2013

Report of the Fraser River Panel to the Pacific Salmon Commission on the 2013 Fraser River Sockeye and Pink Salmon Fishing Season

Prepared by the

Pacific Salmon Commission

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REPORT OF THE
FRASER RIVER PANEL
TO THE PACIFIC SALMON COMMISSION
ON THE 2013 FRASER RIVER SOCKEYE AND PINK SALMON FISHING SEASON

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December 2019

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I. EXECUTIVE SUMMARY

Pre-season Planning

1. Pre-season expectations were for a median run size (p50 level) of 4,765,000 Fraser River sockeye salmon and a one in two chance that the run size would be between 2,655,000 and 8,595,000. The median Fraser River pink salmon run size forecast was 8,926,000 (p50 level) with a one in two chance that the run size would be between 6,401,000 and 12,473,000 (Appendix B, Table B1).
2. Forecasted median abundances by sockeye management group were 211,000 Early Stuart, 253,000 Early Summer, 3,718,000 Summer and 583,000 Late-run sockeye (Table 1).
3. Pre-season expectations of migration parameters included a 35% diversion rate for Fraser River sockeye through Johnstone Strait and a 41% diversion rate for Fraser River pink salmon. For fisheries planning, a separate 18.9% diversion rate was assumed for the Harrison stock. Expected Area 20 50% migration dates were July 5 for Early Stuart, July 23 for Early Summer, August 3 for Summer and August 12 for Late-run sockeye, and August 28 for Fraser pink salmon.
4. Pre-season spawning escapement goals were 108,000 Early Stuart, 141,000 Early Summer, 1,487,000 Summer (including Raft/North Thompson and Harrison) and 313,000 Late-run (including Birkenhead) sockeye for a total of 2,049,000 sockeye spawners, and 6,000,000 pink spawners (Table 1). The goals for each sockeye management group were established by applying Canada's Spawning Escapement Plan (Appendix B, Table B2) to the forecasted run sizes. For pre-season planning purposes, Late-run catches were constrained by a 20% Low Abundance Exploitation Rate (LAER).
5. Management Adjustments (MAs, Table 1) of about 62,000 Early Stuart, 65,000 Early Summer and 143,000 Summer-run fish were added to the spawning escapement targets to increase the likelihood of achieving the targets. Details regarding calculations of management adjustments for individual aggregates are provided in the Management Adjustment section of Appendix F.
6. For Late-run sockeye, the Panel assumed a continuation of the early upstream migration behaviour and associated high mortality that has occurred since 1996. For pre-season planning, the Panel adopted a Late-run MA of 209,000 fish based on the weighted average of a fixed Birkenhead pMA and a cycle-line median pMA for Late-runs (excluding Birkenhead) since 1996, using the p50 forecast abundance level to determine the appropriate weighting.
7. The projected international Total Allowable Catch (TAC, Table 1) of Fraser River sockeye salmon based on the median forecasted abundances and agreed deductions was 1,727,000 sockeye, of which 16.5% (285,000 sockeye) were allocated to the United States (U.S.). The projected TAC of Fraser River pink salmon based on the median forecasted abundance and agreed deductions was 2,843,000 pinks, of which 25.7% (731,000 pinks) were allocated to the U.S.
8. Domestic objectives within the U.S. for Fraser River sockeye salmon included an allocation to Treaty Indian fishers of 67.7% of the U.S. share of the TAC, with the rest allocated to All Citizen fishers. In Canada, pre-season catch expectations for sockeye included 993,000 fish for First Nations FSC, 19,500 fish for recreational and 829,000 fish for commercial (including First Nations economic opportunity ("EO") and demonstration ("Demo")) fishers.
9. Pre-season model runs indicated it was unlikely the Summer-run TAC could be fully harvested, due to the need to constrain fisheries in order to achieve spawning escapement targets for co-migrating Early Summer and Late-run stocks. However, at the assumed marine timing, abundances and diversion rates in the base-case model, both countries were able to achieve their TAC of Fraser pink salmon.
10. The Panel adopted the Management Plan Principles and Constraints (Appendix C), which contained measures to address Late-run concerns, and the 2013 Regulations (Appendix D).

In-season Management Considerations

11. Marine migration timing (Figure 3) was several days (7-11 days) later than pre-season expectations for the Summer and Late-run sockeye management groups, while the Early

Stuart group was 2 days earlier than expected and the Early Summer group was 1 day later than expected. The migration of Fraser pink salmon (Figure 4) was 2 days later than expected.

12. Overall Johnstone Strait diversion rates (Figure 5) were 71% for sockeye and 65% for pink salmon, compared to pre-season expectations of 35% and 41%, respectively.
13. Total sockeye salmon returns were less than the sum of the median pre-season forecast abundances for individual groups, while pink salmon returns exceeded the median pre-season forecast. Of the individual groups, the return abundances of Summer-run and Early Stuart populations were less than their median expectations while the return abundances of Early Summer and Late-run sockeye exceeded their median expectations.
14. River temperatures (Figure 6) were warmer than average and flow levels were initially higher than average but declined to lower than average. As a result of the higher than expected temperature levels, in-season MA models predicted values (Table 1) that were considerably larger than expected especially for Summer-run sockeye (144,000 fish for Early Stuart, 176,000 fish for Early Summer and 3,110,000 fish for the Summer run). Most Late-run sockeye migrated upstream without delaying in the Strait of Georgia. The pre-season MA for the Late-run excluding Birkenhead was not updated in-season due to concerns about the ability to accurately predict the low relative abundance of Late-run sockeye and its' stock proportions in samples from river test fisheries, both of which impact the accuracy of the prediction of upstream timing. However, the MA for the aggregate Late run increased to 288,000 fish because the relative weights of Birkenhead and non-Birkenhead stocks changed over the course of the season.

Run Size, Catch and Escapement

15. Returns of Fraser sockeye (Tables 8 and 9) totalled 4,050,000 fish, about two and a half times the brood year abundance in 2009, but otherwise the lowest return on the cycle since 1965 (Figure 7). Divided into management groups, returns totalled 183,000 Early Stuart, 554,000 Early Summer, 2,658,000 Summer and 655,000 Late-run sockeye. The increase in return relative to the brood year was in part a consequence of the significant restraint exerted by all user groups in 2009 when less than 8% of the run was harvested.
16. Catches of Fraser River sockeye salmon in all fisheries totalled 578,000 fish, including 411,000 fish caught by Canada, 20,000 fish caught by the U.S. in Washington and 46,000 in Alaska, and 100,000 fish caught by test fisheries (Table 8). Most of the Canadian catch occurred in First Nations fisheries (407,000 fish). In Washington, commercial catches totalled 4,000 fish, almost all caught in Treaty Indian fisheries, and Ceremonial catches totalled 16,000 Fraser sockeye. The overall harvest rate (Figure 8) was 14% of the run, which is the second lowest harvest rate since at least 1985, following 2009.
17. DFO's near-final estimates of spawning escapements to streams in the Fraser River watershed totalled 2,479,000 adult and 93,000 jack sockeye (Tables 8 and 9). This was more than double the brood year escapement of 1,056,000 adults and similar to the average for both the cycle and the entire time series since 1985 (Figure 10). By management group and for this cycle line, adult spawning escapements in 2013 were below the 1941-2012 average for the Early Stuart system, the second highest Early Summer escapement, slightly above average for Summer-run escapement, and the second highest Late-run escapement. There were 1,244,000 effective female spawners in the Fraser watershed, representing an overall spawning success of 97%.
18. The in-season run-size estimate of 26,000,000 Fraser River pink salmon was derived by dividing the cumulative catch per unit effort in marine purse seine test fisheries which sample the migration on both the northern and southern migration routes by the appropriate average catchability. It was later revised post-season to 15,898,000 fish (see 19 below), making it 78% larger than forecasted and above average for the years since 1959 when records began (Figure 11). Catches totalled 6,553,000 fish, with 3,314,000 caught by Canada, 3,200,000 by the U.S. and 39,000 in test fisheries (Tables 8 and 9). This catch represents an exploitation rate of 41%, which is the largest since 1997.
19. Since 2009, post-season estimates of pink salmon passage have been obtained through the hydroacoustic program at Mission. In 2013, the run size of Fraser River pink salmon was calculated by adding the total catch of pink salmon below Mission (5,363,000 fish) to the Mission passage estimate (10,535,000 fish), while the spawner abundance (9,344,000 fish) was calculated by subtracting total catch in all fisheries from the run size.

Achievement of Objectives

20. In order of descending priority, the goals of the Panel are to achieve the targets for spawning escapement, and the objectives for international sharing of the TAC and domestic catch allocation.
21. 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 all catch above Mission) were close to the target for Early Stuart sockeye (6% under), higher than the target for Early Summer-run (23% over), below the target for Summer-run (15% under), and close to the target for Late-run (7% under) sockeye (Table 14).
22. Spawning ground estimates of Fraser sockeye abundance totalled 2,479,000 adults, which is 31% above the post-season target (Table 15). Spawner abundances were below target for Early Stuart sockeye (20% under), Early Summer run (7% under) and Late run (8% under) whereas it was above target for Summer run (51% over) sockeye. More than ninety percent of the Early Stuart run was protected from harvest. Thus, the poor result on the spawning grounds for this group was likely a consequence of elevated levels of en route mortality, possibly due to larger than predicted impacts of high discharge levels in the Fraser River during the early portion of the Early Stuart migration period (Figure 6). Despite much higher than average river temperature during its upstream migration, the Summer-run group did not experience the high levels of en-route mortality that were predicted in-season by the Management Adjustment models (Table 6).
23. The TAC (Total Allowable Catch, Table 16) of Fraser sockeye was 83,000 fish, based on the calculation method set out in Annex IV, Chapter 4 of the Pacific Salmon Treaty and the February 17, 2011 Commission Guidance. The Washington catch of 20,200 Fraser sockeye was 6,600 fish more than their 16.5% share. The total Canadian catch of 410,000 Fraser sockeye (excluding the ESSR catch of 1,200 Weaver sockeye) was 59,000 fish less than their in-season catch goal (83.5% of TAC + 400,000 fish AFE). In these calculations, the TAC is fixed on the date that Panel control of the last U.S. Panel Area was relinquished (October 5 in 2013), while catches are post-season estimates.
24. In terms of domestic allocation objectives for Fraser sockeye, Treaty Indian fishers were 10,800 fish over and All Citizen fishers were 4,200 fish under their shares of the U.S. TAC (Table 17).
25. The spawning escapement target for Fraser pink salmon was exceeded by 3,344,000 fish (Table 15), largely because the catch of Fraser pink salmon was constrained by conservation measures to protect Late-run sockeye. The U.S. catch was 1,467,000 fish less than their 25.7% share of the international TAC and the Canadian catch was 10,180,000 fish less than their catch goal (Table 16).
26. In terms of domestic allocation objectives for Fraser River pink salmon, Treaty Indian and All Citizen fishers were respectively 987,000 and 480,000 fish under their shares of the U.S. TAC (Table 18).
27. By-catches (Table 19) of non-Fraser sockeye and pink salmon in commercial net fisheries regulated by the Fraser River Panel totalled 10 sockeye and 930,000 pink salmon. Catches of other Fraser and non-Fraser salmon species included 4,500 Chinook, 12,000 coho, 1,850 chum and 10 steelhead.

Allocation Status

28. There is a U.S. payback of 6,600 Fraser River sockeye to carry forward to 2014 but no payback owed for pink salmon (Table 20).

II. FRASER RIVER PANEL

In 2013, the Panel operated under the terms of Annex IV, Chapter 4 of the Pacific Salmon Treaty between Canada and the United States (U.S.) [1] and the February 2011 "Commission Guidance to the Fraser River Panel" [2]. The Fraser River Panel was 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. 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. 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 and pink 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 and pink 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 D) unless opened by specific order (Appendix E). 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 I) of sockeye and pink salmon run size, migration timing and route, in-river migration abundance (i.e., Mission passage) 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 H) 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.

[1] Pacific Salmon Commission. 2009. Report of the Fraser River Panel to the Pacific Salmon Commission on the 2005 Fraser River sockeye and pink salmon fishing season. Appendix A. Vancouver, B.C.
[2] Pacific Salmon Commission. 2016. Report of the Fraser River Panel to the Pacific Salmon Commission on the 2011 Fraser River sockeye and pink salmon fishing season. Appendix C. Vancouver, B.C.

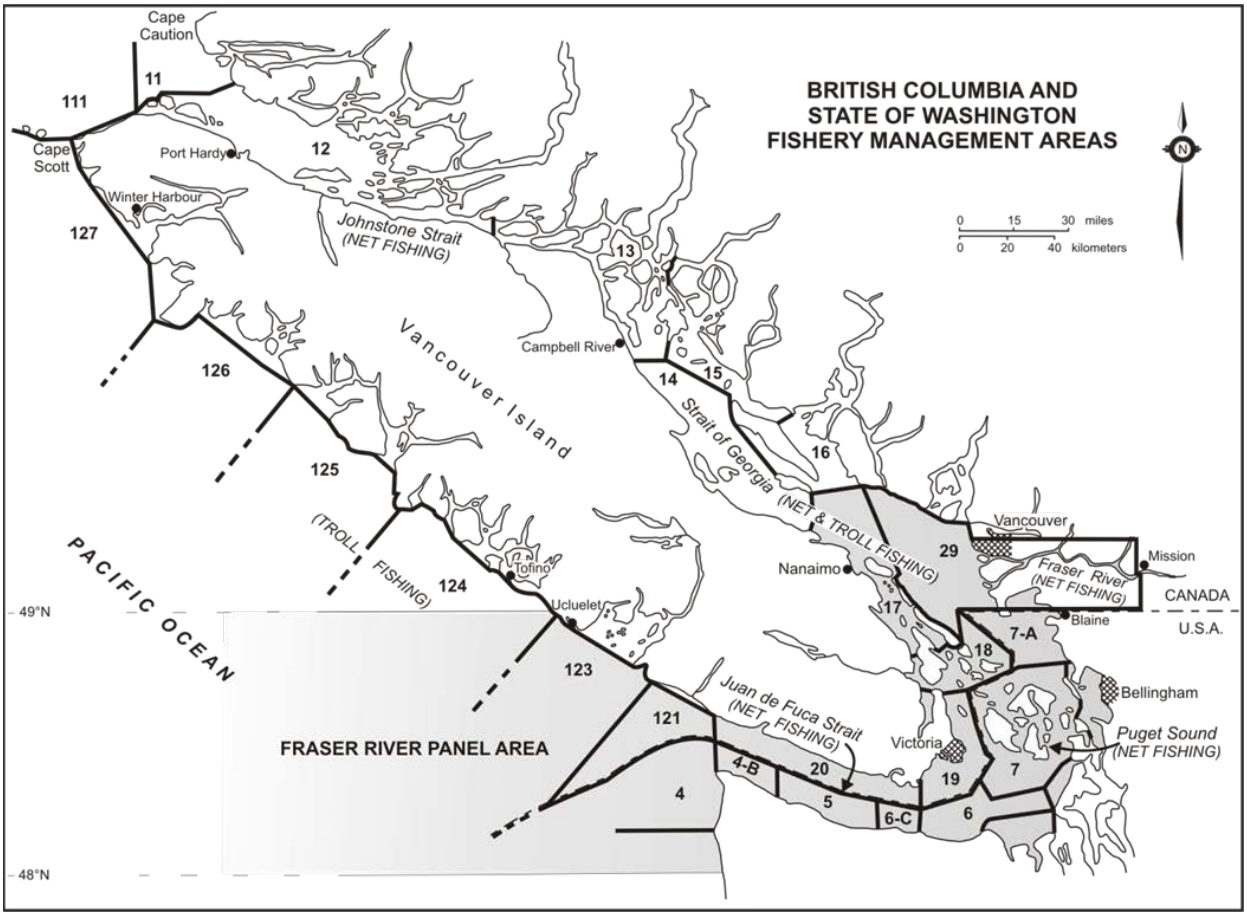

Figure 1. Fishery management areas in the Fraser River Panel Area and south coast waters.

III. PANEL MANAGEMENT ACTIVITIES

Information used for Panel management can be divided into three general categories: (1) pre-season forecasts and expectations, on which pre-season planning activities and the 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. Key information in these 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 Planning Model [3], 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 MAs, plus objectives for spawning escapement and catch allocation. Inputs to the "base case" planning model are summarized under the "Pre-season" rows in Table 1.

[3] 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.

Both countries evaluated fishing plans that included directed sockeye (primarily on the Summer-run group) and pink salmon fisheries. The Canadian fishing plan evaluated limited, almost exclusively in-river, sockeye fisheries. The ability of either country to achieve their sockeye total allowable catch (TAC) was constrained by a zero TAC (10% LAER) on Early Stuart sockeye early in the season and a 20% LAER on Late-run sockeye later in the season. The LAER is applied to accommodate "small but acceptable" amounts of by-catch for management groups with little or no TAC (Appendix C). Both countries were projected to achieve their allocated TAC for Fraser pink salmon. In the modelling, separate accounting of release mortalities for sockeye captured and released during pink-directed fisheries was factored into estimates of exploitation rate but excluded from total catch estimates used to evaluate catches relative to shares of the TACs. Alternative model runs explored the sensitivity of fishing plans to pink salmon run size.

Preliminary run-size forecasts for Fraser River sockeye salmon were produced by Canada using a variety of stock-recruit models similar to those analysed in previous years and including data up to the 2005 brood year. Canada presented the Panel with preliminary sockeye and pink salmon 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 B, Table B1). In 2013, the Panel used the median (i.e., 50% probability level) forecast of about 4.8 million Fraser River sockeye and 8.9 million Fraser River pink salmon as the "base case" scenario for planning purposes. One alternative scenario with 12.5 million Fraser pink salmon (i.e., 75% probability level forecast) was also considered.

Canada used the Total Allowable Mortality (TAM) rules derived from the "Fraser River Sockeye Spawning Initiative" (FRSSI) model to establish escapement goals for the 2012 management season. The spawning escapement plan released by Canada to the Panel (Appendix B, Table B2) was based on FRSSI guidelines with input from a domestic consultation process. Pre-season escapement targets for sockeye management groups at the 50% run-size levels were: Early Stuart – 108,000; Early Summer – 141,000; Summer – 1,487,200; and Lates – 313,000 [4]. The pre-season escapement target for pink salmon at the 50% run-size level was 6,000,000.

In 2013, changes to Canada's Fisheries Act re-introduced the opportunity for "pay fish" or "discretionary" catch to be retained in test fisheries to offset costs of test fish operations. Simulated test fisheries in the Planning Model were modified to reflect this change in mandate. The retention of sockeye and pink salmon pay fish in purse seine test fisheries was structured such that all test fisheries produced a combined total revenue of approximately $1,400,000, assuming average weights of 5.8 pounds and 4 pounds and average price per pound of $2.00 and $0.20 for sockeye and pink salmon, respectively. Sockeye retention was modelled beginning on July 27, one week after the planned purse seine test fishery opening, and continuing until approximately 110,000 sockeye were landed across all test fisheries. The delay in purse seine retention was implemented to limit impacts on Sakinaw sockeye and Early Summer stocks and the limit on total sockeye catch was implemented to limit impacts on Late-run stocks. Initially, pink salmon retention by purse seine test fisheries overlapped with sockeye retention. Pink salmon retention with sockeye release was instated in purse seine test fisheries on August 26 and continued until the last day of purse seine test fishery openings (September 3 in Area 13 and September 10 in Areas 12 and 20). This pattern of pink retention results in an estimated 83,400 Fraser River pink salmon being retained in the Fraser Panel approved test fisheries. Fishing induced mortalities (FIMs) of 25% were applied to any sockeye caught and released by purse seine test fisheries during the latter pink-retention period; timing of this retention window was structured to minimize sockeye FIMs, particularly on Late-run stocks.

Pre-season fisheries management planning was based on assumptions about the proportions of Fraser sockeye and pink salmon that would migrate through Juan de Fuca Strait versus Johnstone Strait (i.e., Johnstone Strait diversion rate, Figure 2) as well as marine timing (i.e., Juan de Fuca or Area 20 50% migration dates). 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. For planning purposes, the Panel adopted the median Area 20 run timing forecasts of July 5 and August 4, respectively, for Early Stuart and Chilko

[4] 2013/2014 Southern B.C. Salmon Integrated Fishery Management Plan. Fisheries and Oceans Canada.

stocks generated by DFOs oceanographic models[5]. These marine dates represent near-normal timing for Early Stuart (historical median is July 4) and earlier than normal timing for Chilko (historical median is August 8) stocks. Area 20 timing for the Early Miscellaneous, Scotch/Seymour, Late Stuart/Stellako, Chilko/Quesnel, Adams/Weaver and Birkenhead stock groups were calculated as a function of Early Stuart and Chilko timing using historical regression models to forecast the timing of component stocks. The timing of individual stock-groups was then weighted by the p50 pre-season forecast run sizes of their components (or the 2009 brood year abundance in the case of Horsefly and Mitchell) to calculate a pre-season timing forecast for each aggregate in the Planning Model. Timing of Harrison and Raft/North Thompson stocks were calculated as a historic offset from Chilko timing (Harrison = Chilko – 3-days; Raft-North Thompson = Chilko + 4-days) due to the relatively short length of their historical time series. For planning purposes, the Panel used weighted average Area 20 dates of July 23 for Early Summer run, August 3 for Summer run and August 12 for Late run based on the timing and abundance of component groups. Figure 3 illustrates the distribution of daily abundances for each sockeye management group given these pre-season assumptions of timing and total run size. DFO also used oceanographic models to produce a pre-season forecast of 35% of Fraser sockeye diverting through Johnstone Strait[5]. A mean historical Area 20 timing of August 28 (Figure 4) and Johnstone Strait diversion of 41% was adopted for Fraser River pink salmon.

The Panel adopted an 8-day upstream "delay" for modeling non-Birkenhead Late-run migratory behaviour, corresponding to the median observed delay on this cycle-line since 1997 and resulting in an August 28 Mission 50% date (i.e., the date 50% of the run has passed Mission) for the non-Birkenhead component and an August 23 Mission 50% date for the overall Late-run group including Birkenhead. To produce this delay scenario, the Planning Model assumed 42% of non-Birkenhead Late-run fish delay in the Gulf and then migrate upstream with a Mission 50% date of September 8, while 58% of non-Birkenhead Late-run fish migrate directly into the river. The same approach was applied to model upstream timing for the Harrison stock. The Panel adopted a 5-day delay for Harrison sockeye (average delay in 2005 and 2009), resulting in a Mission 50% date of August 12. The Harrison delay model also assumed 28% of Harrison fish delay in the Gulf and then migrate upstream with a Mission 50% date of September 7 and 72% of Harrison fish migrate directly into the river.

DFO's Environmental Watch Program provided the Panel with long-range (3-month) projections of Fraser River temperature and discharge conditions. Forecasts projected above-average discharge and near-normal water temperatures for all sockeye management groups. Staff used the environmental forecasts in Management Adjustment (MA) models developed jointly by DFO and the PSC to predict how many additional fish from the Early Stuart, Early Summer and Summer management groups should be allowed to escape to increase the probability of achieving spawning escapement objectives (see references in the MA section of the report). Forecasts of upstream timing were used to forecast MAs for the Late run. The median MA forecast from the Early Stuart model was adopted by the Panel for the "base-case" scenario: Early Stuart pMA = 0.57 (numerical MA = 61,600). Fixed pMAs were adopted for Chilliwack (0.57; the weighted average of the %DBE for 2008-2012, excl. 2009, based on the potential spawning escapement), Pitt (0; assume no pMA because Pitt does not migrate past Mission), Birkenhead (0.34; median of all years) and Harrison (0.37; median of 2004-2012, excluding 2010), and combined with MA model forecasts or historical medians to calculate weighted average aggregate pMAs for the Early Summer, Summer and Late runs.

[5] Folkes, Michael J P and Thomson, Richard E and Hourston, Roy A S. 2017. Evaluating Models To Forecast Fraser Sockeye Return Timing And Diversion Rate. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/021.

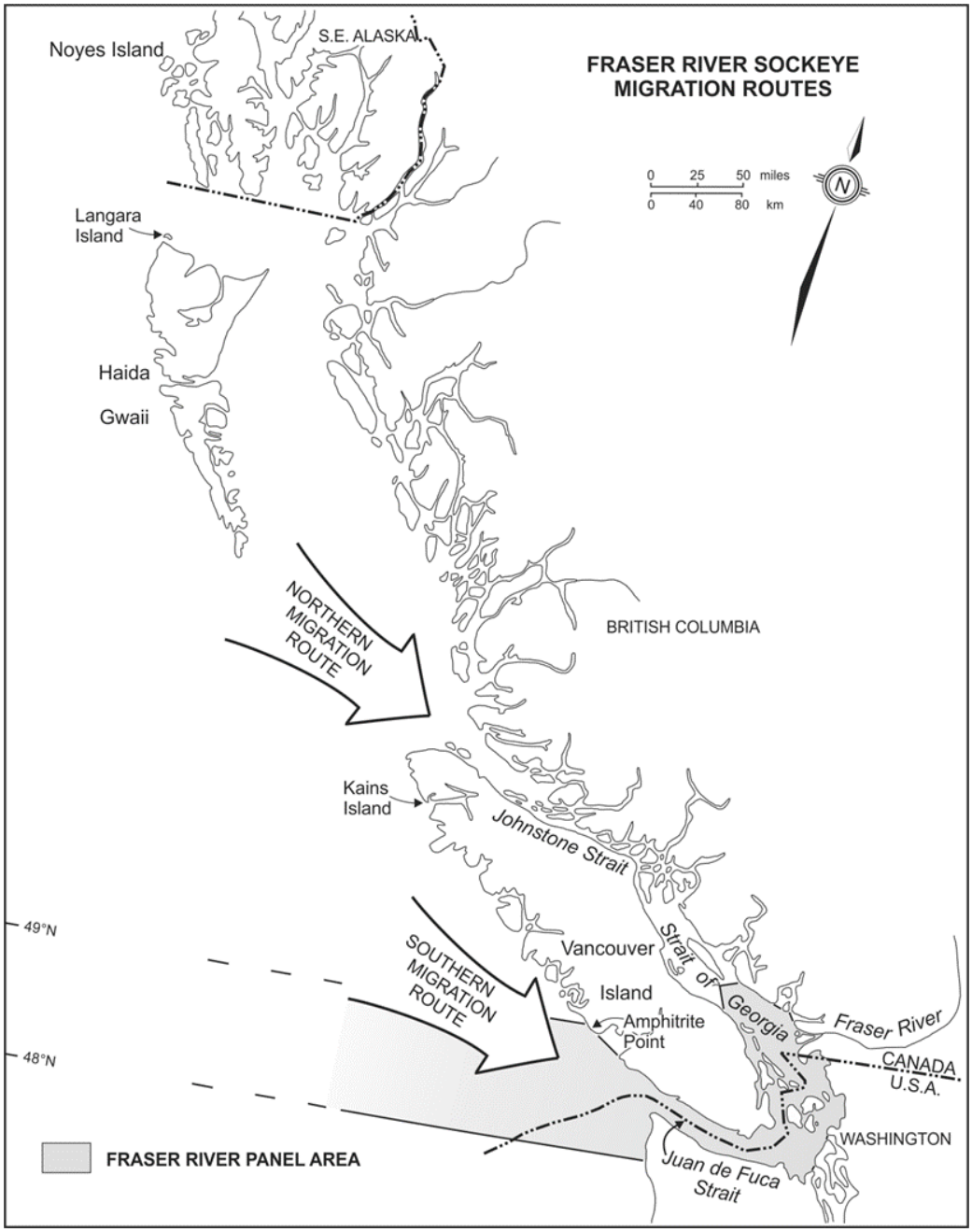

Figure 2. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migration to the Fraser River.

A weighted average using pre-season 50% probability level abundances was used to combine the forecasted Early Summer (excluding Pitt and Chilliwack) pMA of 0.46 with the fixed Chilliwack and Pitt pMAs to produce an overall Early Summer pMA of 0.46 (numerical MA = 64,900). Similarly, a weighted average was used to combine the forecasted Summer (excluding Harrison) pMA of 0.09 with the fixed Harrison pMA to produce an overall Summer pMA of 0.10 (numerical MA = 143,000). Finally, a weighted average was used to combine the cycle-line median pMA of 1.03 for Late-run (excluding Birkenhead) with the Birkenhead pMA to produce an overall Late-run pMA of 0.67 (numerical MA = 209,200).

Given the "base-case" conditions using the biological parameters described above, Canada and the U.S. developed fishing plans for sockeye salmon beginning the weeks of July 7 (Canada; First Nations in-river only) and July 21 (U.S.; Area 4B56C). Due to conservation concerns, a 3-

week moving closure window for Early Stuart sockeye restricted fisheries openings for earlier dates. Canada also planned for two small sockeye commercial fishing openings under the "base-case" scenario. Pink fisheries were scheduled to open the week of August 25 in both Canada and the U.S. Canadian commercial troll and seine fisheries switched to sockeye non-retention on August 10. Fishing induced mortalities were applied to sockeye catches in openings after these dates (25% for seines and 10% for troll). All modelled U.S. fisheries assumed full sockeye retention. The pre-season plan included the "Management Plan Principles and Constraints", and "2013 Regulations" (Appendices C and D). If in-season assessments indicated that the return abundances of sockeye salmon were lower or higher than forecast, that the return timing of sockeye stocks was significantly different than forecast, or that the in-season forecasts of MAs deviated from pre-season forecasts, then the commencement and duration of fisheries and/or assumed exploitation rates could deviate from the proposed plan.

TACs and international harvest shares for Fraser sockeye were calculated according to the February 17, 2011 Commission Guidance to the Fraser River Panel and the 2005 revised Annex IV, Chapter 4 of the Pacific Salmon Treaty. The U.S. (Washington) share was 16.5% of the sockeye salmon TAC. With a pre-season TAC projection of 1,726,500 sockeye for international sharing, the corresponding U.S. share was 284,900 fish. In terms of domestic goals, Treaty Indian fishers were allocated 67.7% and All-Citizen fishers the remaining 32.3% of the U.S. TAC. The Canadian allowable harvest including the 400,000 Aboriginal Fishery Exemption (AFE) was 1,841,600 sockeye. Within non-commercial sectors in Canada, pre-season shares for sockeye were 734,200 fish for in-river First Nations and 259,200 fish for marine First Nations. In the commercial sector the target of 828,700 fish was divided as follows: 48.5% for Area B purse seines, 22.0% for Area D gillnets, 25.5% for Area E gillnets and 4% for Area H trollers.

During the pre-season planning process, both countries identified salmon stocks and marine mammal populations for which they had conservation concerns and that would influence management decisions for fisheries directed at Fraser sockeye and pink salmon. Canada identified interior Fraser River coho, Strait of Georgia coho; Spring 4_2 and 5_2 Chinook; Summer 5_2 Chinook; Lower Georgia Strait and West Coast Vancouver Island Chinook; Fraser Summer-run steelhead; Cultus and Sakinaw sockeye; other Vancouver Island sockeye stocks and Southern Resident killer whales. The U.S. highlighted concerns for Puget Sound Chinook and steelhead, Hood Canal summer-run chum, Puget Sound rockfish, eulachon, green sturgeon and Southern Resident killer whales.

B. In-season Management

In 2013, Fraser sockeye and pink salmon groups generally returned at run sizes that were near to or greater than the median pre-season forecasts and with marine timing near to or later than forecasted (Figure 3). Early Stuart sockeye returned approximately two days earlier than expected, Early Summer one day later than expected, while Summer and Late run arrived 7 days later than expected. The abundance of Early Summer-run sockeye and Fraser River pink salmon were well above their median forecast level. Management challenges arose due to the application of directed pink salmon fisheries by the US with optional sockeye retention, which increased the complexity of evaluating new fisheries plans. Record high Fraser River water temperatures on several days raised concerns about the success of migrating sockeye. The Panel responded to these challenges in-season by modifying management adjustments and fishing plans accordingly.

The Panel convened 22 times from July 15 through September 24, to discuss run status and enact in-season Orders (Appendix E) to regulate fisheries directed at Fraser River sockeye and pink salmon in Panel Areas. Table 1 summarizes pre-season and in-season updates to data used by the Fraser River Panel by management group and by meeting date, including estimates of run size and the various components that result in the calculated TAC (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 last date shown in Table 1 (October 5) is the "TAC date", which is when the Panel relinquished regulatory control of the last U.S. Panel Area and is therefore when the U.S. share of the TAC was established. The main events that transpired each week are summarized below, with a focus on Staff assessments and Panel decisions.

Table 1. Pre-season and in-season updates of run size, spawning escapement targets and other TAC-related values for Fraser River sockeye and pink salmon in 2013. 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.

Date		Management Group	Total Abundance	TAC: Spawning Escapement Target	pMA	Management Adjust.	Test Fishing	Aboriginal Fishery Exemption	Total Allowable Catch	Available Harvest **	Catch to date	Mission Passage to date	50% Migration Date Area 20
June 19	Pre-season	Early Stuart	211,000	108,000	0.57	61,600	5,000	36,400	0	41,400	0	0	5-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	19,500	20,600	47,100	0	0	23-Jul
		Summer	3,718,000	1,487,200	0.10	143,000	89,600	331,100	1,667,100	2,087,800	0	0	3-Aug
		Late	583,000	313,000	0.67	209,200	8,900	13,000	38,900	60,800	0	0	12-Aug
		Sockeye	**4,765,000**	**2,049,200**		**478,700**	**110,500**	**400,000**	**1,726,600**	**2,237,100**	**0**	**0**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug
July 2	In-season	Early Stuart	211,000	108,000	0.57	61,600	5,000	36,400	0	41,400	134	8,727	5-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	19,500	20,600	47,100	40	2,373	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	331,100	1,661,400	2,082,100	0	0	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,000	38,400	60,300	0	0	12-Aug
		Sockeye	**4,765,000**	**2,049,200**		**484,900**	**110,500**	**400,000**	**1,720,400**	**2,230,900**	**174**	**11,100**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug
July 9	In-season	Early Stuart	211,000	108,000	0.57	61,600	5,000	36,400	0	41,400	1,093	99,252	5-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	19,500	20,600	47,100	472	18,767	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	331,100	1,661,400	2,082,100	0	0	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,000	38,400	60,300	0	0	12-Aug
		Sockeye	**4,765,000**	**2,049,200**		**484,900**	**110,500**	**400,000**	**1,720,400**	**2,230,900**	**1,565**	**118,018**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug
July 12	In-season	Early Stuart	217,000	108,000	1.27	137,200	5,000	36,400	0	0	1,600	120,000	4-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	19,500	20,600	47,100	1,200	28,300	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	331,100	1,661,400	2,082,100	100	300	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,000	38,400	60,300	0	0	12-Aug
		Sockeye	**4,771,000**	**2,049,200**		**560,500**	**110,500**	**400,000**	**1,720,400**	**2,189,500**	**2,900**	**148,600**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug
July 16	In-season	Early Stuart	217,000	108,000	1.27	137,200	5,000	36,400	0	0	3,900	148,200	4-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	19,500	20,600	47,100	1,900	63,700	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	331,100	1,661,400	2,082,100	300	3,300	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,000	38,400	60,300	0	300	12-Aug
		Sockeye	**4,771,000**	**2,049,200**		**560,500**	**110,500**	**400,000**	**1,720,400**	**2,189,500**	**6,100**	**215,500**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug
July 19	In-season	Early Stuart	180,000	108,000	1.33	143,600	5,000	13,000	0	0	4,900	167,500	2-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	20,800	19,300	47,100	2,300	88,000	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	352,400	1,640,100	2,082,100	500	9,500	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,800	37,600	60,300	0	300	12-Aug
		Sockeye	**4,734,000**	**2,049,200**		**566,900**	**110,500**	**400,000**	**1,697,000**	**2,189,500**	**7,700**	**265,300**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**200**		28-Aug
July 23	In-season	Early Stuart	180,000	108,000	1.33	143,600	5,000	13,000	0	0	5,000	173,100	2-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	20,800	19,300	47,100	3,000	123,800	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	352,400	1,640,100	2,082,100	1,400	31,000	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,800	37,600	60,300	0	300	12-Aug
		Sockeye	**4,734,000**	**2,049,200**		**566,900**	**110,500**	**400,000**	**1,697,000**	**2,189,500**	**9,400**	**328,200**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**300**		28-Aug
July 26	In-season	Early Stuart	180,000	108,000	1.33	143,600	5,000	13,000	0	0	5,200	177,500	2-Jul
		Early Summer	253,000	141,000	0.46	64,900	7,000	20,800	19,300	47,100	4,800	181,200	23-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	352,400	1,640,100	2,082,100	3,500	49,900	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,800	37,600	60,300	100	600	12-Aug
		Sockeye	**4,734,000**	**2,049,200**		**566,900**	**110,500**	**400,000**	**1,697,000**	**2,189,500**	**13,600**	**409,200**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**1,300**		28-Aug
July 29	In-season	Early Stuart	180,000	108,000	1.33	143,600	5,000	13,000	0	0	5,200	179,900	2-Jul
		Early Summer	400,000	160,000	0.54	86,400	7,000	20,800	125,800	153,600	5,900	226,700	21-Jul
		Summer	3,718,000	1,487,200	0.10	148,700	89,600	352,400	1,640,100	2,082,100	6,800	97,400	3-Aug
		Late	583,000	313,000	0.67	209,700	8,900	13,800	37,600	60,300	200	1,700	12-Aug
		Sockeye	**4,881,000**	**2,068,200**		**588,400**	**110,500**	**400,000**	**1,803,500**	**2,296,000**	**18,100**	**505,700**	
		Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug

Table 1, continued next page

Table 1, continued.

Date	Management Group	Total Abundance	TAC: Spawning Escapement Target	pMA	Manage-ment Adjust.	Test Fishing	Aboriginal Fishery Exemption	Total Allowable Catch	Available Harvest **	Catch to date	Mission Passage to date	50% Migration Date Area 20
August 2 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,300	180,400	2-Jul
	Early Summer	400,000	160,000	0.54	86,400	9,000	21,100	123,500	153,600	18,100	331,400	21-Jul
	Summer	3,718,000	1,487,200	0.10	148,700	89,600	358,600	1,633,900	2,082,100	41,000	249,900	3-Aug
	Late	583,000	313,000	0.67	209,700	8,900	14,100	37,300	60,300	2,100	10,300	12-Aug
	Sockeye	**4,883,000**	**2,068,200**		**588,400**	**109,500**	**400,000**	**1,794,700**	**2,296,000**	**67,500**	**772,000**	
	Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**12,800**		28-Aug
August 6 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,300	179,900	2-Jul
	Early Summer	452,000	180,800	0.57	103,100	9,000	21,100	138,000	168,100	25,900	371,800	22-Jul
	Summer	3,718,000	1,487,200	0.10	148,700	89,600	358,600	1,633,900	2,082,100	81,000	382,800	3-Aug
	Late	583,000	313,000	0.67	209,700	8,900	14,100	37,300	60,300	8,900	22,600	12-Aug
	Sockeye	**4,935,000**	**2,089,000**		**605,100**	**109,500**	**400,000**	**1,809,200**	**2,310,500**	**122,100**	**957,100**	
	Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**20,700**		28-Aug
August 9 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,300	179,900	2-Jul
	Early Summer	452,000	180,800	0.58	104,900	15,000	21,100	130,200	166,300	38,400	401,300	22-Jul
	Summer	2,000,000	1,254,000	1.56	1,956,200	80,000	358,600	0	0	164,600	532,800	8-Aug
	Late	583,000	313,000	0.67	209,700	8,900	14,100	37,300	60,300	16,900	27,200	12-Aug
	Sockeye	**3,217,000**	**1,855,800**		**2,414,400**	**105,900**	**400,000**	**167,500**	**226,600**	**226,200**	**1,141,200**	
	Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**22,700**		28-Aug
August 13 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,100	179,900	2-Jul
	Early Summer	475,000	190,000	0.65	123,500	15,000	21,100	125,400	161,500	48,500	431,300	22-Jul
	Summer	2,000,000	1,254,000	1.56	1,956,200	70,000	358,600	0	0	274,000	756,800	8-Aug
	Late	583,000	313,000	0.67	209,700	10,000	14,100	36,200	60,300	32,300	46,000	12-Aug
	Sockeye	**3,240,000**	**1,865,000**		**2,433,000**	**97,000**	**400,000**	**161,600**	**221,800**	**360,900**	**1,414,000**	
	Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**28,900**		28-Aug
August 16 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,100	179,900	2-Jul
	Early Summer	520,000	208,000	0.72	149,800	15,000	151,300	0	162,200	50,500	477,200	24-Jul
	Summer	2,300,000	1,254,000	2.35	2,946,900	70,000	192,200	0	0	290,800	993,800	9-Aug
	Late	583,000	313,000	0.67	209,700	10,000	50,300	0	60,300	35,000	64,900	12-Aug
	Sockeye	**3,585,000**	**1,883,000**		**3,450,000**	**97,000**	**400,000**	**0**	**222,500**	**382,400**	**1,715,800**	
	Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**0**		28-Aug
August 19 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,000	180,500	2-Jul
	Early Summer	520,000	208,000	0.72	149,800	12,000	151,300	0	162,200	52,100	480,800	24-Jul
	Summer	2,300,000	1,254,000	2.35	2,946,900	72,000	192,200	0	0	326,100	1,273,400	9-Aug
	Late	583,000	313,000	0.67	209,700	12,000	50,300	0	60,300	36,100	114,000	12-Aug
	Sockeye	**3,585,000**	**1,883,000**		**3,450,000**	**98,000**	**400,000**	**0**	**222,500**	**420,300**	**2,048,700**	
	Pink	**8,926,000**	**6,000,000**			**83,400**		**2,842,600**	**2,926,000**	**35,900**		28-Aug
August 23 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,000	180,100	2-Jul
	Early Summer	520,000	208,000	0.72	149,800	12,000	151,300	0	162,200	52,400	493,000	24-Jul
	Summer	2,300,000	1,254,000	2.35	2,946,900	72,000	192,200	0	0	342,500	1,487,700	9-Aug
	Late	583,000	313,000	0.67	209,700	12,000	50,300	0	60,300	36,600	149,500	12-Aug
	Sockeye	**3,585,000**	**1,883,000**		**3,450,000**	**98,000**	**400,000**	**0**	**222,500**	**437,500**	**2,310,300**	
	Pink	**10,000,000**	**6,000,000**			**83,400**		**3,916,600**	**4,000,000**	**38,300**		28-Aug
August 27 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	6,200	0	0	6,000	180,100	2-Jul
	Early Summer	550,000	220,000	0.85	187,000	12,000	65,500	65,500	143,000	52,300	503,500	25-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	72,000	280,000	0	0	342,800	1,798,300	10-Aug
	Late	450,000	313,000	0.90	281,700	12,000	48,300	0	0	38,400	201,700	13-Aug
	Sockeye	**3,582,000**	**1,895,000**		**3,722,200**	**98,000**	**400,000**	**65,500**	**143,000**	**439,500**	**2,683,600**	
	Pink	**14,000,000**	**6,000,000**			**83,400**		**7,916,600**	**8,000,000**	**111,200**		25-Aug
August 29 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	179,900	2-Jul
	Early Summer	550,000	220,000	0.85	187,000	12,000	85,000	46,000	143,000	52,700	512,300	25-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	72,000	284,700	0	0	367,600	1,829,100	10-Aug
	Late	500,000	313,000	0.91	284,800	12,000	26,200	0	0	39,800	254,300	15-Aug
	Sockeye	**3,632,000**	**1,895,000**		**3,725,300**	**98,000**	**400,000**	**46,000**	**143,000**	**466,200**	**2,775,600**	
	Pink	**16,000,000**	**6,000,000**			**83,400**		**9,916,600**	**10,000,000**	**308,100**		29-Aug

Table 1, continued on next page

Table 1, continued.

Date	Management Group	Total Abundance	TAC: Spawning Escapement Target	TAC: pMA	TAC: Manage-ment Adjust.	TAC: Test Fishing	TAC: Aboriginal Fishery Exemption	TAC: Total Allowable Catch	Available Harvest **	Catch to date	Mission Passage to date	50% Migration Date Area 20
September 3 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	179,900	2-Jul
	Early Summer	550,000	220,000	0.85	187,000	12,000	84,800	46,200	143,000	52,800	513,200	25-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	75,000	284,900	0	0	369,000	2,026,200	10-Aug
	Late	600,000	313,000	0.91	284,800	12,000	26,200	0	2,200	40,600	414,900	17-Aug
	Sockeye	**3,732,000**	**1,895,000**		**3,725,300**	**101,000**	**400,000**	**46,200**	**145,200**	**468,500**	**3,134,200**	
	Pink	**24,000,000**	**7,200,000**			**83,400**		**16,716,600**	**16,800,000**	**1,331,700**		29-Aug
September 6 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	180,500	2-Jul
	Early Summer	550,000	220,000	0.80	176,000	12,000	70,400	71,600	154,000	52,800	513,800	24-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	75,000	296,500	0	0	381,200	2,123,700	10-Aug
	Late	600,000	313,000	0.92	288,000	12,000	29,000	0	0	44,000	493,400	17-Aug
	Sockeye	**3,732,000**	**1,895,000**		**3,717,500**	**101,000**	**400,000**	**71,600**	**154,000**	**484,100**	**3,311,400**	
	Pink	**26,000,000**	**7,800,000**			**83,400**		**18,116,600**	**18,200,000**	**2,277,800**		29-Aug
September 10 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	180,500	2-Jul
	Early Summer	550,000	220,000	0.80	176,000	12,000	70,000	72,000	154,000	52,800	514,800	24-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	75,000	296,700	0	0	382,800	2,197,100	10-Aug
	Late	600,000	313,000	0.92	288,000	12,000	29,200	0	0	45,300	532,900	17-Aug
	Sockeye	**3,732,000**	**1,895,000**		**3,717,500**	**101,000**	**400,000**	**72,000**	**154,000**	**487,000**	**3,425,300**	
	Pink	**26,000,000**	**7,800,000**			**83,400**		**18,116,600**	**18,200,000**	**3,708,800**		28-Aug
September 13 In-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	180,500	2-Jul
	Early Summer	550,000	220,000	0.80	176,000	12,000	62,000	80,000	154,000	52,900	514,600	24-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	75,000	303,700	0	0	392,100	2,206,200	10-Aug
	Late	600,000	313,000	0.92	288,000	12,000	30,200	0	0	47,900	551,100	17-Aug
	Sockeye	**3,732,000**	**1,895,000**		**3,717,500**	**101,000**	**400,000**	**80,000**	**154,000**	**499,000**	**3,452,400**	
	Pink	**26,000,000**	**7,800,000**			**83,400**		**18,116,600**	**18,200,000**	**4,819,200**		28-Aug
September 24 End-of-season	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	180,500	2-Jul
	Early Summer	550,000	220,000	0.80	176,000	12,000	55,600	86,400	154,000	53,200	515,000	24-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	75,000	309,100	0	0	398,200	2,220,700	10-Aug
	Late	600,000	313,000	0.92	288,000	12,000	31,200	0	0	49,500	570,100	17-Aug
	Sockeye	**3,732,000**	**1,895,000**		**3,717,500**	**101,000**	**400,000**	**86,400**	**154,000**	**507,000**	**3,486,300**	
	Pink	**26,000,000**	**7,800,000**			**83,400**		**18,116,600**	**18,200,000**	**5,986,800**		28-Aug
October 5 TAC Date	Early Stuart	182,000	108,000	1.33	143,600	2,000	4,100	0	0	6,100	180,500	2-Jul
	Early Summer	550,000	220,000	0.80	176,000	12,000	55,600	86,400	154,000	53,200	515,000	24-Jul
	Summer	2,400,000	1,254,000	2.48	3,109,900	75,000	309,100	0	0	398,200	2,220,700	10-Aug
	Late	600,000	313,000	0.92	288,000	12,000	31,200	0	0	49,500	570,100	17-Aug
	Sockeye	**3,732,000**	**1,895,000**		**3,717,500**	**101,000**	**400,000**	**86,400**	**154,000**	**507,000**	**3,486,300**	
	Pink	**26,000,000**	**7,800,000**			**83,400**		**18,116,600**	**18,200,000**	**5,986,800**		28-Aug

* 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 30– July 6: The Panel only met on July 2 this week. Strong tides likely affected the Area 20 gillnet test fishing sets. Lake Washington sockeye made up almost 50% of samples taken in the Area 20 gillnet test fishery, while the majority of Fraser sockeye migrating through Area 20 were Early Stuart with some fish in samples being attributed to the Chilliwack stock group. Rainfall in the Fraser watershed resulted in high water levels at Mission and hydroacoustic estimates were based on a modified system including a left bank DIDSON and mobile split beam unit. As of July 2, 9,500 sockeye had passed Mission. There was too little data on which to base an update of Early Stuart run size, marine timing or pMA.

July 7-July 13: Stock identification analyses of Area 20 sockeye samples indicated contributions of approximately 65% Early Summer, 25% Early Stuart and 10% Summer-run sockeye (primarily Harrison). Fraser River discharge levels at Hope decreased and were below average by the end of the week, while water temperatures at Qualark Creek were approximately 1.5 °C higher than average. The Panel approved an increased Early Stuart run size from the pre-season forecast of 211,000 fish to 217,000 fish with 50% marine timing through Area 20 of July 4, one day earlier than forecast. An increased Early Stuart pMA of 1.27 was also adopted. The pink salmon catch in the Area 20 gillnet test fishery was much higher than average. The majority of these pink salmon were likely destined for spawning grounds in Washington and non-Fraser areas in Canada.

July 14-July 20: Fraser sockeye catches in the Area 20 gillnet test fishery declined considerably. The diversion rate of Fraser sockeye through Johnstone Strait was slightly less than 20%. Fraser River discharge levels were approximately 20% below average, while water temperatures were about 1 °C higher than average. Comparisons of sockeye passage at the Mission and Qualark hydroacoustic sites showed good consistency between the estimators. The Panel approved a decreased Early Stuart run size from 217,000 fish to 180,000 fish with a 50% Area 20 date of July 2, and an increased Early Stuart pMA from 1.27 to 1.33. Assessments of Early Summer-run abundance indicated they were tracking close to forecast, however it was too early to update their abundance. Summer-run contributions to marine test fishery catches were tracking below expectations, however it was very early in their migration. Test fishing catches of pink salmon in marine areas continued to track above average for the date.

July 21-27: Test fishery catches of Fraser sockeye in marine areas increased but were still below expectations. The diversion of Fraser sockeye through Johnstone Strait increased to about 43%. Fraser River water temperatures continued to increase up to 20.0 °C. Water temperatures in this range may slow the migration of Fraser sockeye and cause elevated levels of en route mortality. Early Summer abundance appeared to be larger than forecast, while the Summer run appeared to be later and/or smaller than forecast.

July 28-August 3: The daily abundances of Fraser sockeye in marine areas remained relatively constant due to lower than expected daily abundances of Summer-run sockeye, and of Chilko and Quesnel stocks in particular. The Johnstone Strait diversion rate of Fraser sockeye increased to about 65%. In-river observations indicated that migrating sockeye were in good condition. The Panel adopted increased run sizes of 182,000 fish for Early Stuart, and 400,000 fish for Early Summer sockeye (Area 20 date of July 21) and increased the pMA for the Early Summer run to 0.54. In particular, the Pitt and Early Thompson components of the Early Summer run appeared to be exceeding their median forecast abundances. The Panel approved a Treaty Indian drift gillnet fishery in Areas 4B, 5 and 6C. DNA analyses of samples from purse seine test fisheries indicated that Fraser River pink salmon made up only 10% of pink salmon migrating through marine areas.

August 4 – August 10: Although the passage of Fraser sockeye through marine areas increased, daily abundances were still far lower than expected because of the apparent weaker than expected return of Summer-run sockeye. The Johnstone Strait diversion rate for Fraser sockeye was 62%. Migration conditions for sockeye in the Fraser River deteriorated further, with water temperatures reaching record high levels for the date. The Panel consequently adopted increased MA factors for Early Summer (from 0.54 to 0.58) and especially for Summer-run sockeye (from 0.10 to 1.56). The Panel also adopted an increased Early Summer-run run size of 452,000 fish (Area 20 50% date of July 22), and decreased Summer-run abundance of 2,000,000 fish. Fraser River pink salmon continued to constitute a small proportion of the pink salmon migrating through marine areas, however; the overall daily abundance of pink salmon was estimated to be much higher than expected for the date.

August 11 – August 17: The diversion rate of Fraser sockeye through Johnstone Strait was estimated to be 71%. Daily Fraser River water temperatures reached record highs with a maximum temperature of 21.6 °C on August 11 and 12. Such high temperatures were expected to cause considerable en route and pre-spawning mortality of Fraser sockeye. Sockeye were observed holding at the mouths of cooler tributaries of the Fraser River. The number of floating sockeye carcasses in the river also increased, although most living sockeye were reported to be in good condition. The Panel adopted increased Early Summer run sizes of 475,000 fish and later 520,000 fish, with a 50% marine timing date of July 24. Similarly, the Panel adopted an increased Summer-run abundance of 2,300,000 fish, with an Area 20 50% date of August 9. Quesnel sockeye, which were expected to contribute about one-third of the Summer-run return, instead constituted less than 10% of the return. Although it was too early to provide an estimate of overall Late-run abundance, the Birkenhead component was returning at much lower than expected abundances. Marine purse seine test fishing catches of pink salmon continued to be strong and the proportion of Fraser pink salmon was increasing, so their assessed abundance to-date was tracking above forecast. As a result of the record high Fraser River water temperatures, pMAs for the Early Summer and Summer runs increased to 0.72 and 2.35, respectively. In addition, the Panel

terminated some test fisheries earlier than planned, and specified that only sockeye and pink salmon samples that were critical for fisheries management could be retained due to conservation concerns for Summer-run sockeye. All Panel Areas remained closed to fishing.

August 18 – August 24: The abundance of Fraser sockeye migrating through Johnstone and Juan de Fuca Straits was steady this week, while the abundance of Fraser pink salmon increased considerably. The diversion rates of Fraser sockeye and pink salmon through Johnstone Strait were approximately 90% and 50%, respectively. Most Late-run sockeye appeared to be migrating directly into the Fraser River without delaying in the Strait of Georgia. Sockeye mortalities in the Fraser and Thompson Rivers were reported, likely due to the extremely high water temperatures that many Fraser sockeye had been exposed to since late July. Although migration conditions for Fraser sockeye improved as water temperatures decreased by approximately 2 °C, river temperatures remained at levels expected to cause migration stress. Assessments of Late Shuswap/Portage generated abundance estimates that exceeded their median forecast levels while daily abundance estimates for Birkenhead and Weaver were tracking levels consistent with total returns at the lower end of their forecast distributions, with the result that the abundance of the aggregate Late run was tracking below its median forecast level. Conversely, the Panel adopted an increased Fraser pink salmon abundance of 10,000,000 fish. The Panel approved U.S. fisheries directed at the harvest of pink salmon. Due to conservation concerns for Fraser sockeye, All Citizen fishers were required to release all sockeye while Treaty Indian fishers were only allowed to retain sockeye for Ceremonial and Subsistence use.

August 25 – August 31: High abundances of Fraser pink salmon were migrating through Johnstone and Juan de Fuca Straits. The diversion rate of Fraser sockeye and pink salmon through Johnstone Strait was 91% and 35%, respectively. Fraser River water temperatures declined but still exceeded 18 °C, high enough to stress migrating sockeye. The later marine timing of Fraser sockeye coupled with higher than expected purse seine test fishing catches of sockeye in Johnstone Strait resulted in increased run-size estimates for the Early Summer and Summer-run groups. The Panel adopted abundances of 550,000 Early Summer and 2,400,000 Summer-run sockeye. Conversely, the Panel adopted decreased estimates of Late-run abundance, first to 450,000 (from 583,000) and then later increasing 500,000 fish (50% marine timing date of August 15). The pMAs for Early Summer and Summer-run sockeye were increased to 0.85 and 2.48, respectively. The Panel also increased the Late-run pMA from the pre-season estimate of 0.67 to 0.91. The Panel approved run-size increases of 14,000,000 and then 16,000,000 Fraser pink salmon, with an Area 20 50% date of August 29. Several fisheries were announced in U.S. waters to harvest the available TAC of Fraser pink salmon; however, they were constrained to minimize the catch of Fraser sockeye.

September 1 – September 7: The marine migration of Fraser sockeye declined considerably. High abundances of Fraser pink salmon continued to migrate through Johnstone Strait, where they made up 80-85% of the daily migration. Pink abundances in marine areas declined by the end of the week, however. Estimates from the hydroacoustic program at Mission indicated a strong migration of pink salmon into the Fraser River. Fraser River water temperatures were still much higher than average and near the end of the week were about 18.5 °C. The Panel adopted an increased Late-run abundance of 600,000 fish. The very large test fishery catches in marine areas resulted in the adoption of increased run sizes of 24,000,000 and then 26,000,000 Fraser pink salmon. This latter estimate was equal to the return in 2003, which was the highest return since records began in 1959. Several commercial fisheries in Canada and the U.S. were opened to harvest the large available TAC of Fraser pink salmon. These fisheries were designed to minimize harvest impacts on Fraser sockeye salmon. The Early Summer pMA decreased from 0.85 to 0.80 while for Late-run sockeye, the pMA increased slightly from 0.91 to 0.92.

September 8 – September 14: The marine migration of Fraser pink salmon declined considerably and for Fraser sockeye it neared completion. Test fisheries in marine areas concluded for the season, while gillnet test fisheries in the Fraser River continued. Assessments indicated that the remaining Late-run sockeye in marine areas were continuing to migrate directly into the Fraser River without delaying in the Strait of Georgia. The temperature of the Fraser River at Qualark Creek on September 9 was 19.1 °C, which was 3.8 °C higher than average and a record high temperature for this date. Although Fraser River water temperatures had been much higher than

average through much of the Fraser sockeye migration, the expected level of mortalities had not been observed to date. Commercial fisheries in Canada and the U.S. continued to harvest the large available TAC of Fraser pink salmon.

September 15 – September 21: The Fraser River Panel met only once this week and it was in a small-group format on September 17. Canada announced an Area B seine ITQ fishery in Area 29 for pink salmon with non-retention of sockeye salmon. The U.S. announced that it would relinquish regulatory control of Areas 4B, 5 and 6C on September 18, and that the All Citizen reefnet fishery in Area 7 would remain open until further notice.

September 24 (end-of-season meeting): The final in-season estimate of 3,732,000 Fraser sockeye included 182,000 Early Stuart, 550,000 Early Summer, 2,400,000 Summer and 600,000 Late-run sockeye (Table 1). The estimate for Fraser pink salmon was 26,000,000 fish.

On October 5, Panel control of the last U.S. Panel Area was relinquished, in accordance with the pre-season regulations. The inputs used to calculate the TAC and international shares were frozen on this date, with the exception of the test fishery catch deduction which would be updated using post-season estimates, in accordance with the revised Annex IV, Chapter 4 of the Pacific Salmon Treaty [1] and the Commission Guidance to the Panel [2]. The achievement of these in-season catch allocation objectives will be assessed by comparison with post-season catch estimates in the Achievement of Objectives section of this report.

Overviews of commercial fisheries openings in Canadian and U.S. Panel Areas are contained in Tables 2 and 3, respectively. Although considered to be commercial fisheries, fishing effort in Canadian First Nations Economic Opportunity (Lower Fraser) and Demonstration (BC Interior) fisheries is not included in Table 2.

Table 2. Number of days when Canadian commercial fisheries were open for directed harvest of Fraser River sockeye or pink salmon in 2013. Regulatory control of Canadian Panel Areas was relinquished by the Panel on September 21 for Area 20, September 28 for Areas 17 and 18, and October 12 for Area 29, in accordance with pre-season regulations (Appendix D).

	Panel Areas					Non-Panel Areas			
	20		29		18, 29	11-16			
Date	Purse Seine	Gillnet	Purse Seine	Gillnet	Troll	Purse Seine	Gillnet	Troll H	Troll G
Jun.9-Jul.27									
Jul.28-Aug.3									
Aug.4-Aug.10									
Aug.11-Aug.17									
Aug.18-Aug.24									
Aug.25-Aug.31									
Sep.1-Sep.7			7			7		2	
Sep.8-Sep.14			3			3		2	
Sep.15-Sep.21			4			2			
Sep.22-Sep.28									
Sep.29-Oct.5									
Total	0	0	14	0	0	12	0	4	0

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 or pink salmon in 2013. Regulatory control of U.S. Panel Areas was relinquished by the Panel on September 18 for Areas 4B, 5 and 6C by in-season order, and on September 28 for Areas 6, 7 and 7A and October 5 for the remaining portions of Area 7A in accordance with pre-season regulations (Appendix D).

	Treaty Indian		All Citizen		
	Areas	Areas	Areas 7 and 7A		
Date	4B, 5, 6C	6, 7, 7A	Purse Seine	Gillnet	Reefnet
Jun.9-Jul.27					
Jul.28-Aug.3	5				
Aug.4-Aug.10	7				
Aug.11-Aug.17					
Aug.18-Aug.24	1				1
Aug.25-Aug.31	7	7	2	2	5
Sep.1-Sep.7	7	7	2	2	7
Sep.8-Sep.14	7	7	2	2	7
Sep.15-Sep.21	4	3			7
Sep.22-Sep.28					7
Sep.29-Oct.5					
Total	38	24	6	6	34

Table 4. Panel-approved stock monitoring operations (test fishery, hydroacoustic and observer) conducted in 2013.

Area	Location	Gear	Dates	Operated by
Canadian Panel Areas				
20	Juan de Fuca Str.	Gillnet	June 24 - August 11	PSC
20	Juan de Fuca Str.	Purse Seine	July 22 - September 11	PSC
29-14	Fraser R. (Cottonwood)	Gillnet	July 10 - September 16	PSC
29-16	Fraser R. (Whonnock)	Gillnet	June 24 - October 4	PSC
29-16	Fraser R. (Mission)	Hydroacoustic	June 26 - September 26	PSC
	Fraser R. (Qualark)	Gillnet	July 1 September 28	PSC
	Fraser R. (Hells Gate)	Observer	July 2 - September 30	PSC
Canadian non-Panel Areas				
12	Queen Charlotte Str. (Round Is.)	Gillnet	July 12 - August 11	DFO
12	Johnstone Str. (Naka Cr.)	Gillnet	July 18 - July 31	DFO
12	Johnstone Str. (Blinkhorn)	Purse Seine	July 22 - September 10	DFO
13	Lower Johnstone Str.	Purse Seine	July 24 - September 5	DFO
United States Panel Areas				
5	Juan de Fuca Str.	Gillnet	July 17 - July 25	PSC
7	San Juan Islands	Reefnet	July 20 - August 13	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 F). 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 and to apportion the total abundance pink salmon into Fraser and non-Fraser components. These data are augmented with catch information from commercial, First Nations, recreational and other fisheries that are provided by the two counties.

Table 5. Individual stocks included in the Fraser River sockeye stock groups used in 2013. North Thompson (formerly in the Early Summer group) and Harrison stocks (formerly in the Late-run group) were moved to the Summer-run group beginning in 2012.

Stock Group	Component Stocks
Early Stuart	
Early Stuart	Early Stuart stocks
Early Summer	
Pitt	Pitt, Alouette, Coquitlam
Chilliwack	Chilliwack
Early Miscellaneous	Nadina, Bowron, Gates, Nahatlatch, Taseko
Early Thompson	Upper Barriere (formerly labeled Fennell), Shuswap Lake (Scotch, Seymour, early Eagle), Adams Lake (Cayenne, Upper Adams River)
Summer	
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
Late	
Birkenhead	Birkenhead, Big Silver, Widgeon
Late Shuswap/Portage	Seton Lake (Portage Creek), Shuswap Lake (Lower Adams, Lower Shuswap, Middle Shuswap, Shuswap Lake, late Eagle)
Weaver/Cultus	Weaver, Cultus

There were two notable changes in how stocks were grouped, beginning in 2012. The main purpose of the change was to group together stocks that have similar migration times. Raft/North Thompson stocks, with the exception of Upper Barriere (i.e., Fennell), were reassigned from the Early Summer management group into the Summer-run group. Similarly, the Harrison stock was reassigned from the Late-run group into the Summer-run group. In 2013, Widgeon was included with the Birkenhead stock group in the Late-run management group. Table 5 shows the sockeye stock resolution that was reported in 2013.

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.

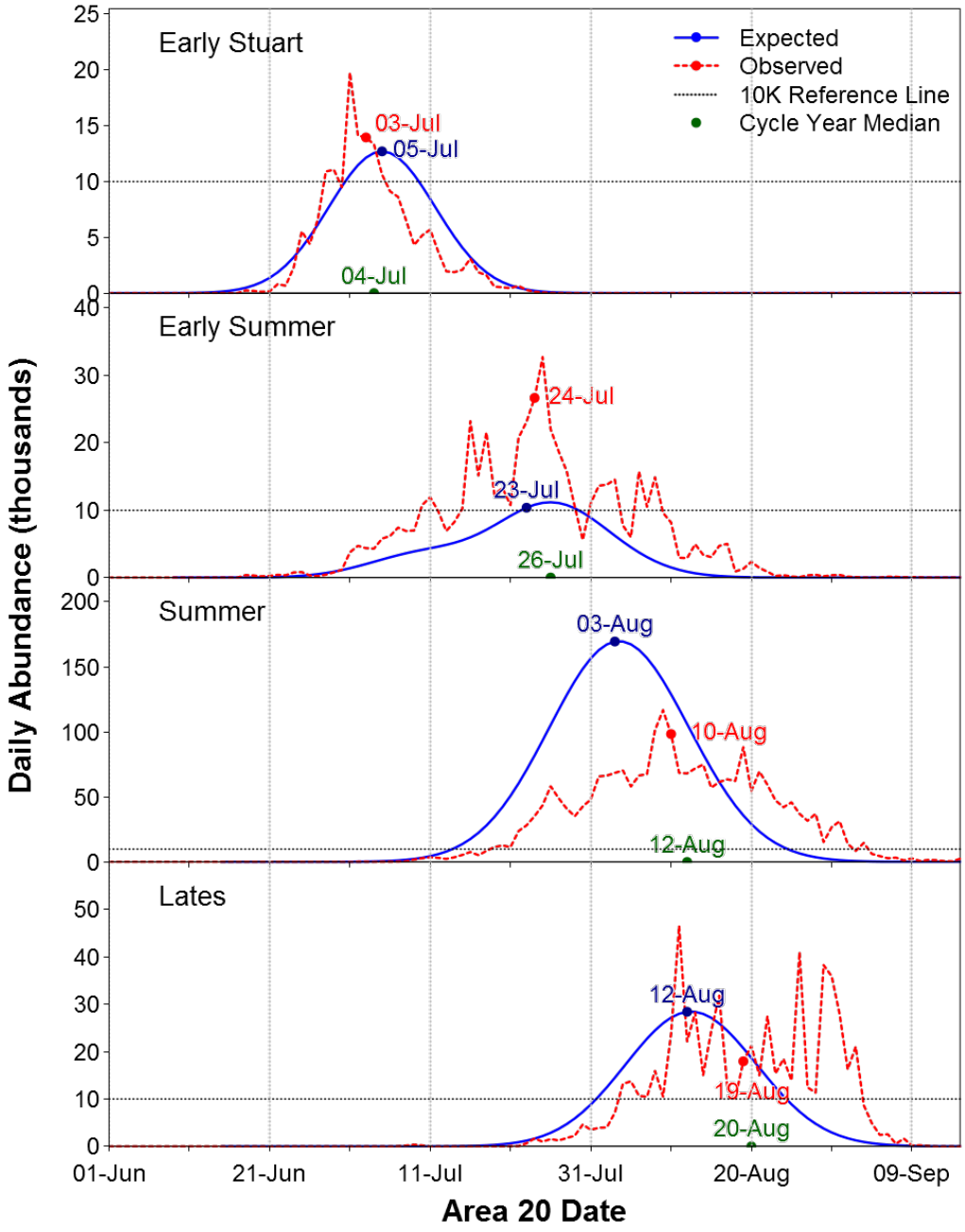

Figure 3. Pre-season projections and post-season reconstructions of daily Fraser River sockeye salmon abundance by management group in 2013 (Area 20 date), including the 50% dates. The cycle-year median dates are also shown.

A. Abundance

Final in-season estimates of run size adopted by the Panel totalled 3,732,000 Fraser sockeye and 26,000,000 Fraser pink salmon (Table 1). This small sockeye run size combined with the very large pink run size resulted in substantial opportunities to harvest Fraser pinks but with constraints such as sockeye non-retention imposed to protect Fraser sockeye. The post-season abundance estimate for Fraser sockeye (4,050,000 fish, Tables 8 and 9), based on accounted catches, spawning ground enumerations and preliminary run-size adjustments is 15% lower than the median pre-season forecast (4,765,000 fish) and 9% higher than the final in-season estimate (3,732,000 fish). For Fraser pink salmon, the post-season abundance estimate (15,898,000 fish,

Tables 8 and 9), based on accounted catches and Mission passage estimates, is 78% higher than the median pre-season forecast (8,926,000 fish) and 39% lower than the final in-season estimate (26,000,000 fish) that was based on purse seine test fishery CPUE divided by historical average catchability.

B. Migration Timing and Diversion Rate

Figures 3 and 4 show the forecasted and estimated daily migrations, and Area 20 50% migration dates for each sockeye management group and for total Fraser sockeye and pink salmon. The end-of-season estimates of marine migration timing in 2013 were earlier than expected pre-season for Early Stuart (2 days earlier) and later than expected for Early Summer (1 day later), Summer (7 days later) and Late-run sockeye (7 days later). The migration dates for these groups were slightly earlier than the historical averages of the cycle year for Early Stuart, Early Summer and Summer-run stocks but slightly later than the historical average for Late-run stocks. The migration timing of Fraser River pink salmon was 2 days later than the long-term average and the expected date.

Diversion rates in 2013 were much higher than forecast for both Fraser sockeye and pink salmon. The observed annual diversion through Johnstone Strait was 71% of the Fraser sockeye return, compared to the initial forecast of 35% used for pre-season planning (Figure 5). For Fraser River pink salmon, the Johnstone Strait diversion rate was 65% instead of the pre-season expectation of 41%.

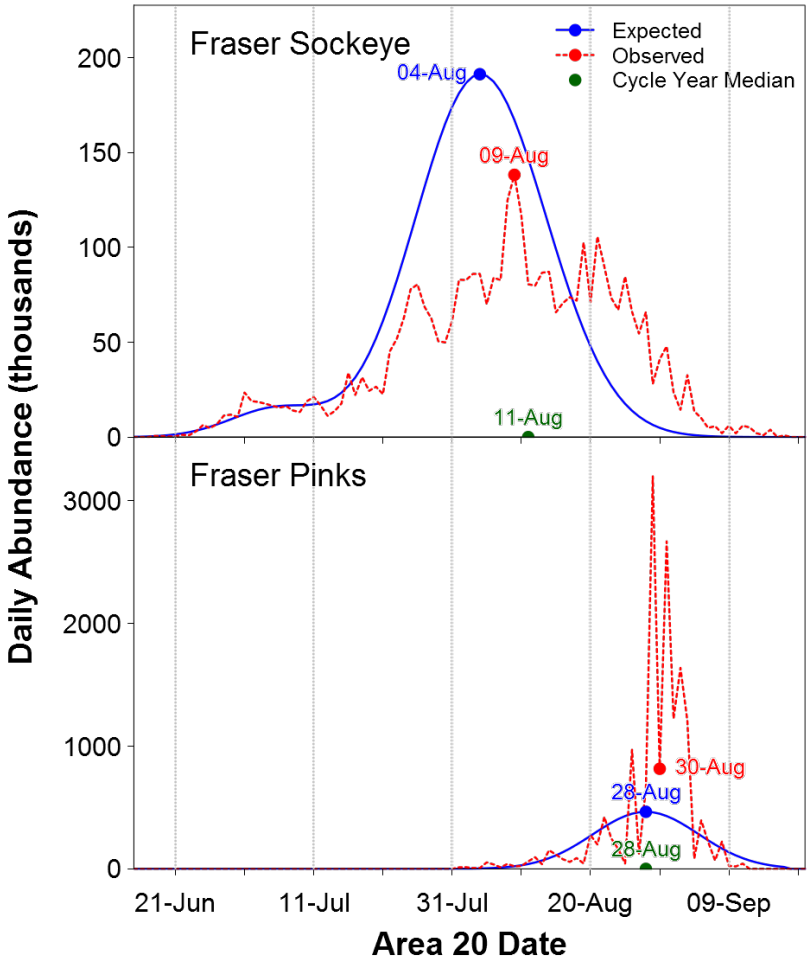

Figure 4. Pre-season projections and post-season reconstructions of daily Fraser River sockeye and pink salmon abundance in 2013 (Area 20 date), including the 50% dates.

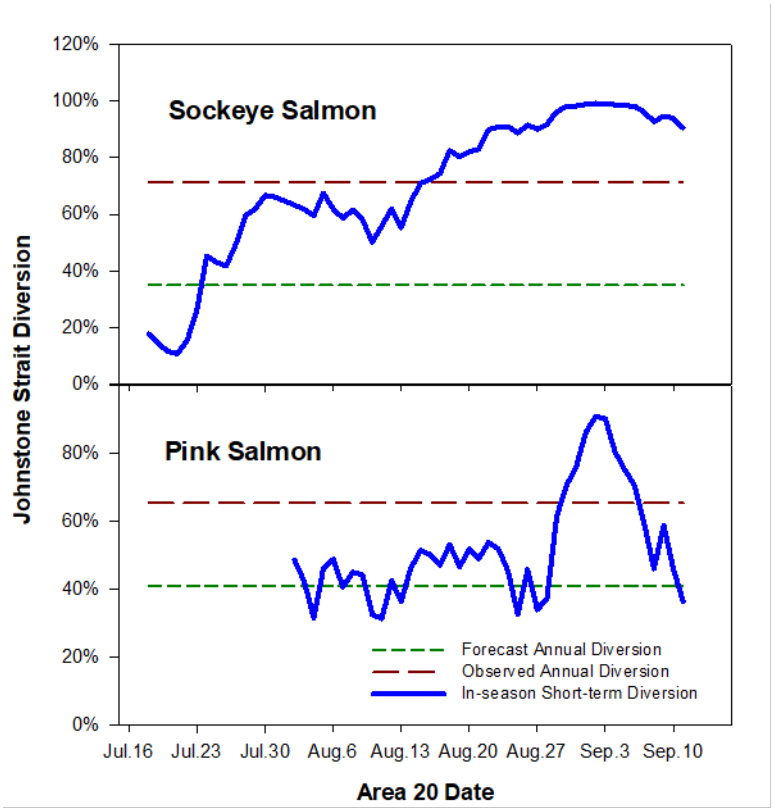

Figure 5. Pre-season forecasts of annual Johnstone Strait diversion rate for Fraser sockeye and pink salmon, 35% and 41%, respectively, compared to observed short-term and annual rates, 71% and 65%, respectively.

C. Management Adjustments and DBEs

Management adjustments or MAs are based on statistical models [6,7,8,9] 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 Fraser River. When discharge levels or temperatures are above average, DBEs tend to be higher than average. 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),

[6] 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.
[7] Macdonald, J.S., Patterson, D.A., Guthrie, I., Lapointe, M. 2008. Improvements to environmental management adjustment models: SEF final report.
[8] 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.
[9] 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.

which captures the negative impact of the early migration behaviour on the migration success of these stocks that has been observed since the mid 1990s.

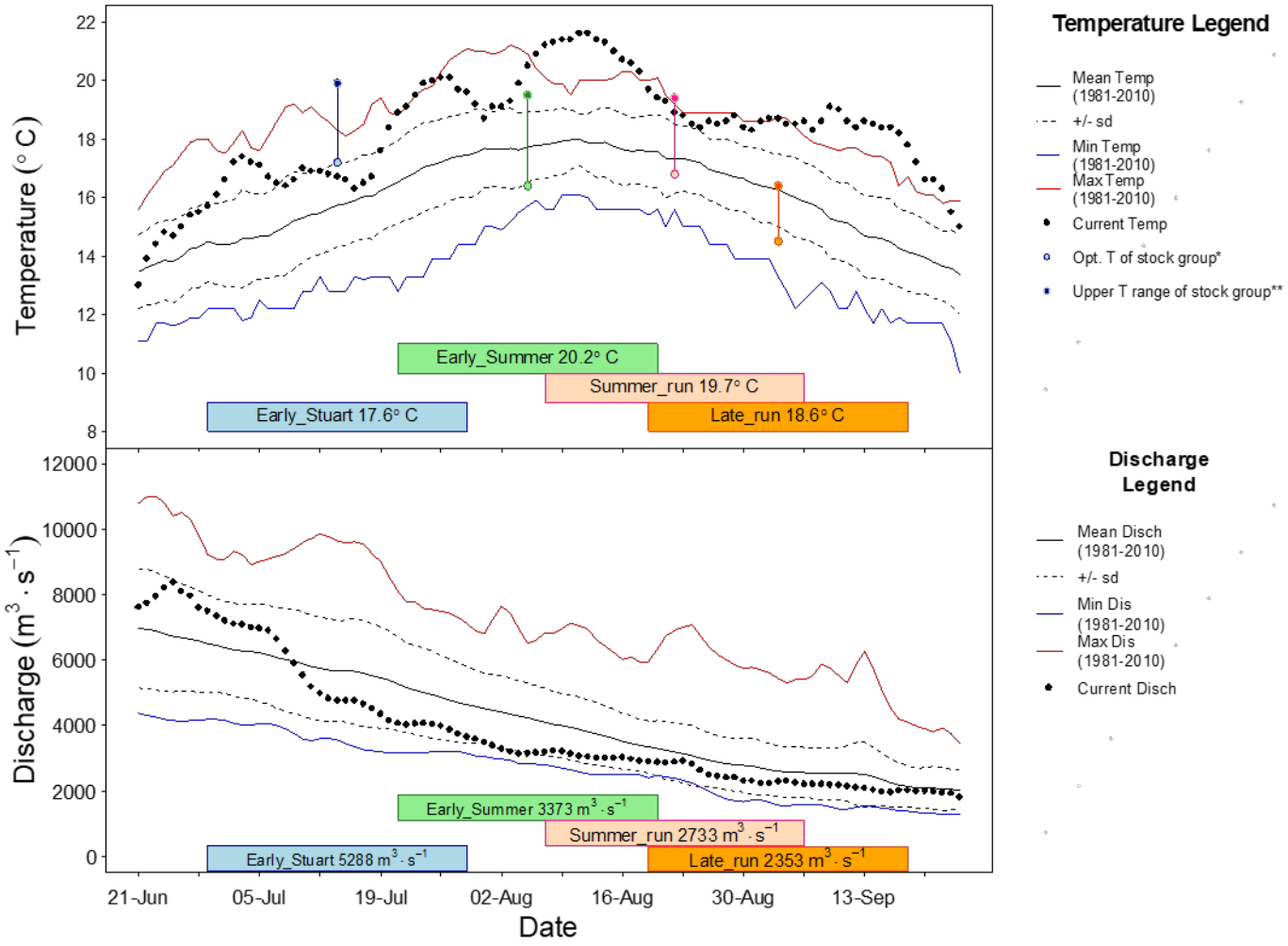

Figure 6. Fraser River temperature and discharge measured near Hope in 2013. Also shown are the run timing bars that represent a 31-day spread of the run centred around the Hells Gate date and the mean temperature and discharge for the 31-day spread.

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 generated using updated migration timing estimates and observed and/or short-range forecasts of river discharge and temperature in combination with other considerations such as watershed-wide environmental conditions, and evidence of migratory distress (i.e. carcasses, fish holding, fish straying). 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.

Due to warm spring conditions and average to low winter snowpack, discharge levels in the lower Fraser River (Figure 6) were initially higher than average until early July and then dropped below average, staying near the levels consistent with one standard deviation below average for the rest of the season. With low discharge and high air temperatures, water temperatures (Figure 6)

were well above average for most of the season. Water temperatures rose to record high levels for more than 20 days. Observed temperatures rose beyond the upper range of the optimum temperature for aerobic swimming for Early Summer, Summer and Late-run sockeye during most of their 31-day migration periods centered on the median migration date past Hells Gate[10]. Late-run sockeye did not delay in the Strait of Georgia and the Mission 50% timing estimate was August 30th. The final in-season pMA predicted from the upstream timing model for Late-run excluding Birkenhead was 3.77. However, this prediction did not change the in-season management approach because the Late-run group was managed to limit harvest levels consistent with the 20% LAER.

A summary of the pre-season and in-season MA models adopted during 2013 are provided in the "Management Adjustment and DBE" section in Appendix F. Comparisons of %DBE (pMA) estimates for the pre-season, in-season and post-season periods are shown in Table 6. Values adopted in-season were greater (more negative %DBEs, larger pMAs) than those forecasted pre-season for all management groups. Post-season values were slightly lower than in-season estimates for Early Stuart and significantly lower than in-season for Summer runs. The Early Stuart observed DBE was -50% compared to an in-season expectation of -57%, while the Summer run DBE was much lower than expected (-7% compared to an in-season expectation of -71%). In contrast the Early Summer observed DBE was -58% compared to an in-season expectation of -44%, and the observed Late run DBE of -48% was the same as the value adopted in-season estimate.

Table 6. Pre-season, in-season and post-season estimates of DBEs (differences between estimates) and implied pMAs (proportional management adjustments). Pre-season pMA predictions are based on long-range forecasts of migration timing and of 31-day mean Fraser River temperature and discharge for Early Stuart, a weighted average of the historical median Chilliwack pMA, zero Pitt pMA and forecasted non-Chilliwack non-Pitt pMA for Early Summers, a weighted average of the historical median Harrison pMA and forecasted non-Harrison pMA for Summers, and a weighted average of the historic median Birkenhead pMA and non-Birkenhead pMA for Lates. In-season estimates reflect the final values adopted by the Panel for in-season management. 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.

Description	Early Stuart [1]		Early Summer [2]		Summer [3]		Late [4]	
	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA
Pre-season prediction	-36%	0.57	-32%	0.46	-9%	0.10	-40%	0.67
In-season prediction	-57%	1.33	-44%	0.80	-71%	2.48	-48%	0.92
Observed [5]	-50%	0.98	-58%	1.39	-7%	0.07	-48%	0.94

1 The Early Stuart pMA was estimated from a model based on river temperature and discharge.

2 The Early Summer aggregate pMA was the weighted average of the pMA for the non-Chilliwack non-Pitt component (that is updated in-season based on river conditions), the pMA for Chilliwack (0.57, that remains fixed in-season) and the pMA for Pitt (zero pre-season and 0.175 in-season), based on p50 abundance levels.

3 The Summer aggregate pMA was the weighted average of the pMA for the non-Harrison component (that is updated in-season based on river conditions) and the pMA for Harrison (0.37, that remains fixed in-season), based on p50 abundance levels.

4 The Late aggregate pMA was the weighted average of the pMA for the non-Harrison component (1.03, that remains fixed in-season) and the pMA for Birkenhead (0.34, that remains fixed in-season), based on p50 abundance levels.

5 Derived from DFO's near-final spawning escapement estimates.

[10] Eliason, 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.

In recent years, pre-season MA estimates for some management groups have been estimated based on the weighted average of component abundances and their respective MAs (see caption and notes for Table 6). In such cases, changes in relative abundances of component stocks may impact the MAs for the aggregate even when river conditions are relatively unchanged. For example, the difference between pre-season and in-season relative abundances of Birkenhead and non-Birkenhead Late run affected the in-season estimate (48%) compared to the pre-season estimate (40%) as shown in Table 6.

D. Mission Escapement

Estimates of Mission passage totalled 3,491,000 sockeye and 10,535,000 pink salmon. Included in the sockeye total are 181,000 Early Stuart, 515,000 Early Summer, 2,224,000 Summer and 571,000 Late-run sockeye (Table 7). Details of the Mission hydroacoustic program in 2013 are contained in Appendix F.

Table 7. Fraser River sockeye and pink salmon passage at Mission in 2013.

Management Group	Mission Passage	
Stock Group	fish	%
Early Stuart	**180,500**	**5%**
Early Summer	**515,100**	**15%**
Chilliwack	45,600	1%
Early Miscellaneous	141,800	4%
Early Thompson	113,700	3%
Barriere River/Taseko	17,600	1%
Pitt[1]	196,500	6%
Summer	**2,223,600**	**64%**
Raft/N.Thompson	125,100	4%
Chilko	1,271,600	36%
Quesnel	224,800	6%
Late Stuart/Stellako	248,200	7%
Harrison	353,900	10%
Late	**571,400**	**16%**
Birkenhead	92,700	3%
Late Shuswap/Portage	361,700	10%
Weaver/Cultus	117,000	3%
Total Sockeye	**3,490,700**	**100%**
Pink Salmon	**10,535,000**	**100%**

[1] 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

A. Sockeye Salmon

The total abundance of sockeye salmon in 2013 was 4,050,000 fish (Tables 8 and 9), which is 15% lower than the median forecast of 4,765,000 fish and 2½ times larger than the brood year abundance of 1,637,000 fish in 2009. With the exception of the very poor 2009 return, this was the smallest return on the 2013 cycle since 1965 (Figure 7).

Table 8. Catch, escapement, difference between estimates and run size for Fraser River sockeye (by management group) and pink salmon in 2013.

	Fraser Sockeye						Fraser Pinks	
	Early Stuart	Early Summer	Summer	Late	Total	% of Run	Total	% of Run
CANADIAN CATCH	**9,500**	**45,300**	**324,100**	**32,500**	**411,300**	**10%**	**3,313,700**	**21%**
Commercial Catch	**0**	**0**	**1,200**	**900**	**2,100**	0%	**1,994,300**	**13%**
Panel Area	0	0	700	500	1,200	0%	1,322,500	8%
Non-Panel Areas	0	0	500	400	900	0%	671,800	4%
First Nations Catch	**9,400**	**45,200**	**322,400**	**30,400**	**407,400**	10%	**1,220,700**	**8%**
Marine FSC	20	10,100	96,700	16,100	122,900	3%	2,900	0%
Fraser River FSC	9,400	35,100	225,600	14,200	284,400	7%	8,200	0%
Economic Opportunity	0	0	70	70	100	0%	1,209,600	8%
Non-commercial Catch	**10**	**80**	**500**	**1,200**	**1,800**	0%	**98,700**	**1%**
Marine Recreational	0	0	0	0	0	0%	30,200	0%
Fraser Recreational	0	0	0	0	0	0%	63,800	0%
Charter (Albion)	10	80	500	70	700	0%	200	0%
ESSR	0	0	0	1,200	1,200	0%	4,500	0%
UNITED STATES CATCH	**50**	**2,500**	**49,700**	**14,400**	**66,600**	**2%**	**3,200,400**	**20%**
Washington Total	**0**	**1,500**	**13,300**	**5,400**	**20,200**	**0%**	**3,200,400**	**20%**
Commercial catch	**0**	**500**	**3,400**	**500**	**4,300**	0%	**3,186,700**	**20%**
Treaty Indian	0	500	3,300	400	4,100	0%	1,340,600	8%
All Citizen	0	0	90	90	200	0%	1,846,100	12%
Non-commercial Catch	**0**	**1,000**	**9,900**	**5,000**	**15,900**	0%	**13,700**	**0%**
Ceremonial	0	1,000	9,900	5,000	15,900	0%	5,900	0%
Recreational	0	0	0	0	0	0%	7,800	0%
Alaska	50	1,000	36,500	8,900	46,400	1%	0	0%
TEST FISHING CATCH	**2,000**	**12,000**	**73,900**	**11,800**	**99,700**	**2%**	**39,200**	**0%**
PSC (Panel Areas)	**2,000**	**6,800**	**23,300**	**4,400**	**36,600**	**1%**	**22,000**	**0%**
Canada	2,000	5,500	18,300	3,700	29,600	1%	15,500	0%
United States	0	1,200	5,000	700	7,000	0%	6,600	0%
Canada (non-Panel Areas)	**20**	**5,200**	**50,500**	**7,400**	**63,100**	**2%**	**17,200**	**0%**
TOTAL RUN	**182,500**	**554,400**	**2,658,200**	**655,200**	**4,050,300**	**100%**	**15,897,800**	**100%**
Total Catch in All Fisheries	11,600	59,700	447,700	58,600	577,600	14%	6,553,300	41%
Adult Spawning Escapement *	86,300	205,400	1,899,200	288,700	2,479,500	61%	9,344,500	59%
Jack Spawning Escapement	50	5,300	53,200	34,300	92,800	2%	0	0%
Difference Between Estimates**	84,700	284,000	258,200	273,600	900,500	22%	0	0%
Percentage of Total Run	**100%**	**100%**	**100%**	**100%**	**100%**		**100%**	
Total Catch in All Fisheries	6%	11%	17%	9%	14%		41%	
Spawning Escapement	47%	38%	73%	49%	64%		59%	
Difference Between Estimates	46%	51%	10%	42%	22%		0%	

* Spawning escapement estimate for Cultus sockeye includes 200 individuals captured as brood stock.

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

Returns of Early Stuart and Summer-run sockeye were less than their median forecast levels, while returns for Early Summer and Late-run sockeye were larger than their median forecast levels. The total return of Early Stuart sockeye was 183,000 adults (Table 9), 13% smaller than its median forecast abundance. Early Summer returns totalled 549,000 adult sockeye, two times larger than its median forecast level. The largest Early Summer stock components were the Early Miscellaneous (154,000 adults), Early Thompson (129,000 adults) and Pitt stock groups (203,000 adults). The abundance of Summer-run sockeye was 2,605,000 adults, 30% smaller than its median forecast abundance. Most Summer-run fish were from the Chilko group. As noted earlier, the Summer-run management group in 2012 and 2013 included two new stock groups - Raft/North Thompson which was reassigned from the Early Summer group and Harrison which was reassigned from the Late-run group. The abundance of Late-run sockeye was 621,000 adults, 7% more than its median forecast abundance. Late Shuswap/Portage was the main component in the Late-run management group.

Table 9. Catch, escapement, difference between estimates, run size and exploitation rate for Fraser River sockeye (by management group) and pink salmon in 2013.

Management Group / Stock Group	Catch	Adult Spawning Escapement	Difference Between Estimates	Abundance Adult	Abundance Jack [2]	Abundance Total	Portion of Run	Adult Exploitation Rate
Fraser Sockeye Salmon								
Early Stuart	**11,600**	**86,300**	**84,700**	**182,500**	**50**	**182,500**	**5%**	**6%**
Early Summer-run	**59,700**	**205,400**	**284,000**	**549,100**	**5,300**	**554,400**	**14%**	**11%**
Chilliwack	1,200	11,700	33,400	46,300	0	46,300	1%	3%
Early Miscellaneous	25,400	73,500	55,100	154,100	2,700	156,800	4%	16%
Early Thompson	22,700	57,200	46,400	126,200	2,600	128,800	3%	18%
Barriere River/Taseko	3,500	3,700	12,000	19,100	50	19,200	0%	18%
Pitt	6,900	59,200	137,200	203,400	30	203,400	5%	3%
Summer-run	**447,700**	**1,899,200**	**258,200**	**2,605,000**	**53,200**	**2,658,200**	**66%**	**17%**
Raft/N.Thompson	12,100	37,900	83,600	133,500	80	133,600	3%	9%
Chilko	294,100	1,197,700	0	1,491,800	37,500	1,529,300	38%	20%
Quesnel	33,300	183,800	40,900	258,000	2,500	260,400	6%	13%
Late Stuart/Stellako	86,200	229,700	33,000	348,800	13,100	362,000	9%	25%
Harrison	22,100	250,100	100,700	372,900	30	373,000	9%	6%
Late-run	**58,600**	**288,700**	**273,600**	**620,900**	**34,300**	**655,200**	**16%**	**9%**
Birkenhead/Widgeon	6,200	90,500	3,400	100,100	60	100,200	2%	6%
Late Shuswap/Portage	44,300	160,300	192,400	397,000	32,400	429,500	11%	11%
Weaver/Cultus [1]	8,100	37,800 [3]	77,800	123,800	1,700	125,500	3%	7%
Total	**577,600**	**2,479,500**	**900,500**	**3,957,500**	**92,800**	**4,050,300**	**100%**	**15%**
Portion of Total Run	14%	61%	22%	98%	2%	100%		
Fraser Pink Salmon								
Total	**6,553,300**	**9,344,500** [3]	**0**	**15,897,800**	**0**	**15,897,800**	**100%**	**41%**
Portion of Total Run	41%	59%	-	100%		100%		

1 ESSR catches are included in the Weaver salmon total.

2 Jack ratios were not estimated for fisheries; estimates include only those jacks that were actually sampled and are therefore underestimates.

3 Spawing escapement estimate of Cultus sockeye includes 200 individuals captured as brood stock.

The total catch of 578,000 fish was about 14% of the run (Tables 8 and 9). This exploitation rate is the 2nd lowest since records began in 1893, with the lowest being the brood year (7.5% in 2009, Figure 8). Of the total catch, 411,000 fish were caught in Canada, 20,000 fish in Washington state, 46,000 fish in Alaska and 100,000 fish in test fisheries. Almost all of the Canadian catch was taken in First Nations fisheries, although a small portion was taken in Area B seine fisheries Table 10. In Washington State the catch was almost exclusively taken in Treaty Indian fisheries, with three quarters of it landed for Ceremonial and Subsistence use and the remainder sold as commercial catch (Table 11).

DFO annually assesses the spawning ground abundance of sockeye populations in the Fraser watershed (Figure 9). In 2013, the near-final estimate of adult spawners (primarily age 4 and age 5 fish) totalled 2,479,000 fish, or 61% of the total run. This was more than twice the brood year (2009) escapement of 1,056,000 adults.

Spawner abundances exceeded those observed in the brood year (2009, Figure 10) for all management groups. In a historical context, spawning escapements in 2013 represent the: (1) continuation of low escapements to the Early Stuart system observed for the last three cycle years; (2) the 2nd highest Early Summer-run escapement on the 2013 cycle since records began in 1938; (3) a bit lower than previous Summer-run escapements on the 2013 cycle observed since 1985; (4) the 2nd highest Late-run escapement on the 2013 cycle since records began in 1938 (Figure 10).

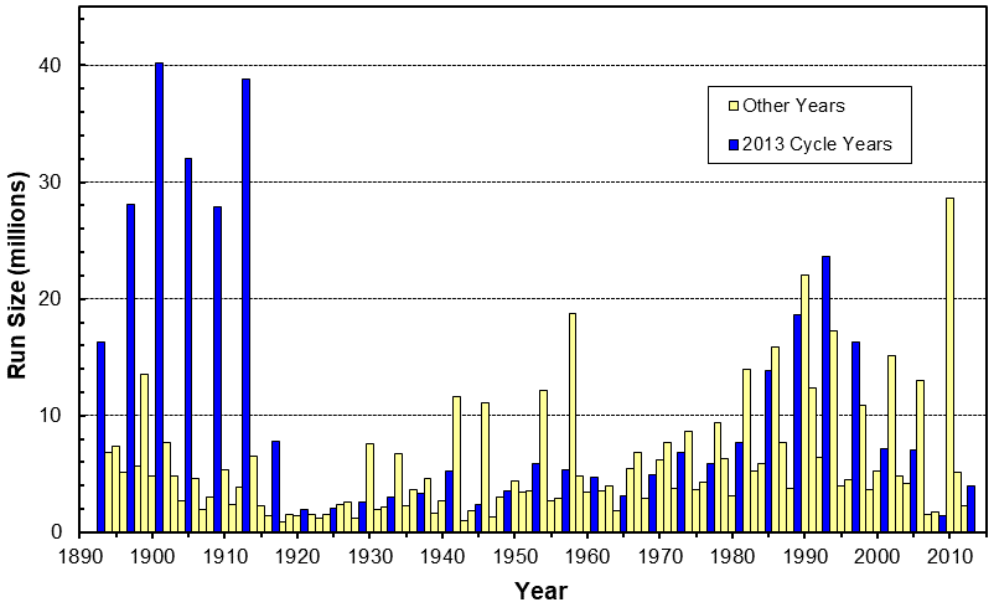

Figure 7. Total abundance of Fraser River sockeye salmon in 1893-2013, with returns on the 2013 cycle emphasized.

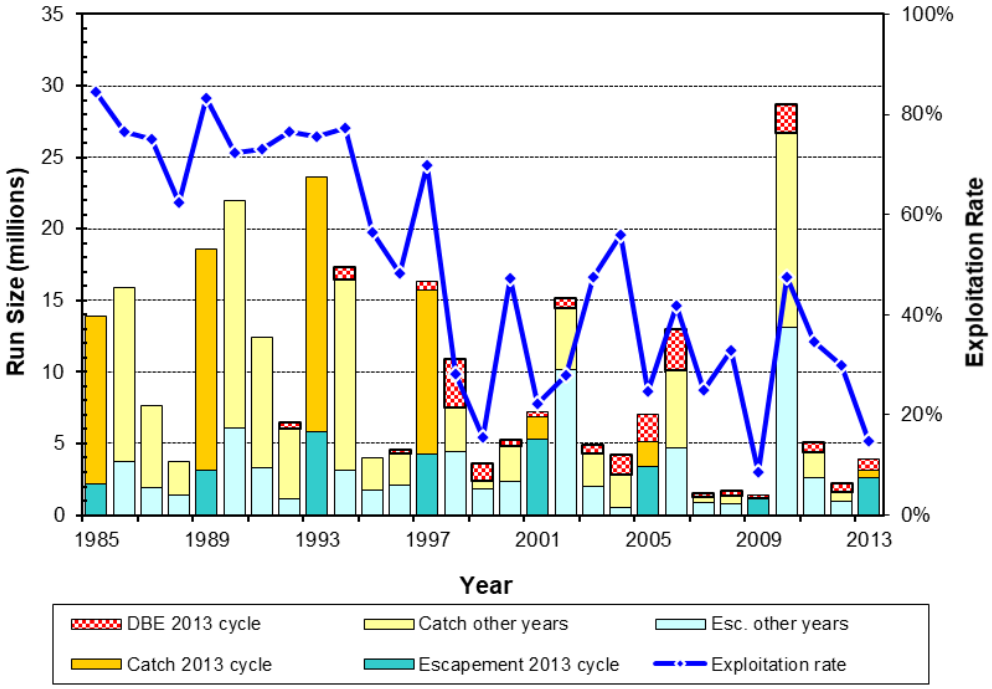

Figure 8. Total catch, escapement, difference between estimate, run size and exploitation rate for Fraser River sockeye salmon in 1985-2013, with returns on the 2013 cycle emphasized.

The overall spawning success of adult female sockeye in the Fraser watershed was 97%, based on the estimates of 1,284,000 female spawners and 1,244,000 effective female spawners. This effective female spawning population was more than double the brood year (2009) estimate. In a historical cycle-line context, the number of effective females spawners in 2013 was: (1) Early Stuart (40,000 fish, 87% spawning success) – almost double the brood year abundance but still the 2nd lowest since 1965; (2) Early Summer (100,000 fish, 90% spawning success) – 2½ times the

brood year estimate and the 2nd largest following 2001; (3) Summer (944,000 fish, 99% spawning success) – 2½ times the very low brood year but otherwise much less than estimates for the 1989 – 2005 period; and (4) Late (161,000 fish, 95% spawning success) - more than double the brood year (2009) estimate and the 2nd largest following 1993.

Table 10. Canadian commercial catches of Fraser River sockeye salmon by gear type, license designation and statistical area in 2013. Grey areas indicate fishery areas are not part of the license-area designation.

Fishery	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
Commercial	**0**	**2,100**	**0**	**0**	**0**	**0**	**0**	**0**	**2,100**
Panel Areas	**0**	**1,230**	**0**	**0**	**0**	**0**	**0**	**0**	**1,230**
20		0			0		0		0
17, 18, 29		1,230			0			0	1,230
121-124 *		0			0		0		0
Non-Panel Areas	**0**	**870**	**0**	**0**	**0**	**0**	**0**	**0**	**870**
1-10	0		0			0			0
11-16		870		0	0		0	0	870
124-127 *		0			0		0		0
First Nations Economic Opportunity and Demo Fisheries									**100**
Total Catch									**2,200**

* 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 2013.

Areas	Troll	Purse Seine	Gillnet	Reefnet	Total
Panel Area (Washington)	**0**	**190**	**4,100**	**0**	**4,300**
Treaty Indian *	**0**	**40**	**4,080**	**0**	**4,120**
4B, 5 and 6C	0	0	4,080	0	4,080
6 and 7	0	30	0	0	30
7A	0	10	0	0	10
All Citizen **	**0**	**160**	**20**	**0**	**180**
7	0	160	20	0	180
7A	0	0	0	0	0
Alaska (District 104) Catch					**46,400**
United States Total					**50,700**

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

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

The DBE[11] estimate was 900,500 fish, or 22% of the total return. As a percentage of run size for each management group, Early Stuart (46%), Early Summer (51%) and Late run (42%) had the largest DBEs, while the Summer run (10%) had the lowest (Tables 8 and 9).

[11] 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

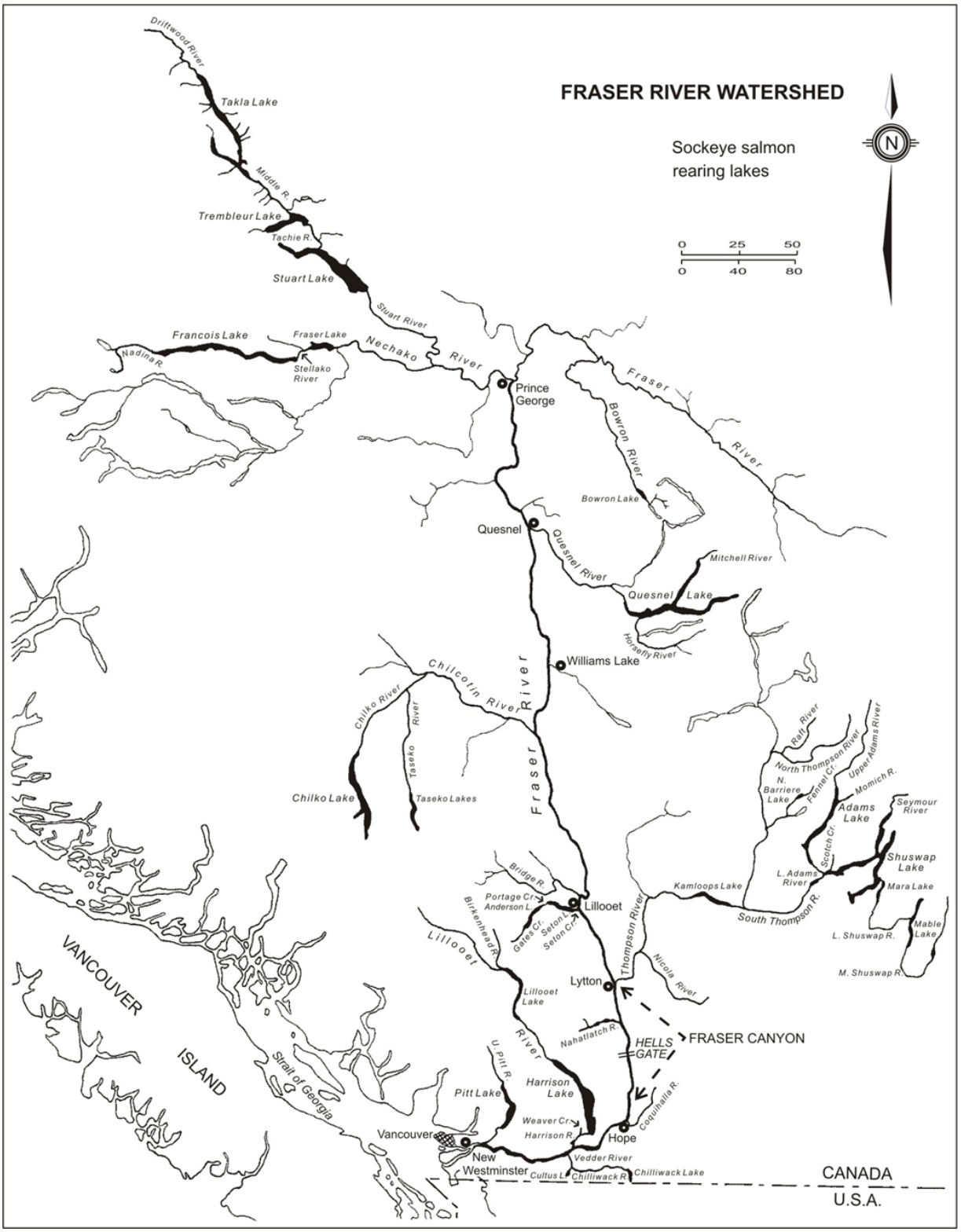

Figure 9. Sockeye salmon spawning areas in the Fraser River watershed.

stock are used to develop both pre-season abundance forecasts and escapement policy. The methods used to estimate RSAs are currently under review by PSC and DFO staff and members of the Fraser River Technical Committee.

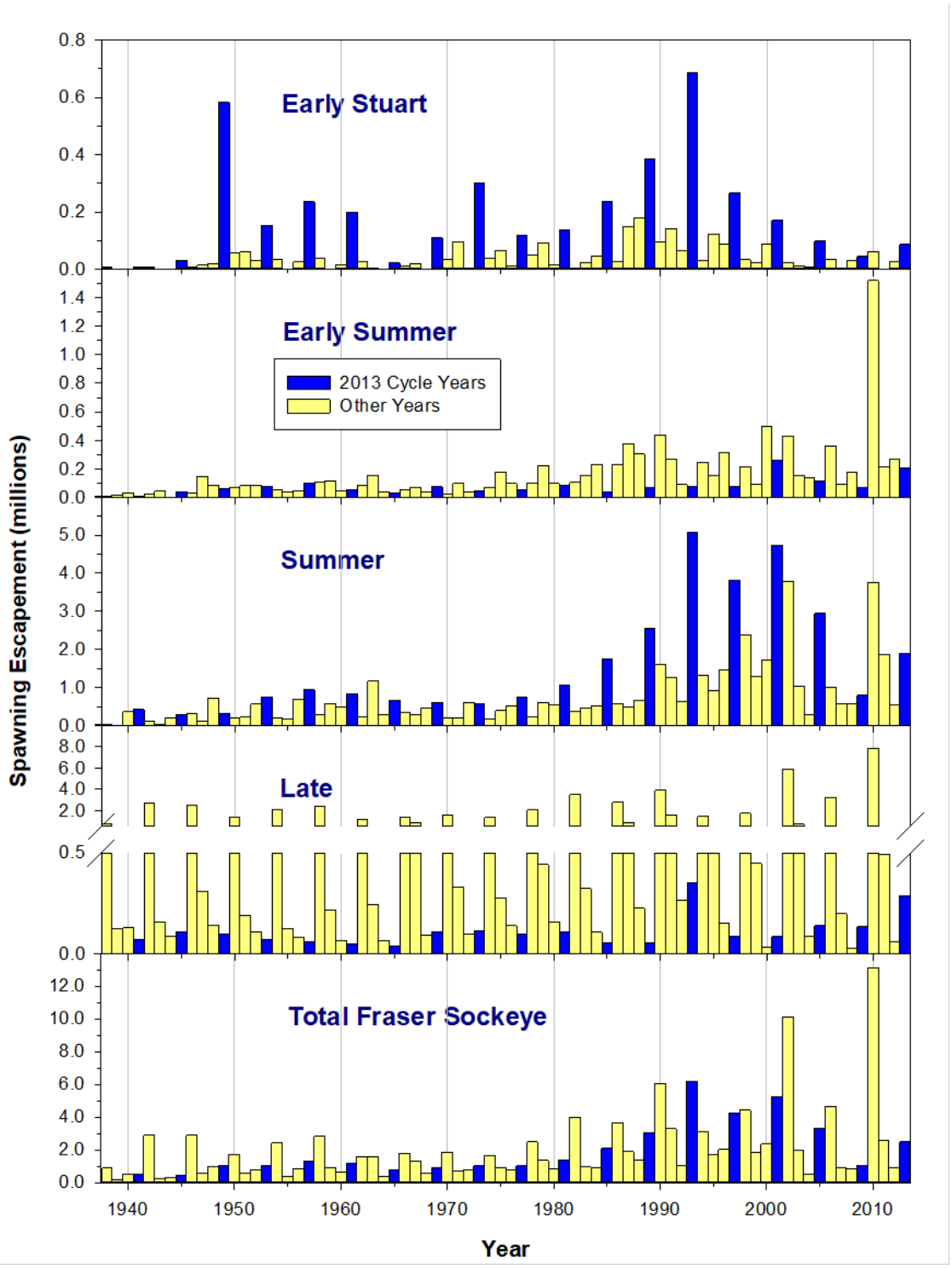

Figure 10. Annual adult spawning escapement of Fraser River sockeye salmon for each management group and for total sockeye in 1938-2013, with escapements on the 2013 cycle emphasized.

B. Pink Salmon

The in-season run-size estimate of 26,000,000 fish was derived by dividing the cumulative catch per unit effort in marine purse seine test fisheries which sample the migration on both the northern and southern migration routes by the appropriate average catchability. It was almost 3 times the median pre-season forecast of 8,926,000 fish (Table 1). The post-season estimate (Tables 8 and 9) of 15,898,000 fish was lower but still almost twice the forecast. The post-season estimate of total Fraser pink abundance was obtained by adding the hydroacoustic estimate of passage at Mission (10,535,000 fish) to the catch below Mission (5,363,000 fish). The total catch in all fisheries (6,553,000 fish) was then subtracted from the run size to estimate the spawning escapement (9,344,000 fish).

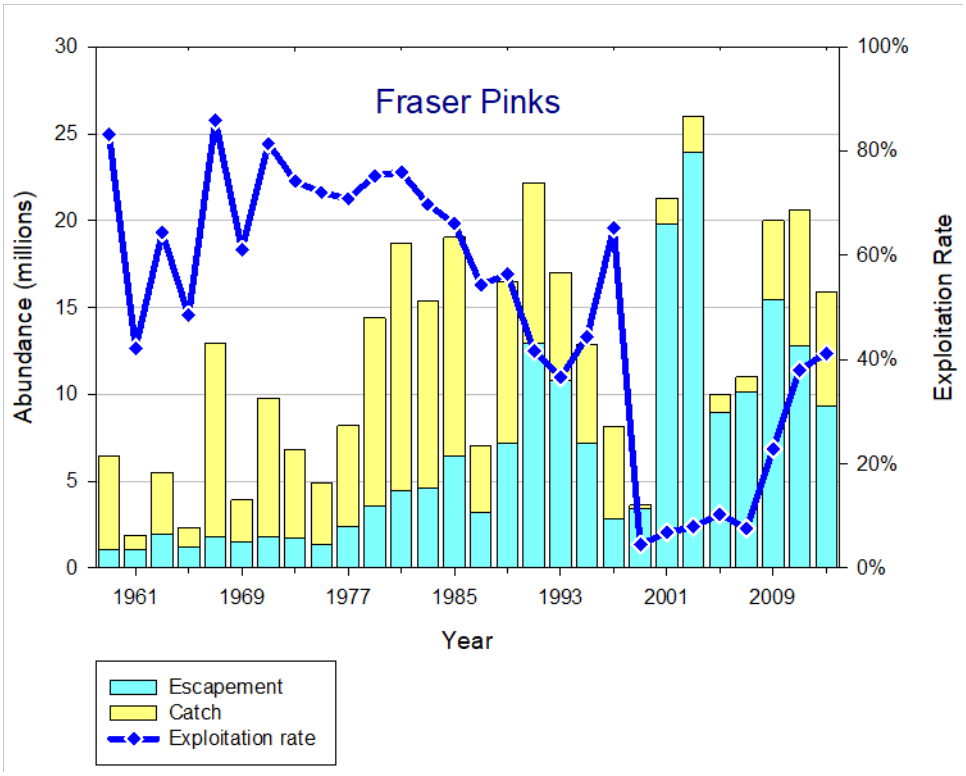

Figure 11. Total catch, escapement and exploitation rate for Fraser River pink salmon in 1959-2013.

The 2013 return of Fraser pink salmon (Figure 11) was in the range observed in recent years. The exploitation rate was 41%, similar to the brood year (2011) but substantially higher than the low exploitation rates (5-10%) observed in 1999-2007 and much lower than the 1959-1989 average exploitation rate of 68%.

Of the total Fraser River pink salmon catch, 3,314,000 fish were caught in Canada, 3,200,000 in the U.S. and 39,000 in test fisheries (Table 8). The Canadian catch included a commercial catch of 1,994,000 fish, First Nations' catches of 1,210,000 fish in Economic Opportunity (EO) fisheries, 11,000 fish in First Nations' FSC fisheries, and a recreational catch of 94,000. The Canadian commercial catch was taken almost entirely in Area B seine fisheries, with a very small component in Area H troll fisheries (Table 12). The U.S. catch included a commercial catch of 3,187,000 fish, with 1,846,000 fish caught in All Citizen fisheries and 1,341,000 fish in Treaty Indian fisheries (Table 13).

Table 12. Canadian commercial catches of Fraser River pink salmon by gear type, license designation and statistical area in 2013. Grey areas indicate fishery areas are not part of the license-area designation.

Fishery	Purse Seine		Gillnet			Troll			
Areas	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Total
Commercial	**0**	**1,994,200**	**0**	**0**	**0**	**0**	**0**	**80**	**1,994,300**
Panel Areas	**0**	**1,322,500**	**0**	**0**	**0**	**0**	**0**	**0**	**1,322,500**
20		0			0		0		0
17, 18, 29		1,322,500			0			0	1,322,500
121-124 *		0			0		0		0
Non-Panel Areas	**0**	**671,700**	**0**	**0**	**0**	**0**	**0**	**80**	**671,800**
1-10	0		0			0			0
11-16		671,700		0	0		0	80	671,780
124-127 *		0			0		0		0
First Nations Economic Opportunity and Demo Fisheries									**1,209,600**
Total Catch									**3,203,900**

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

Table 13. U.S. commercial catches of Fraser River pink salmon by user group, gear type and statistical area in 2013.

Areas	Purse Seine	Gillnet	Reefnet	Total
Panel Area (Washington)	**2,954,000**	**10,000**	**223,000**	**3,187,000**
Treaty Indian *	**1,337,000**	**4,000**	**0**	**1,341,000**
4B, 5 and 6C	0	2,000	0	2,000
6 and 7	1,061,000	1,000	0	1,062,000
7A	276,000	1,000	0	277,000
All Citizen **	**1,617,000**	**6,000**	**223,000**	**1,846,000**
7	632,000	2,000	223,000	857,000
7A	985,000	4,000	0	989,000
Non-Panel Area				**0**
United States Total				**3,187,000**

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

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

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 that are set 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 as specified by Canada. Spawning escapement targets were determined by applying Canada's spawning escapement plan to abundance estimates for each management group, which resulted in the calculation of TAM 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 measurable 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 Early Stuart (6% under) and Late-run (7% under) groups, exceeded for the Early Summer group (23% over) and less than the target (15% under) for the Summer-run group (Table 14). The overall in-season target for Fraser sockeye (3,578,000 fish) was exceeded by 9%. Figure 12 shows the available harvest and catch-to-date of total Fraser sockeye though the fishing season.

Table 14. Comparison of in-season spawning escapement targets and in-season estimates of potential spawning escapement (PSE) for adult Fraser River sockeye salmon in 2013.

	Final	Potential Spawning Escapement (PSE)					
	In-season	Spawning		In-season			
Management	Abundance	Escapement	Management	PSE **	PSE ***	Difference	
Group	Estimate	Target	Adjustment *	Target	Estimate	Fish	%
Adult sockeye	**3,732,000**	**1,895,000**	**3,717,500**	**3,578,000**	**3,258,000**	**-320,000**	**-9%**
Early Stuart	182,000	108,000	143,600	182,000	171,000	-11,000	-6%
Early Summer	550,000	220,000	176,000	396,000	489,000	93,000	23%
Summer	2,400,000	1,254,000	3,109,900	2,400,000	2,037,000	-363,000	-15%
Late	600,000	313,000	288,000	600,000	561,000	-39,000	-7%

* 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.

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 estimated abundances on the spawning grounds. The total spawning escapement of Fraser sockeye was estimated to be 31% greater than the post-season target (Table 15). Spawning escapements of Early Stuart (20% below), Early Summer (7% below) and Late-run (8% below) sockeye were slightly below the targets, while Summer-run (51% over) escapements were substantially above the target. The reason that Summer-run stocks exceeded their spawning escapement target may be due to the high DBEs (-71%, Table 6) predicted in-season, which were based on the record high river temperatures during the upstream migration of these stocks. This predicted DBE resulted in fishery restraints that increased the number of fish that escaped upriver. Despite the high river temperatures, however, the migration success of Summer-run sockeye was relatively high (-7% DBE) and more fish than expected arrived on the spawning grounds.

Due to constraints on pink harvests needed to protect sockeye salmon, the spawning escapement of Fraser pink salmon was 56% higher than the target (Table 15).

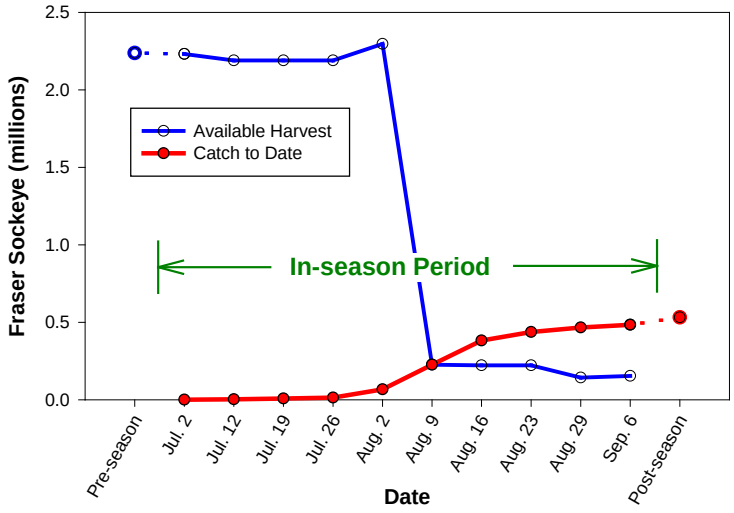

Figure 12. Available harvest of Fraser sockeye compared to catch to date in all fisheries in 2013. The available harvest is calculated as run size minus spawning escapement target and management adjustment and represents fish that are available for catch in all commercial, recreational, First Nations and test fisheries.

Table 15. Comparison of post-season spawning escapement targets and escapement estimates for adult Fraser River sockeye and pink salmon in 2013. Post-season estimates of sockeye escapement are from spawning ground enumeration programs (DFO), while the pink salmon escapement is the total estimated Mission passage plus catch seaward of Mission.

Management Group	Post-season Run-size Estimate	Spawning Escapement			
		Post-season Target	Adult Estimate	Difference Fish	Difference %
Sockeye salmon	**4,050,300**	**1,896,800**	**2,479,500**	**582,800**	**31%**
Early Stuart	182,500	108,000	86,300	-21,700	-20%
Early Summer	554,400	221,800	205,400	-16,400	-7%
Summer	2,658,200	1,254,000	1,899,200	645,200	51%
Late	655,200	313,000	288,700 *	-24,300	-8%
Pink salmon	**15,897,800**	**6,000,000**	**9,344,500**	**3,344,500**	**56%**

* Late-run escapement estimate include 200 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 and pink salmon. In accordance with Annex IV, Chapter 4 of the Pacific Salmon Treaty [1] and the February 17, 2011 Commission Guidance [2], the 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 5). The test fishing catch deduction is the post-season estimate, however.

With the total in-season abundance estimate of 3,732,000 Fraser sockeye, minus deductions for spawning escapement, MA, test fishing catch and AFE, the TAC in 2013 was 83,000 sockeye (Table 16). The Washington share of the TAC (16.5%) was 13,600 fish and their catch was 20,200 fish, resulting in a catch overage of 6,600 Fraser sockeye. Canada's catch (excluding ESSR catch) of 410,000 Fraser sockeye was 59,000 fish less than the total Canadian TAC. A detailed version of the TAC calculations by management group is presented in Table G5 in Appendix G.

For Fraser pink salmon, the in-season run size of 26,000,000 fish generated a TAC of 18,161,000 fish, of which 25.7% were allocated to fishers in Washington (Table 16). Their catch was 1,467,000 fish below this target. Similarly, the Canadian catch was 10,180,000 fish below their allocation.

Table 16.Total allowable catch (TAC) and achievement of international catch shares for Fraser River sockeye and pink salmon in 2013. 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 5), in accordance with Annex IV of the Treaty and the February 17, 2011 Commission Guidance.

		Sockeye		Pink	
TOTAL ALLOWABLE CATCH					
In-season Total Run Size		**3,732,000**		**26,000,000**	
Deductions		**6,112,200**		**7,839,200**	
In-season Spawning Escapement Target		1,895,000		7,800,000	
In-season Management Adjustment		3,717,500		n/a	
Aboriginal Fishery Exemption (AFE)		400,000		n/a	
Post-season Test Fishing Catch		99,700		39,200	
Total Allowable Catch	*1, 2*	**82,700**		**18,160,800**	
UNITED STATES					
Washington Share		**13,600**		**4,667,300**	
Washington Share of TAC	*1, 3*	13,600	16.5%	4,667,300	25.7%
Payback		0		0	
Washington Catch		**20,200**		**3,200,400**	
Deviation		**-6,600**		**1,467,000**	
In-season Alaska Catch Estimate		0		0	
CANADA					
Canadian Share of TAC + U.S. Payback + AFE		**469,000**		**13,493,400**	
Canadian Catch excluding ESSR Catch		**410,100**		**3,313,700**	
Deviation		**58,900**		**10,179,700**	

1 TAC and Washington sockeye share according to Annex IV of the Pacific Salmon Treaty and Feb. 17, 2011, Commission Guidance.

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. In regards to Fraser sockeye, Treaty Indian fishers in Washington caught 10,800 fish more than their share of the TAC and All Citizen fishers caught 4,200 fish fewer (Table 17). For Fraser pink salmon, Treaty Indian fishers caught 987,000 fewer fish and All Citizen fishers caught 480,000 fewer fish than their share of the U.S. allocation (Table 18). There is no domestic allocation to report for Canadian commercial fisheries.

Table 17. Achievement of domestic catch goals in Washington for Fraser River sockeye salmon in 2013.

User Category	Actual Catch Fish	Actual Catch %	Share of TAC Fish	Share of TAC %	Deviation
Washington Total	**20,200**	**100.0%**	**13,600**	**100.0%**	**6,600**
Treaty Indian *	20,000	99.0%	9,200	67.7%	10,800
All Citizen **	200	1.0%	4,400	32.3%	-4,200

* Treaty Indian catch includes commercial and ceremonial catches.

** All Citizen catch includes commercial and recreational catches.

Table 18. Achievement of domestic catch goals in Washington for Fraser River pink salmon in 2013.

User Category	Actual Catch Fish	Actual Catch %	Share of TAC Fish	Share of TAC %	Deviation
Washington Total	**3,200,400**	**100.0%**	**4,667,300**	**100.0%**	**-1,466,900**
Treaty Indian *	1,346,500	42.1%	2,333,700	50.0%	-987,200
All Citizen **	1,853,900	57.9%	2,333,700	50.0%	-479,800

* 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 10 sockeye and 930,000 pink salmon in 2013 (Table 19). Catches of other Fraser and non-Fraser salmon species included 4,500 Chinook, 12,000 coho, 1,850 chum and 10 steelhead.

Table 19. Catches of non-Fraser sockeye and pink salmon and catches of other salmon species in commercial fisheries regulated by the Fraser River Panel in 2013.

Area and Gear	Non-Fraser Sockeye	Non-Fraser Pink	Fraser and Non-Fraser Chinook	Coho	Chum	Steelhead
United States *	**10**	**800,740**	**4,450**	**11,680**	**910**	**10**
Areas 4B, 5 and 6C Net	10	6,290	560	1,710	80	10
Areas 6, 7 and 7A Net	0	794,450	3,900	9,970	830	0
Canada **	**0**	**128,940**	**80**	**430**	**940**	**0**
Area 20 Net	0	0	0	0	0	0
Area 29 Net	0	128,940	80	430	940	0
Total	**10**	**929,680**	**4,530**	**12,110**	**1,850**	**10**

* 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

In accordance with Panel agreements, to determine whether U.S. paybacks are owed in future years, the first step is to assess whether the U.S. exceeded their catch allocation on the day that the TAC was established (i.e., when Panel control of the last U.S. fishery was relinquished). If the U.S. exceeded its share at the time of relinquishment, then the Panel considers the TAC in effect

on the day of the last Panel decision about U.S. fisheries. If the TAC decreased after the last fishery decision, then the TAC on this decision day is used. Otherwise, the TAC calculated at the time of relinquishment is used for calculations of allocation status.

Table 20. Allocation status for Fraser River sockeye and pink salmon in 2009-2013. After 2013, the U.S. owed a payback of 6,600 Fraser sockeye salmon.

Fraser Sockeye

	2009	2010	2011	2012	2013
TOTAL ALLOWABLE CATCH					
Total Run Size	1,370,000	34,546,000	5,077,000	2,515,000	3,732,000
Escapement and other deductions	1,370,000	18,769,100	2,999,200	1,796,000	3,649,400
Total Allowable Catch:	0	15,776,900	2,077,800	719,000	82,600
UNITED STATES					
Washington Catch	4,300	1,959,600	278,800	111,300	20,200
Washington Share (exclds payback) *	0	2,603,200	342,800	118,600	13,600
Deviation:	4,300	-643,600	-64,000	-7,300	6,600
Cumulative Allocation Status:	**4,300**	**0 ****	**0 ****	**0 ****	**6,600**
CANADA					
Catch	73,800	11,558,700	1,405,200	510,400	410,100
Share + Aboriginal Exemption	146,800	13,573,700	2,135,000	1,000,400	469,000
Deviation:	-73,000	-2,015,000	-729,800	-490,000	-58,900

Fraser Pinks

	2009	2011	2013
TOTAL ALLOWABLE CATCH			
Total Run Size	19,500,000	18,300,000	26,000,000
Escapement and other deductions	6,021,800	6,013,100	7,883,400
Total Allowable Catch:	13,478,200	12,286,900	18,116,600
UNITED STATES			
Washington Catch	2,815,600	2,916,500	3,200,400
Washington Share *	3,463,900	3,157,700	4,656,000
Deviation:	-648,300	-241,200	-1,455,600
Cumulative Allocation Status:	**0 ****	**0 ****	**0 ****
CANADA			
Catch	1,714,500	4,931,000	3,309,300
Share	10,014,300	9,129,200	13,460,600
Deviation:	-8,299,800	-4,198,200	-10,151,300

* Washington share of the TAC according to Annex IV of the Pacific Salmon Treaty:
2009: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks.
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.

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

In 2013, the U.S. exceeded its share of Fraser sockeye according to calculations at the time of relinquishment (October 5, Tables 1 and 16) and the TAC did not decrease after the last decision about U.S. fisheries (September 17, Appendix E). Thus, the TAC calculation in effect on October

5 was used to determine allocation status. Using this method the U.S. caught more than their share of Fraser sockeye and so there is a payback of 6,600 Fraser sockeye to carry forward to the 2014 fishing season (Table 20).

For Fraser pink salmon, the U.S. caught less than their allocation, so there are no paybacks to carry forward.

VIII. APPENDICES

APPENDIX A: GLOSSARY OF TERMS AND ABBREVIATIONS

Bayesian inference: 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.

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 4th 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=PSE–SE, %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 Weaver Creek sockeye that are "Excess Salmon to Spawning Requirements".

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

APPENDIX B: 2013 PRE-SEASON FORECASTS AND SPAWNING ESCAPEMENT TARGETS FOR FRASER RIVER SOCKEYE AND PINK SALMON

Table B1. Pre-season forecasts for Fraser River sockeye and pink salmon in 2013, provided to the Panel by Fisheries and Oceans Canada.

A	B	C	D	E	F	G	H	I	J	K	L
Run timing group		BY (09)	BY (08)	Ret	Mean Run Size		Probability that Return will be at/or Below Specified Run Size [a]				
Stocks	Forecast Model [b]	(EFS)	(EFS)	2013	all cycles [c]	2013 cycle [d]	10%	25%	50%	75%	90%
Early Stuart	*Ricker (Ei)*	21,900	14,400		**311,000**	**792,000**	**92,000**	**137,000**	**211,000**	**331,000**	**507,000**
Early Summer					**478,000**	**274,000**	**73,000**	**130,000**	**253,000**	**468,000**	**844,000**
(total excluding miscellaneous)					***478,000***	***274,000***	**55,000**	**94,000**	**180,000**	**342,000**	**621,000**
Bowron	*MRS*	1,000	300		39,000	24,000	2,000	3,000	7,000	14,000	26,000
Fennell	*Power*	700	200		25,000	12,000	3,000	5,000	9,000	15,000	25,000
Gates	*Larkin*	5,300	1,800		53,000	40,000	24,000	37,000	67,000	115,000	191,000
Nadina	*MRJ*	3,700	10,200		80,000	72,000	10,000	20,000	44,000	95,000	189,000
Pitt	*Larkin*	18,100	5,400		72,000	74,000	5,000	9,000	15,000	28,000	50,000
Scotch	*Ricker*	2,700	100		78,000	25,000	4,000	8,000	17,000	39,000	82,000
Seymour	*Ricker-cyc*	3,100	300		131,000	27,000	7,000	12,000	21,000	36,000	58,000
Misc (EShu & Taseko) [e]	*RS (Sc/Se)+RS(Chilko)*	1,500	500		NA	NA	2,000	4,000	13,000	18,000	20,000
Misc (Chilliwack) [f]	*RS (Esum)*	2,400	19,700		NA	NA	15,000	31,000	57,000	103,000	194,000
Misc (Nahatlatch) [f]	*RS (Esum)*	400	150		NA	NA	1,000	1,000	3,000	5,000	9,000
Summer					**3,822,000**	**6,791,000**	**1,222,000**	**2,095,000**	**3,718,000**	**6,663,000**	**12,131,000**
(total excluding miscellaneous)					***3,822,000***	***6,791,000***	**1,218,000**	**2,088,000**	**3,705,000**	**6,637,000**	**12,079,000**
Chilko [g]	*Power (juv) (Pi)*	35 M	11.8 M		1,350,000	824,000	736,000	1,147,000	1,829,000	2,929,000	4,482,000
Late Stuart	*Power*	43,300	57,900		560,000	1,654,000	80,000	151,000	333,000	686,000	1,393,000
Quesnel	*Ricker-cyc*	82,800	2,500		1,358,000	3,956,000	277,000	596,000	1,218,000	2,445,000	5,188,000
Stellako	*Larkin*	15,800	73,800		462,000	245,000	91,000	131,000	192,000	291,000	423,000
Raft [h]	*Ricker (PDO)*	6,000	3,600		32,000	28,000	22,000	32,000	51,000	81,000	124,000
Harrison [h & i]	*Ricker (Ei)*	100,600	399,661		60,000	84,000	**12,000	**31,000	**82,000	**205,000	**469,000
Misc (N. Thomp. Tribs) [h & j]	*R/S (Ra/Fe)*	70	200		NA	NA	100	300	1,000	1,000	2,000
Misc (N. Thomp River) [h & j]	*R/S (Ra/Fe)*	1,700	1,000		NA	NA	4,000	7,000	12,000	25,000	50,000
Late					**2,960,000**	**834,000**	**167,000**	**293,000**	**583,000**	**1,133,000**	**2,126,000**
(total exlcuding miscellaneous)					***2,960,000***	***834,000***	***160,000***	***280,000***	***559,000***	***1,091,000***	***2,053,000***
Cultus [g]	*MRJ*	174,000	145,300		39,000	14,000	2,000	3,000	7,000	16,000	33,000
Late Shuswap	*Ricker-cyc*	20,200	80		2,152,000	182,000	14,000	36,000	111,000	274,000	574,000
Portage	*Larkin*	800	60		40,000	47,000	2,000	5,000	12,000	28,000	61,000
Weaver	*MRS*	12,900	600		363,000	281,000	42,000	76,000	147,000	281,000	506,000
Birkenhead	*Ricker (Ei)*	34,500	6,800		366,000	310,000	100,000	160,000	282,000	492,000	879,000
Misc. non-Shuswap [k]	*R/S (Lillooet-Harrison)*	3,700	900		NA	NA	7,000	13,000	24,000	42,000	73,000
TOTAL SOCKEYE SALMON					-	-	**1,554,000**	**2,655,000**	**4,765,000**	**8,595,000**	**15,608,000**
(TOTAL excluding miscellaneous)					***(7,571,000)***	***(8,579,000)***	***(1,529,000)***	***(2,606,000)***	***(4,668,000)***	***(8,427,000)***	***(15,312,000)***
TOTAL PINK SALMON	*Power (SSS)*	2011 Brood Year Fry 520 M			**12,580,000**	**12,580,000**	**4,794,000**	**6,401,000**	**8,926,000**	**12,473,000**	**17,111,000**

a. Probability that return will be at, or below, specified projection.
b. See Table 5 for model descriptions
c. Sockeye: 1953-2009 (depending on start of time series)
d. Sockeye: 1953-2009 (depending on start of time series)
e. Misc. Early Shuswap stocks use Scotch and Seymour R/EFS in forecast; Misc. Taseko uses Chilko R/EFS in forecast
f. Misc. Chilliwack & Nahatlach use Early Summer Run stocks R/EFS in forecast
g. Brood year smolts in columns C & D (not effective females)
h. Raft, Harrison, Miscellaneous North Thompson stocks moved in current forecast to Summer Run timing group due to changes in run timing of these stocks
i. Harrison are age-4 (column C) and age-3 (column D).
j. Misc. North Thompson stocks use Raft & Fennel R/EFS in forecast
k. 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 (2009/2010) that are out of the historical data range

Definitions: BY: Brood year; BY09: brood year 2009; BY08: brood year 2008; EFS: effective female spawners; Ei (Entrance Island sea-surface-temperature); PDO (Pacific Decadal Oscillation), Pi (Pine Island sea-surface temperature).

Table B2. Spawning escapement plan for Fraser River sockeye and pink salmon in 2013, provided to the Panel by Fisheries and Oceans Canada.

2013 Lower & Upper Fishery Reference Points for Early Stuart, Early Summer, Summer and Late Run sockeye

	Harvest Rule Parameters				
Management Unit	Low Abundance ER	TAM Cap	Lower Fishery Reference Point	Upper Fishery Reference Point	Pre-season pMA
Early Stuart	10%	60%	108,000	270,000	0.67
Early Summer (w/o misc)	10%	60%	100,000	250,000	0.51
Summer	10%	60%	1,250,000	3,125,000	0.10
Late (w/o misc)	20-30%	60%	300,000	750,000	0.67

Table Abbreviations

MA	Management Adjustment
ER	Exploitation Rate
TAM	Total Allowable Mortality
pMA	Proportional Management Adjustment
BY	Brood Year
S	Spawners

Escapement Plan for the Fraser River Sockeye timing groups over a range of preseason forecasts

Management Unit		Pre-season Forecast Return p10	p25	**p50**	p75	p90
Early Stuart	forecast	92,000	137,000	**211,000**	331,000	507,000
	TAM Rule (%)	0%	21%	**49%**	60%	60%
	Escapement Target	92,000	108,000	**108,000**	132,400	202,800
	MA	61,600	72,400	**72,400**	88,700	135,900
	Esc. Target + MA	153,600	180,400	**180,400**	221,100	338,700
	LAER	10%	10%	**10%**	10%	10%
	ER at Return	0%	0%	**15%**	33%	33%
	Allowable ER	10%	10%	**15%**	33%	33%
	available for harvest	9,200	13,700	**30,600**	109,900	168,300
	2013 Performance					
	Projected S (after MA)	50,000	74,000	**108,000**	132,000	203,000
	BY Spawners	45,300	45,300	**45,300**	45,300	45,300
	Proj. S as % BY S	110%	163%	**238%**	291%	448%
	cycle avg S	210,300	210,300	**210,300**	210,300	210,300
	Proj. S as % cycle S	24%	35%	**51%**	63%	97%

Management Unit		Pre-season Forecast Return p10	p25	**p50**	p75	p90
Early Summer (w/o RNT)	lower ref. pt. (w misc)	141,000	141,000	**141,000**	141,000	141,000
	upper ref. pt. (w misc)	351,000	351,000	**351,000**	351,000	351,000
	forecast (incl. misc)	73,000	130,000	**253,000**	468,000	844,000
	TAM Rule (%)	0%	0%	**44%**	60%	60%
	Escapement Target	73,000	130,000	**141,000**	187,200	337,600
	MA	37,200	66,300	**71,900**	95,500	172,200
	Esc. Target + MA	110,200	196,300	**212,900**	282,700	509,800
	LAER	10%	10%	**10%**	10%	10%
	ER at Return	0%	0%	**16%**	40%	40%
	Allowable ER	10%	10%	**16%**	40%	40%
	available for harvest	7,300	13,000	**40,100**	185,300	334,200
	2013 Performance					
	Projected S (after MA)	44,000	77,000	**141,000**	187,000	338,000
	BY Spawners	80,200	80,200	**80,200**	80,200	80,200
	Proj. S as % BY S	55%	96%	**176%**	233%	421%
	cycle avg S	91,000	91,000	**91,000**	91,000	91,000
	Proj. S as % cycle S	48%	85%	**155%**	205%	371%

Table B2, continued on next page

Table B2, continued.

Management Unit		Pre-season Forecast Return p10	p25	**p50**	p75	p90
Summer (w. RNT & Har)	lower ref. pt. (w misc)	1,254,000	1,254,000	**1,254,000**	1,254,000	1,254,000
	upper ref. pt. (w misc)	3,136,000	3,136,000	**3,136,000**	3,136,000	3,136,000
	forecast	1,222,000	2,095,000	**3,718,000**	6,663,000	12,131,000
	TAM Rule (%)	0%	40%	**60%**	60%	60%
	Escapement Target	1,222,000	1,254,000	**1,487,200**	2,665,200	4,852,400
	MA	122,200	125,400	**148,700**	266,500	485,200
	Esc. Target + MA	1,344,200	1,379,400	**1,635,900**	2,931,700	5,337,600
	LAER	10%	10%	**10%**	10%	10%
	ER at Return	0%	34%	**56%**	56%	56%
	Allowable ER	10%	34%	**56%**	56%	56%
	available for harvest	122,200	715,600	**2,082,100**	3,731,300	6,793,400
	2013 Performance					
	Projected S (after MA)	1,000,000	1,254,000	**1,487,000**	2,665,000	4,852,000
	BY Spawners	796,200	796,200	**796,200**	796,200	796,200
	Proj. S as % BY S	126%	157%	**187%**	335%	609%
	cycle avg S	1,825,400	1,825,400	**1,825,400**	1,825,400	1,825,400
	Proj. S as % cycle S	55%	69%	**81%**	146%	266%

Management Unit		Pre-season Forecast Return p10	p25	**p50**	p75	p90
Late (w/o Har)	lower ref. pt. (w misc)	313,000	313,000	**313,000**	313,000	313,000
	upper ref. pt. (w misc)	782,000	782,000	**782,000**	782,000	782,000
	forecast	167,000	293,000	**583,000**	1,133,000	2,126,000
	TAM Rule (%)	0%	0%	**46%**	60%	60%
	Escapement Target	167,000	293,000	**313,000**	453,200	850,400
	MA	111,900	196,300	**209,700**	303,600	569,800
	Esc. Target + MA	278,900	489,300	**522,700**	756,800	1,420,200
	LAER	20%	20%	**20%**	30%	30%
	ER at Return	0%	0%	**10%**	33%	33%
	Allowable ER	20%	20%	**20%**	33%	33%
	available for harvest	33,400	58,600	**116,600**	376,200	705,800
	2013 Performance					
	Projected S (after MA)	80,000	140,000	**279,000**	453,000	850,000
	BY Spawners	134,000	134,000	**134,000**	134,000	134,000
	Proj. S as % BY S	60%	104%	**208%**	338%	634%
	cycle avg S	104,200	104,200	**104,200**	104,200	104,200
	Proj. S as % cycle S	77%	134%	**268%**	435%	816%
Available for Harvest (TF, US, CDN)		172,100	800,900	**2,269,400**	4,402,700	8,001,700
Total projected spawners		1,174,000	1,545,000	**2,015,000**	3,437,000	6,243,000

Fraser River pink salmon spawning escapement target plan

7,059,000	Lower Fishery Reference Point
20,000,000	Upper Fishery Reference Point
70%	Maximum Exploitation Rate

	Pre-season Forecast Return p10	p25	**p50**	p75	p90
forecast	4,794,000	6,401,000	8,926,000	12,473,000	17,111,000
escapement target	4,306,000	5,530,000	6,000,000	6,000,000	6,000,000
allowable ER	10%	14%	33%	52%	65%

APPENDIX C: 2013 FRASER RIVER PANEL MANAGEMENT PLAN PRINCIPLES AND CONSTRAINTS (agreed June 20, 2013)

1. Fisheries and Oceans Canada (DFO) has provided the Panel with run-size forecasts for Fraser River sockeye and pink 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 (4,765,000 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 2,655,000 fish and there is a three in four chance that the actual number of returning sockeye will be at or below 8,595,000 fish. By stock grouping, the 50% probability forecasts are 211,000 Early Stuart, 253,000 Early Summer-run, 3,718,000 Summer-run, and 583,000 Late-run sockeye [12]. When sufficient information is available in-season, the Panel will update run size estimates of Fraser River sockeye salmon, as appropriate. The pre-season forecast for Fraser River pink salmon is highly uncertain, in part due to changes in return estimation methods over time. For pre-season planning of Fraser River pink salmon, the Panel used the 50% probability level forecast of 8,926,000 fish. To put the uncertainty around the pink salmon forecast into context, there is a one in four chance that the actual return of pink salmon will be below 6,401,000, and a three in four chance that the return will be below 12,473,000.

2. The Panel's first priority in 2013 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 February 17, 2011 Commission Guidance to the Fraser River Panel and the 2012 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 2013, the Panel agreed to pre-season Fraser River Aboriginal Exemptions as follows: Early Stuart sockeye, 36,400 fish; Early Summer-run sockeye, 19,500 fish; Summer-run sockeye, 331,100 fish; and Late-run sockeye, 13,000 fish. There is no TAC for international sharing for Early Stuart sockeye at the 50% probability level of abundance and pre-season pMAs. 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. 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. Under the terms of Annex IV, Chapter 4, of the Pacific Salmon Treaty, the United States share of the TAC for Fraser River pink salmon is 25.7%.

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. Given the low anticipated return of Late-run sockeye in 2013, it is unlikely that PSC staff will be able to provide the Panel with predictions of Late-run upstream timing and mortality during the in-season management period.

5. Given pre-season assumptions about marine timing and recent delay behavior, the Fraser Panel has agreed to use the median Management Adjustment (pMA) for the 2013 cycle of 0.67. As a result no directed harvest of Late-run sockeye is planned at the p50 run size forecast. However, some limited by-catch of Late-run sockeye may occur in fisheries directed at other Fraser sockeye management groups with harvestable surpluses and Fraser River pink salmon. If the return of Late-run sockeye is less than the 75% probability level forecast (1,133,000 fish) the by-catch of Late-run sockeye will be limited to a maximum exploitation

[12] Similar to the 2012 management season, Raft, North Thompson, and Harrison sockeye will again be managed as part of the Summer-run group in 2013.

rate of 20% and if their return is equal or greater than the 75% probability level forecast, the maximum exploitation rate is 30%.

Regulations

i) If the abundance of Early Summer-run sockeye salmon is tracking at approximately the 50% probability level (253,000 fish) and the abundance of Summer-run sockeye salmon is tracking at approximately the 50% probability level (3,718,000 fish) and the runs arrive at or near expected dates, low impact fisheries would be expected to commence during the fourth week of 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 2013 management season.

APPENDIX D: 2013 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 20, 2013.

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 30th day of June, 2013, to the 21st day of September, 2013, both dates inclusive.

b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 20-1, 3 and 4 from the 30th day of June, 2013, to the 21st day of September, 2013, both dates inclusive.

2 a) No person shall commercially fish for sockeye or pink salmon in Pacific Fishery Management Areas 17 and 18 with nets from the 30th day of June, 2013 to the 28th day of September, 2013, both dates inclusive.

b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 18-1, 4 and 11 from the 30th day of June, 2013, to the 28th day of September, 2013, 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 30th day of June, 2013, to the 12th day of October, 2013, both dates inclusive.

b) No person shall troll commercially for sockeye or pink salmon in Pacific Fishery Management Area 29 from the 30th day of June, 2013, to the 12th day of October, 2013, 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 2013 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 2013 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 30th day of June, 2013 to the 21st day of September, 2013, both dates inclusive.
2. No Treaty Indian shall commercially fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from the 30th day of June, 2013, to the 28th day of September, 2013, 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 29th day of September, 2013, to the 5th day of October, 2013, both dates inclusive.

All-Citizen Fisheries:

1. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, and 6C with nets from the 30th day of June, 2013, to the 21st day of September, 2013, both dates inclusive.
2. No person shall fish for sockeye or pink salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from the 30th day of June, 2013, to the 28th day of September, 2013, 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 29th day of September, 2013, to the 5th day of October, 2013, 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 2013 season, the Fraser River Panel will adopt Orders establishing open fishing periods based on a 2013 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 E: 2013 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, 2013

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Open to drift gillnets 12:00 p.m. (noon), Tuesday, July 30, 2013, to 12:00 p.m. (noon) Saturday, August 3, 2013.

August 2, 2013

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon), Saturday, August 3, 2013, to 12:00 p.m. (noon) Wednesday, August 7, 2013.

August 6, 2013

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon), Wednesday, August 7, 2013, to 12:00 p.m. (noon) Saturday, August 10, 2013.

August 23, 2013

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Open to drift gillnets from 12:00 p.m. (noon) Saturday, August 24, 2013 to 12:00 p.m. (noon), Wednesday August 28, 2013.

Areas 6,7 and 7A

Open to net fishing from 5:00 a.m. Sunday, August 25 through 9:00 a.m. Tuesday, August 27, 2013, in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Saturday, August 24, 2013 and Sunday, August 25, 2013.

Areas 7 and 7A

Open to purse seines with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Tuesday, August 27, 2013, in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

Areas 7 and 7A

Open to gillnets with non-retention of sockeye salmon from 8:00 a.m. to 11:59 p.m. (midnight) Tuesday, August 27, 2013, in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

August 27, 2013

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon), Wednesday August 28, 2013 to 12:00 p.m. (noon) Friday August 30, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

Areas 6,7 and 7A

Open for net fishing from 5:00 a.m. Wednesday, August 28 through 9:00 a.m. Friday, August 30, 2013 in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia. Purse seines must release all sockeye salmon. Gillnets may retain sockeye salmon for ceremonial and subsistence purposes only.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Wednesday, August 28, 2013, Thursday, August 29, 2013 and Friday, August 30, 2013.

Areas 7 and 7A

Open to purse seines with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Friday, August 30, 2013 in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

Areas 7 and 7A

Open to gillnets with non-retention of sockeye salmon from 8:00 a.m. to 11:59 p.m. (midnight) Friday, August 30, 2013 in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

August 29, 2013

Canada

Areas 18-1, 18-4, and 18-11 and Areas 29-6, 29-7 and 29-9

Open to Area B seine assessment (2 vessels) ITQ fishery for pink salmon with non-retention of sockeye salmon 6:00 a.m. to 9:00 p.m. daily on Sunday, September 1, 2013 until further notice.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon) Friday, August 30, 2013 to 12:00 p.m. (noon) Wednesday, September 4, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

Areas 6,7 and 7A

Open for net fishing from 5:00 a.m. Saturday, August 31 through 9:00 a.m. Monday, September 2, 2013, and from 5:00 a.m. Tuesday, September 3, 2013 through 9:00 a.m. Wednesday, September 4, 2013 in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. daily on Saturday, August 31, 2013, Sunday, September 1, 2013, Monday, September 2, 2013 and Tuesday, September 3, 2013.

Area 7 and 7A

Open to purse seines with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Monday, September 2, 2013 in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

Area 7 and 7A

Open to gillnets with non-retention of sockeye salmon from 8:00 a.m. to 11:59 p.m. (midnight) Monday, September 2, 2013 in the area southerly and easterly of a straight line drawn from Iwersen's dock on Point Roberts in the State of Washington to the Georgina Point Light at the entrance to Active Pass in the Province of British Columbia.

September 3, 2013

Canada

Area 29-6, 29-7 and 29-9

Open to Area B seine ITQ fishery for pink salmon with non-retention of sockeye salmon 6:00 a.m. to 9:00 p.m. daily on Wednesday, September 4 until further notice.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon) Wednesday, September 4, 2013 to 12:00 p.m. (noon) Saturday, September 7, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

Areas 6,7 and 7A

Extended for net fishing from 9:00 a.m. Wednesday, September 4, 2013 through 9:00 a.m. Thursday, September 5, 2013 and open from 5:00 a.m. Friday, September 6, 2013 through 9:00 a.m. Saturday, September 7, 2013. Sockeye may be retained for ceremonial and subsistence purposes only.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. daily on Wednesday, September 4, 2013, Thursday, September 5, 2013, and Friday, September 6, 2013.

Area 7 and 7A

Open to purse seines with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Thursday, September 5, 2013.

Area 7 and 7A

Open to gillnets with non-retention of sockeye salmon from 8:10 a.m. to 11:59 p.m. (midnight) Thursday, September 5, 2013.

September 6, 2013

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon) Saturday, September 7, 2013 through 12:00 p.m. (noon) Wednesday, September 11, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

Areas 6,7 and 7A

Extended for net fishing from 9:00 a.m. Saturday, September 7, 2013 through 9:00 a.m. Monday, September 9, 2013, and open for net fishing from 5:00 a.m. Tuesday, September 10, 2013 through 9:00 a.m. Wednesday, September 11, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Saturday, September 7, 2013, Sunday September 8, 2013, Monday, September 9, 2013, and Tuesday, September 10, 2013.

Area 7 and 7A

Open to purse seines with non-retention of sockeye salmon from 5:00 a.m. to 9:00 p.m. Monday, September 9, 2013.

Area 7 and 7A

Open to gillnets with non-retention of sockeye salmon from 8:15 a.m. to 11:59 p.m. (midnight) Monday, September 9, 2013.

September 9, 2013

Canada

Area 29-4, 29-6, 29-7 and 29-9

Open to Area B seine ITQ fishery for pink salmon with non-retention of sockeye salmon 6:00 a.m. to 9:00 p.m. daily on Wednesday, September 4 until further notice.

September 10, 2013

Canada

Area 29-4, 29-6, 29-7 and 29-9

Closes to Area B seine ITQ fishery for pink salmon with non-retention of sockeye salmon at 9:00 p.m. Tuesday, September 10, 2013.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon) Wednesday, September 11, 2013 through 12:00 p.m. (noon) Saturday, September 14, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

Areas 6,7 and 7A

Extended for net fishing from 9:00 a.m. Wednesday, September 11, 2013 through 9:00 a.m. Friday, September 13, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye salmon daily from 5:00 a.m. to 9:00 p.m. on Wednesday, September 11, 2013, Thursday, September 12, 2013, and Friday, September 13, 2013.

Area 7 and 7A

Open to purse seines with non-retention of sockeye salmon from 8:30 a.m. to 4:30 p.m. Friday, September 13, 2013.

Area 7 and 7A

Open to gillnets with non-retention of sockeye salmon from 8:20 a.m. to 11:59 p.m. (midnight) Friday, September 13, 2013.

September 13, 2013

Canada

Area 29-4, 29-6, 29-7 and 29-9

Open to Area B seine ITQ fishery for pink salmon with non-retention of sockeye salmon 6:00 a.m. to 9:00 p.m. daily on Sunday, September 15, 2013 until further notice.

United States

Treaty Indian Fishery

Areas 4B, 5 and 6C

Extended for drift gillnets from 12:00 p.m. (noon) Saturday, September 14, 2013 through 12:00 p.m. (noon) Wednesday, September 18, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

Areas 6,7 and 7A

Open for net fishing from 5:00 a.m. Saturday, September 14, 2013 through 12:00 p.m. (noon) Tuesday, September 17, 2013. Sockeye salmon may be retained for ceremonial and subsistence purposes only.

All Citizen Fishery

Area 7

Open to reefnets with non-retention of sockeye from 5:00 a.m. to 9:00 p.m. daily from Saturday, September 14, 2013 until further notice.

September 17, 2013

Canada

Area 29-4, 29-6, 29-7 and 29-9

The Area B seine ITQ fishery for pink salmon with non-retention of sockeye salmon that was announced on Friday, September 13 has been amended to open from 6:00 a.m. to 9:00 p.m. daily from Tuesday, September 17, 2013 through Thursday, September 19, 2013.

United States

Areas 4B, 5 and 6C

Relinquish regulatory control effective 12:01 p.m., Wednesday September 18, 2013.

September 18, 2013

Canada

Area 29-4, 29-6, 29-7 and 29-9

The Area B seine ITQ fishery for pink salmon with non-retention of sockeye salmon that was previously scheduled to be open from 6:00 a.m. to 9:00 p.m. daily from Tuesday, September 17, 2013 through Thursday, September 19, 2013 will now close at 9:00 p.m., Wednesday, September 18, 2013.

Fraser River Panel control of Canadian Panel Areas was relinquished in accordance with pre-season regulations (Appendix D) as follows: Area 20 on September 21; Areas 17 and 18 on September 28; and Area 29 on October 12. Panel control of United States Panel Areas were relinquished as follows; Areas 4B, 5 and 6C on September 18 by in-season order; Areas 6, 7 and 7A on September 28 in accordance with pre-season Regulations; and the remaining portions of Area 7A on October 5 in accordance with pre-season Regulations.

APPENDIX F: 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 and pink salmon, 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 F1 summarizes more detailed information about the nets and sampling strategies employed.

Table F1. Sampling details for Panel-approved test fisheries conducted in 2013.

Area	Name	Gear	Number of Vessels	Net Length (m)	Net Depth (meshes)	Mesh Size (mm)	Mesh Size (in)	Number of Sets	Set Duration (minutes)
Canadian Panel Areas									
20	Juan de Fuca Str.	Gillnet	2	547	90	130	5 1/8	2	300
20	Juan de Fuca Str.	Purse Seine	1	n/a	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	319	Variable	Variable		2	20
	Fraser R. (Qualark)	Gillnet	1	30	Variable	Variable		6	5
United States Panel Areas									
5	Juan de Fuca Str.	Gillnet	1	803	220	130	5 1/8	2	400
7	San Juan Islands	Reefnet [1]	3	n/a	n/a	n/a		n/a	n/a
Canadian Non-Panel Areas									
12	Queen Charlotte Str. (Round Is.)	Gillnet [2]	1	365	60-90	130	5 1/8	4	100
12	Johnstone Str. (Naka Cr.)	Gillnet [2]	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

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

2 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). For Fraser River pink salmon, CPUE and stock composition data from the seine test fisheries in Areas 20 and 12 are particularly important for estimating total abundance. Test fisheries in the Fraser River (Area 29) are used to assess species and stock composition for application to Mission passage estimates. When the Mission hydroacoustic program is not active or when high abundances of pink salmon confounds estimates of sockeye proportions migrating upstream, lower river (Area 29) test fisheries provide passage estimates through the use of CPUE models.

In 2013, gillnet and purse seine test fishery catches in Juan de Fuca Strait were similar to those in the 2009 brood year and below cycle year averages, except for a period between August 4 and August 13 where they were more in line with cycle year averages. Early in the season, Area 12 gillnet catches struggled to consistently reach catch levels similar to the brood year as well as the cycle average while later in the season, purse seine test fishery catches greatly exceeded brood year catches, while initially matching and later exceeding cycle line average catches.

In the Fraser River, sockeye test fishery catches exceeded brood year catches, especially in marine purse seine test fisheries as well as at Cottonwood and Whonnock, but did not reach historic cycle line averages.

Purse seine test fishery catches of pink salmon in both approaches were higher than in the brood year as well as the cycle line average, especially in Johnstone Strait.

B. Mission Hydroacoustics

PSC Staff have operated a hydroacoustic facility on the Fraser River approximately 1 km upstream from the Mission Railway Bridge since 1977, for the purpose of providing 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[13,14]. In 2013, daily total salmon escapement at Mission was estimated using a sonar counting system that included a side-looking split-beam system on the left bank of the river (i.e., left side when facing downstream, south bank of Fraser), a vessel-towed downward looking split-beam transducer that transected the river, and a Long Range Dual frequency IDentification SONar system (LR DIDSON) on the right bank (i.e., right side when facing downstream, north bank of Fraser). The 3 sonar systems operated 24-hrs/day and provided information about the density, behaviour, speed and direction of travel of fish targets, as well as size distributions. Due to high water discharge at Mission from late June to early July, 7700 m^3/s to 9911 m^3/s, the shore-based split-beam and DIDSON systems could not be deployed on either bank. Instead, during this high-water period a tripod-mounted scanning DIDSON was deployed in the near-shore area off the left bank to collect fish-passage data within 20 m from the shore while the vessel-based mobile split-beam system collected cross-river fish density data beyond the 20 m range from the left bank. In addition, a vessel-based standard DIDSON unit was deployed during the daily stationary sounding periods near both banks to collect image data of fish targets. The image data validated fish densities estimated from the mobile split-beam system during the high-water period when large amounts of debris were drifting downriver. During this period, the near-shore fish passage counted by the DIDSON was combined with the offshore fish-passage estimated by the vessel-based sonar to produce the daily salmon estimate.

River discharge at Mission dropped below 7700 m^3/s by July 9, which allowed the deployment of a shore-based split-beam system on the left bank. The left-bank split-beam system consisted of two side-looking elliptical beam transducers, 2°×10° and 4°×10°, attached to a rotator to control pan and tilt of the transducers, thereby allowing stratified sampling of the water column by the narrow vertical sonar beams at multiple aiming angles. The aim and orientation of the transducers were monitored and verified with an attitude sensor. An extendable fish-deflection weir prevented fish from swimming in acoustic blind zones (behind or too close to the transducers), and also increased the duration for which they were insonified (i.e., detectable in the sonar beam). This ensured adequate numbers of echoes for tracking individual fish, particularly pink salmon which typically migrate close to shore. Transducer aims were optimized to reduce un-

[13] 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.

[14] 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.

sampled areas where migratory abundance must be estimated by extrapolation. This system was operational from July 9 to September 26.

The vessel-based system consisted of a downward-looking split-beam circular-beam transducer (6°) that transected the river every five minutes to obtain target density information. The right-bank shore-based LR DIDSON system that commenced operation on July 17 had a 30° field of view consisting of 48 fan-shaped composite beams and a 14° vertical beam, allowing sampling of nearly the entire near-shore water column on the right bank . Data can be collected at different frequencies (high frequency or low frequency) and at different ranges (0-40 m) to accommodate the local acoustic conditions. Files collected on high frequency (HF) and low frequency (LF) settings and with range windows of 1-11 m, 11-21 m and 21-31 m were used for the in-season daily estimate. The aim and orientation of the DIDSON were monitored and verified with an orientation sensor. Similar to the left-bank, a telescopic fish deflection weir was deployed that prevented fish from swimming behind or too close to the sonar. The deflection weir increased the duration of insonifcation of individual fish targets.

Traces of individual fish as they passed through the sound beam of the split-beam systems were acquired by analyzing the echo data from both shore and vessel-based systems using an alpha-beta tracker [15,16]. The resulting trace data (i.e., "tracks") were classified as fish or noise (e.g., debris, air bubbles) using statistical methods [17] (i.e., DFA or "discriminate function analysis"). The integrity of statistically identified fish tracks was further verified by trained staff, and unusual or atypical targets were removed using graphical user interface (GUI) 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. Final fish track data were imported to a fish-flux (i.e., abundance) estimation software. Daily fish passage in the areas sampled by the left-bank and mobile split-beam systems was then estimated by the software, which also projected fish flux through the un-sampled areas (acoustical blind zones). Daily high and low frequency DIDSON files for net upstream fish (i.e., upstream – downstream) were counted using a hand tally counter. These counts were expanded in time to estimate daily fish passage near the right-bank area. The daily total salmon passage was estimated by summing daily flux estimates produced by the 3 sonar systems. Total salmon estimates were further apportioned by species and sockeye stocks based on species composition and stock identification information obtained from lower river test fisheries.

Due to the large uncertainty in test fishing-based estimates of species composition when sockeye and pink salmon co-migrate, a new methodology was introduced from August 21- 31 to apportion sockeye and pink salmon. This methodology utilized fish length data from the left-bank inshore DIDSON, which were run through a "mixture" model[18] to estimate the proportions of resident fish, pink , sockeye and Chinook salmon. The model used fixed means and standard deviations to apportion species on a daily basis. The resulting proportions were applied to the Mission total salmon estimate to derive the pink and sockeye salmon numbers. Whonnock test fishery CPUE data were used to estimate daily upstream passage of sockeye salmon after August 31.

In addition to the operational split-beam and DIDSON program at Mission, several other experimental programs were conducted in 2013, as described below:

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[15] Blackman, S. S. and R. Popoli. Design and Analysis of Modern Tracking Systems. Artech House, Boston, 1999.

[16] 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.

[17] 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.

[18] Xie, Y., F. J. Martens, Catherine G. J. Michielsens and James D. Cave. 2013. Implementation of stationary hydroacoustic sampling systems to estimate salmon passage in the Lower Fraser River: A final project report to the southern boundary restoration and enhancement fund. Pacific Salmon Commission. May, 2013.

i. DIDSON insonification of near-shore fish passage (SEF project)

An important application of DIDSON technology in the 2013 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 with an X2 rotator, purchased with funds from the Southern Endowment Fund (SEF) in 2013, was deployed on the left-bank from July 9 - September 26. The X2 rotator was not operational from July 24 – August 15 due to a failure of one of the motors. This system collected continuous daily fish passage data up to 22 m offshore using an hourly systematic sampling scheme. The stratified sampling scheme had two vertical aims, -13° and +1°, that scanned the water column. Each of these aims was broken into two range bins, bin 1 and bin 2, that insonified from 2-12 m and 12-22 m, respectively. Having a DIDSON unit mounted on a rotator appeared to be much more robust than the conventional split-beam sonar technology in enumerating pink salmon passage in September when extremely high passage densities occurred in near-shore waters. The results of this study are reported in a project to the Southern boundary restoration and enhancement fund[19] .

ii. DIDSON insonification of off-shore fish passage on the right-bank

As a result of a project funded by the SEF in 2011 and 2012, a right-bank offshore DIDSON was deployed from July 23 to September 25, to improve the accuracy and precision of daily salmon estimation in the offshore area [20,21]. The system looked up from a bottom mounted tripod that was placed in an area where the estimate is currently derived from the split-beam system deployed on the transecting vessel. It consisted of four vertical aims, -8º, +14º, +36º and +58º with a bearing of 110º for each aim, which scanned the water column on an hourly basis. Post season calculations incorporated off-shore fish passage data from the right bank into the current estimation model resulting in a more stream lined estimation process.

iii. DIDSON insonification of offshore fish behaviour

A DIDSON system was used to collect offshore fish behaviour information from June 26 to September 26 at the Mission site. Our objective was to compare fish behaviour statistics measured by the left-bank split-beam sonar with the offshore statistics from the DIDSON. These statistics include upstream and downstream fish swimming speed, standard deviation of upstream swimming speed and the upstream:downstream ratio. However, we have not completed the analysis of the data yet.

iv. In-season data exchange with DFO's Qualark hydroacoustic site and comparison of estimates

2013 was the sixth consecutive season that DFO operated an in-season hydroacoustic monitoring site using DIDSON systems at Qualark Creek, which is located 95 km upstream from Mission, between Hope and Hells Gate. 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 Mission estimates of sockeye salmon passage. Daily Mission projected sockeye passage estimates were similar to the DFO Qualark site prior to the heavy in-river migration of pink salmon in late August. For the sockeye time period (June 26-August 31; Mission date), Qualark estimated a total of 2.5 million sockeye salmon while

[19] 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.

[20] 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.

[21] 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.

the Mission escapement estimated a total of 2.3 million (8% difference). During pink-dominated periods in September, estimates of daily salmon at the two sites tracked each other very well in terms of their temporal pattern; however, the Mission program estimated a much larger pink salmon escapement than Qualark.

The post-season estimate of total passage was 10.5 million pink salmon, 5% higher than the in-season estimate. The use of inshore and offshore DIDSON's for enumerating salmon passage at Mission, especially in pink salmon return years, was accepted as the official estimate in 2009 and 2011[22].

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 migration past Mission into discrete stock groups. Stock identification methods for sockeye salmon in 2013 used DNA and scale pattern analyses from fish caught in marine and in-river fisheries. 2013 was the fourth year that stock identification for pink salmon relied on DNA analyses rather than the protein electrophoretic techniques used previously; these analyses were applied to mixtures sampled in marine fisheries. For both sockeye and pink salmon, continuing a practice developed in recent years, a multinomial extrapolation procedure was used for predicting stock composition estimates in catches that had not yet occurred or had not yet been analyzed. For pink salmon, these extrapolations used prior information from stock composition estimates in previous years whereas, for sockeye, only information from 2013 samples was used.

A. Sockeye Salmon

Stock identification methods for sockeye salmon relied on DNA[23] (using the program CBAYES[24]) and scale pattern analyses[25,26,]. Both 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").

Samples from test fishery catches were analyzed daily, beginning in early-July and continuing through the end of September. PSC staff sampled sockeye from most test fishery catches and commercial fishery landings. Sampling locations included Port Renfrew and the lower Fraser River in British Columbia, and Bellingham and Sekiu in Washington. DFO provided samples from test fisheries in Johnstone Strait and in the Fraser River at Albion and Qualark. Alaska's Department of Fish and Game (ADF&G) collected samples for the PSC from District 104 purse seine landings in Ketchikan and Petersburg, and Langara Fishing Adventures provided samples

[22] Grant, S.C.H., M. Townsend, B.White, and M. Lapointe. 2014. Fraser River Pink Salmon (Oncorhynchus gorbuscha) Data Review: Inputs for Biological Status and Escapement Goals. A project report to Southern boundary restoration and enhancement fund. Pacific Salmon Commission, Vancouver, British Columbia. February.

[23] 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.

[24] 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).

[25] Gable, J. and S. Cox-Rogers. Stock identification of Fraser River sockeye salmon: methodology and management application. PSC Tech. Rep. No. 5, October, 1993.

[26] Kalinowski, S.T., K.R. Manlove, and M.L. Taper. 2008. ONCOR: a computer program for genetic stock identification, v2.0. Montana State University, Bozeman.

from recreational catches near Haida Gwaii. DFO and First Nations personnel obtained samples from Fraser River First Nations catches when available.

Proportions of Fraser River sockeye in District 104 seine catches were estimated by DNA analyses in 2013. Estimates provided by the National Oceanic and Atmospheric Administration and ADF&G, examining Single Nucleotide Polymorphisms [27], were verified with the same suite of genetic loci and style of analysis that generated the DNA results reported here and to the Fraser Panel. Results from the two approaches were similar. Sockeye catches in District 104 totalled 83,000 with the highest frequency of Fraser sockeye detected in mid to late August. Post-season estimates of Fraser sockeye caught in District 104 totalled 46,000 in 2013, 56% of the purse seine sockeye catch there. Work is ongoing to study variance in vulnerability among Fraser sockeye stocks in these fisheries. For example, compared to samples from more southerly areas in 2013, Harrison sockeye were encountered infrequently in the Alaska catch – less than one percent of Fraser sockeye detected in District 104 were from the Harrison stock, whereas approximately ten percent of the Fraser sockeye return in 2013 comprised Harrison sockeye. Analysis of more samples across more years is required to confirm the generality of such results.

B. Pink Salmon

Pink salmon mixtures are apportioned into three components - Fraser, Canada South Coast (excluding Fraser) and Washington. The ability to accomplish this requires baseline genetic information from numerous stocks from each region. In 2013, the baseline was composed similarly to other recent years with pink salmon stocks from the three regions as follows: Fraser River – lower Fraser mainstem, Vedder, Harrison, Weaver, Chehalis, Coquihalla, Nahatlatch, Churn, Thompson, North Thompson, Gates, Cayoosh, Portage, Seton and Bridge River stocks; Canada South Coast (non-Fraser) – Quatse, Cluxewe, Wakeman, Adam, Kakweiken, Glendale, Klinaklini, Lull, Heydon, Big Qualicum, Keogh, Nanaimo, Quinsam, Puntledge, Ahta, Salmon, Oyster, Squamish and Indian river stocks; and Washington – Nooksack, Skagit, Stillaguamish, Snohomish, Green, Puyallup, Hamma Hamma, Duckabush, Dosewallips, Dungeness, Hood Canal, and Nisqually river stocks. The stocks in this baseline represent most of the pink salmon production that contribute to marine fishery catches where Fraser pinks are typically harvested.

During the 2013 in-season management period, tissue samples from up to 100 pink salmon were collected at approximately weekly intervals from particular fisheries. DNA analysis was similar to recent years with genotypic data from 16 microsatellite loci being compared to 46 baseline stocks using the program ONCOR [26]. Stock composition estimates derived from these analyses were used primarily for assessing catch, migration route (diversion rate) and abundance of Fraser River pinks.

DNA results were obtained for Canadian statistical Areas 12, 13 and 20, and U.S. Areas 7 and 7A from late July to early September. Estimated proportions of Fraser River pink salmon in these various samples are presented in Figure F1. Fraser pinks in both Johnstone Strait and the Strait of Juan de Fuca increased from less than 15% in late July and early August to over 75% by late August and early September.

[27] Habicht, C., Seeb, L.W., Myers, K.W., Farley, E.V., Seeb, JE. 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.

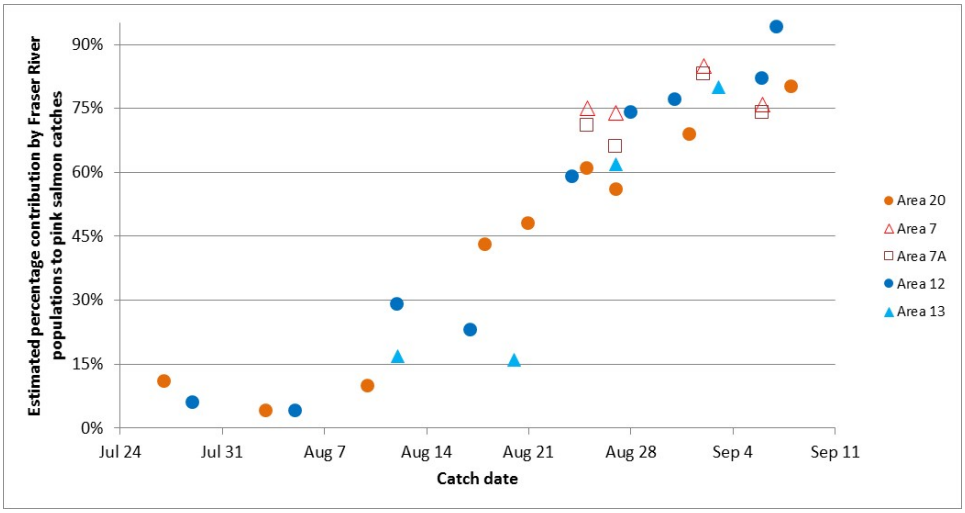

Figure F1. Percentages of Fraser River pink salmon in commercial and test fishery samples from Canadian Areas 12, 13, 20 and U.S. Areas 7 and 7A. Dates are approximate catch dates unadjusted for migration.

Stock Assessment

Assessment of Fraser River sockeye and pink salmon 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 [28, 29]. 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 of 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 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 F2a, b, c, d and e provide an overview of the run-size estimates from the stock assessment model and the accounted run size at various dates during the season (median and 80%

[28] 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.
[29] 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.

probability interval). These estimates can be compared against the Panel adopted in-season run-size estimates used for management purposes and against the final in-season estimates of the accounted run-to-date. In 2013, pre-season forecasts overestimated the run size of Summer-run sockeye, while for Early Summer-run sockeye and Fraser River pink salmon, the final run size was larger than forecasted. For Early Stuart and Late-run sockeye, the final run size was close to the median pre-season forecast. The timing of the run was earlier than forecast for Early Stuart sockeye, as forecasted for Fraser River pink salmon and later than forecast for Early Summer, Summer and Late-run sockeye.

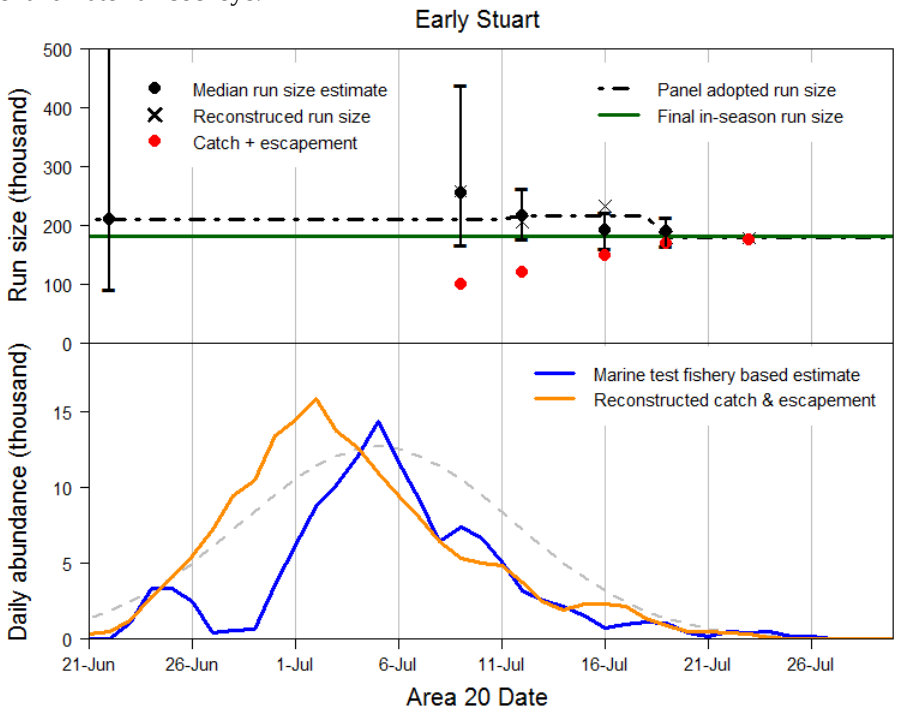

Figure F2a. Daily reconstructed abundance estimates for Early Stuart sockeye and corresponding run-size estimates at different times during the season.

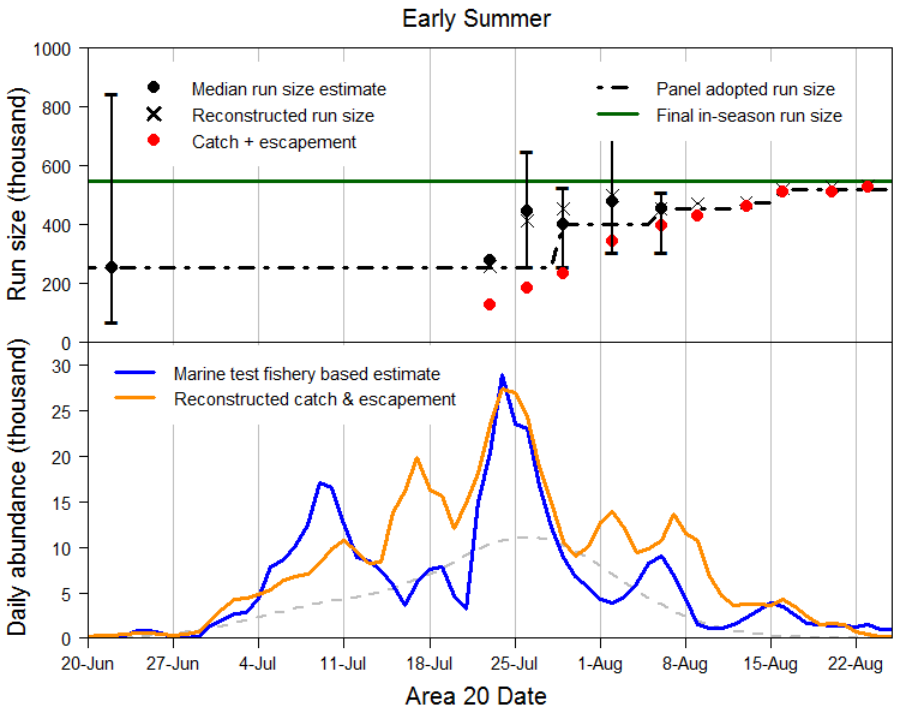

Figure F2b. Daily reconstructed abundance estimates for Early Summer-run sockeye and corresponding run-size estimates at different times during the season.

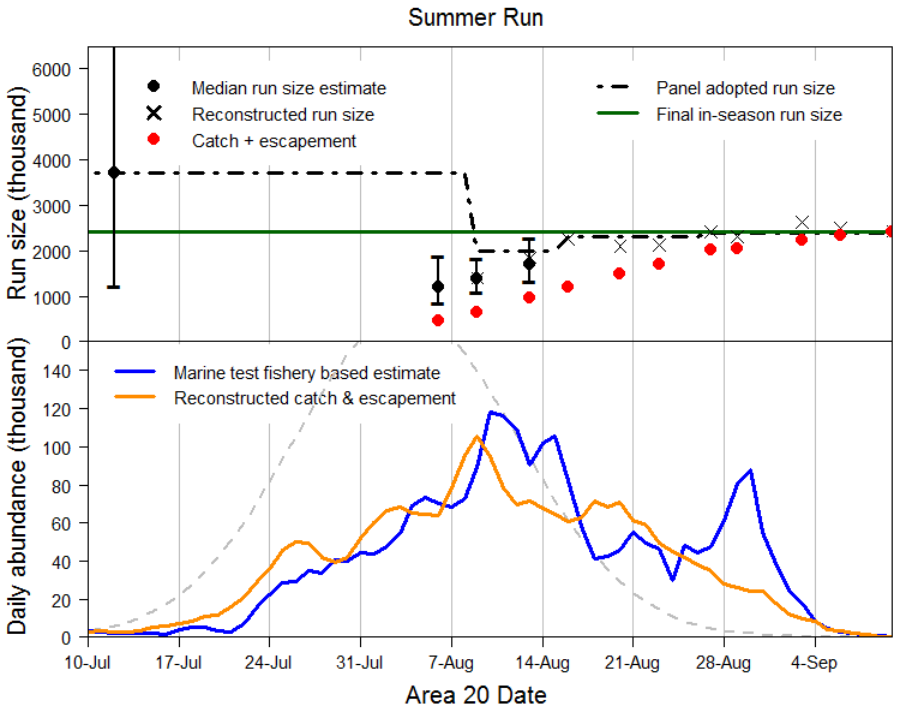

Figure F2c. Daily reconstructed abundance estimates for Summer-run sockeye and corresponding run-size estimates at different times during the season.

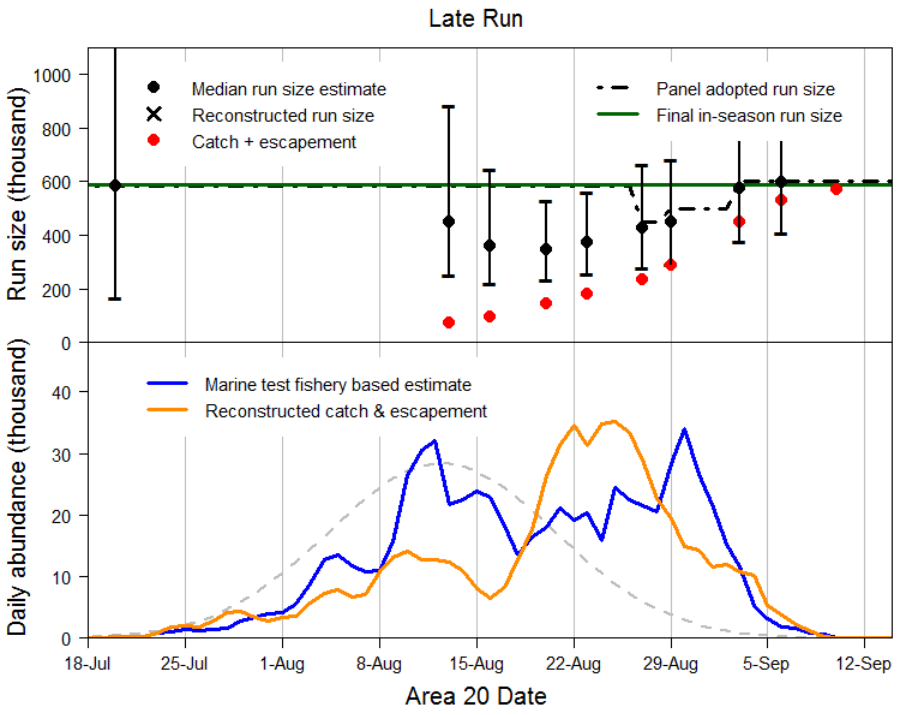

Figure F2d. Daily reconstructed abundance estimates for Late-run sockeye and corresponding run-size estimates at different times during the season.

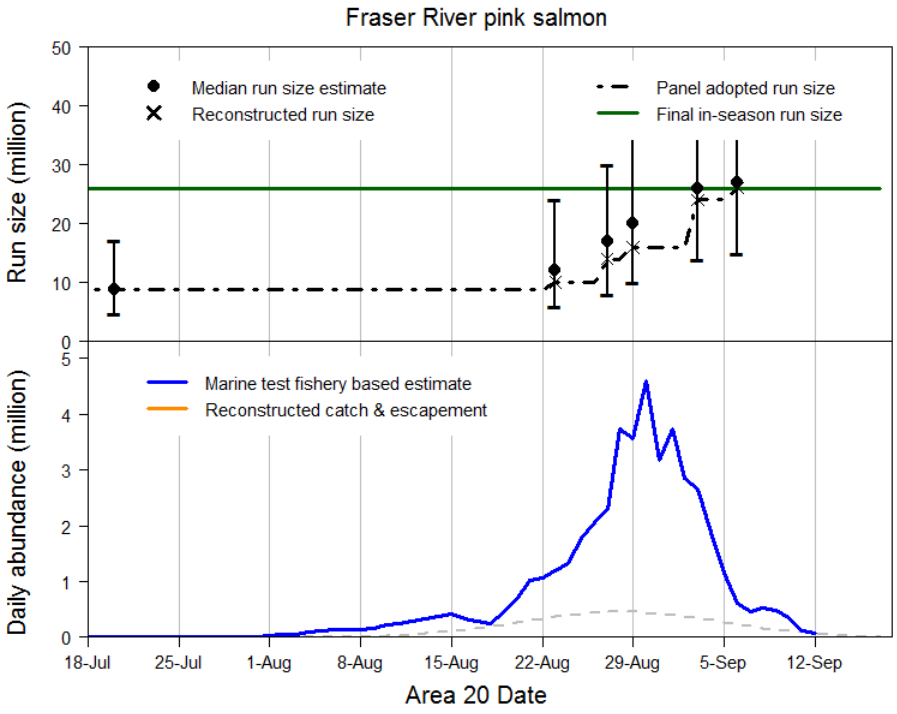

Figure F2e. Daily reconstructed abundance estimates for Fraser River pink salmon and corresponding run-size estimates at different times during the season.

Management Adjustment and DBE

For pre-season planning, the Environmental Watch program at Fisheries and Oceans Canada presented a long-range forecast of Fraser River environmental conditions. Spring snowpack values

were below 50% of average for most of the Fraser Watershed; however, the critical Upper Fraser and Thompson Basin's snowpack values were higher, although still below average. The forecast called for higher than average temperatures at Qualark and lower than average discharge at Hope. Staff used the environmental forecasts in Management Adjustment (MA) models developed jointly by DFO and the PSC to predict how many additional sockeye should be allowed to escape to increase the probability of achieving spawning escapement objectives (see references in the MA section of the Management Information section).

For pre-season planning purposes, the Panel adopted the proportional Management Adjustment (pMA) forecast from the environmental MA models for Early Stuart, the non-Pitt and non-Chilliwack Early Summer- and the non-Harrison Summer-run groups (Table F3). Management Adjustments (MAs) of 61,600 Early Stuart, 64,900 Early Summer, 143,000 Summer and 209,200 Late-run sockeye were added to the spawning escapement targets to increase the likelihood of achieving the targets. The Early Stuart, Early Summer (excluding Pitt and Chilliwack) and Summer-run (excluding Harrison) MAs were based on relationships between river conditions (discharge and temperature) and historic differences between lower and upriver escapement estimates. The Early Summer-run aggregate pMA was the weighted average of the forecasted pMA for the non-Pitt, non-Chilliwack Early Summer component and fixed pMAs for Chilliwack and Pitt, with the weights determined by the p50 forecast abundances. The MA for the total Summer-run was the weighted average of a fixed Harrison pMA and the forecasted pMA for the non-Harrison Summer-run component.

In-season, with increasing temperatures, the environmental MA models were predicting higher Difference Between Estimates (DBE) than adopted pre-season. The Panel adopted higher pMAs for Early Stuart, Early Summer-run and Summer-run sockeye. With the addition of a higher MA to the spawning escapement target, decisions that could impact the Early Stuart and the Summer-run were based on a low abundance exploitation rate (LAER) of 10%. For Early Summer run, a pMA of zero was assumed for Pitt pre-season but there were concerns in-season about the large Pitt contribution causing a decrease in the Early Summer-run aggregate pMA, As a result, the Panel adopted a fixed Pitt pMA of 0.18 (Table F2).

For Late-run sockeye, the Panel considered two options in 2013: (1) using historical median pMAs from past years' data and (2) using predicted pMAs based on upstream timing estimates derived from timing and delay assumptions. They chose the first option, recognizing that it would be difficult to obtain in-season estimates of in-river migration timing. The Panel adopted a pMA of 0.34 (all years' median) for Birkenhead and 1.03 (2013 cycle median) for the non-Birkenhead component (Table F2). To calculate the aggregate Late-run pMA, these estimates were combined as a weighted average, based on the forecasted p50 abundance level. Post-season, the Mission timing for the non-Birkenhead component was estimated to be August 30. The final in-season pMA predicted from the upstream timing model for Late-run excluding Birkenhead was 3.77. However, this prediction did not change the in-season management approach.

Table F2. DBEs and pMAs adopted pre-season and in-season to generate weighted pMA values for Early Summer, Summer and Late-run groups.

Management Group	Pre-season Predictor variables	In-season Predictor variables	Cycle lines Used	Excluded Years
Early Stuart	31-day temp and discharge [1]	19-day temp and discharge[1]	All	1977, 1980, 1982, 1984, 1986
Early Summer (excl. Chw & Pitt)	31-day temp and discharge [1]	19-day temp and discharge[1]	All	1993
Pitt	DBE assumed to be 0	Median of all years, using in-season data for 1998, 2000-2004	All	1982, 1983, 1999, 2005, 2006
Chilliwack	Weighted based on 2008-2012	Weighted based on 2008-2012	NA	2009
Summer (excl. Harrison)	31-day temp and discharge [1]	19-day temp and discharge[1]	All	2002
Harrison	Historical Median 2004-2012	Historical Median 2004-2012	NA	2010
Birkenhead	Median of all years	Median of all years	All	NA
Late (excl. Birkenhead)	Historical Median on 2013 cycle	Historical Median on 2013 cycle and Mission timing model[2]	All	1977, 1979-1981, 1983-1985, 1987-1989, 1991-1993, 1995, 2006, 2010

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

[2] $\ln(DBE) = a + bR$ where R is Mission timinig

Table F3. Pre-season and in-season MA models and assumptions used for each Fraser sockeye management group in 2013. 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.

Description	Early Stuart		Early Summer (excld. Pitt and Chw)		Pitt*		Chilliwack*		Summer (excld. Harrison)		Harrison*		Lates* (excld. Birk.)		Birkenhead*	
	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA
Adopted Pre-season	-36%	0.57	-32%	0.46	0	0	-36%	0.57	-8%	0.09	-27%	0.37	-51%	1.03	-25%	0.34
Adopted In-season	-57%	1.33	-55%	1.23	-15%	0.18	-36%	0.57	-73%	2.73	-27%	0.37	-51%	1.03	-25%	0.34

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

APPENDIX G: HISTORICAL CATCH, ESCAPEMENT AND PRODUCTION DATA, AND DETAILED TAC CALCULATION

Table G1. Catch by user group, spawning escapement, difference between estimates and run size of Fraser River sockeye salmon for cycle years 2001-2013.

	Fraser Sockeye Salmon			
	2001	**2005**	**2009**	**2013**
CANADIAN CATCH	**1,196,900**	**1,142,600**	**73,600**	**411,300**
Commercial Catch	**297,400**	**129,400**	**0**	**2,100**
Panel Area	132,500	3,400	0	1,200
Non-Panel Areas	164,900	126,000	0	900
First Nations Catch	**847,600**	**956,200**	**71,600**	**407,400**
Marine FSC	183,800	266,600	9,800	122,900
Fraser River FSC	489,000	684,200	61,900	284,400
Economic Opportunity	174,900	5,500	0	100
Non-commercial Catch	**51,900**	**57,000**	**2,000**	**1,800**
Marine Recreational	3,200	7,000	0	0
Fraser Recreational	34,000	42,600	0	0
Charter	11,700	700	2,000	700
ESSR	3,000	6,600	0	1,200
UNITED STATES CATCH	**284,000**	**495,300**	**17,200**	**66,600**
Washington Total	**241,300**	**201,000**	**4,300**	**20,200**
Commercial catch	**230,500**	**200,000**	**0**	**4,300**
Treaty Indian	160,100	138,900	0	4,100
Non-Indian	70,400	61,200	0	200
Non-commercial Catch	**10,800**	**1,000**	**4,300**	**15,900**
Ceremonial	10,800	1,000	4,300	15,900
Recreational	0	0	0	0
Alaska	**42,800**	**294,300**	**12,900**	**46,400**
TEST FISHING CATCH	**122,900**	**117,500**	**32,000**	**99,700**
PSC (Panel Areas)	**92,600**	**48,000**	**20,400**	**36,600**
Canada	92,600	42,200	16,900	29,600
United States	0	5,800	3,600	7,000
Canada (non-Panel Areas)	**30,300**	**69,500**	**11,600**	**63,100**
TOTAL RUN	**7,212,500**	**7,077,200**	**1,637,400**	**4,050,300**
Total Catch in All Fisheries	1,603,900	1,755,500	122,900	577,600
Adult Spawning Escapement	5,256,700	3,308,000	1,055,700	2,479,500
Jack Spawning Escapement	21,000	52,800	47,900	92,800
Difference Between Estimates	330,900	1,961,000	410,900	900,500
Percentage of Total Run	**100%**	**100%**	**100%**	**100%**
Total Catch in All Fisheries	22%	25%	8%	14%
Adult Spawning Escapement	73%	47%	64%	61%
Jack Spawning Escapement	0%	1%	3%	2%
Difference Between Estimates	5%	28%	25%	22%

Table G2. Catch by user group, spawning escapement and run size of Fraser River pink salmon for cycle years 2007-2013.

	Fraser Pink Salmon			
	2007	2009	2011	2013
CANADIAN CATCH	**406,100**	**1,726,800**	**4,927,200**	**3,313,700**
Commercial Catch	**1,900**	**915,600**	**3,757,200**	**1,994,300**
Panel Area	0	75,100	797,700	1,322,500
Non-Panel Areas	1,900	840,400	2,959,500	671,800
First Nations Catch	**326,900**	**520,500**	**1,050,300**	**1,220,700**
Marine FSC	5,900	10,500	21,600	2,900
Fraser River FSC	11,700	2,000	37,400	8,200
Economic Opportunity	309,300	508,000	991,300	1,209,600
Non-commercial Catch	**77,200**	**290,800**	**119,700**	**98,700**
Marine Recreational	59,200	38,600	63,200	30,200
Fraser Recreational	18,000	237,200	55,300	63,800
Charter	0	2,700	1,200	200
ESSR	0	12,300	0	4,500
UNITED STATES CATCH	**395,100**	**2,815,600**	**2,916,500**	**3,200,400**
Washington Total	**395,100**	**2,815,600**	**2,916,500**	**3,200,400**
Commercial catch	**368,200**	**2,793,600**	**2,901,500**	**3,186,700**
Treaty Indian	210,100	1,031,400	1,403,800	1,340,600
Non-Indian	158,100	1,762,200	1,497,700	1,846,100
Non-commercial Catch	**26,900**	**22,000**	**15,000**	**13,700**
Ceremonial	400	1,000	13,800	5,900
Recreational	26,500	21,000	1,200	7,800
Alaska	**0**	**0**	**0**	**0**
TEST FISHING CATCH	**38,800**	**21,800**	**13,100**	**39,200**
PSC (Panel Areas)	**25,100**	**18,300**	**11,900**	**22,000**
Canada	23,600	12,500	9,300	15,500
United States	1,600	5,800	2,600	6,600
Canada (non-Panel Areas)	**13,700**	**3,500**	**1,200**	**17,200**
TOTAL RUN	**11,000,000**	**19,993,000**	**20,641,300**	**15,897,800**
Total Catch in All Fisheries	839,900	4,564,200	7,856,800	6,553,300
Adult Spawning Escapement	10,160,100	15,428,800	12,784,500	9,344,500
Percentage of Total Run	**100%**	**100%**	**100%**	**100%**
Total Catch in All Fisheries	8%	23%	38%	41%
Adult Spawning Escapement	92%	77%	62%	59%

Table G3. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 2001-2013*.

DISTRICT / Stock Group / Stream/Lake	Year 2001	2005	2009	2013
NORTHEAST				
Upper Bowron R.	5,842	1,730	2,170	3,268
STUART				
Early Stuart				
Driftwood R.	15,684	15,911	8,292	23,875
Takla L. Streams	76,141	41,887	16,513	27,011
Middle R. Streams	39,509	23,201	9,877	18,441
Trembleur L. Streams	38,087	15,841	10,580	16,258
Miscellaneous	1,560	1,697	35	677
Late Stuart				
Kazchek Cr.	5,607	1,557	1,271	1,800
Kuzkwa Cr.	15,926	13,681	4,109	5,282
Middle R.	131,505	72,228	28,831	24,293
Tachie R.	187,645	185,879	47,415	96,385
Miscellaneous	10,886	19,779	5,338	4,004
NECHAKO				
Nadina R. (Late)	19,922	9,049	7,008	4,973
Nadina Channel	34,933	12,785	4,392	8,247
Stellako R.	151,409	175,299	27,541	97,757
QUESNEL				
Horsefly R.	1,829,662	657,844	62,627	70,659
Horsefly Channel	0	0	8,162	8,670
McKinley Cr.	267,413	142,200	11,527	14,510
Mitchell R.	1,040,092	553,111	46,065	62,127
Miscellaneous	373,753	94,226	21,019	25,740
CHILCOTIN				
Chilko R. & L.	668,671	535,967	213,379	1,197,733
Chilko Channel	0	0	0	0
Taseko L.	1,000	520	40	201
SETON-ANDERSON				
Gates Cr.	459	2,020	4,688	42,357
Gates Channel	12,462	13,130	5,190	12,582
Portage Cr.	3,150	12,082	1,773	7,327
NORTH THOMPSON				
North Thompson R.	8,655	77,700	4,957	21,498
Raft R.	32,498	26,456	11,504	16,368
Fennell Cr.	5,860	4,304	1,170	3,471
SOUTH THOMPSON				
Early Summer-run				
Scotch Cr.	2,449	4,163	4,672	23,867
Seymour R.	6,892	3,590	5,164	22,594
Upper Adams / Momich / Cayenne	963	330	268	538
Miscellaneous	2,743	1,348	2,363	10,191
Late-run				
Adams R.	3,142	12,423	16,057	114,194
Little R.	991	7,916	14,491	30,892
Lower Shuswap R.	196	382	598	2,445
Miscellaneous	529	392	1,335	5,450
HARRISON-LILLOOET				
Birkenhead R.	44,450	53,546	53,977	80,085
Big Silver Cr. & misc. Birk. types	12,348	5,315	7,620	8,742
Harrison R.	15,309	388,605	307,210	250,087
Weaver Cr.	4,205	12,948	8,442	8,099
Weaver Channel	15,710	35,568	27,114	27,438
LOWER FRASER				
Nahatlatch R. & L.	5,441	2,168	1,439	2,099
Cultus L.	515	261 *1*	987 *1*	2,306 *1*
Upper Pitt R.	131,481	62,047	31,034	59,247
Chilliwack L./Dolly Varden Cr.	30,272	3,407	5,587	11,705
MISCELLANEOUS *2*	1,016	3,525	1,980	3,974
ADULTS	5,256,983	3,308,018	1,055,811	2,479,467
JACKS	21,834	52,763	47,792	92,840
TOTAL NET ESCAPEMENT	5,278,817	3,360,781	1,103,603	2,572,307

* Estimates are from DFO.

1 Cultus estimates include 149 sockeye in 2005, 282 in 2009 and 200 in 2013 removed for broodstock.

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

Table G4. Fraser River pink salmon production for odd brood years in 1961-2011 (return years 1963-2013).

Brood Year	Spawners		Potential Egg Deposition	Fry Production	Adult Returns (Catch + Escapement)		% Survival		Average To Date
	Total (millions)	Female (millions)	(millions)	(millions)	(millions)		Fresh Water	Marine	
(by)	*(by)*	*(by)*	*(by)*	*(by+1)*	*(by+2)*				
1961	1.092	0.654	1,569	143.6	5.482		9.2%	3.8%	3.8%
1963	1.954	1.216	2,435	284.2	2.320		11.7%	0.8%	2.3%
1965	1.194	0.692	1,488	274.0	12.963		18.4%	4.7%	3.1%
1967	1.831	0.973	2,132	308.0	3.931		14.4%	1.3%	2.7%
1969	1.531	0.957	2,018	287.7	9.763		14.3%	3.4%	2.8%
1971	1.805	1.096	1,923	273.6	6.801		14.2%	2.5%	2.8%
1973	1.754	1.009	1,865	212.3	4.894		11.4%	2.3%	2.7%
1975	1.367	0.781	1,493	319.7	8.209		21.4%	2.6%	2.7%
1977	2.388	1.362	2,960	483.7	14.404		16.3%	3.0%	2.7%
1979	3.561	2.076	3,787	341.3	18.685		9.0%	5.5%	3.0%
1981	4.488	2.560	4,814	607.0	15.346		12.6%	2.5%	2.9%
1983	4.632	2.931	4,702	557.4	19.038		11.9%	3.4%	3.0%
1985	6.461	3.561	5,900	264.5	7.172		4.5%	2.7%	3.0%
1987	3.224	1.856	3,471	436.0	16.484		12.6%	3.8%	3.0%
1989	7.189	4.383	7,198	400.4	22.174		5.6%	5.5%	3.2%
1991	12.943	8.002	12,330	685.5	16.983		5.6%	2.5%	3.1%
1993	10.768	6.454	9,192	437.7	12.904		4.8%	2.9%	3.1%
1995	7.175	4.248	10,233	279.1	8.176		2.7%	2.9%	3.1%
1997	2.842	1.740	2,863	257.5	3.608		9.0%	1.4%	3.0%
1999	3.445	1.885	2,702	219.0	21.262		8.1%	9.7%	3.4%
2001	19.814	9.543	16,274	714.4	24.250		4.4%	3.4%	3.4%
2003	n/a	n/a	n/a	419.0	9.870	*1*	n/a	2.4%	3.3%
2005	n/a	n/a	n/a	614.5	8.490	*1*	n/a	1.4%	3.2%
2007	n/a	n/a	n/a	497.0	19.936	*1*	n/a	4.0%	3.3%
2009	15.429	n/a	n/a	1062.4	20.649	*2*	n/a	1.9%	3.2%
2011	12.788	n/a	n/a	519.3	15.898	*2*	n/a	3.1%	3.2%
Average	5.638	2.761	4,826	419.2	12.680		10.6%	3.2%	

1 Estimates of adult returns between 2005-2009 (2003-2007 brood years) are highly uncertain because pink salmon escapement enumeration programs were not conducted by DFO. Instead, estimates of adult returns for these years are based on in-season abundance estimates by the PSC.

2 Estimates of escapements for the 2009 - 2017 return years are from the PSC's Mission hydroacoustic program

Table G5. Detailed calculation of total allowable catch (TAC) and achievement of international catch shares for Fraser sockeye (by management group) and pink salmon in 2013. 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 5), in accordance with Annex IV of the Treaty and the February 17, 2011 Commission Guidance.

	Fraser Sockeye						Fraser Pinks	
	Early Stuart	Early Summer	Summer	Late	Total			
RUN STATUS, ESCAPEMENT NEEDS & AVAILABLE SURPLUS								
In-season Abundance Estimate	**182,000**	**550,000**	**2,400,000**	**600,000**	**3,732,000**		**26,000,000**	
Spawning Escapement Target (SET)	108,000	220,000	1,254,000	313,000	1,895,000		7,800,000	
%SET from TAM rules	*59%*	*40%*	*52%*	*52%*			0	
Management Adjustment (MA)	143,600	176,000	3,109,900	288,000	3,717,500		n/a	
Proportional MA (pMA)	*0.00*	*0.00*	*0*	*0.92*				
Test Fishing Catch (TF, post-seas. est.)	2,000	12,000	73,900	11,800	99,700		39,200	
Surplus above Adjusted SET & TF *	**0**	**142,000**	**0**	**0**	**142,000**		**18,160,800**	
DEDUCTIONS & TAC FOR INTERNATIONAL SHARING								
Aboriginal Fishery Exemption (AFE)	**9,200**	**59,400**	**317,500**	**13,900**	**400,000**		**n/a**	
Total Deductions (Adj.SET + TF + AFE)	193,200	467,300	2,791,400	625,700	4,077,700		7,839,200	
Available TAC (Abundance - Deductions)	**0**	**82,700**	**0**	**0**	**82,700**		**18,160,800**	
UNITED STATES (Washington) TAC								
Propor. distrib. TAC - Payback	**0**	**13,600**	**0**	**0**	**13,600**		**4,667,300**	
Proportionally distributed TAC **	0	13,600	0	0	13,600	16.5%	4,667,300	25.7%
U.S. Payback	0	0	0	0	0		0	
Washington Catch	0	1,500	13,300	5,400	20,200		3,200,400	
Deviation from TAC - Payback	**0**	**12,200**	**-13,300**	**-5,400**	**-6,600**		**1,467,000**	
CANADIAN TAC								
Propor. distrib. TAC + Payback + AFE	**9,200**	**128,400**	**317,500**	**13,900**	**469,000**		**13,493,400**	
Propor. distrib. TAC + U.S. Payback	0	69,000	0	0	69,000	83.5%	13,493,400	74.3%
AFE	9,200	59,400	317,500	13,900	400,000		0	
Canadian Catch excluding ESSR Catch	9,500	45,300	324,100	31,300	410,100		3,313,700	
Deviation from TAC + Payback + AFE	**-300**	**83,100**	**-6,600**	**-17,300**	**58,900**		**10,179,700**	
TOTAL								
Available TAC + U.S. Payback + AFE	**9,200**	**142,000**	**317,500**	**14,000**	**482,700**		**18,160,800**	
Total Catch excluding ESSR Catch	9,500	46,800	337,400	36,700	430,300		6,514,100	
Deviation from TAC + U.S. Payback + AFE	**-300**	**95,300**	**-19,900**	**-22,800**	**52,300**		**11,646,700**	

* The surplus cannot exceed the estimated abundance.

** Washington sockeye and pink shares according to Annex IV of the Pacific Salmon Treaty and the February 17, 2011 Commission Guidance to the Fraser River Panel.

APPENDIX H: MEMBERS OF THE FRASER RIVER PANEL TECHNICAL COMMITTEE IN 2013

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

APPENDIX I: STAFF OF THE PACIFIC SALMON COMMISSION IN 2013

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

Ken Medlock, Finance and Administration Officer

Bonnie Dalziel, Accountant

Victor Keong, Program Assistant, Restoration & Enhancement Funds

Angus Mackay, Fund Coordinator, Restoration & Enhancement Funds

FISHERIES MANAGEMENT DIVISION

Mike Lapointe, Chief Biologist

STOCK ASSESSMENT GROUP

Catherine Michielsens, Quantitative Fisheries Scientist

Merran Hague, Quantitative Fisheries Biologist

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

Jim Cave, Head

Mike Bartel-Sawatzky, Hydroacoustic Technician

Keith Forrest, Test Fishing Biologist

Fiona Martens, Senior Hydroacoustic Technician

Jacqueline Nelitz, Hydroacoustic Technician

Yunbo Xie, Hydroacoustic Scientist