 6, 2014, to 12:00 p.m. (noon) Saturday, August 9, 2014.

Areas 6, 7 and 7A

Open to net fishing from 5:00 a.m. Thursday, August 7, 2014 through 9:00 a.m. Saturday, August 9, 2014.

All Citizen Fishery

Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Saturday, August 9, 2014.

Area 7 and 7A

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Saturday, August 9, 2014.

Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. Sunday, August 10, 2014.

August 8, 2014

Canada

Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17

Open to Area E gillnets from 3:00 p.m. to 6:00 p.m., Monday, August 11, 2014.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Saturday, August 9, 2014, to 12:00 p.m. (noon) Wednesday, August 13, 2014.

Areas 6, 7 and 7A

Open for net fishing from 5:00 a.m. Sunday, August 10, 2014 through 9:00 a.m. Tuesday, August 12, 2014.

All Citizen Fishery

Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Tuesday, August 12, 2014.



Area 7 and 7A

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Tuesday, August 12, 2014.

Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. Monday, August 11, 2014.

August 12, 2014

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Wednesday, August 13, 2014, to 12:00 p.m. (noon) Saturday, August 16, 2014.

Areas 6, 7 and 7A

Open for net fishing from 5:00 a.m. Wednesday, August 13, 2014 through 9:00 a.m. Thursday, August 14, 2014 and from 5:00 a.m. Friday, August 15, 2014 through 9:00 a.m. Saturday, August 16, 2014.

All Citizen Fishery

Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Thursday, August 14, 2014.

Area 7 and 7A

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Thursday, August 14, 2014.

Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. Wednesday, August 13, 2014.

August 15, 2014

Canada

Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17

Open to Area E gillnets from 11:00 a.m. to 5:00 p.m., Tuesday, August 19, 2014.

Areas 123 and 124

Open to Area G troll ITQ fishery from 12:01 a.m. Sunday, August 17 to 11:59 p.m. Monday, August 18, 2014.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Saturday, August 16, 2014, to 12:00 p.m. (noon) Wednesday, August 20, 2014.

Areas 6, 7 and 7A

Extended for net fishing from 9:00 a.m. Saturday, August 16, 2014 through 9:00 a.m. Monday, August 18, 2014.

Areas 6, 7 and 7A

Open for net fishing from 5:00 a.m. Tuesday, August 19, 2014 through 9:00 a.m. Wednesday, August 20, 2014.

All Citizen Fishery

Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Monday, August 18, 2014.

Area 7 and 7A

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Monday, August 18, 2014.

Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. Monday, August 18, 2014.

August 19, 2014

Canada

Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17

Extended for Area E gillnets from 5:00 p.m. Tuesday, August 19, 2014 to 7:00 p.m. Tuesday, August 19, 2014.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Wednesday, August 20, 2014, to 12:00 p.m. (noon) Saturday, August 23, 2014.

Areas 6, 7 and 7A

Extended for net fishing from 9:00 a.m. Wednesday, August 20, 2014 through 9:00 a.m. Thursday, August 21, 2014.

All Citizen Fishery

Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Thursday, August 21, 2014 and Friday, August 22, 2014.

Area 7 and 7A

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Thursday, August 21, 2014 and Friday, August 22, 2014.

Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Wednesday, August 20, 2014, through Friday, August 22, 2014.

August 22, 2014

Canada

Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17

Open to Area E gillnets from 8:00 a.m. Monday, August 25, 2014, to 8:00 a.m. Tuesday, August 26, 2014.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Saturday, August 23, 2014, to 12:00 p.m. (noon) Wednesday, August 27, 2014.

Areas 6, 7 and 7A

Open net fishing from 5:00 a.m. Saturday, August 23, 2014 through 9:00 a.m. Monday, August 25, 2014.

All Citizen Fishery

Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Monday, August 25, 2014 and Tuesday, August 26, 2014.

Area 7 and 7A

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Monday, August 25, 2014 and Tuesday, August 26, 2014.

Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Saturday, August 23, 2014 through Tuesday, August 26, 2014.

August 26, 2014

Canada

Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17

Open to Area E gillnets from 8:00 a.m. Wednesday, August 27, 2014, to 8:00 p.m. Wednesday, August 27, 2014.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets 12:00 p.m. (noon), Wednesday, August 27, 2014, to 12:00 p.m. (noon) Saturday, August 30, 2014.

Areas 6, 7 and 7A

Open to net fishing from 5:00 a.m. Wednesday, August 27, 2014 through 9:00 a.m. Saturday, August 30, 2014.

**All Citizen Fishery**

**Area 7 and 7A**

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Wednesday, August 27, 2014 through Friday, August 29, 2014.

August 29, 2014

**Canada**

**Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17**

Open to Area E gillnets from 9:00 a.m. to 3:00 p.m. Tuesday, September 2, 2014.

**United States**

**Treaty Indian Fishery**

**Areas 4B, 5 and 6C**

Extended for drift gillnets 12:00 p.m. (noon), Saturday, August 30, 2014, to 12:00 p.m. (noon) Wednesday, September 3, 2014.

**Areas 6, 7 and 7A**

Extended for net fishing from 9:00 a.m. Saturday, August 30, 2014 through 9:00 a.m. Sunday, August 31, 2014.

**Areas 6, 7 and 7A**

Open for net fishing from 12:01 a.m. (midnight) Tuesday, September 2, 2014 through 9:00 a.m. Wednesday, September 3, 2014.

**All Citizen Fishery**

**Area 7 and 7A**

Open to purse seines from 5:00 a.m. to 9:00 p.m. Sunday August 31, 2014.

**Area 7 and 7A**

Open to gillnets from 8:00 a.m. to 11:59 p.m. (midnight) Monday, September 1, 2014.

**Area 7 and 7A**

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Saturday, August 30, 2014 through Tuesday, September 2, 2014.

September 2, 2014

**Canada**

**Area 29: Portions of 29- 3, 4, 6, 7, 9, 10 and 11 to 17**

Extended for Area E gillnets from 3:00 p.m. to 5:00 p.m. Tuesday, September 2, 2014.

**Area 29: Portions of 29- 3, 4, 9, 10 and 11 to 17**

Open to Area E gillnets from 10:00 a.m. to 6:00 p.m. Thursday, September 4, 2014.

**United States**

**Treaty Indian Fishery**

**Areas 4B, 5 and 6C**

Extended for drift gillnets 12:00 p.m. (noon), Wednesday, September 3, 2014, to 12:00 p.m. (noon) Saturday, September 6, 2014.

**Areas 6, 7 and 7A**

Extended for net fishing from 9:00 a.m. Wednesday, September 3, 2014 through 9:00 a.m. Friday, September 5, 2014.

**All Citizen Fishery**

**Area 7 and 7A**

Open to purse seines from 5:00 a.m. to 9:00 p.m. Friday September 5, 2014.

**Area 7 and 7A**

Open to gillnets from 8:05 a.m. to 11:59 p.m. (midnight) Friday, September 5, 2014.

**Area 7 and 7A**

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Wednesday, September 3, 2014 through Friday, September 5, 2014.

## September 5, 2014

### Canada

#### Area 29: Portions of 29- 3, 4, 9, 10 and 11 to 17

Open to Area E gillnets from 8:00 a.m. Monday, September 8, 2014 to 8:00 a.m. Tuesday, September 9, 2014.

### United States

#### Treaty Indian Fishery

##### Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon), Saturday, September 6, 2014, to 12:00 p.m. (noon) Wednesday, September 10, 2014.

##### Areas 6, 7 and 7A

Open for net fishing from 5:00 a.m. Sunday, September 7, 2014 through 9:00 a.m. Wednesday, September 10, 2014.

#### All Citizen Fishery

##### Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Saturday September 6, 2014.

##### Area 7 and 7A

Open to gillnets from 8:10 a.m. to 11:59 p.m. (midnight) Saturday, September 6, 2014.

##### Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Saturday, September 6, 2014 through Tuesday, September 9, 2014.

## September 9, 2014

### Canada

#### Area 29: Portions of 29- 3, 4, 9, 10 and 11 to 17

Open to Area E gillnets from 8:00 a.m. Thursday, September 11, 2014 to 8:00 a.m. Friday, September 12, 2014.

### United States

#### Treaty Indian Fishery

##### Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon), Wednesday, September 10, 2014, to 11:59 p.m. (midnight) Saturday, September 13, 2014.

##### Areas 6, 7 and 7A

Extended for net fishing from 9:00 a.m. Wednesday, September 10, 2014 through 9:00 a.m. Saturday, September 13, 2014.

#### All Citizen Fishery

##### Area 7 and 7A

Open to purse seines from 5:00 a.m. to 9:00 p.m. Saturday September 13, 2014.

##### Area 7 and 7A

Open to gillnets from 8:20 a.m. to 11:59 p.m. (midnight) Saturday, September 13, 2014.

##### Area 7 and 7A

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Wednesday, September 10, 2014 through Friday, September 12, 2014.

## September 12, 2014

### Canada

#### Area 29: Portions of 29- 3, 4, 9, 10 and 11 to 17

Open to Area E gillnets from 6:00 p.m. Saturday, September 13, 2014 to 8:00 p.m. Sunday, September 14, 2014.

### United States

#### Treaty Indian Fishery

##### Areas 6, 7 and 7A

Extended for net fishing from 9:00 a.m. Saturday, September 13, 2014 through 11:59 p.m. (midnight) Saturday, September 20, 2014.

**All Citizen Fishery**

**Area 7 and 7A**

Open to reefnets from 5:00 a.m. to 9:00 p.m. daily from Saturday, September 13, 2014 through Saturday, September 20, 2014.

**September 15, 2014**

**Canada**

**Area 29-3, 29-4, 29-6, and 29-10**

Open to Area B purse seine ITQ fishery in waters deeper than 45 meters from 6:00 a.m. to 9:00 p.m. daily from Tuesday, September 16, 2014, through Thursday, September 18, 2014.

**September 18, 2014**

**Canada**

**Area 29-3, 29-4, 29-6, and 29-10**

Open to Area B purse seine ITQ fishery in waters deeper than 45 meters from 6:00 a.m. to 9:00 p.m. daily from Friday, September 19, 2014, through Monday, September 22, 2014.

**United States**

**Area 7A**

Extend Fraser River Panel regulatory control from 11:59 p.m. (midnight) Saturday, September 20 to 11:59 p.m. (midnight) Saturday, September 27, 2014.

**Treaty Indian Fishery**

**Area 7A**

Open to net fishing from 5:00 a.m. Monday, September 22, 2014 to 9:00 a.m. Wednesday, September 24, 2014.

**All Citizen Fishery**

**Area 7 and 7A**

Open to purse seines from 5:00 a.m. until 9:00 p.m. Saturday, September 20, 2014.

**Area 7A**

Open to purse seines from 5:00 a.m. until 9:00 p.m. Sunday, September 21, 2014.

**Area 7 and 7A**

Open to gillnets from 8:25 a.m. until 11:59 pm (midnight), Saturday, September 20, 2014.

**Area 7A**

Open to gillnets from 8:30 a.m. until 11:59 p.m. (midnight), Sunday, September 21, 2014.

**September 22, 2014**

**Canada**

**Area 29-3, 29-4, 29-6, and 29-10**

Open to Area B purse seine ITQ fishery in waters deeper than 45 meters from 6:00 a.m. to 9:00 p.m. daily beginning Tuesday, September 23, 2014 until further notice.

**United States**

**Treaty Indian Fishery**

**Area 7A**

Extended for net fishing from 9:00 a.m. Wednesday, September 24, 2014 through 11:59 p.m. (midnight) Saturday, September 27, 2014.

**All Citizen Fishery**

**Area 7A**

Open to purse seines from 5:00 a.m. until 9:00 p.m. Wednesday, September 24, 2014.

**Area 7A**

Open to gillnets from 8:35 a.m. until 11:59 pm (midnight), Wednesday, September 24, 2014.

September 25, 2014

Canada

Area 29-1 to 6

The Area H troll ITQ fishery closes at 9:00 p.m. Saturday September 27, 2014.

Area 29-3, 29-4, 29-6, and 29-10

The Area B purse seine ITQ fishery closes at 9:00 p.m. Saturday, September 27, 2014.

Fraser River Panel control of Canadian Panel Areas was relinquished in accordance with pre-season regulations (Appendix E) as follows: Area 20 on September 13; Areas 17 and 18 on September 27; and Area 29 on October 18. Panel control of United States Panel Areas were relinquished as follows: Areas 4B, 5 and 6C on September 13; Areas 6, 6A and 7 on September 20; and portions of Area 7A on October 4 in accordance with pre-season Regulations. Regulatory control of the remaining portions of Area 7A was extended to September 27 by in-season order.

## APPENDIX G: PSC Staff Activities: Stock Monitoring, Identification and Assessment, and Management Adjustments

### Stock Monitoring

Stock monitoring programs assess the abundance and migration timing of Fraser River sockeye and pink salmon at different points along their migration route. In conjunction with stock composition information from the Stock Identification Group, the Stock Monitoring Group uses test fishery data from marine and freshwater areas, hydroacoustic abundance estimates collected in the Fraser River at Mission, B.C., and visual observations at Hells Gate. In addition to providing estimates of daily and cumulative passage in marine areas and at Mission, stock monitoring analyses provide projections of the number of fish migrating between marine areas and Mission, and estimates of diversion rates through Johnstone Strait. This information is required for the development of fishing plans that aid in meeting spawning escapement and catch allocation objectives.

### A. Test Fishing

Test fisheries provide much of the data used to assess the migrations of Fraser sockeye, including abundance-related data such as catch-per-unit-effort (CPUE) and biological samples from which stock composition estimates are obtained. While Table 4 in the main body of the report summarizes the locations and temporal patterns of Panel-approved test fisheries, Table G1 summarizes more detailed information about the nets and sampling strategies employed.

**Table G1.** Sampling details for Panel-approved test fisheries conducted in 2014.

Area	Name	Gear	Number of Vessels	Net Length (m)	Net Depth (meshes)	Mesh Size (mm) (in)	Number of Sets	Set Duration (minutes)
<b>Canadian Panel Areas</b>								
20	Juan de Fuca Str.	Gillnet	2	549	90	130 5 1/8	2	300
20	Juan de Fuca Str.	Purse Seine	1	549	875	95 3 3/4	6	20
29-14	Fraser R. (Cottonwood)	Gillnet	1	292	Variable	Variable	1	30
29-16	Fraser R. (Whonnock)	Gillnet	1	320	Variable	Variable	2	20
	Fraser R. (Qualark)	Gillnet	1	30	Variable	Variable	6	5
<b>United States Panel Areas</b>								
5	Juan de Fuca Str.	Gillnet	1	803	220	130 5 1/8	2	400
7	San Juan Islands	Reefnet <sup>1</sup>	3	n/a	n/a	n/a	n/a	n/a
<b>Canadian Non-Panel Areas</b>								
12	Johnstone Str. (Round I.)	Gillnet <sup>2</sup>	1	365	60-90	130 5 1/8	4	100
12	Johnstone Str. (Naka Cr.)	Gillnet <sup>2</sup>	1	365	90	130 5 1/8	4	100
12	Johnstone Str. (Blinkhorn)	Purse Seine	1-2	401	575	95 3 3/4	6	20
13	Lower Johnstone Str.	Purse Seine	1	401	575	95 3 3/4	6	20

<sup>1</sup> Reefnet observations are made during periods of favorable tides. Fish are counted as they swim through the gear but are not harvested.

<sup>2</sup> Round Island vessels used a 60 mesh nylon net and Naka Creek vessels a 90 Mesh Alaska twist net.

Information pertaining to the migration of Fraser River sockeye and pink salmon through marine areas is provided primarily by test fisheries in Area 20 (Juan de Fuca Strait) and Areas 12 and 13 (upper and lower Johnstone Strait), but is augmented during the early part of the season by test fisheries in U.S. Areas 4B and 5 (Juan de Fuca Strait) and Area 7 (San Juan Islands). Test fisheries in the Fraser River (Area 29) are used to assess species and stock composition for application to Mission passage estimates. To reduce the rate that seals remove salmon from the Cottonwood test fishery gillnet, the PSC uses an electric deterrent system in this test fishery. When the Mission hydroacoustic program is not active, lower river (Area 29) test fisheries provide passage estimates through the use of CPUE models.



In 2014, at the start of the season, Area 20 gillnet test fisheries catches were similar to the cycle average but not quite as high as the 2010 brood year. Near the end of July, as the Area 20 purse seine test fishery started up, Juan de Fuca catches in both the gillnet and purse seine test fisheries were substantially below the 2010 brood year as well as the cycle average. As Area 20 catches decreased, Area 12 test fishery catches increased in both the gillnet and the purse seine test fisheries to levels matching or exceeding brood year as well as cycle averages. Near the middle of August, Johnstone Strait purse seine catches in Areas 12 and 13 declined below brood year catches to cycle average levels, while reaching record levels once more near the end of August and beginning of September.

In the Fraser River, test fishery catches of sockeye at both Cottonwood and Whonnock were modest (20-30 sockeye/set on most days) and similar to past years' catches on this cycle. At Cottonwood, catches exceeded 100 sockeye per set on August 4 while at Whonnock, catches were below 100 sockeye/set until August 14. Peak catches at these sites lined up relatively well with each other and with peak escapements at Mission.

## **B. Mission Hydroacoustics**

PSC Staff operate a hydroacoustic facility on the Fraser River above the Mission Railway Bridge from June to September to provide timely in-season estimates of sockeye and pink salmon escapement through the lower river. This program has benefited from improved technologies and research in recent years<sup>12,13</sup>. In the 2014 season, daily salmon passage at Mission was estimated using a split-beam echo sounding system on the left bank of the river, a split-beam transducer mounted from a vessel that transected the river, and two imaging sonar DIDSON's on the right bank: a long range DIDSON (LR DIDSON) in the near shore area and a standard DIDSON (with a scanning rotator) on a bottom mounted tripod in the off-shore area. The sampling geometry of the four sonar systems is shown in Figure G1. The sonar systems operated 24 hours a day and provided key information on density, behaviour, speed and direction of travel as well as size distributions of detected fish targets. Information on the behaviour of fish migrating in offshore areas was also gathered using a vessel-based standard DIDSON during stationary soundings to verify assumptions used in the estimation of offshore fish flux (i.e., abundance). The offshore DIDSON data was used periodically to assess and validate fish densities estimated from the mobile split-beam system when the river had large amounts of debris but very low abundance of salmon (a daily passage of a few thousand) at the beginning of the season. Throughout the season, a daily estimate of fish abundance past Mission was produced by combining the estimates from the four sonar systems.

The left-bank shore-based split-beam system operated from June 30-October 1, and consisted of a side-looking transducer with an elliptically shaped beam pattern of  $2^{\circ} \times 10^{\circ}$ . The transducer was attached to a rotator to control its pan and tilt, thereby allowing stratified sampling of the water column by the narrow vertical beam at multiple aiming angles. This was the first season that we did not operate the  $4^{\circ} \times 10^{\circ}$  elliptical transducer as we found from a detailed analysis that saturation tended to occur more readily on the  $4^{\circ} \times 10^{\circ}$  transducer than the  $2^{\circ} \times 10^{\circ}$  transducer<sup>14</sup>. The aim and orientation of the transducer was monitored and verified with an attitude sensor. The transducer was deployed near the far end of an extendable fish-deflection weir that prevented fish from swimming behind or too close to the transducer. This ensured that the echo sounder acquired adequate numbers of echoes from individual fish targets in the insonified (i.e., detectable in the sonar beam) zone for

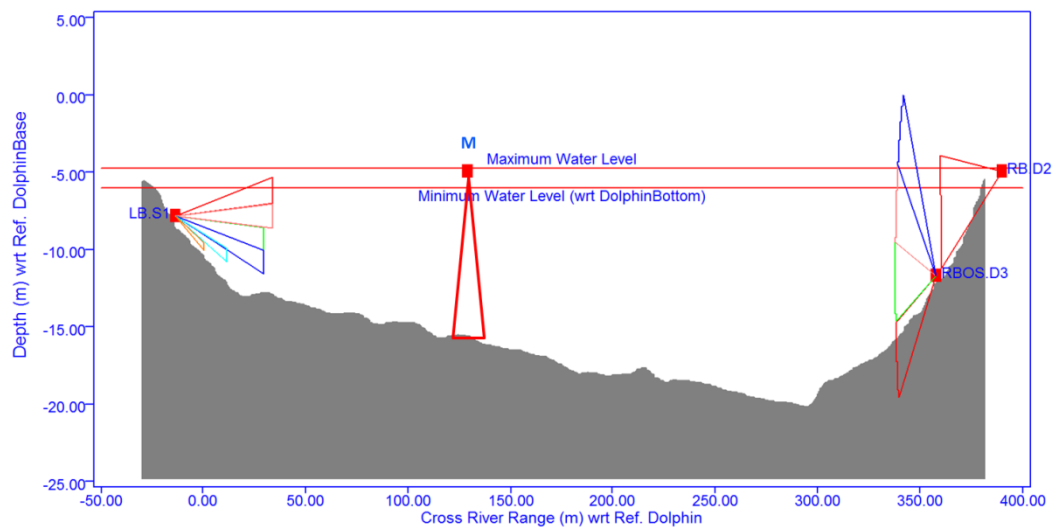
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<sup>12</sup> Xie, Y., A. P. Gray, F. J. Martens, and J. D. Cave. 2007. Development of a shore-based hydroacoustics system on the right bank of the Lower Fraser River to monitor salmon passages: A project report to Southern boundary restoration and enhancement fund. Pacific Salmon Commission, Vancouver, British Columbia. April, 2007.

<sup>13</sup> Xie, Y., C. G. J. Michielsens, A. P. Gray, F. J. Martens, and J. L. Boffey. 2009. Observations of avoidance reactions of migrating salmon to a mobile survey vessel in a riverine environment. *Can. J. Fish. Aquat. Sci.* 65: 2178-2190.

<sup>14</sup> F. J. Martens and Y. Xie. 2014. Implementation of stationary estimation of near-shore salmon passage using stratified vertical sampling by DIDSON sonar: *A final project report to the southern boundary restoration and enhancement fund*. Pacific Salmon Commission. June, 2014.

target tracking. The transducer aim was optimized to reduce un-sampled areas where migratory abundance must be estimated by extrapolation.



**Figure G1.** Cross river view of the sampling geometry of the four sonar systems operated 24hrs per day at the Mission hydroacoustic facility. The four systems include the left-bank split-beam (LB.S1), mobile split-beam (M), right-bank offshore DIDSON (RBOS.D3) and the right-bank inshore DIDSON (RB.D2).

The vessel-based system consisted of a downward-looking split-beam circular beam transducer ( $6^\circ$ ) that transected the river every five minutes to obtain target density information. A standard DIDSON was also deployed from the vessel approximately 6 times per day when the vessel was anchored near the left or right bank for stationary samplings. The DIDSON was aimed offshore from the vessel during the stationary soundings and the imaging data collected at the two anchored locations were used to assess and validate fish densities estimated from the mobile split-beam system when the river had large amounts of debris during the high-water period at the beginning of the season.

The two right-bank DIDSON systems both had a  $30^\circ$  horizontal field of view (FOV) which was synthesized by 48 fan-shaped composite beams with a  $14^\circ$  vertical beam. This  $14^\circ$  vertical beam fit almost perfectly to the entire water column bounded by the concave near-shore bottom profile of the right bank up to a 30m range from the shoreline (see Figure G1), allowing the inshore DIDSON to sample the near-shore water column with little obstruction at a fixed aim. However, a scanning rotator was required for the offshore DIDSON to perform stratified sampling (via 4 aims) of the much deeper water column in the offshore area (see Figure G1). For the inshore right-bank DIDSON (D2), data were collected at different frequencies (high frequency and low frequency) for different range bins. High frequency files with range windows from 1 to 11m, 11 to 21m, and low frequency files for 21 to 31m were used for the daily in-season estimate. The DIDSON aim (tilt) and pan (compass bearing),  $-8^\circ$  and  $120^\circ$ , respectively, were monitored and verified with an orientation sensor. Similar to the deployment of the split-beam system on the left bank, a telescopic fish deflection weir was deployed to prevent fish from swimming behind or too close to the DIDSON. The right-bank inshore DIDSON operated from July 8 onwards and the data from this unit was used in the daily estimate. The 2014 season was the first season that we used the counting software IntelliHAT (Intelligent Hydro-Acoustics Tracker) to produce fish counts from the LR DIDSON data. The software counts were verified periodically by small sets of manual counts that were randomly selected to ensure that the software achieved statistically similar counts to the manual counts.

The right-bank offshore DIDSON (D3) was deployed 40 m offshore from the shoreline which required the use of a rotator to cover the entire water column. The system looked upward from a bottom mounted tripod. It consisted of four 20 m, vertical aims at  $-10^\circ$ ,  $+5^\circ$ ,  $+20^\circ$  and  $+35^\circ$  with a bearing of  $110^\circ$  (looking offshore) for each aim. This stratified sampling of the water column was

repeated on an hourly basis. This system was fully operational on July 29 and the fish counts from this system were incorporated into the daily estimate after this date.

Fish counts from both the right-bank inshore and offshore DIDSONs were apportioned through a mixture model into salmon sized fish counts using a subset of length data estimated from the same imaging data that produced the fish counts.

Acoustic targets detected by the split-beam systems were tracked using an alpha-beta tracker<sup>15,16</sup>. The resulting tracks were classified as fish or noise (e.g., debris, air bubbles) using discriminate function analysis<sup>17</sup>. The integrity of statistically identified fish tracks was further verified by trained staff. Unusual or atypical targets were removed using graphical user interface (GUI) utilities in the editing software. This data processing procedure was performed each day for all the data collected from both the left-bank and vessel-based split-beam systems. The finalized fish track data were imported to a fish-flux estimation software program. Daily fish passages in the sampling areas by the left-bank and mobile split-beam systems were then estimated from the software, which also projected fish flux through the un-sampled areas. Daily DIDSON files collected by D3 for net upstream fish were counted using a hand tally counter while files collected by D2 were automatically counted by the software IntelliHAT. These counts were expanded in time to estimate daily fish passage near the right-bank area. The 2014 season was also the first season that these DIDSON fish counts were imported to the fish-flux estimation software program. The daily total salmon passage was estimated by merging daily flux estimates produced by the four sonar systems. The total salmon estimates were further apportioned by species and sockeye stocks based on species composition and stock identification information obtained from daily test-fishing data.

Two other DIDSON systems were deployed and operated in the left-bank inshore and offshore area for the 2014 sampling season to collect fish flux and behaviour information. Also included in the 2014 program were data exchanges and estimate comparisons between Mission and DFO's Qualark hydroacoustic site.

#### i. DIDSON insonification of left-bank near-shore fish passage

An important application of DIDSON technology in the 2014 field season was to insonify and estimate fish passage in near-shore areas of the left bank at Mission. To achieve this goal a standard DIDSON unit and X2 rotator were deployed on the left-bank from June 30 to October 1. This system collected continuous daily fish passage data in a range bin from 1-21m from the end of the fish fence using an hourly systematic sampling scheme. The stratified sampling scheme had two vertical aims, -10° and +5°, which scanned the water column. Each of these aims was broken into two range bins, bin 1 and bin 2, which insonified from 1- 11m and 11- 21m, respectively. Post-season trials and tests are underway to use the left-bank inshore DIDSON data to estimate near-shore salmon passage for in-season management use. Due to challenges observed in the 2013 season from the convex bottom profile, testing is still underway to examine the feasibility of incorporating the fish counts from this DIDSON into the in-season estimate.

#### ii. DIDSON insonification of left-bank off-shore fish passage

As part of the enhanced field program that was conducted in consultation with the Fraser River Panel (FRP), a DIDSON unit was deployed 20m offshore from the end of left-bank fish fence from August 19 to September 30. This system was not operational from September 3-10 due to rotator problems. The goal of the study was to improve the accuracy and precision of daily

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<sup>15</sup> Blackman, S. S. and R. Popoli. Design and Analysis of Modern Tracking Systems. Artech House, Boston, 1999.

<sup>16</sup> Xie, Y., A. P. Gray, F. J. Martens, J. L. Boffey and J. D. Cave. 2005. Use of dual-frequency identification sonar to verify salmon flux and to examine fish behaviour in the Fraser River. Pacific Salmon Comm. Tech. Rep. No. 16: 58 p. Vancouver, B.C.

<sup>17</sup> Xie, Y., C.G.J. Michielsens, and F.J. Martens. 2012. Classification of fish and non-fish acoustic tracks using discriminant function analysis. – ICES Journal of Marine Science, doi:10.1093/icesjms/fsr198.

salmon estimation in the offshore area<sup>18, 19</sup>. The DIDSON sitting on a bottom-mounted tripod was placed in an area where estimates are currently derived from the left-bank split-beam system. The system consisted of four vertical aims, -5°, +10°, +25° and +40° with a bearing of 338° for each aim (looking offshore). This stratified sampling of the water column was repeated on an hourly basis. The sounding range for each aim was 20m except for the last aim, which was 10m. Post-season work is underway on the continued development of a robust method of using the DIDSON data to estimate the left-bank offshore salmon passage.

### iii. In-season data exchange with DFO's Qualark Hydroacoustic site and comparison of estimates

2014 was the seventh consecutive season that DFO operated an in-season acoustic counting site using DIDSON systems at Qualark Creek (95 km upstream from Mission). PSC and DFO staff at the Mission and Qualark sites exchanged daily salmon estimates beginning in early July. By the end of the season, regular information exchanges occurred 2 times each week. This timely exchange of information between the two sites greatly enhanced Staff confidence in the in-season estimates of sockeye salmon passage in 2014. For the sockeye time period (June 30-October 1), Qualark estimated a total of 7 million sockeye escapement while Mission projected a total of 8.5 million sockeye past Qualark.

## **Stock Identification**

PSC staff conduct programs designed to identify the stock proportions of Fraser River sockeye and pink salmon in commercial, test, First Nations and recreational catches. Coupled with abundance indices from stock monitoring programs, these data provide information on the abundance and timing of sockeye and pink salmon as they migrate to their natal rivers in the Fraser watershed. Stock identification data are also used to account for Fraser sockeye and pink salmon wherever they are caught, and to apportion the daily estimates of sockeye escapement past Mission into discrete stock groups. Stock identification methods for sockeye salmon in 2014 used DNA and scale pattern analyses from fish caught in marine and in-river fisheries. No stock composition estimates were produced for pink salmon in 2014 because the Fraser River pink salmon run is virtually non-existent in even numbered years.

### A. Sockeye Salmon

Stock identification methods for sockeye salmon relied on DNA<sup>20</sup> (using the program CBAYES<sup>21</sup>) and scale pattern analyses<sup>22</sup>. Both techniques involve comparing the attributes of individuals in mixture samples (e.g., from mixed-stock fisheries) to the attributes of pure samples obtained from the spawning grounds of each of the named stocks (i.e., “standards” or “baselines”). For some samples that were not time sensitive, a hybrid approach was used in which scales were

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<sup>18</sup> Xie, Y., F. J. Martens and Andrew P. Gray. 2010. A feasibility study on using a stationary hydroacoustic sub-sampling method to estimate offshore fish flux in the lower Fraser River: A project report to Southern boundary restoration and enhancement fund. Pacific Salmon Commission, Vancouver, British Columbia. February, 2010.

<sup>19</sup> Xie, Y., F. J. Martens, and J. L. Nelitz 2012. Implementation of stationary sub-sampling systems to estimate salmon passage in the Lower Fraser River: *Year 1 of 2011 and 2012 project report to Southern boundary restoration and enhancement fund*. Pacific Salmon Commission, Vancouver, British Columbia. May, 2012.

<sup>20</sup> Beacham, T.D., M. Lapointe, J.R. Candy, B. McIntosh, C. MacConnachie, A. Tabata, K. Kaukinen, L. Deng, K.M. Miller and R.E. Withler. 2004. Stock identification of Fraser River sockeye salmon using microsatellites and major histocompatibility complex variation. *Trans. Am. Fish. Soc.* 133: 1117-1137.

<sup>21</sup> Neaves, P.I., C.G. Wallace, J.R. Candy, and T.D. Beacham. 2005. CBAYES: Computer program for mixed stock analysis of allelic data, v5.01. Department of Fisheries and Oceans (Canada). Available: <http://www.pac.dfo-mpo.gc.ca/science/facilities-installations/pbs-sbp/mgl-lgm/apps/index-eng.htm> (January 2012).

<sup>22</sup> Gable, J. and S. Cox-Rogers. Stock identification of Fraser River sockeye salmon: methodology and management application. PSC Tech. Rep. No. 5, October, 1993.

examined to identify Harrison sockeye, with DNA analyzed to provide the stock composition of only non-Harrison individuals.

Samples from test fishery catches were analyzed daily, beginning in early July and continuing to late September. PSC staff sampled sockeye from most test fishery catches and commercial fishery landings. Sampling locations included Port Renfrew, Nanaimo, Vancouver, Delta, Richmond, and the lower Fraser River in British Columbia, and Bellingham and Neah Bay in Washington. DFO provided samples from test fisheries in Johnstone Strait and from in-river test fisheries at Albion and Qualark; DFO also provided samples from some northern catches landed in Prince Rupert. Alaska's Department of Fish and Game collected samples for the PSC from District 104 purse seine landings in Ketchikan and Petersburg, and Langara Fishing Adventures provided samples from recreational catches near Haida Gwaii. DFO and First Nations personnel obtained samples from Fraser River First Nations catches (from the river mouth to Prince George) when available.

Catches in District 104 totaled 702,481 sockeye, including sustained catches late in the season. Extracted DNA of fish putatively originating from southern stocks (as determined by examination of Single Nucleotide Polymorphisms<sup>23</sup> by the US National Oceanic and Atmospheric Administration laboratory in Auke Bay, Alaska) was obtained and analyzed with methods consistent with all DNA results reported here and to the Fraser Panel. The catch of Fraser River sockeye in Alaska was estimated to be 185,797, which is 26% of the overall sockeye catch there. Prevalence of Fraser sockeye increased over time from near 0% in mid-July to near 60% in the second half of August.

More samples than usual were obtained near Haida Gwaii in 2014, including samples from FSC seining, recreational angling, and commercial trolling operations. These catches occurred mostly in early to mid-August and comprised very high proportions of Fraser River sockeye. The stock composition of these samples matched the overall return of Fraser River stocks quite well. This may be contrasted to the Fraser sockeye caught in Alaska which comprised higher fractions of Summer run stocks like Chilko, Quesnel, Late Stuart/Stellako, and lower fractions of Late Shuswap/Portage than the run composition observed near Vancouver Island.

The spatial distribution of Harrison sockeye catch was also notable in 2014. This stock was very infrequent in samples from Alaska and Haida Gwaii relative to samples closer to the Fraser River. Consistent with observations in previous years, and possibly related to their low prevalence in northern samples, Harrison sockeye were considerably more prevalent in samples from Juan de Fuca Strait than in samples from Johnstone Strait. For example, Area 20 purse seine samples from late July to early August comprised 15-30% Harrison sockeye whereas Area 12 purse seine samples (representing a more northern migration to the Fraser River) never exceeded 13% Harrison sockeye during the season.

A new application of sockeye stock identification was explored during the 2014 management season<sup>24</sup>. Samples of juvenile migrants in 2012, made available by DFO programs in the lower Fraser River<sup>25</sup> and along the marine migration route<sup>26</sup>, were examined for their ratio of Late

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<sup>23</sup> Habicht, C., Seeb, L.W., Myers, K.W., Farley, E.V., Seeb, J.E. 2010. Summer-Fall Distribution of Stocks of Immature Sockeye Salmon in the Bering Sea as Revealed by Single-Nucleotide Polymorphisms. *Trans. Am. Fish. Soc.* 139: 1171-1191.

<sup>24</sup> Latham, S., C. Michielsens, C. Wallace, T. Whitehouse, J. Tadey, C. Neville, M. Trudel. (2015, May 17). Stock identification of Fraser sockeye smolt samples provides marine fisheries managers with more timely and accurate estimates of adult run size. North Pacific Anadromous Fish Commission. Retrieved from <http://www.npafc.org/new/events/symposium/2015symposium/Presentations/Poster%20Presentations/Poster-42%20Latham%20et%20al.pdf>

<sup>25</sup> Mahoney, J.E., Tadey, J.A., Whitehouse, T.R., Neville, C., and Kalyn, S.M. 2013. Evaluation of Timing, Size, Abundance and Stock Composition of Downstream Migrating Juvenile Sockeye Salmon in the Lower Fraser River – A Report to the Pacific Salmon Commission. Fisheries and Oceans Canada, Delta, BC. 2013.

<sup>26</sup> Neville, C., Trudel, M., Beamish, R.J., Johnson, S.C. 2013. The Early Marine Distribution of Juvenile Sockeye Salmon Produced from the Extreme Low Return in 2009 and the Extreme High Return in 2010. North Pacific Anadromous Fish Commission, Technical Report No. 9: 65-68.

Shuswap/Portage stocks to Early Thompson stocks. Both stock groups rear primarily within Shuswap Lake and appear to be otherwise similar in size and behaviour as juveniles, so it was assumed that they would be equally vulnerable to sampling gear and would share similar survivals within cohorts. Furthermore, these stocks are similar in age at maturity such that the abundance ratio of the stocks should be similar between ocean entry as juveniles and the adult run two years later, if survivals were similar during the intervening period. Previous observations indicated that ratios among Fraser River sockeye stocks sampled as post-smolts in marine areas showed promise in being predictive of relative abundance in adult returns, even for stocks that are less similar (E.Jenkins, PSC pers. comm.).

For meetings on August 28 and 29, the ratio of Late Shuswap/Portage to Early Thompson stocks from the juvenile programs (5.3x) was applied to the estimate of Early Thompson run size at that time (1.5 million) to generate an estimate of the Late Shuswap/Portage run (8 million). This estimate was independent of the uncertain reconstruction-based estimate available at the time and was therefore valuable in providing context for the evaluation of abundance indices. This estimate compared favorably to the final in-season estimate of Late Shuswap/Portage (9.4 million) considering that the Early Thompson stock group was late in 2014 and increased into early September (such that the ratio produced a more similar estimate of the later run).

Subsequent work on this method supported its ability to usefully provide an early and independent prediction of the abundance of later-returning runs when: (i) the abundance of the earlier run is well-estimated long before the later run can be estimated, (ii) the later run comprises a large proportion of the relevant management groups for fisheries, and (iii) the ratio between later and earlier stocks in juveniles is well-known and can be confidently anticipated during adult returns. These conditions are most likely to be met on the dominant Shuswap cycle, and research will proceed on applicability of this method in the 2018 return year.

### **Stock Assessment**

Assessment of Fraser River sockeye abundance by stock group is primarily based on catch, effort, escapement and stock composition data. Stock assessment methods mainly rely on catch and cpue data from test fishing vessels to assess abundances by stock group. These data are analysed using Bayesian stock assessment models<sup>27, 28</sup>. These models compare the reconstructed daily migration pattern to ideal run-timing curves, assuming the run is normally distributed. By assuming the run follows this idealized pattern, the run size can be estimated once the 50% migration date (i.e., the date 50% of the run has migrated past the reference location, which corresponds to the peak of the normal distribution) has been identified, by doubling the abundance up to that date. Prior to observing the peak of the run, there is considerable uncertainty about the run size. Based on initial observations before the peak of the run, the estimates can indicate the run to be either earlier and smaller than forecast, or later and larger than forecast.

The uncertainty about the actual size of the run is estimated using Bayesian methodology. The Bayesian version of the cumulative normal model relies on additional information (pre-season forecasts of run size based on historic stock-recruit data and timing based on sea-surface temperature (SST) and eastward current speed index in the Gulf of Alaska, expected duration of the run, average historical expansion line estimates and pre-season forecasts of diversion rate based on SST) to reduce the uncertainty and keep the run-size estimates within realistic bounds. This prior information is incorporated within the Bayesian model through the use of prior probability distributions (priors). These priors indicate a range of values that are assumed plausible for the various model parameters and depending on the shape of the prior probability distribution indicate which parameter values are assumed more plausible than others. Theoretically the Bayesian version of the cumulative normal model should provide more stable estimates since it relies on both in-season data as well as historical data. Retrospective analyses have confirmed that incorporating prior knowledge is especially advantageous before the 50% migration date is

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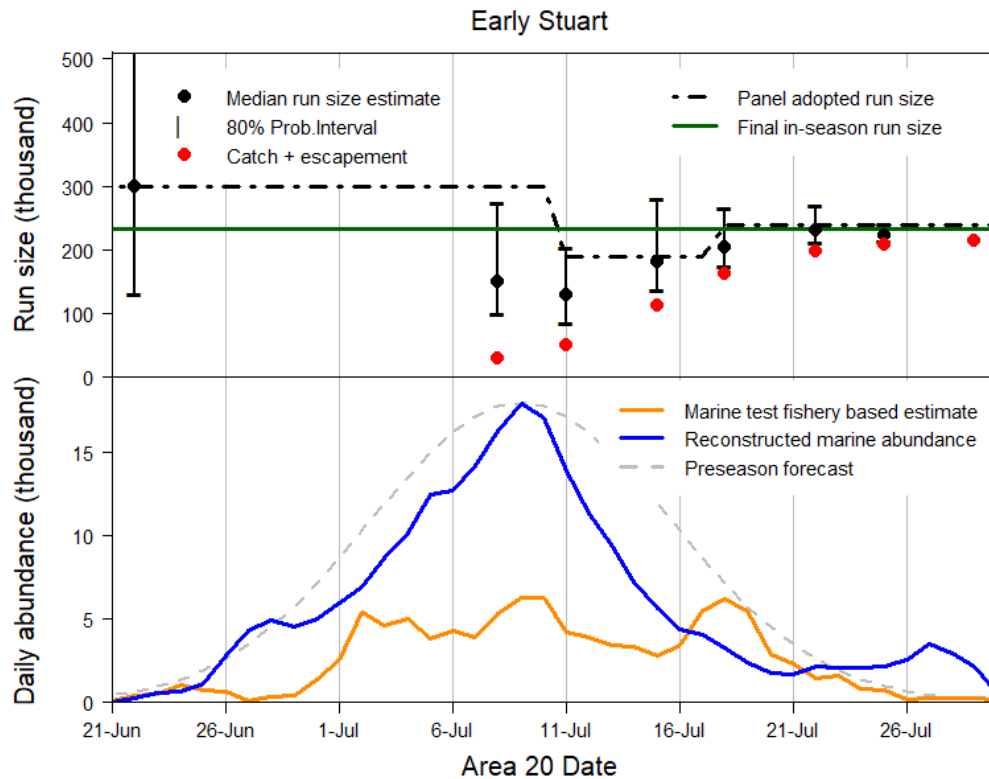
<sup>27</sup> Pacific Salmon Commission. 1995. Pacific Salmon Commission run-size estimation procedures: An analysis of the 1994 shortfall in escapement of Late-run Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 6: 179 p.

<sup>28</sup> 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.



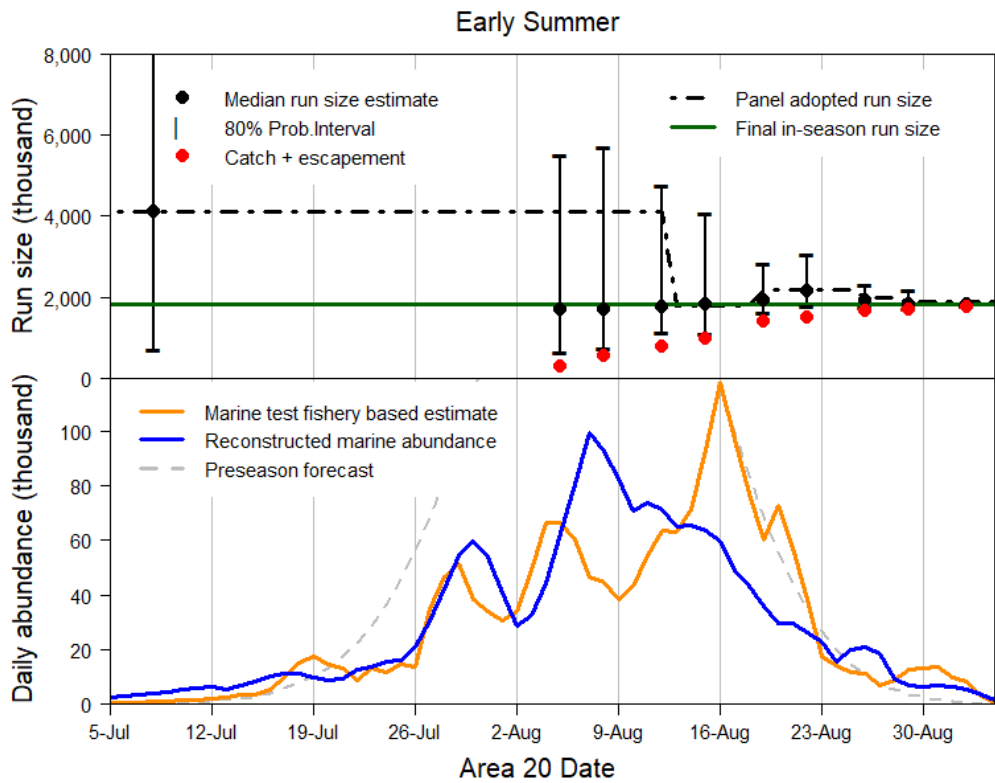
known. Bayesian stock assessment models are especially useful around the 50% migration date of the run as well as immediately after. After this period, when the run size depends on the remainder of the run still to come, the run size can be estimated by adding the Bayesian estimate of the tail of the normal distribution to the accounted run-to-date.

Figures G2a, b, c and d provide an overview of run-size estimates from the stock assessment model and the accounted run size at various dates during the season (median and 80% probability interval). These estimates can be compared against the in-season run-size estimates adopted by the Panel for management purposes and against the final in-season estimates of the accounted run-to-date. In 2014, pre-season forecasts overestimated the run size of Early Stuart, Early Summer and Late-run sockeye, while for Summer-run sockeye the final run was larger than forecasted. Overall, the final run size of Fraser River sockeye was close to the forecast. The timing of the run was later than forecast pre-season for all management groups.

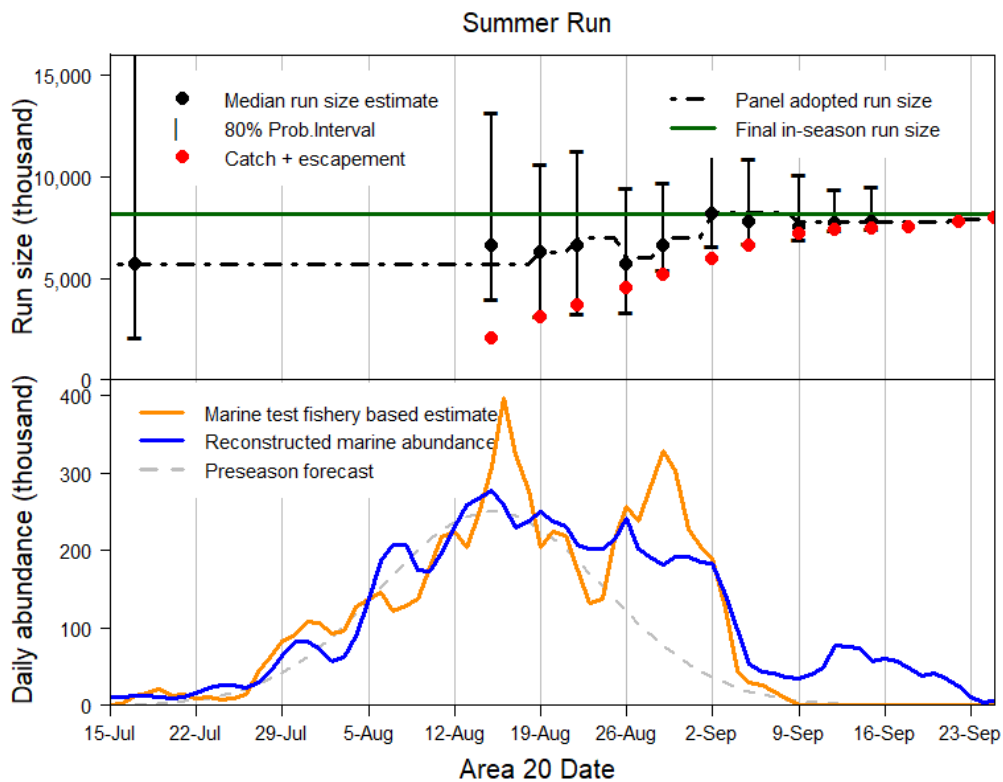


**Figure G2a.** Daily reconstructed abundance estimates for Early Stuart sockeye and corresponding run-size estimates at different times during the season.

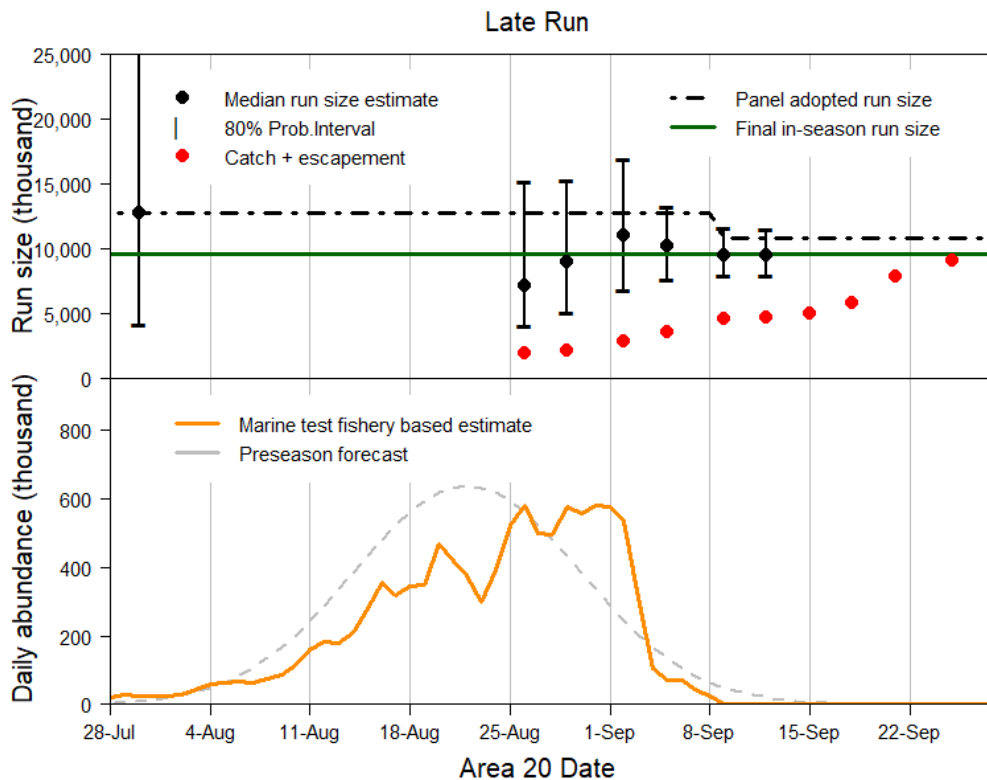




**Figure G2b.** Daily reconstructed abundance estimates for Early Summer-run sockeye and corresponding run-size estimates at different times during the season.



**Figure G2c.** Daily reconstructed abundance estimates for Summer-run sockeye and corresponding run-size estimates at different times during the season.



**Figure G2d.** Daily reconstructed abundance estimates for Late-run sockeye and corresponding run-size estimates at different times during the season.

### Management Adjustment and DBE

For pre-season planning, the Environmental Watch program at Fisheries and Oceans Canada presented a pre-season forecast of Fraser River environmental conditions that suggested the river would experience average discharge levels and above-average water temperatures during the sockeye migration. MA estimates for Early Stuart were based on a relationship between river conditions (discharge and temperature) and historical differences between lower and upriver escapement estimates. Historical median or mean pMA values were used for the other stock groups.

The pre-season Early Stuart pMA (0.86, Tables 1 and 6, Table G2) was predicted by the all cycle-years temperature + discharge MA model (Table G3). The Early Summer-run pMA (0.42) was the median of the historical pMAs for the Early Summer group with Pitt and Chilliwack excluded, but then because Pitt and Chilliwack were but minor components of the management group, this median was applied to the aggregate Early Summer group with Pitt and Chilliwack included. The Summer-run pMA (0.11) was calculated as a weighted (by p50 forecast abundances) mean of the median historical pMA for Harrison sockeye (0.39) and the median historical pMA for non-Harrison Summer-run sockeye (0.08). A similar approach was used for the Late run. The Late-run pMA (0.28) was calculated as a weighted (by p50 forecast abundances) mean of the median historical pMA for Birkenhead sockeye (0.26) and the mean of the 1998, 2002 and 2010 pMAs for non-Birkenhead Late-run sockeye (0.10). The same methodologies were applied during the in-season period, with one exception. For the Late run, the timing model for predicting Late-run pMAs was employed later in the season, and this prediction replaced the historical mean for non-Birkenhead Late run described above in the weighted mean calculation.

An important aspect of the weighting scheme applied to the Summer and Late-run calculations is that the aggregate pMA will change due to shifts in the relative abundances of the component stocks, e.g., Harrison versus non-Harrison Summers. This can happen even when pMA estimates for the component stocks do not change.

**Table G2.** Summary of DBEs and pMAs adopted pre-season and in-season to generate weighted pMA values for Early Summer, Summer and Late-run groups.

Description	Early Stuart		Early Summer		Summer				Lates*			
					Group excluding Harrison		Harrison*		Group excluding Birkenhead		Birkenhead*	
	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA
Pre-season	-46%	0.86	-30%	0.42	-7%	0.08	-28%	0.39	-22%	0.28	-21%	0.26
In-season	-66%	1.96	-30%	0.42	-7%	0.08	-28%	0.39	-9%	0.10	-21%	0.26

\*The pMAs adopted pre-season for these stocks remained fixed in-season.

**Table G3.** Summary of the pre-season and in-season MA models and assumptions used for each Fraser sockeye management group in 2014. In-season timing refers to the final updated date for each group. Details regarding assumptions for pre-season timing can be found in the Pre-season Planning section (under Panel Management Activities) of the report.

Management Group	Pre-season				In-season			
	Predictor variables	Upstream 50% Date <sup>1</sup>	Cycle lines	Excluded years	Predictor variables	Upstream 50% Date <sup>1</sup>	Cycle lines	Excluded years
Early Stuart	31-day temp and discharge <sup>2</sup>	15-Jul	All	1977, 1980, 1982, 1984, 1986	19-day temp and discharge <sup>2</sup>	14-Jul	All	1977, 1980, 1982, 1984, 1986
Early Summer	Historical Median	NA	2010/2011 cycle	1993	Historical Median	NA	2010/2011 cycle	1993
Summer	Historical Median	NA	All	2002	Historical Median	NA	All	2002
Harrison	Historical Median 2004-2012	NA	NA	2010	Historical Median 2004-2012	NA	NA	2010
Birkenhead	Median of all years	NA	All	NA	Median of all years	NA	All	NA
Late <sup>3</sup>	Mean of 1998,2002 and 2010	NA	2010 cycle	NA	Timing Model	19-Sep	2010/2011 cycle	1979, 1983, 1987, 1991, 1995, 2006

<sup>1</sup> Hells Gate timing for Early Stuart, Early Summer and Summer runs. Mission timing for Late runs.

<sup>2</sup>  $\ln(\text{DBE}) = a + b_1T + b_2T^2 + b_3Q + b_4Q^2$  where  $T = 31\text{-day}$  (or  $19\text{-day}$ ;  $3\text{-days before}$ ,  $15\text{-days after}$ ) temperature centred on the Hells Gate 50% date and  $q = 31\text{-day}$  ( $19\text{-day}$ ) discharge.

<sup>3</sup>  $\ln(\text{DBE}) = a + bR$  where  $R$  is Mission timing

## APPENDIX H: Historical Catch, Escapement and Production Data, and detailed TAC Calculation

**Table H1.** Catch by user group, spawning escapement, difference between estimates and run size of Fraser River sockeye salmon for cycle years 2002-2014.

	Fraser Sockeye Salmon			
	2002	2006	2010	2014
<b>CANADIAN CATCH</b>	<b>3,617,800</b>	<b>4,571,100</b>	<b>11,569,200</b>	<b>10,123,400</b>
<b>Commercial Catch</b>	<b>2,218,600</b>	<b>3,247,000</b>	<b>9,243,700</b>	<b>7,989,400</b>
Panel Area	1,352,100	921,300	3,459,100	3,022,200
Non-Panel Areas	866,400	2,325,700	5,784,600	4,967,300
<b>First Nations Catch</b>	<b>1,155,600</b>	<b>1,144,900</b>	<b>2,015,100</b>	<b>1,776,600</b>
Marine FSC	264,700	297,700	308,500	321,100
Fraser River FSC	890,900	391,100	570,100	615,800
Economic Opportunity	0	456,100	1,136,500	839,600
<b>Non-commercial Catch</b>	<b>243,600</b>	<b>179,100</b>	<b>310,400</b>	<b>357,400</b>
Marine Recreational	5,100	37,400	80,500	110,300
Fraser Recreational	122,700	134,300	212,800	242,400
Charter	7,000	600	6,600	4,100
ESSR	108,800	6,900	10,500	600
<b>UNITED STATES CATCH</b>	<b>449,700</b>	<b>727,200</b>	<b>1,959,500</b>	<b>887,200</b>
<b>Washington Total</b>	<b>449,000</b>	<b>707,600</b>	<b>1,959,500</b>	<b>701,600</b>
<b>Commercial catch</b>	<b>434,600</b>	<b>703,100</b>	<b>1,945,100</b>	<b>698,200</b>
Treaty Indian	298,200	486,800	1,202,600	470,300
Non-Indian	136,300	216,300	742,500	227,900
<b>Non-commercial Catch</b>	<b>14,400</b>	<b>4,500</b>	<b>14,400</b>	<b>3,400</b>
Ceremonial	14,400	4,500	14,400	3,400
Recreational	0	0	0	0
<b>Alaska</b>	<b>800</b>	<b>19,600</b>	<b>0</b>	<b>185,500</b>
<b>TEST FISHING CATCH</b>	<b>155,200</b>	<b>140,000</b>	<b>71,900</b>	<b>148,700</b>
<b>PSC (Panel Areas)</b>	<b>140,500</b>	<b>72,000</b>	<b>27,000</b>	<b>41,000</b>
Canada	140,500	62,600	17,800	35,100
United States	0	9,400	9,200	5,800
<b>Canada (non-Panel Areas)</b>	<b>14,700</b>	<b>68,000</b>	<b>44,900</b>	<b>107,800</b>
<b>TOTAL RUN</b>	<b>15,137,000</b>	<b>12,980,000</b>	<b>28,672,800</b>	<b>20,215,000</b>
Total Catch in All Fisheries	4,222,700	5,438,300	13,600,600	11,159,300
Adult Spawning Escapement	10,201,000	4,661,500	13,130,900	5,877,300
Jack Spawning Escapement	5,400	1,700	12,100	5,600
Difference Between Estimates	707,900	2,878,600	1,929,200	3,172,800
<b>Percentage of Total Run</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Total Catch in All Fisheries	28%	42%	47%	55%
Adult Spawning Escapement	67%	36%	46%	29%
Jack Spawning Escapement	0%	0%	0%	0%
Difference Between Estimates	5%	22%	7%	16%

**Table H2.** Escapements of sockeye salmon to Fraser River spawning areas for cycle years 2002-2014\*.

DISTRICT		Year			
Stock Group					
Stream/Lake		2002	2006	2010	2014
NORTHEAST					
Upper Bowron R.		8,770	1,554	8,983	12,147
STUART					
Early Stuart					
Driftwood R.		5,218	7,230	25,783	21,774
Takla L. Streams		10,007	10,261	11,061	14,193
Middle R. Streams		5,683	11,576	16,971	24,351
Trembleur L. Streams		3,492	6,671	6,447	8,234
Miscellaneous		237	78	0	58
Late Stuart					
Kazchek Cr.		760	104	32	9
Kuzkwa Cr.		2,810	3,139	3,610	4,325
Middle R.		7,452	7,513	13,340	9,086
Tachie R.		19,608	14,178	57,887	36,036
Miscellaneous		3,868	2,570	372	1,235
NECHAKO					
Nadina R. (Late)		421	4,144	4,783	30,235
Nadina Channel		1,504	4,511	21,359	31,154
Stellako R.		322,711	147,189	202,783	506,157
QUESNEL					
Horsefly R.		1,963,020	110,388	128,121	463,621
Horsefly Channel		0	19,599	22,493	18,078
McKinley Cr.		0	3,007	1,534	10,266
Mitchell R.		1,022,192	22,446	75,029	277,953
Miscellaneous		0	14,328	21,854	64,458
CHILCOTIN					
Chilko R. & L.		382,753	468,947	2,459,946	1,025,587
Chilko Channel		0	0	0	0
Taseko L.		1,300	2,140	1,117	107
SETON-ANDERSON					
Gates Cr.		222	0	6,280	9,679
Gates Channel		1,951	2,858	9,486	6,071
Portage Cr.		14,953	18,882	57,870	24,275
NORTH THOMPSON					
North Thompson R.		5,866	25,488	8,044	22,741
Raft R.		18,369	6,111	5,119	17,078
North Barriere		7,331	11,482	10,808	11,451
SOUTH THOMPSON					
Early Summer-run					
Scotch Cr.		101,269	144,199	522,367	135,100
Seymour R.		113,408	107,941	552,149	114,002
Upper Adams / Momich / Cayenne		1,234	370	3,101	5,810
Miscellaneous		94,461	39,717	351,176	246,918
Late-run					
Adams R.		3,760,540	1,461,673	3,867,225	707,883
Little R.		678,652	416,790	422,358	213,304
Lower Shuswap R.		886,719	901,059	2,897,006	1,027,591
Miscellaneous		206,352	118,187	332,429	259,290
HARRISON-LILLOOET					
Birkenhead R.		189,446	266,459	128,285	35,548
Big Silver Cr. & misc. Birk. types		31,890	23,076	12,578	6,011
Harrison R.		41,542	168,259	761,668	399,531
Weaver Cr.		66,327	6,967	23,833	2,207
Weaver Channel		34,706	32,814	36,064	22,439
LOWER FRASER					
Nahatlatch R. & L.		7,305	1,678	5,413	3,873
Cultus L.		4,873	3,785	10,026	4,603
Upper Pitt R.		90,280	38,816	16,818	36,496
Chilliwack L./Dolly Varden Cr.		3,841	1,097	2,775	3,470
MISCELLANEOUS	2	2,233	2,178	4,482	2,909
ADULTS		10,125,576	4,661,459	13,130,865	5,877,344
JACKS		5,449	1,674	12,056	5,588
TOTAL NET ESCAPEMENT					
		10,131,025	4,663,133	13,142,921	5,882,932

\* Estimates are from DFO.

1 Cultus estimates include 276 sockeye in 2006, 357 in 2010 and 225 in 2014 removed for broodstock.

2 'Miscellaneous' category includes fish from small stocks throughout the Fraser watershed.

**Table H3.** Detailed calculation of total allowable catch (TAC) and achievement of international catch shares for Fraser sockeye salmon by management group in 2014. Calculations are based on the in-season estimates of abundance, spawning escapement target and management adjustment at the time the Panel relinquished control of the last U.S Panel Area (October 4), in accordance with Annex IV of the Treaty.

	Fraser Sockeye				
	Early Stuart	Early Summer	Summer	Late	Total
RUN STATUS, ESCAPEMENT NEEDS & AVAILABLE SURPLUS					
In-season Abundance Estimate	233,500	1,900,000	8,150,000	9,600,000	19,883,500
Spawning Escapement Target (SET)	108,000	665,000	2,852,500	3,360,000	6,985,500
%SET from TAM rules	46%	35%	35%	35%	
Management Adjustment (MA)	211,700	279,300	399,400	336,000	1,226,300
Proportional MA (pMA)	0.00	0.00	0	0.1	
Test Fishing Catch (TF, post-seas. est.)	2,800	26,600	78,800	40,500	148,700
Surplus above Adjusted SET & TF *	0	929,100	4,819,300	5,863,500	11,611,900
DEDUCTIONS & TAC FOR INTERNATIONAL SHARING					
Aboriginal Fishery Exemption (AFE)	22,600	55,800	157,500	164,100	400,000
Total Deductions (Adj.SET + TF + AFE)	258,900	1,026,700	3,488,200	3,900,600	8,674,400
Available TAC (Abundance - Deductions)	0	873,300	4,661,800	5,699,400	11,234,500
UNITED STATES (Washington) TAC					
Propor. distrib. TAC - Payback	0	143,600	766,500	937,100	1,847,100
Proportionally distributed TAC **	0	144,100	769,200	940,400	1,853,700 16.5%
U.S. Payback	0	-500	-2,700	-3,300	-6,600
Washington Catch	0	18,900	195,500	487,200	701,600
Deviation from TAC - Payback	0	124,700	570,900	449,800	1,145,500
CANADIAN TAC					
Propor. distrib. TAC + Payback + AFE	22,600	785,500	4,052,900	4,926,500	9,787,400
Propor. distrib. TAC + U.S. Payback	0	729,700	3,895,400	4,762,400	9,387,400 83.6%
AFE	22,600	55,800	157,500	164,100	400,000
Canadian Catch excluding ESSR Catch	23,100	774,100	4,273,900	5,051,700	10,122,800
Deviation from TAC + Payback + AFE	-500	11,400	-221,000	-125,200	-335,400
TOTAL					
Available TAC + U.S. Payback + AFE	22,600	929,600	4,822,100	5,866,900	11,641,100
Total Catch excluding ESSR Catch	23,100	793,000	4,469,400	5,538,900	10,824,400
Deviation from TAC + U.S. Payback + AFE	-500	136,600	352,600	328,000	816,700

\* The surplus cannot exceed the estimated abundance.

\*\* Washington sockeye and pink shares according to Annex IV, Chapter 4 of the Pacific Salmon Treaty.

## APPENDIX I: Members of the Fraser River Panel Technical Committee in 2014

Canada	United States
A. Huang, Co-Chair <i>Fisheries and Oceans Canada</i>	G. Graves, Co-Chair <i>Northwest Indian Fisheries Commission</i>
K. Benner <i>Fisheries and Oceans Canada</i>	A. Dufault <i>Washington Department of Fish and Wildlife</i>
S. Grant <i>Fisheries and Oceans Canada</i>	P. Mundy <i>National Marine Fisheries Service</i>
M. Mortimer <i>Fisheries and Oceans Canada</i>	
J. Scroggie <i>Fisheries and Oceans Canada</i>	
M. Staley <i>First Nations Advisor</i>	

## **APPENDIX J: Staff of the Pacific Salmon Commission in 2014**

### **EXECUTIVE OFFICE**

John Field, Executive Secretary  
Kimberly Bartlett, Secretary/Receptionist  
Sandie Gibson, Information Technology Support Specialist  
Vicki Ryall, Meeting Planner  
Teri Tarita, Records Administrator/Librarian

### **FINANCE AND ADMINISTRATION**

Ilinca Manisali, Controller  
Bonnie Dalziel, Accountant  
Witty Lam, Accountant Assistant  
Victor Keong, Program Assistant, Restoration & Enhancement Funds  
Angus Mackay, Manager, Restoration & Enhancement Funds

### **FISHERIES MANAGEMENT DIVISION**

Mike Lapointe, Chief Biologist

#### **STOCK ASSESSMENT GROUP**

Catherine Michielsens, Quantitative Fisheries Scientist  
Merran Hague, Quantitative Fisheries Biologist  
Kent Collens, Database Manager (Term)  
Cory Lagasse, Data Processing Technician (Term)

#### **STOCK IDENTIFICATION GROUP**

Ian Guthrie, Head  
Holly Anozie, Scale Lab Assistant  
Erica Jenkins, Salmon Technician  
Steve Latham, Sockeye Stock Identification Biologist  
Maxine Reichardt, Senior Scale Analyst  
Julie Sellars, Scale Analyst  
Bruce White, Pink Stock Identification Biologist

#### **STOCK MONITORING GROUP**

Keith Forrest, Test Fishing Biologist  
Fiona Martens, Senior Hydroacoustic Technician  
Mike Bartel-Sawatzky, Hydroacoustic Technician  
Jacqueline Nelitz, Hydroacoustic Technician  
Yunbo Xie, Hydroacoustic Scientist