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Fraser River Panel Annual Report on the 2024 Fraser River Sockeye Salmon Season

Prepared by:

PACIFIC SALMON COMMISSION

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FRASER RIVER PANEL ANNUAL REPORT ON THE 2024 FRASER RIVER SOCKEYE SALMON SEASON

Prepared by

FISHERIES MANAGEMENT DIVISION

of the

PACIFIC SALMON COMMISSION

February 2026

2024 PANEL MEMBERS AND ALTERNATES

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Fisheries and Oceans Canada

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First Nations

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M. Griswold
Troll fisher

K. Malloway
First Nations

M. Frost
Salmon processing industry

A. Murray
Gillnet fisher

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S. Hollingsworth (Alternate)
Sport fisher

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First Nations

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National Marine Fisheries Service

J. Gobin
Treaty Tribes

R. Charles (Alternate)
Treaty Tribes

J. Giard (Alternate)
Reefnet fisher

A. Siniscal (Alternate)
National Marine Fisheries Service

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I. EXECUTIVE SUMMARY

The data presented in this report are accurate as of the time of publication. For updates and access to the data, please see our Fraser River Panel (FRP) Annual Report App found at: psc1.shinyapps.io/PSC_Annual_Fraser. The following paragraphs describe the planning of the 2024 season, the in-season Panel management actions and the outcome in terms of the achieving Panel objectives:

Pre-season Planning

1. Pre-season, the median run size forecast (p50 level, Appendix B) was 567,000 Fraser River sockeye salmon and there was a one in two chance that the run size would be between 299,000 and 1,121,000. This was the lowest run size forecast on record.
2. Pre-season expectations of migration parameters included a 33% diversion rate for Fraser River sockeye salmon through Johnstone Strait. The Panel adopted the following Area 20 50% migration dates: July 7 for Early Stuart, July 19 for Early Summer, July 30 for Summer, and August 7 for Late-run sockeye salmon.
3. At median (p50) forecast abundance levels, pre-season spawning escapement goals were 180 Early Stuart, 131,400 Early Summer, 379,000 Summer, and 29,000 Late-run sockeye for a total of 539,600 sockeye salmon (Table 1).
4. Management Adjustments (MAs) of 200 Early Stuart, 73,600 Early Summer, 106,100 Summer-run, and 14,200 Late-run sockeye were added to the spawning escapement targets to increase the likelihood of achieving the targets (Table 1).
5. There was no projected Total Allowable Catch (TAC) of Fraser River sockeye salmon based on the median forecasted abundances and agreed deductions.
6. The Panel adopted the 2024 Fraser River Panel Management Plan and 2024 Regulations (Appendices C, D).

In-season Management Considerations

7. As the Early Stuart pre-season forecast was very small, less than 180 fish, no in-season assessments were done for this management group.
8. The in-season marine migration timing (Figure 3) was earlier than pre-season expectations for the Early Summer run, and later for the Summer run and Late run: 5 days early for the Early Summer run, 3 days later for the Summer run and 5 days later for the Late run. In-season marine migration timing was not determined for Early Stuarts as no in-season assessments were done for this management group.
9. The overall Johnstone Strait diversion rate (Figure 4) for Fraser River sockeye was 42% which was slightly higher than the pre-season forecast.
10. Returns for Fraser sockeye salmon were below the median pre-season forecast Early Summer run: 10%, and Summer run: 27% but above for Late run: 31%.
11. Throughout the season, extremely high temperatures and low discharge caused migration challenges for all management groups. The Panel adopted proportional Management Adjustments (pMAs) for Early Stuart and Summer run based on the retrospective analysis presented to the Panel pre-season (Appendix C) to ensure spawning escapement targets were met. No in-season changes were made to the Early Summer run as the pre-season model was identified as the best approach based on the retrospective analysis. For Late run, changes to the MA were the result of change in relative abundance for the Birkenhead/Big Silver and non-Birkenhead/Big Silver groups, not due to change in method (Table 3).
12. A landslide on the Chilcotin River on July 30 (Figure 7), severely impacted migration conditions for all sockeye migrating through the Fraser River, due to the high turbidity and sediment loads. Taseko and Chilko sockeye salmon were especially impacted as there was a full blockage on the river, for 6 days, downstream of the spawning grounds during the key migration window. As a result of the slide, Chilko spawners (53,000 with 30% females) arrived at the spawning grounds over one month after the slide breached.

Run Size, Catch, Escapement and Migration patterns

13. A revision to the estimated total run size was made post-season resulting in an increase to the total sockeye passage at Mission to 647,700. This was made as species composition information collected at Mission highlighted an underestimation of sockeye and over estimation of Chinook salmon in the 2024 season.
14. Estimated returns of adult Fraser sockeye totalled 667,300 fish (Tables 6 and 7) which was the third smallest run size on record but 45% greater than the run size of 365,200 fish in the primary brood year (2020). Divided into management groups, returns totalled 600 Early Stuart, 198,700 Early Summer-run, 430,200 Summer-run and 39,000 Late-run sockeye (Table 6).
15. All Fraser River sockeye management groups remained in a low abundance exploitation rate (LAER).
16. Catches of Fraser River sockeye salmon in all fisheries totalled 24,000 fish, including 18,200 fish caught by Canada, and 5,800 fish caught by test fisheries (Table 6). There was no catch in Washington.
17. The Canadian catch, 18,200, was a mix of First Nations Catch, 500 and non-commercial catch, 17,700, which included 'other' catch (17,400; unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species). The preliminary estimate of Alaska District 104 sockeye catch is 4,200. The overall exploitation rate of Fraser River sockeye salmon was 4% of the run, which excludes Alaska District 104 catch (Figure 12). This sockeye exploitation rate is the second lowest on record.
18. DFO's near-final estimates of adult spawning escapements to streams in the Fraser River watershed totalled 473,600 adult sockeye and were below cycle line averages for all run timing groups except Early Summer (Table 9, Figure 11). This was the second lowest escapement on record following the Fraser sockeye 2020 brood year escapement of 273,000 adults, which was impacted by the Big Bar landslide. In 2024, there were 186,117 effective female spawners in the Fraser watershed and overall spawning success was 81%.

Achievement of Objectives

19. In order of descending priority, the goals of the Panel are to achieve the targets for spawning escapement, international sharing of the TAC, and domestic catch allocation.
20. In-season management decisions are based on targets for spawning escapement, which are represented in-season by potential spawning escapement targets (i.e., spawning escapement targets plus MAs). The Panel adopted larger MAs in-season to ensure the spawning escapement targets were met for Early Stuart and Summer run, while the pre-season MAs for Early Summer was not changed. For Late run, the Panel adopted a change in stock proportions between Birkenhead/Big Silver and non-Birkenhead/Big Silver resulting in a small change to the MA.
21. In-season, the spawning escapement target equalled the run size for Early Stuart, Summer and Late run. For Early Summer run, the spawning escapement target was very close to the run size, so the escapement target could only be obtained in the absence of catches *and* limited difference between estimates. Even with the rigorous management approach that was applied in 2024, spawning escapement targets could not be met for any management groups given the challenging migration conditions encountered in 2024 (Table 8). The exploitation rates for all management groups were lower than their respective LAERs.
22. Post-season spawning ground estimates of Fraser sockeye abundance totalled 465,300 adults, which is 23% less than the post-season target. Spawner abundance was below target for Early Stuart sockeye (100% under), above target for Early Summer-run (31% over), below target for Summer-run (39% under) and below target for Late-run sockeye (18% under) (Table 9). While the Early Stuart spawning escapement was well below target, there were a record number of jacks that returned to the area, 330, compared to previous years. The Early Summer run management group exceeded its spawning escapement target by 31% (Table 9) due to Nadina sockeye which returned in greater numbers than expected and accounted for 70% of the Early Summer-run escapement. All other Early Summer run stocks returned at or below the post-season target.
23. There was no available international TAC of Fraser sockeye (Table 10) based on the calculation method set out in Annex IV, Chapter 4 of the Pacific Salmon Treaty. Canada reported 'other' sockeye catch (unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species). The total Canadian catch of 18,200 Fraser sockeye (excluding single stock food, social and ceremonial (SSFSC) catch) consisted mostly of 'other' catch as well as 530 First Nations catch and 240 fish caught in the Charter test fisheries (Albion). This Canadian catch exceeded the Canadian share of TAC + Aboriginal Fisheries Exemption (AFE). In these calculations, the TAC is based on the TAC on the date of the last adopted run size in-season (August 23, 2024), while catches are post-season estimates.

Allocation Status

24. By Panel agreement there is a United States (U.S.) payback of 2,770 Fraser River sockeye (Table 11), carried forward from the 2023 season.

II. FRASER RIVER PANEL

In 2024, the Panel operated under the terms of Annex IV, Chapter 4 of the Pacific Salmon Treaty (hereinafter "Treaty") between Canada and the United States (the two Parties).[1] The Fraser River Panel was responsible for in-season management of fisheries that target Fraser River sockeye and pink salmon within the Fraser River Panel Area (hereinafter "Panel Area", Figure 1), including commercial net fisheries in both countries and the Canadian troll fishery in the Strait of Georgia. Fisheries directed at Fraser River sockeye and pink salmon that occur outside of the Panel Area are coordinated with those in the Panel Area, but are the responsibility of the appropriate agencies, largely Fisheries and Oceans Canada (DFO). Coordination of directed harvest of other salmon species (coho and chum) intercepted south of Cape Caution 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.

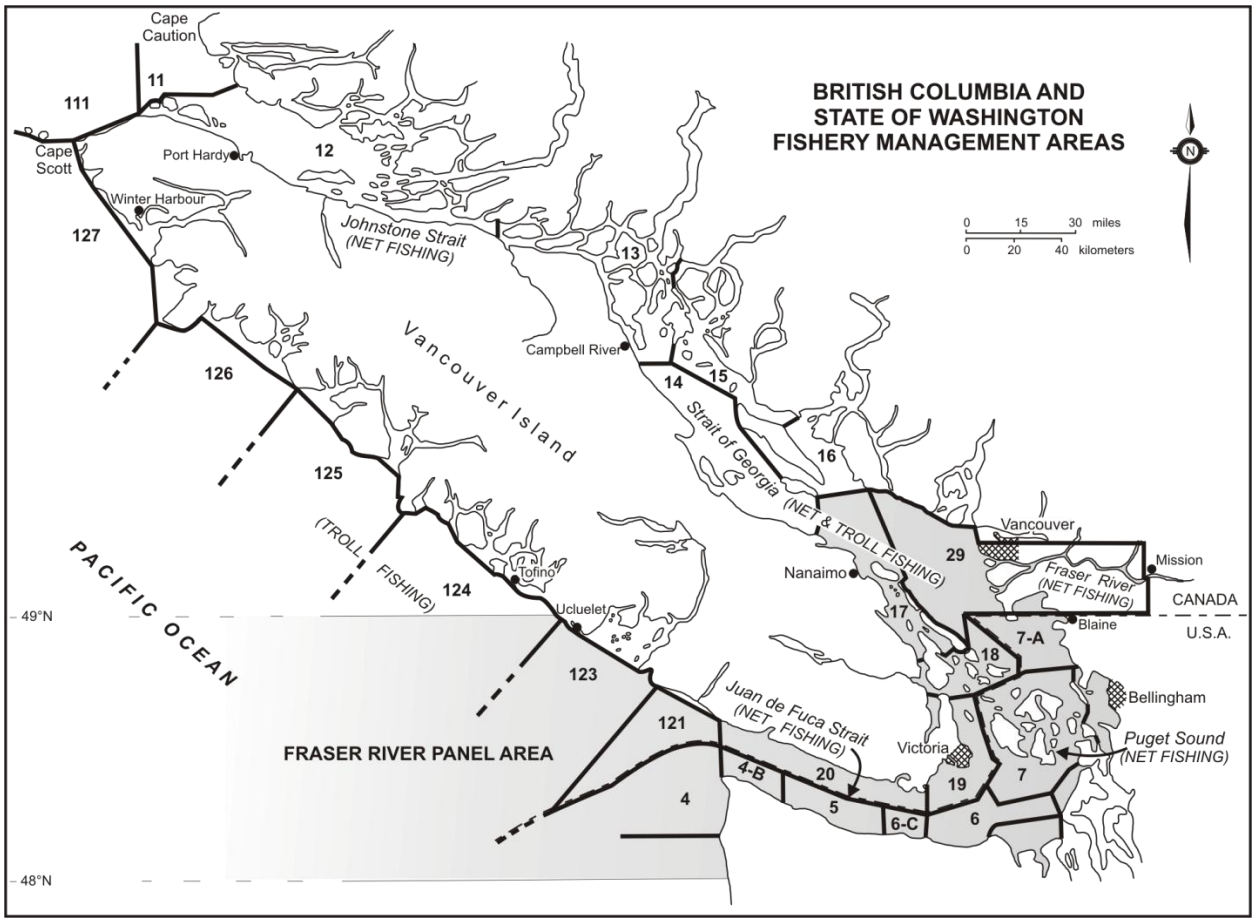

Figure 1. Fishery management areas in the Fraser River Panel Area and south coast waters.

Prior to the fishing season, the Fraser River Panel (hereinafter "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 Fisheries and Oceans Canada (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 bycatch in fisheries directed at Fraser River sockeye and pink salmon are generally addressed domestically with some international coordination. While not under Panel regulatory control,

[1] Pacific Salmon Treaty as modified through January 2020.

management of Canadian non-Panel Area fisheries directed at Fraser River sockeye and pink salmon is based on the same in-season information and hierarchy of objectives.

The Panel's regulatory authority is implemented based on 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 the Panel objectives given pre-season expectations. However, the Panel typically determines the actual pattern of fishery openings based on in-season assessments by PSC Staff (hereinafter "Staff", Appendix J) of Fraser sockeye and pink salmon run size, migration timing and route, in-river migration abundance (i.e., Mission escapement) and Management Adjustments (MAs). Thus, the Panel responds to deviations from pre-season expectations in their weekly fishing plans and most substantive fishery decisions are based on in-season rather than pre-season assessments. The Fraser River Panel Technical Committee (Appendix I) works in conjunction with Staff to facilitate Panel activities by providing their respective National Sections of the Panel with technical advice and ensuring timely exchange of data between Staff and the Parties.

III. PANEL MANAGEMENT ACTIVITIES

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

A. Pre-season Planning

Pre-season fisheries management plans for Fraser River sockeye-directed fisheries were developed by the Panel using the Fishery Planning Model.[2,3] This model allows the evaluation of the impacts of alternative fishery options on the achievement of management objectives. Model inputs include forecasts of run size, migration timing, diversion rate, migration delays in the Strait of Georgia, MAs, test fishery deductions, as well as objectives for spawning escapement and catch allocation.

The preliminary run-size forecast for Fraser River sockeye salmon was produced by Canada using a variety of stock-recruit models with data up until the 2020 brood year (2021 brood year for Harrison).[4] Canada presented the Panel with run-size forecasts corresponding to five probability levels (10%, 25%, 50%, 75%, and 90%) (Appendix B, Table B1). The median forecast (50th percentile, or p50) represented an equal chance (i.e., a one in two chance) that the return would fall below the forecast value. For planning purposes, the Panel used the median (i.e., p50) run size forecast of 567,000 Fraser River sockeye as the "base case" scenario. The Panel also explored two alternative Fraser River sockeye abundance forecasts for pre-season planning. One assuming a run size corresponding to the p75 of the distribution of the forecasted run size (p75: 1.12 million) as well as one assuming a run size corresponding to the p90 of the distribution of the forecasted run size (p90: 2.17 million).

Pre-season fisheries management planning was based on assumptions about the proportions of Fraser River sockeye migrating through Johnstone Strait instead of Juan de Fuca Strait (i.e., Johnstone Strait diversion rate, Figure 2) as well as marine timing (i.e., 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. DFOs oceanographic models generated timing forecasts of July 8 for the

[2] 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.
[3] Hague, M.J. 2022. Assessment of Fisheries Plans. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 38-64 p.
[4] DFO. 2024. Pre-season run size forecasts for Fraser River Sockeye (*Oncorhynchus nerka*) in 2024. Can. Sci. Advis. Sec. Sci. Resp. 2024/0##.

Early Stuart run and August 3 for the Chilko run[5]. The timing forecast of July 8 for the Early Stuart run was considered to be too extreme for planning purposes as it was later than the 90th percentile of the historical median timing. Therefore, the Panel adopted an Early Stuart run timing of July 7 for pre-season planning, which corresponded with the 90th percentile of the historical median timing for this stock. There was no difference between the Chilko historical cycle-line median timing of August 3 (for all years on the 2024 cycle line) and the forecast Chilko timing of August 3 and therefore, no timing offset was applied for other component stock groups within the Fisheries Planning Model. Median timing for each management group was derived based on the aggregated daily abundances of component stocks assuming normal run timing distributions. The Panel adopted the resulting timing estimates of July 7 for the Early Stuart run, July 19 for the Early Summer run, July 30 for the Summer run and August 7 for the Late run.

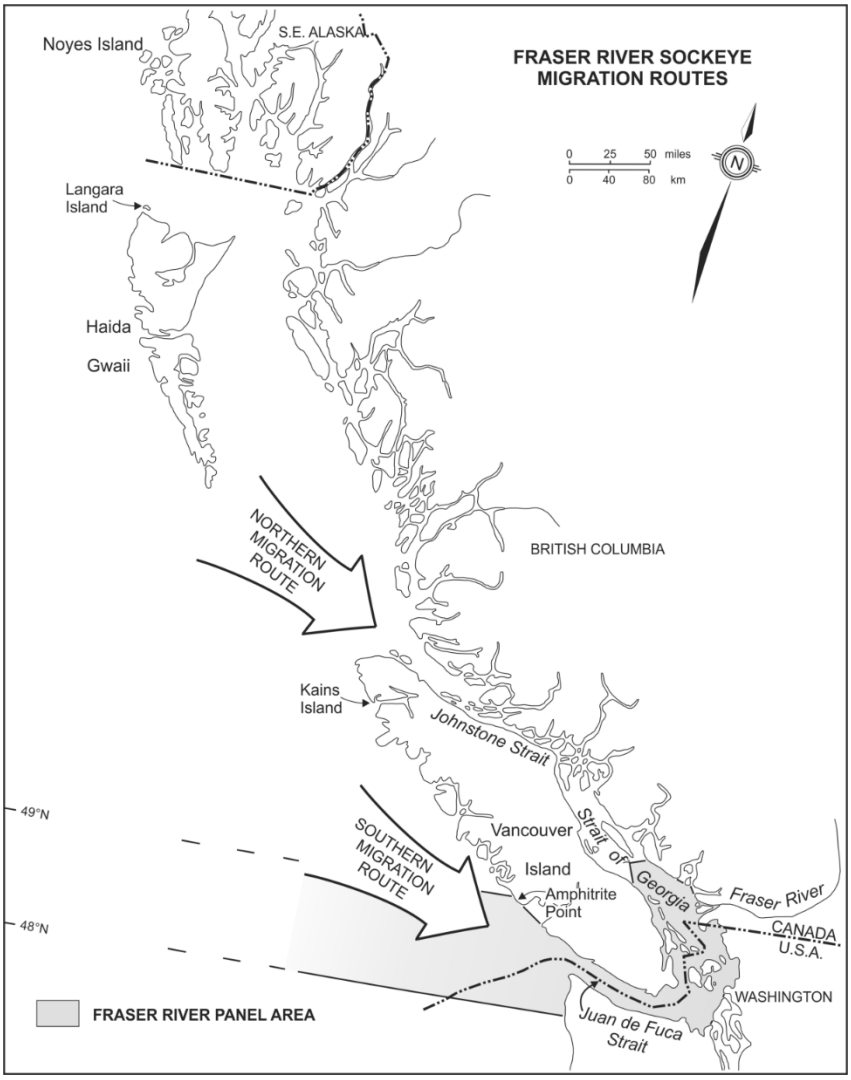

Figure 2. The northern (Johnstone Strait) and southern (Juan de Fuca Strait) routes for sockeye and pink salmon migration to the Fraser River.

The pre-season Fraser River sockeye diversion rate of 33% was derived by DFO using a combination of current velocities and sea surface temperatures.[6] The Panel adopted this diversion rate. Figure 3 illustrates the distribution of daily abundances by management group given the pre-season assumptions of Area 20 timing and total run size.

[5] Folkes, M.J.P., Thomson, R.E., and Hourston, R.A.S. 2018. Evaluating Models to Forecast Return Timing and Diversion Rate of Fraser Sockeye Salmon. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/021. vi + 220 p.
[6] Folkes, M.J.P., Thomson, R.E., and Hourston, R.A.S. 2018. Evaluating Models to Forecast Return Timing and Diversion Rate of Fraser Sockeye Salmon. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/021. vi + 220 p.

Pre-season, the Panel assumed a component of the Late-run and Summer-run management groups would delay their migration into the Fraser River. There has been some evidence of increasing delay in recent years. The model assumed an 18-day delay for the Late-run, equivalent to the delay observed in 2020. For planning purposes, the model assumed 8% of the non-Birkenhead Late-run group would delay in the Strait of Georgia and would migrate upstream on September 2. For the overall Late run group, this resulted in 50% of the run migrating upstream by August 14 assuming an 8-day migration time between Area 20 and Mission without holding. The model also assumed 34% of Harrison sockeye salmon would delay in the Strait of Georgia prior to migrating upstream on August 16. For the entire Harrison stock group, this resulted in an August 13 Mission 50% date and assumed 16-days of migration delay.

DFO's Environmental Watch (E-Watch) Program provided the Panel with long-range (3-month) projections of Fraser River temperature and discharge conditions. The Fraser River at Hope Snow Basin Index for June 1 was well below normal at 57%. Due to the low snowpack, early snowmelt and lingering impacts from on-going drought, there was a low risk of snow-related flood and an elevated risk of drought hazards for the upcoming season. The forecast was for low discharge and high water temperature in the Fraser River. The environmental forecast was applied to environmental MA models and, where applicable, to the best performing proportional difference between estimates (pDBE) forecast methods identified by a retrospective analysis to forecast the pDBEs (see Table 3 and F7). From this, a prediction can be made as to how many additional sockeye should be allowed to escape to achieve spawning escapement objectives.[7] Due to the below average discharge, there was little concern regarding sockeye migration at the Big Bar slide. For 2024, the Panel chose to adopt the proportional management adjustments (pMAs) (Table 4) based on the best pDBE forecast method identified by the retrospective analysis of the pre-season pDBE approaches (Table 3).

As the 2024 forecast for Fraser River sockeye was the lowest on record, all possible effort was made to limit the impact of the test fisheries while obtaining the information needed for in-season management. Test fisheries that supplement the core assessment program (i.e., the Area 13 purse seine, the Area 5 gill net, and the Gulf troll in Area 29), were not scheduled. In addition, the Area 20 and Area 12 gillnet test fisheries were not scheduled to minimize impacts of non-discretionary gillnet catches on early migrating management groups such as Early Stuart and Early Summer run given the low probability of directed harvest based on the preseason forecast. Instead, the Area 20 and Area 12 purse seine test fisheries were advanced six days earlier to July 14 and July 15 in Area 12 and 20, respectively, to provide timely in-season assessment information. To further minimize impacts on early migrating management groups, four days of experimental live sampling, starting July 17, was planned in the Area 20 purse seine during which no fish would be retained for sale, including the sampled fish (Appendix G). Also, in-river fisheries were delayed compared to previous years on this cycle. The start of the Whonnock and Qualark test fisheries were delayed by five and 17 days, respectively, to June 28 and July 18. In 2024, the Cottonwood gillnet was permanently replaced by the Brownsville Bar gillnet, previously an experimental test fishery funded by the Southern Endowment Fund (SEF).[8] The PSC's Test Fishing Policy and associated Financial Regulation in the PSC By-laws provided guidelines around retention policy and the resulting accounting of deficits and surpluses incurred by the test fishing program.[9,10] Approximately one fifth of the cost of the proposed test fisheries (a total program cost of $628,000), was anticipated to be covered by non-discretionary catches (i.e., those unavoidably killed in gill net test fisheries or those retained for sampling purposes). As the likelihood of pay fish for the 2024 season was low, the Test Fishing Revolving Fund would be used to offset program costs.

The total non-discretionary catch associated with the approved test fisheries for Fraser River sockeye (6,811) was estimated using the historical relationship between non-discretionary catch and sockeye run size. The distribution of this catch across management groups was based on the average proportions of the non-discretionary catch observed over the last three years on the cycle line.

During the pre-season planning process, both countries identified salmon stocks and cetaceans with conservation concerns that could influence management decisions for fisheries directed at Fraser River sockeye. Canada identified Early Stuart, Cultus Lake sockeye salmon and other weak Fraser stocks recently assessed by the

[7] Forrest, M.R. and Hague, M.J. 2022. Fraser River sockeye management adjustments. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 24-28p

[8] Sutherland, T., Baltzell, M., Jantz, L., and A. Fisher. 2024. Lower Fraser River Gillnet Test Fishery Site Evaluation. SEF Final Report.

[9] Pacific Salmon Commission Test Fishing Policy. Feb. 10, 2021. Pacific Salmon Commission

[10] Rule 25: Test Fishing Revolving Fund. Pacific Salmon Commission. PSC Bylaws: Chapter IX

Committee on the Status of Endangered Wildlife in Canada (COSEWIC)[11], Sakinaw, Nimpkish, and other sockeye salmon stocks in Areas 11-13, interior South Coast and Lower Fraser chum salmon, interior Fraser River coho salmon (Fraser Canyon, mid-Fraser, Lower/North/South Thompson), Fraser steelhead salmon (Thompson, Chilcotin, West Fraser), Fraser River Chinook salmon (Spring 4_2, Spring 5_2, Summer 5_2, Fall 4_1), Middle Georgia Strait Chinook salmon, West Coast Vancouver Island wild Chinook salmon, and the Southern Resident Killer whale population. The U.S. highlighted concerns for Puget Sound Chinook, Hood Canal summer chum salmon, and the Southern Resident Killer whale population.

Canada used the Fraser River Sockeye Spawning Initiative (FRSSI) model in combination with pre-season stakeholder consultations to establish escapement goals for 2024. These are documented in the Pacific Region Integrated Fisheries Management Plan (IFMP).[12] The spawning escapement plan released by Canada to the Panel (Appendix B, Table B2) relies on the application of a Total Allowable Mortality (TAM) rule, defined by a Lower Fishery Reference Point, an Upper Fishery Reference Point, a TAM cap, and a Low Abundance Exploitation Rate (LAER). The LAER is applied to accommodate "small but acceptable" amounts of bycatch for management groups, or species, with little or no total allowable catch (TAC). The resulting pre-season escapement targets for sockeye at the p50 run size levels by management group were: 181 Early Stuart; 131,200 Early Summer run; 379,247 Summer run; and 28,958 Late run. Due to conservation concerns for the Early Stuart and Early Summer runs, these runs were managed at a LAER of 5% and 7%, respectively. The Summer and Late run management groups were managed at a 10% LAER to allow for harvest on co-migrating salmon. There was no pre-season TAC for international sharing of Fraser River Sockeye at the p50, p75, or p90 abundance forecast scenarios.

Canada and the U.S. developed a pre-season management plan under the "base case" conditions which included the "FRP Management Plan 2024" and "2024 Regulations" (Appendices C & D) and evaluated fishing plans directed at catching Fraser River sockeye salmon. Assuming the median run size estimate (p50 or 50th percentile), there was no available harvest and directed fisheries targeting Fraser River sockeye salmon.

Alternative model runs explored the sensitivity of fishing plans to salmon run size. One alternative assumed sockeye run sizes at the pre-season p75 abundance; this resulted in a balance of 59,264 sockeye to Canada, all of which were part of the Early Summer management group. No Canadian commercial fisheries were planned under this scenario, but 57,673 sockeye were expected to be caught in First Nations fisheries. There was no U.S. share of the TAC under this scenario. Canadian fisheries planned in this scenario were constrained by the timing overlap of the Early Summer and Summer runs and this resulted in substantial catch of the Summer run for which there was no available TAC. Additionally, fishing on Early Summer sockeye was limited by the 5-week window closure to protect early-timed sockeye stocks (i.e., Early Stuart and the early-timed Early Summer Run sockeye). As a result, an alternative p75 scenario was proposed which included single-stock FSC fisheries targeting abundant Early Summer run stocks, specifically Nadina and Chilliwack sockeye. This scenario allowed for higher exploitation rates of abundant Early Summer-run stocks and lower exploitation rates of Early Summer-run stocks of concern as well as Summer and Late-run sockeye. A third alternative scenario assumed run sizes at pre-season p90 abundance which resulted in a balance of 201,401 sockeye to Canada. No Canadian commercial fisheries were planned under this scenario, but 181,423 sockeye were expected to be caught in First Nations fisheries.

B. In-season Management

Based on end of season run size, all sockeye salmon management groups returned at run sizes below the median pre-season forecasts with the exception of Late run (Table 1). The marine timing was slightly earlier than forecast for Early Summer run but later than forecast for Summer and Late run. For Early Stuart, it was not possible to generate in-season run size estimates due to the extremely low abundance so the pre-season timing forecast was used (Figure 3).

The Fraser River Panel convened 15 times between July 12, 2024 and August 30, 2024 to discuss run status and enact in-season orders (Appendix E) to regulate fisheries directed at Fraser River sockeye harvest in Panel Areas. Table 1 summarizes pre-season and in-season estimates by management group and by meeting date, including estimates of run size and the various deductions that result in the calculated TAC (i.e., spawning escapement target, pMA, MA, projected test fishery catch and Aboriginal Fishery Exemption). Also shown are estimates of available

[11]Huang, A-M., Pestal, G., Guthrie, I. 2021. Recovery Potential Assessment for Fraser River Sockeye Salmon (Oncorhynchus nerka) – Nine Designatable Units: Probability of Achieving Recovery Targets - Elements 12, 13, 15, 19-22. DFO Can. Sci. Advis. Sec. Res. Doc. 2021/043. x + 96.

[12] Fisheries and Oceans Canada. 2024. Southern Salmon Integrated Fisheries Management Plan 2024/2025. 23-2367: 628p.

harvest (run size minus spawning escapement target and MA), catch to date, and Mission escapement to date. The main events of the season are summarized below. Much of the corresponding in-season data are shown in Table 1.

Table 1. Pre-season and in-season updates of run size, spawning escapement targets and other TAC-related values for Fraser River sockeye salmon in 2024. The available harvest (run size minus spawning escapement target and management adjustment), catch to date, and Mission escapement to date are also shown.

				TAC*									
Date		Management Group	Total Abundance	Spawning Escapement Target	pMA	Manage-ment Adjust.	Test Fishing	Aboriginal Fishery Exemption	Total Deductions	Total Allowable Catch	Available Harvest **	Downstream Catch to date	Mission Escape. to date
June 20	Pre-season***	Early Stuart	180	200	1.17	200	1	0	180	0	0	0	0
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	0	0
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	0	0
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	0
		Sockeye	**567,180**	**539,600**		**194,100**	**6,812**	**0**	**567,180**	**0**	**0**	**0**	**0**
July 12	In-season	Early Stuart	180	200	1.17	200	1	0	180	0	0	0	0
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	38	22,200
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	0	0
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	0
		Sockeye	**567,180**	**539,600**		**194,100**	**6,812**	**0**	**567,180**	**0**	**0**	**38**	**22,200**
July 16	In-season	Early Stuart	180	200	1.17	200	1	0	180	0	0	0	0
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	400	52,500
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	200	2,200
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	0
		Sockeye	**567,180**	**539,600**		**194,100**	**6,812**	**0**	**567,180**	**0**	**0**	**600**	**54,700**
July 19	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	600	60,300
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	200	12,900
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	0
		Sockeye	**567,180**	**539,600**		**194,300**	**6,812**	**0**	**567,180**	**0**	**0**	**800**	**73,400**
July 23	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	800	83,400
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	500	22,900
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	0
		Sockeye	**567,180**	**539,600**		**194,300**	**6,812**	**0**	**567,180**	**0**	**0**	**1,300**	**106,500**
July 26	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	900	92,200
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	900	34,800
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	300
		Sockeye	**567,180**	**539,600**		**194,300**	**6,812**	**0**	**567,180**	**0**	**0**	**1,800**	**127,500**
July 30	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	159,000	131,400	0.56	73,600	1,561	0	159,000	0	0	1,200	113,500
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	1,400	52,200
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	100
		Sockeye	**567,180**	**539,600**		**194,300**	**6,812**	**0**	**567,180**	**0**	**0**	**2,600**	**166,000**
August 2	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	136,000	131,400	0.56	73,600	1,561	0	136,000	0	0	1,200	120,500
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	1,800	73,800
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	0	400
		Sockeye	**544,180**	**539,600**		**194,300**	**6,812**	**0**	**544,180**	**0**	**0**	**3,000**	**194,900**
August 6	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	136,000	131,400	0.56	73,600	1,561	0	136,000	0	0	1,300	128,700
		Summer	379,000	379,000	0.28	106,100	4,701	0	379,000	0	0	2,400	112,000
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	100	1,500
		Sockeye	**544,180**	**539,600**		**194,300**	**6,812**	**0**	**544,180**	**0**	**0**	**3,800**	**242,400**

Table 1, continued on next page

Table 1, continued.

Date		Management Group	Total Abundance	TAC* Spawning Escapement Target	pMA	Manage-ment Adjust.	Test Fishing	Aboriginal Fishery Exemption***	Total Deductions	Total Allowable Catch	Available Harvest **	Downstream Catch to date	Mission Passage to date
August 9	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	140,000	131,400	0.56	73,600	1,561	0	140,000	0	0	1,300	131,300
		Summer	300,000	300,000	0.56	168,000	4,701	0	300,000	0	0	2,600	141,700
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	100	3,000
		Sockeye	**469,180**	**460,600**		**256,200**	**6,812**	**0**	**469,180**	**0**	**0**	**4,000**	**276,200**
August 13	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	140,000	131,400	0.56	73,600	1,561	0	140,000	0	0	1,300	138,600
		Summer	300,000	300,000	0.56	168,000	4,701	0	300,000	0	0	2,800	181,000
		Late	29,000	29,000	0.49	14,200	549	0	29,000	0	0	100	4,800
		Sockeye	**469,180**	**460,600**		**256,200**	**6,812**	**0**	**469,180**	**0**	**0**	**4,200**	**324,600**
August 16	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	142,000	131,400	0.56	73,600	1,650	0	142,000	0	0	1,300	140,500
		Summer	300,000	300,000	0.56	168,000	4,701	0	300,000	0	0	3,000	210,800
		Late	18,000	18,000	0.49	8,800	350	0	18,000	0	0	100	7,600
		Sockeye	**460,180**	**449,600**		**250,800**	**6,702**	**0**	**460,180**	**0**	**0**	**4,400**	**359,100**
August 20	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	142,000	131,400	0.56	73,600	1,650	0	142,000	0	0	1,300	140,700
		Summer	300,000	300,000	0.56	168,000	4,701	0	300,000	0	0	3,200	234,500
		Late	18,000	18,000	0.49	8,800	350	0	18,000	0	0	200	13,400
		Sockeye	**460,180**	**449,600**		**250,800**	**6,702**	**0**	**460,180**	**0**	**0**	**4,700**	**388,800**
August 23	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	143,000	131,400	0.56	73,600	1,650	0	143,000	0	0	1,400	140,500
		Summer	275,000	275,000	0.56	154,000	4,701	0	275,000	0	0	3,300	254,700
		Late	38,000	38,000	0.43	16,300	350	0	38,000	0	0	200	18,900
		Sockeye	**456,180**	**444,600**		**244,300**	**6,702**	**0**	**456,180**	**0**	**0**	**4,900**	**414,300**
August 27	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	143,000	131,400	0.56	73,600	1,650	0	143,000	0	0	1,400	140,400
		Summer	275,000	275,000	0.56	154,000	4,701	0	275,000	0	0	3,400	281,200
		Late	38,000	38,000	0.43	16,300	350	0	38,000	0	0	200	20,700
		Sockeye	**456,180**	**444,600**		**244,300**	**6,702**	**0**	**456,180**	**0**	**0**	**5,000**	**442,500**
August 30	In-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	143,000	131,400	0.56	73,600	1,650	0	143,000	0	0	1,400	140,500
		Summer	275,000	275,000	0.56	154,000	4,701	0	275,000	0	0	3,500	291,400
		Late	38,000	38,000	0.43	16,300	350	0	38,000	0	0	200	24,700
		Sockeye	**456,180**	**444,600**		**244,300**	**6,702**	**0**	**456,180**	**0**	**0**	**5,100**	**456,800**
September 25	Post-season	Early Stuart	180	200	1.94	400	1	0	180	0	0	0	200
		Early Summer	143,000	131,400	0.56	73,600	1,650	0	143,000	0	0	1,400	140,400
		Summer	275,000	275,000	0.56	154,000	4,701	0	275,000	0	0	3,500	303,400
		Late	38,000	38,000	0.43	16,300	350	0	38,000	0	0	200	24,300
		Sockeye	**456,180**	**444,600**		**244,300**	**6,702**	**0**	**456,180**	**0**	**0**	**5,100**	**468,300**

* The TAC is determined by the run sizes and TAC deductions (spawning escapement targets, management adjustments, projected test fishing catches and AFE Exemptions) that were in effect when Panel had the last in-season meeting (Aug. 23).

** Available Harvest = Total abundance minus spawning escapement target and Management Adjustment. Management groups that meet the criteria of Low Abundance Exploitation Rate (LAER) are assumed to have no Available Harvest (ie. 0) because a LAER is not intended to provide direct harvest

*** Pre-season values reflect those adopted by the Panel in effect on the date shown. In some cases there may be slight differences between these values and those used in the base case planning model that was completed earlier during pre-season planning.

July 7 - 13, 2024:

The first in-season Panel meeting took place on Friday, July 12. In-river test fisheries started on June 28 and July 8 at Whonnock and Brownsville Bar, respectively and catches had been low. Hydroacoustic sonar estimates at Mission commenced on July 5. On July 12, observers at Hells Gate had counted only a few sockeye salmon into the fishways.

Due to the extremely low forecast for Early Stuart sockeye, 180 fish, it was challenging to produce an in-season run size estimate. The estimated escapement plus catch of Early Summer-run sockeye through July 11 was 22,200. Only the early-timed Early Summer-run component was represented in the test fishing catches (Chilliwack, Pitt, Nadina/Bowron).

On July 11, the Fraser River water discharge at Hope was about 4,024 cms, which was approximately 29% lower than average, while the temperature was 18.9˚C, 2.7˚C higher than average. Reports from Big Bar indicated there were no concern with salmon passage, which consisted solely of Chinook salmon.

July 14 – 20, 2024:

Marine purse seine test fisheries started on July 14 and 15 in Area 12 and 20, respectively. The majority of sockeye en-route to the Fraser River were migrating through the Juan de Fuca Strait route rather than through Johnstone Strait resulting in a 25% northern diversion rate.

Given the conservation concerns identified preseason, a live sampling program was operated in Area 20 from July 17-20 as a feasibility study (Appendix G). DNA and scale samples were collected from 167 live fish, of which 163 were considered in good condition upon release. To minimize fish handling and to ensure better survival rates, it was not possible to obtain length, weight and sex information. Most of the fish live sampled were from the Nadina/Bowron, Late Stuart, and Stellako groups. While the study was successful in terms of reducing mortality associated with the test fishery, it was noted that it did incur additional costs to the test fishing program due to the additional personnel needed on board the vessel for the live sampling as well as the lost revenue from the foregone sale of fish. The Panel agreed not to extend live sampling for the season but noted further discussion would ensue post-season as to future implementation.

Due to the low return for Early Stuart, it was not possible to derive an in-season run size estimate for this management group. In addition, the extremely warm water temperatures in the Fraser River were expected to negatively impact Early Stuart migration success to the spawning grounds. The estimated escapement plus catch of Early Summer-run sockeye through July 18 was 60,900. The Early Summer run was dominated by Chilliwack and Nadina which are earlier-timed stock components of this management group. For Summer run sockeye, a limited number of fish had been observed in the marine and in-river test fisheries. The estimated escapement plus catch of Summer-run sockeye through July 18 was 13,100.

On July 18, the Fraser River water discharge at Hope was about 3,470 cms, which was 33% lower than average and the temperature was 20.1˚C, 3.1˚C higher than average. Observers at Hells Gate continued to see sockeye salmon migrating into the fishways and reports from Big Bar similarly indicated no concern with salmon passage. A total of 270 sockeye thus far made it past the Churn Creek sonar site. Given the high in-river temperatures and the expected negative impact on migration success, the Panel increased the proportional Management Adjustment (pMA) for the Early Summer run from 1.17 to 1.94. This change had no international management implications but highlighted the Panel's concern for the extremely low run of Early Stuart sockeye and the extreme in-river environmental conditions.

July 21 – 27, 2024:

The estimated catch plus escapement for Early Stuart, Early Summer-run, Summer-run and Late-run sockeye as of July 26 was 200, 93,100, 35,700 and 300 fish, respectively. The Early Summer run was dominated by Nadina and Chilliwack and abundances to date were below preseason expectations. Marine test fishing catches remained low throughout the week and below preseason expectations. Early migrating Summer-run stocks such as Late Stuart, Stellako and Harrison were dominating marine catches based on stock identification samples. The majority of sockeye en-route to the Fraser River were migrating through the Juan de Fuca Strait route resulting in a 31% diversion rate.

As of July 25, the Fraser River water discharge at Hope remained low while the temperature remained at 20.1˚C, which was 2.2˚C higher than average for this date. At Big Bar, a total of 8,127 sockeye had passed the Churn Creek sonar site, upstream of Big Bar.

July 28 – August 3, 2024:

Approximately 197,900 Fraser sockeye had been accounted for in catch plus escapement as of August 2: 200 Early Stuart, 121,700 Early Summer run, 75,600 Summer run and 400 Late run. At the meeting on Friday, August 2, the Panel adopted an Early Summer-run run size of 136,000 with an associated Area 20 timing of July 13. The diversion rate increased to 68% which was greater than the pre-season forecast of 33%. On July 31, a significant landslide event occurred in the lower Chilcotin River, approximately 28 km upstream from the confluence with the Fraser River and approximately 50 km southwest of Williams Lake, BC. The slide resulted in a large deposit of debris which blocked the entire width of the Chilcotin River for several hundred meters, preventing the Chilcotin River from flowing into the Fraser River. First Nation and Provincial governments enacted emergency management measures supported by relevant Canadian federal agencies. Several populations of Pacific salmonids were impacted including sockeye, Summer and Spring Chinook, coho and Steelhead. The Early Summer and Summer run sockeye stocks with spawning grounds above the Chilcotin landslide included Taseko and Chilko, respectively. Preseason expectations for Taseko were very limited given the record low escapement numbers in 2020 following migration challenges due to high water flows in the Fraser Canyon Big Bar landslide area. Based on the preseason forecast,

Chilko sockeye was expected to account for 46% of the Summer-run management group and 31% of the total Fraser sockeye run size.

On August 1, the Fraser River water discharge at Hope was 2,610 cms which was 38% lower than average for this date. The temperature of the Fraser River at Qualark was 20.0˚C which was 1.7˚C greater than average for this date. It was too early to know the impact of the slide on management adjustments however, there was a possibility of warmer water temperatures for sockeye stocks migrating through the Fraser River main stem as well as increased mortality of Chilko and Taseko stocks due to delays in reaching the spawning grounds.

Reports from Big Bar indicated no concern with salmon passage past the site and the sonar program was decommissioned on July 31, a few days earlier than planned due to concerns of flooding from the Chilcotin landslide that could impact staff safety and equipment.

August 4 – August 10, 2024:

The total accounted run to date was 280,200 sockeye salmon, consisting of 200 Early Stuart, 132,600 Early Summer run, 144,300 Summer run and 3,100 Late run.

At the meeting on Friday, August 9, the Panel adopted an Early Summer-run run size of 140,000 with an associated 50% marine timing of July 14, but the Management Adjustment (0.56) remained the same. They also adopted a Summer-run run size of 300,000 with an associated 50% marine timing in Area 20 of August 2 and increased the proportional Management Adjustment (pMA) for the Summer run from 0.28 to 0.56, given the elevated temperature and low river discharge. It was still too early to make any assessments for Late run, but this management group appeared to be tracking below the p50 forecast of 29,000.

Given the fact that all management groups remained in a Low Abundance Exploitation Rate (LAER) and no directed fisheries were anticipated, the marine purse seine fisheries in Area 20 and Area 12 concluded as planned on August 3 and 4, respectively. The annual diversion through Johnstone Strait was 42% which was higher than the preseason expectation of 33%.

Migration conditions in the Fraser River continued to be impacted by the consequences of the Chilcotin slide. On August 5, the dam was breached, initially resulting in a flood surge, in particular in the Chilcotin itself. It was assumed that the slide area would clear itself of acute hydraulic challenges for migrating salmon over the week. In the main stem of the Fraser River, including at Hells Gate and at Big Bar the flows receded back to pre-event levels over the week. While there was not a significant increase in water levels, the amount of debris and sediment in the river was extreme. Increased sediment and turbidity negatively impact fish by causing physiological damage, and delaying migration to the spawning grounds. While reports in the lower Fraser did not indicate any change to fish migration, reports at the Qualark hydroacoustic program ,which is in the Fraser Canyon, indicated that fish passage had slowed considerably. Qualark test fishery crew had observed fish in mouths of clear creeks which were likely seeking relief from the high sediment load in the Fraser River.

For Taseko and Chilko sockeye, it was estimated that it takes 12-13 days (based on historical estimates) for these fish to migrate from Mission to the landslide area. For Taseko sockeye this indicated that peak migration would have occurred around August 7-8 and for Chilko sockeye their peak migration to the slide area was expected to be August 25-26. It was expected that migration for these two stocks past the landslide area could be impacted by delaying the migration and by decreasing migration success. These impacts were monitored for Chilko at the Lingfield hydroacoustic site, 5 days upstream of the slide area. The Tŝilhqot'in National Government, in partnership with DFO, monitor Taseko sockeye arriving at the spawning grounds. In late July, a few sockeye had been detected by the sonar and seemed to have reached the spawning ground prior to the slide. Taseko sockeye has been identified as an endangered stock by COSEWIC (Committee on the Status of Endangered Wildlife) and emergency enhancement had been planned prior to the occurrence of the slide.

As of August 8, the Fraser River water discharge at Hope was 2,711 cms, which was back to pre-event levels and 26% below the historical mean discharge level for this date while temperature was 19.8˚C, which was 1.2˚C, greater than average for this date.

August 11 - 17, 2024:

As of August 16, the total accounted run to date was 363,500 Fraser River sockeye, consisting of, 141,800 Early Summer run, 213,800 Summer run and 7,700 Late run. The majority of the Late run sockeye (7,000) consisted of Birkenhead and Big Silver which do not delay their migration up the Fraser River. The remainder of the Late run (Late Shuswap, Portage, Weaver, Cultus) was expected to be very small, about 4,000 sockeye based on the median preseason forecast. The in-season ability to accurately assess these delaying Late run stocks was limited given the very low abundances. At the Panel meeting on Friday, August 16, the Panel adopted an updated run size estimate for

the Early Summer run of 142,000, with a timing of July 14 and adopted an updated run size for the Late run of 18,000, with a timing of August 9.

Migration conditions in the Fraser River continued to be worse than normal as a consequence of the Chilcotin slide. The amount of sediment in the river continued to decrease over the last week but was still not back to pre-event levels. On August 15, the Fraser River water discharge at Hope was about 2,267 cms, which was back to pre-event levels and 29% below the historical mean discharge level for this date while the temperature was 21.2˚C, which is 2.6˚C higher than average for this date. The negative impacts of high temperatures on migration success were likely exacerbated by high sediment loads and water turbidity. Within the Chilcotin, there were episodic pulses of sediment from continued sloughing, but this impact was greatly diluted once the water hit the Fraser main stem. Water conditions had improved at Hells Gate and observers were able to see fish passage through this area of difficult migration.

The in-season run size for Chilko was 117,000 sockeye. At the hydroacoustic site at Lingfield (five migration days upstream of the slide area), a total of 512 sockeye had been observed, while under normal migration conditions 2,664 sockeye would have been expected. It was assumed that the salmon counted at Lingfield had migrated past the slide site prior to the landslide. Peak migration of Chilko sockeye past the landslide area (normally around August 25-26) was expected to be delayed due to the current migration conditions in the Fraser River. Due to the low expected Taseko sockeye return, it was not possible to provide in-season updates of run size and timing for this stock.

August 18 – 24, 2024:

The total accounted run to date was 419,200 sockeye salmon, consisting of 141,900 Early Summer run, 258,000 Summer run and 19,100 Late-run sockeye. Birkenhead and Big Silver sockeye appear to have later timing than forecast and were tracking above the median pre-season forecast (24,000).

At Friday's meeting (August 23), the Panel increased the Early Summer run, and Late-run run size to 143,000, and 38,000, respectively. For the Summer run, the Panel decreased the run size to 275,000. The associated 50% marine timing in Area 20 for the different management groups was July 14 for Early Summer run, August 1 for the Summer run and August 15 for the Late run. Due to the relative increase in Birkenhead/Big Silver in relationship to the remainder of the Late run stocks, the Panel decreased the Late run pMA from 0.49 to 0.43.

Migration conditions continued to be worse than normal as a consequence of the Chilcotin slide. Within the Chilcotin River, turbidity levels remained high and turbidity monitoring sensors had been installed at five locations ranging from Big Bar to Chilko Lake. As turbidity disrupts migration, these monitoring sites were expected to help determine when fish movement would be expected. The sediment levels in the Fraser River main stem were gradually decreasing but had not yet returned to pre-event levels. Observers at Hells Gate reported active fish passage. To better monitor fish passage past the slide area, the Fisheries Department of the Tŝilhqot'in National Government in collaboration with their technical partner EcoFish deployed a new sonar at Hanceville, upstream of the slide site. As of August 20, only 31 Chinook and 16 sockeye have been detected passing through the slide area, indicating potential delays and obstructions in fish migration.

On August 22, the Fraser River water discharge at Hope was about 1,915 cms, which is 33% below the historical mean discharge level while the temperature was 19.4˚C, which is 1.1˚C higher than average.

August 25 – August 31, 2024:

The total accounted run to date for sockeye was 461,900 consisting of 200 Early Stuart, 141,900 Early Summer, 294,900 Summer and 24,900 Late-run sockeye.

Migration conditions continued to be poor as a consequence of the Chilcotin slide but there was some evidence that Chilko sockeye were successfully migrating past the slide. Between the period of August 24 to 29, 113 sockeye were detected passing through the slide area, and it was anticipated that these numbers would continue to go up.

On August 29, the Fraser River water discharge at Hope was about 1,941 cms, which is 23% below the historical mean discharge level while the temperature was 18.4˚C, which is 1˚C higher than average.

The post-season meeting was held on September 25 and there were no changes to adopted run sizes or timing.

IV. MANAGEMENT INFORMATION

To facilitate decision making, the Panel requires information about the abundance, timing, migration route and expected catch levels of Fraser River sockeye (by management group) and pink salmon (odd years only). Pre-season, these quantities are provided by DFO in the form of forecasts that are augmented by 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 and hydroacoustics. The locations and schedule for these PSC and DFO programs are listed in Table 2, and the data can be found on the PSC website in the Fraser Panel Data Application. These data are augmented with catch information from commercial, First Nations, recreational and other fisheries that are provided by the two countries. Stock identification programs collect and analyze biological samples (e.g., DNA, scales) from various fisheries, which are used to apportion the total abundance of sockeye into component stock groups (PSC_Fraser_Sockeye_Stock_Group_Definitions.pdf).

Table 2. Panel-approved stock monitoring operations (test fishery, hydroacoustic and observer) conducted during the 2024 fishing season. Details on these operations can be found in the Fraser Panel Data Application.

Area	Location	Gear	Dates	Operated by
Canadian Panel Areas				
20	Juan de Fuca Str.	Purse Seine	July 15 - August 3	PSC
29-16	Fraser R. (Whonnock)	Gillnet	June 28 - September 8	PSC
29-16	Fraser R. (Mission)	Hydroacoustic	July 5 - September 5	PSC
29-17	Fraser R. (Brownsville Bar)	Gillnet	July 8 - August 25	PSC
Canadian non-Panel Areas				
12	Johnstone Str. (Blinkhorn)	Purse Seine	July 14 - August 4	DFO
	Fraser R. (Hells Gate)	Observer	July 3 - August 28	PSC
	Fraser R. (Qualark)	Gillnet	July 18 - September 6	DFO
	Fraser R. (Qualark)	Hydroacoustic	July 1 - September 4	DFO

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 MAs, which are a measure of how many additional fish should be allowed to escape past Mission to increase the likelihood of achieving sockeye spawning escapement targets, given historical discrepancies, current year migration timing and observed and forecasted river conditions from DFO's Environmental Watch program. These data are compiled and analysed by Staff and the results are provided to the Panel. The section "In-season Management" above summarized how these estimates changed each week as data from the programs accumulated. The following sections provide a summary of the end-of-season results.

A. Abundance

The final in-season run size estimate adopted by the Panel was 456,200 Fraser River sockeye salmon (Table 1). There were no sockeye directed fishing opportunities in the U.S. or Canada. A revision to the estimated total run size was made post-season resulting in an increase to the total sockeye passage at Mission to 647,700. This was made as species composition information collected at Mission highlighted an underestimation of sockeye and over estimation of Chinook salmon in the 2024 season.

The post-season abundance estimate for sockeye salmon (668,500 fish, Tables 6 and 7) based on spawning ground enumerations, accounted catches and differences between estimates is 32% greater than the end-of-season estimate as well as the pre-season median forecast (567,200).

B. Migration Timing and Diversion Rate

Figure 3 shows the forecasted and observed daily abundances, and Area 20 50% migration dates for each sockeye management group and for the total Fraser River sockeye. Due to the low abundance of Early Stuart, in-

season timing could not be estimated. The end-of-season estimates of marine migration timing in 2024 were earlier than preseason expectations for Early Summer-run (5-days earlier) and later than preseason expectations for the Summer-run (3-days later) and Late-run (6-days later) management groups. Timing was earlier than the cycle line median for the Early Summer (6-days earlier) and later than the cycle line median for Summer run (1-day later) and Late run (6-days later) management groups. The overall in-season Fraser River sockeye run-timing was 2-days later than expected pre-season and equal to the cycle line median.

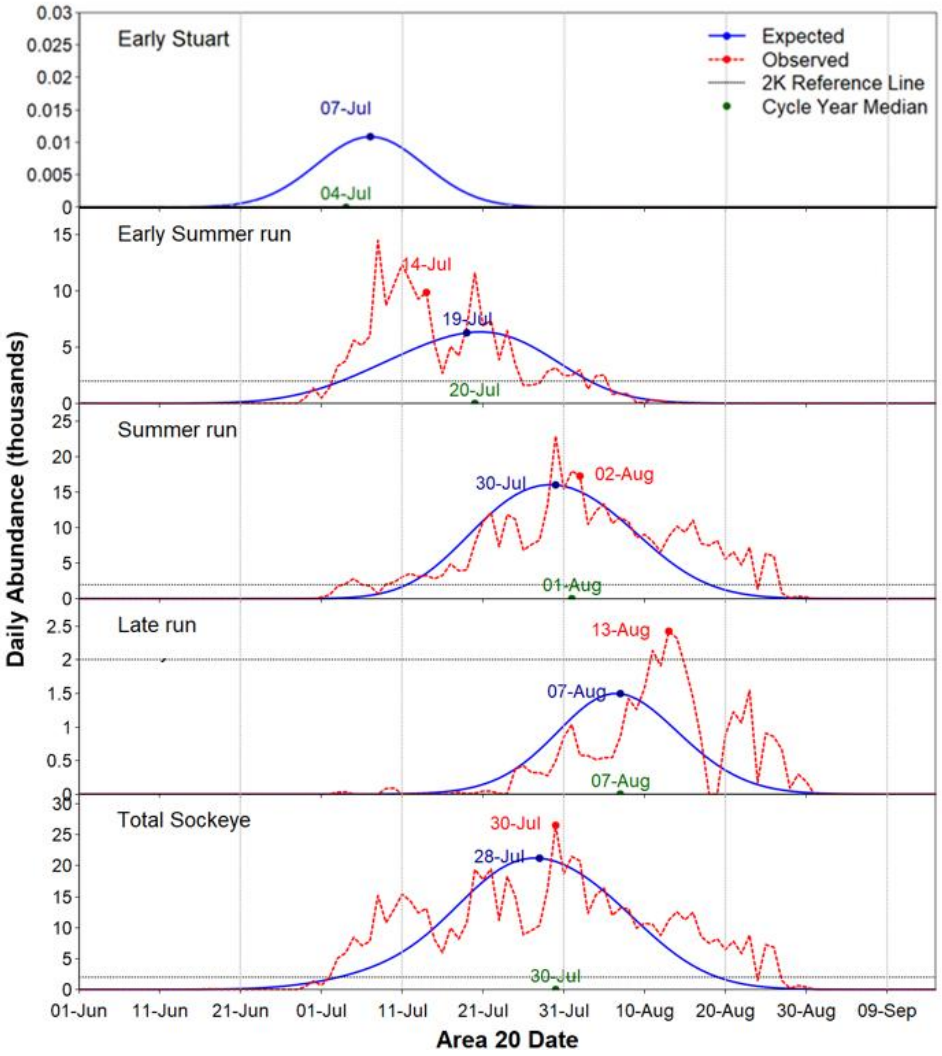

Figure 3. Pre-season expectations and post-season reconstructions of daily Fraser River sockeye salmon abundance by management group in 2024 (Area 20 date), including the observed 50% dates and number of days difference with pre-season expectations.

The in-season diversion rate in 2024 was higher than forecast for Fraser sockeye. The observed annual diversion through Johnstone Strait was 42%, compared to the pre-season forecast from DFO of 33% (Figure 4).

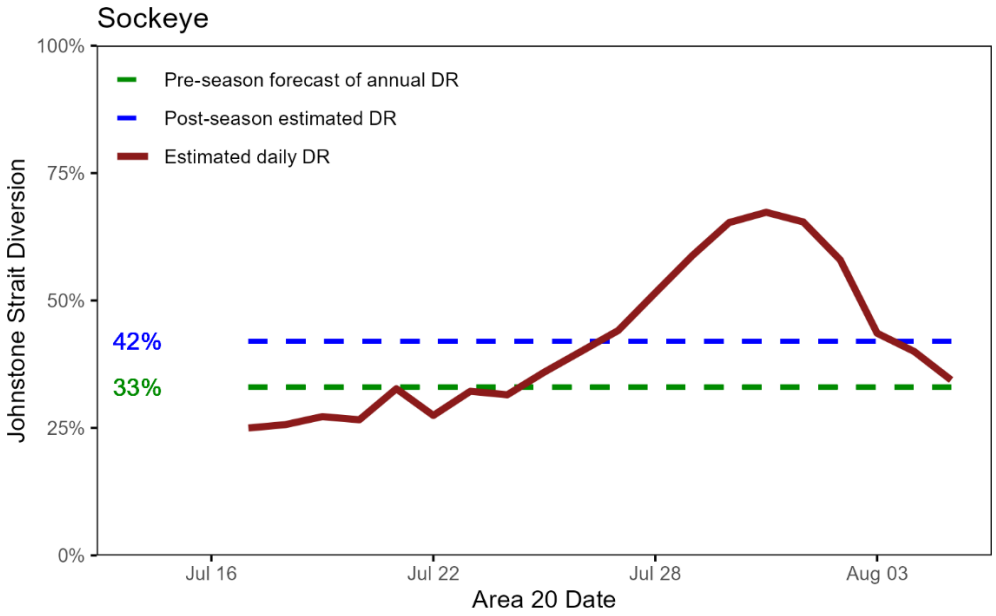

Figure 4. Pre-season forecast of annual Johnstone Strait diversion rate (DR) for Fraser sockeye salmon, compared to post-season estimates of daily and annual rates for 2024.

C. Landslides

Big Bar

On, June 23, 2019, the Big Bar rockslide was discovered along the Fraser River north of Lillooet, close to the Big Bar Ferry (Figure 5). The response both immediate and on-going was to improve site safety, improve natural and assisted passage through or over the slide and monitor successful passage and fish condition of the Fraser River salmon spawning above Big Bar.

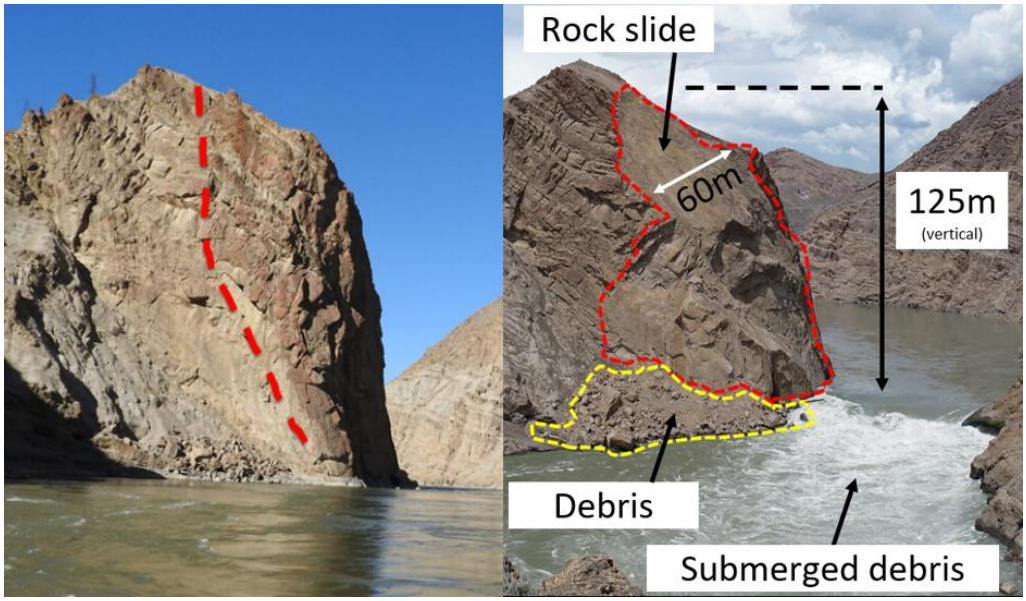

Figure 5. Big Bar Site before (A) and after (B) the slide. (A) The red line depicts what part of the cliff fell into the Fraser River. (B) Rock and debris 125 m in height and 60 m in width fell onto the banks and into the Fraser River.

In 2024, 69% of the total Fraser River sockeye run, 100% of the Early Stuart, 62% of the Early Summer run, and 77% of the Summer run migrated past the slide site. To provide in-season feedback to managers on the natural

passage success of salmon during the potentially high discharge period, monitoring operations were conducted throughout July. Hydroacoustic fish monitoring stations were set up downstream (Alfalfa) and upstream (Churn Creek) of the slide (Figure 6). The SONAR program operated from July 4 to July 31, but there was no radio tagging program in 2024.

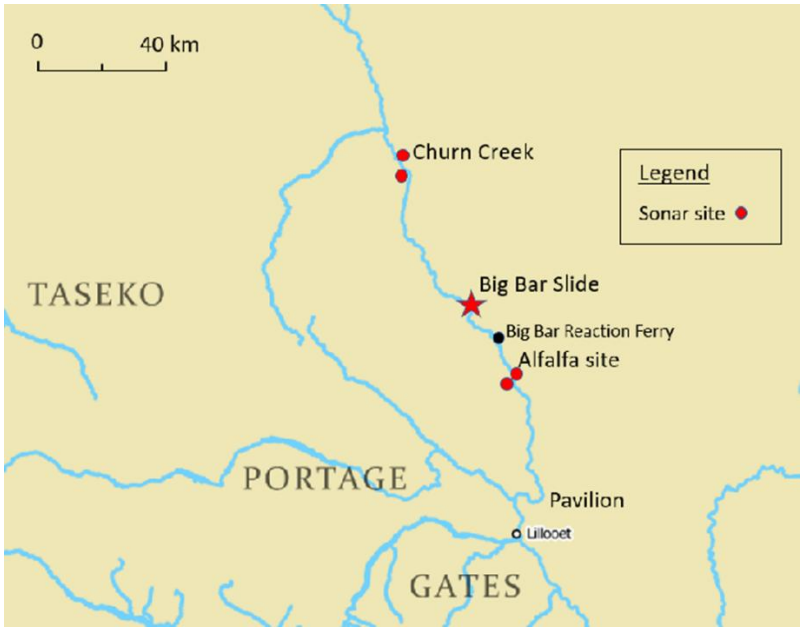

Figure 6. Map of sonar locations on the Fraser River near the Big Bar landslide in 2024.

Discharge levels at Big Bar were near the historical minima (1991-2020) throughout the sockeye migration, and there were no upstream migration problems reported at the Big Bar slide site.

Chilcotin River

On, July 30, 2024, a significant landslide event occurred on the Chilcotin River, approximately 28 km upstream of the confluence with the Fraser River (Figure 7). The site is located approximately 65 km southwest of Williams Lake, British Columbia. In response to the event, the Tŝilhqot'in National Government (TNG) established a technical tripartite Emergency Salmon Task Force with TNG, DFO and BC governments, with Upper Fraser Fisheries Conservation Alliance (UFFCA) indigenous partner and EcoFish Research technical support to assess the impacts of the slide (Seminar #25: Tŝilhqox Landslide: Implications for Salmon in 2025 and Beyond - Pacific Salmon Commission).

The landslide deposited a large volume of debris, blocking the entire width of the Chilcotin River for several days until floodwaters breached the blockage on August 5. As a result, Chilcotin salmon experienced significant migration delays and migration stress due to high suspended sediment concentrations, and poor water clarity due to high turbidity levels. An array of SONARs was installed in the Chilcotin system to monitor fish passage past the landslide (Figure 8). Initial natural sockeye passage past the slide area was observed between August 25-26, with a significant increase noted on August 28.

The slide impacted both Taseko and Chilko sockeye passage. A few Taseko sockeye were detected by the Taseko SONAR prior to the slide so some had already reached the spawning grounds. Only a few hundred Chilko sockeye were upstream of the slide at the time. The post-season Chilko spawning ground estimate was an estimated 53,326 sockeye, which was 96% of the 2020 brood year escapement. This suggests that 46% of the Chilko River sockeye successfully migrated to the spawning grounds. The majority of the spawners were males (68%). Spawning success was below average at 84%. Although normal passage was reestablished in-season, it is highly likely further slides will occur as tension cracks have been observed post slide in Farwell Canyon (Figure 9).

Figure 7. Chilcotin landslide that blocked the Chilcotin River starting on July 30, 2024 for six days. The material that was deposited in the river is estimated to be roughly 1,000 meters in length, 600 meters in width, and 30 meters deep.

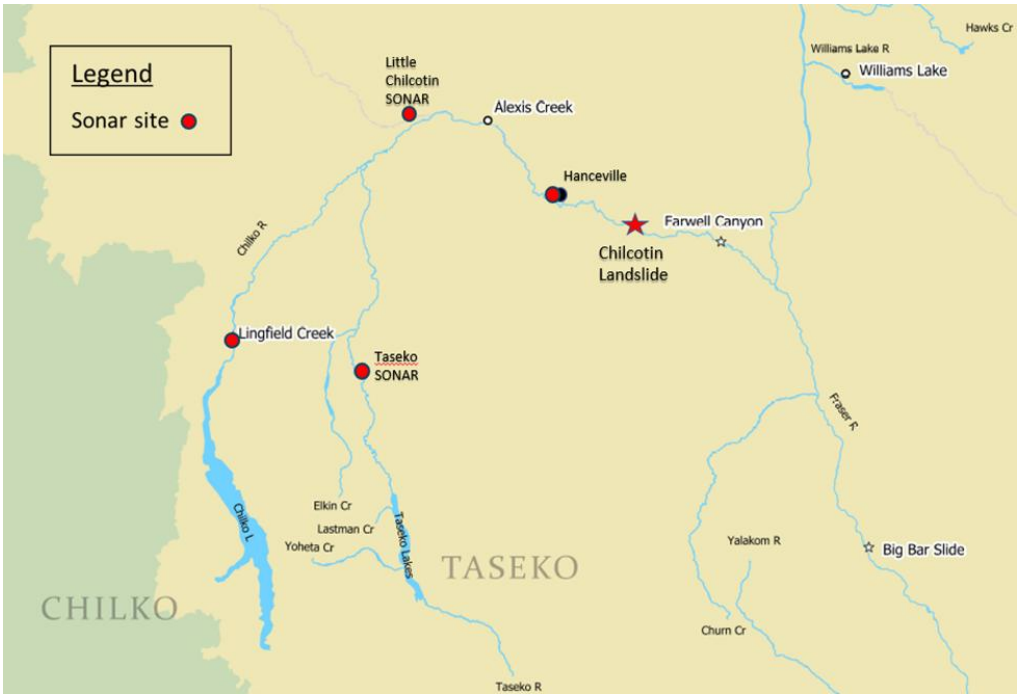

Figure 8. Map of sonar locations on the Chilcotin River to monitor fish passage through the Chilcotin landslide in 2024.

Figure 9. Farwell Canyon A) during the outbreak flood, and B) as waters rescinded and left massive tension cracks in the rock hillside (to the left).

D. Management Adjustments and DBEs

Management Adjustments (MAs) are based on statistical models [13] that consider the historical differences between in-season projections of spawning escapement (i.e., Mission escapement minus catch above Mission, or "potential spawning escapement") and post-season estimates (i.e., spawning ground estimates).[14]

Pre-season MA predictions and Difference Between Estimates (DBEs) are based on median values from historical datasets for each management group or are based on models using long-range forecasts of river conditions (temperature and discharge) and in-river migration timing.[15] In-season values are generated using updated migration timing estimates and observed and/or short-range forecasts of lower river discharge and temperature in combination with other considerations such as watershed-wide environmental conditions, and evidence of migratory distress.[14,15]

[13] Forrest, M.R. and Hague, M.J. 2022. DBE Temperature and Discharge Model. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 192-196 p

[14] Forrest, M.R. and Hague, M.J. 2022. Management Adjustments. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 179-184 p

[15] Forrest, M.R. and Hague, M.J. 2022. Fraser River Sockeye Management Adjustments. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 24-28 p

In contrast, post-season values are calculated independently of any environmental data using post-season estimates of potential spawning and spawning ground escapements.

In 2024, low discharge levels and high temperature dominated conditions in the Fraser River. On May 1st, the River Forecast Centre reported that the overall provincial snowpack was significantly below normal for the time of year. The average of all snow measurements for the entire Fraser River basin was at 66% of normal. As of June 15th, the basin snow water index was averaging 38% across the province. The discharge levels at Hope were near the historical minima (1991-2020) for the entire sockeye migration (Figure 10). Due to the low discharge levels, the Fraser River was more susceptible to above average air temperatures. Fraser River temperatures at Qualark were more than one standard deviation above the median and near the historical maxima (1991-2020) for most of the season (Figure 10).

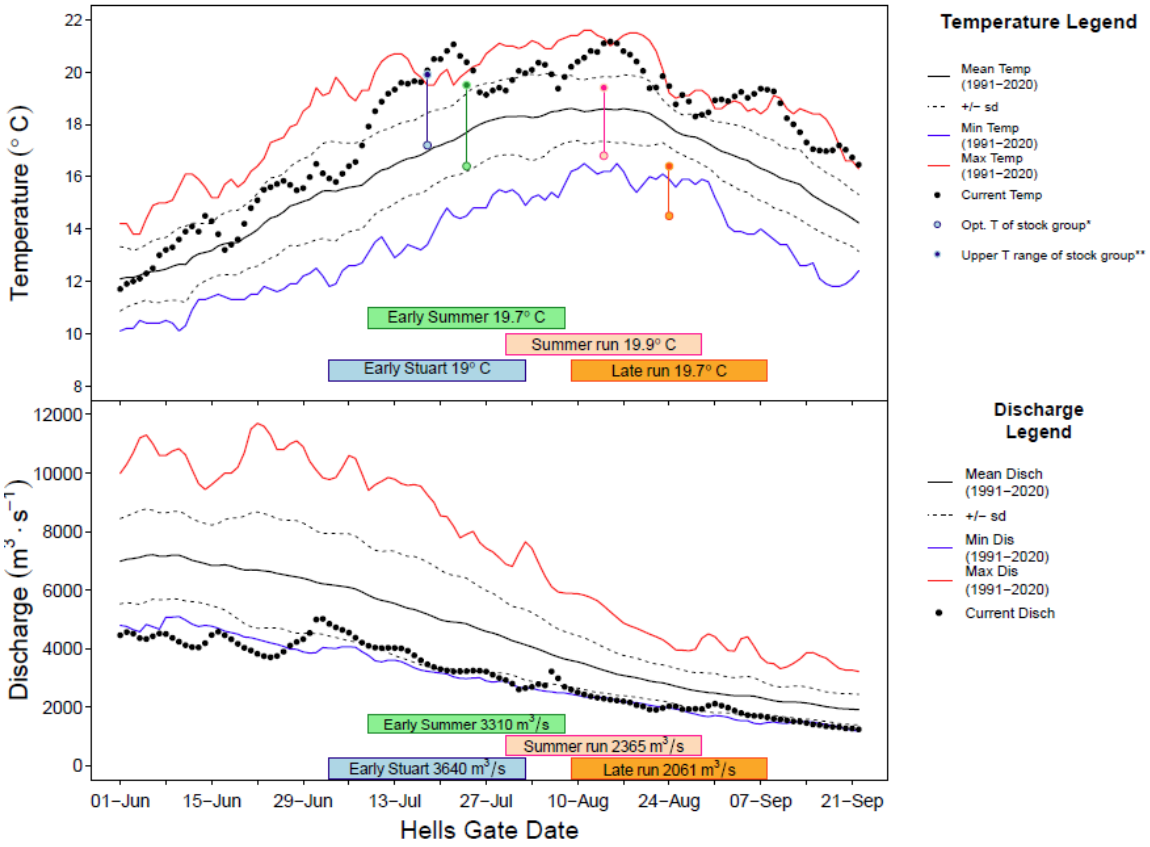

Figure 10. Fraser River temperature and discharge measured near Hope in 2024. Also shown are run timing bars that represent a 31-day spread of the run centred around the median migration date past Hells Gate and the average temperature and discharge during those 31 days.

A summary of the pre-season and in-season MA models used during 2024 are provided in the "Management Adjustment and DBE" section in Table F7. Pre-season, the adopted pMAs were based on the best performing pre-season forecast method identified in the retrospective analysis of the different pDBE approaches (Table 3). Due to the low pre-season forecasts, all four management groups were managed in a low abundance exploitation rate (LAER). For Early Stuart, Summer-run and Late-run sockeye, the spawning escapement target (SET) equalled the run-size at the median forecast abundance level and MAs would have no management implications for these groups. For Early Summer run, although the run size at the median forecast abundance level exceeded the SET, the addition of the MA put the group into a LAER scenario. In-season, the Panel was presented with pDBE estimates for each management group from the best performing in-season pDBE approaches (Table 3) identified in a retrospective analysis. High temperatures triggered the threshold approach for both the Early Stuart and the Summer run with the 19-day mean temperature exceeding 17°C for Early Stuart and 19.4°C for Summer run. The Panel therefore adopted the median pMA of high temperature (>17°C) years for Early Stuart and the median pMA of high temperature (>19.4°C) years for Summer run (Table 3). For both Early Summer run and Late run, a weighted pDBE approach

was used. While the adopted pMAs for Late run excluding Birkenhead/Big Silver and Birkenhead/Big Silver did not change, the Panel adopted an updated pMA for the Aggregate management group due to the change in relative abundance of the two groups. In the case of the Early Summer run, the relative abundance of Early Summer run (excluding Pitt and Chilliwack), Pitt and Chilliwack did not change, so the adopted pMA remained unchanged.

Table 3. Best performing pDBE approach identified by the retrospective analysis of the pre-season and in-season pDBE approach for each management group.

	Pre-Season recommended method	**In-Season recommended method**
Early Stuart	Median (1995-2023)	Threshold Approach: If Temperature >17°C or Discharge >8000m^3/, use median of relevant historical years versus median of years with more benign Temperature and Discharge
Early Summer run	All-years median	All-years median
Summer run	Pre-season 31-day model	Threshold Approach: If Temperature > 19.4°C, use the median of High Temperature (>19.4°C) years versus Pre-season 31-day model.
Late run	Dominant/other years median (1996-2023)	Dominant/other years median (1996-2023)

Due to the extremely low abundance of Early Stuart, it was not possible to generate an in-season estimate of run size or migration past Mission. The observed pDBE for Early Stuart (-91%) was based on the pre-season run-size forecast and had a high degree of uncertainty. This observed value was more negative than the pDBE adopted in season (-66%). For the Early Summer run, the the observed DBE was -11% which compared to a predicted pre-season and in-season DBE of -36%. The less negative pDBE for Early Summer was obtained despite the fact that sockeye that migrated past Hells Gate after July 30th may have been impacted by high water turbidity and high sediment loads caused by the Chilcotin landslide. In-season, the Panel adopted a more negative DBE (-36%) for the Summer run based on the Threshold Approach which was almost equal to the observed pDBE (-33%) and more negative than predicted pre-season (-22%). Similarly to Early Summer run sockeye, Summer run stocks that migrated past Hells Gate after July 30th may have been impacted by the high water turbidity and high sediment loads. Chilko sockeye saw an observed pDBE of (-64%) due to the landslide on the Chilcotin River. For the Late run, there was almost no pDBE (-1%) (Table 4),however, this was due to the additional fish observed in the Birkenhead/Big Silver group. The Shuswap/Portage and Weaver/Cultus groups saw fewer sockeye on the spawning grounds than predicted in-season. All Late run migration experienced temperatures greater than 16.4°C. Spawning ground estimates exceeded the spawning escapement target (SET) for the Early Summer run; however, the SET was not achieved for the Early Stuart, the Summer run and the Late run.

Table 4. Pre-season, in-season and observed estimates of DBEs (differences between estimates) and pMAs (proportional management adjustments). Pre-season and in-season adopted values reflect the final values adopted by the Panel either prior to the season or for in-season management. Observed DBEs are calculated from final in-season estimates of potential spawning escapement and post-season estimates (observed) of spawning populations based on field enumeration programs conducted by DFO. (See Appendix A: Glossary of terms and abbreviations for DBE definition; and footnotes and Appendix F for more details on the methodologies and data sets used for each aggregate).

Description	**Early Stuart**		**Early Summer**		**Summer**		**Late**	
	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA
Pre-season adopted	-54%	1.17	-36%	0.56	-22%	0.28	-33%	0.49
In-season adopted	-66%	1.94	-36%	0.56	-36%	0.56	-30%	0.43
Observed [1]	-91%	10.12	-11%	0.13	-33%	0.49	-1%	0.01

F. Mission Passage

The estimate for upstream passage of Fraser sockeye at Mission was 647,700, consisting of 300 Early Stuart, 195,200 Early Summer-run (including Pitt), 419,500 Summer-run (including Widgeon), and 32,800 Late-run sockeye (Table 5). Sockeye passage was estimated using the hydroacoustics monitoring facility at Mission from July 5 to September 2. After termination of the program, estimates were generated based on the expansion of CPUE (catch per unit effort) data from the Whonnock gillnet test fishery from September 3 to 8.

The sampling methodology used to estimate salmon passage at Mission was consistent with recent years: combined observations from a vessel-based mobile Adaptive Resolution Imaging Sonar (ARIS; offshore), a shore-based (left bank) split-beam, and two shored-based ARIS systems (one per bank). On days with missing data (e.g., due to Food, Social, and Ceremonial Fisheries, Chilcotin landslide debris), imputation procedures[16] were used. A detailed account of the 2024 hydroacoustics estimation approach is provided in Appendix F.

Table 5. Fraser River sockeye salmon passage at Mission in 2024.

Management Group	Mission Escapement	
Stock Group	fish	%
Early Stuart[1]	**300**	**0%**
Early Summer	**195,200**	**30%**
Chilliwack	26,800	4%
Early Miscellaneous	145,700	22%
Early South Thompson	2,900	0%
North Barriere/Taseko	4,700	1%
Pitt[2]	15,100	2%
Summer	**419,500**	**65%**
Raft/N.Thompson	23,000	4%
Chilko	157,000	24%
Quesnel	7,800	1%
Late Stuart/Stellako	158,500	24%
Harrison	73,100	11%
Late	**32,800**	**5%**
Birkenhead	27,000	4%
Late Shuswap/Portage	1,600	0%
Weaver/Cultus	4,200	1%
Total Sockeye	**647,700**	**100%**

[1] *The estimate for Early Stuart is the preseason p50 forecast of abundance*

[2] *Pitt River sockeye do not migrate past Mission, but are shown*

[16] Bzonek, P., Hornsby, R.L, Xie, Y., Nelitz, J., Bartel Sawatzky, M., Martens, F., and Michielsens, C.G.J. 2022. Mission Data Imputation During Fishery Openings: A report to the Southern Boundary Restoration and Enhancement Fund. Pacific Salmon Commission, March 2022.

V. RUN SIZE, CATCH AND ESCAPEMENT

A. Sockeye Salmon

The total abundance of sockeye salmon in 2024 was 668,500 fish (Tables 6 and 7), which is greater than the median forecast of 567,300 fish and a little more than 1.7 times the total adult return in 2020 (396,200) which was the lowest on record. However, the 2024 return was 79% below the historical cycle line average (3,200,000; 1896-2020) and the second lowest return on record (Figure 11).

Due to the low abundance, run size estimates of Early Stuart remain very uncertain, even post-season. The final run size estimate of 600 Early Stuart was larger than the pre-season p50 forecast (180). The Early Summer, Summer and Late run management groups returned at abundances greater than their median (p50 level) pre-season forecast. Early Summer-run sockeye returns totalled 198,700 fish, which was 25% greater than the median forecast level. The abundance of Summer-run sockeye was 430,200, 14% greater than the median forecast level. Late-run abundances, 39,000, were 34% greater than the median forecast level (29,000). This was due to the high return of the Birkenhead/Big Silver stock group which was 31% greater than the median forecast level.

Table 6. Catch, escapement, difference between estimates and run size for Fraser River sockeye (by management group) in 2024.

	Fraser Sockeye					
	Early Stuart	Early Summer	Summer	Late	Total	% of Run
CANADIAN CATCH	0	1,100	16,500	500	18,200	3%
Commercial Catch	0	0	0	0	0	0%
Panel Area	0	0	0	0	0	0%
Non-Panel Areas	0	0	0	0	0	0%
First Nations Catch	0	50	60	420	530	0%
Marine FSC	0	0	0	0	0	0%
Fraser River FSC	0	50	60	420	530	0%
Economic Opportunity	0	0	0	0	0	0%
Non-commercial Catch	0	1,100	16,500	90	17,700	3%
Marine Recreational	0	0	0	0	0	0%
Fraser Recreational	0	0	0	0	0	0%
Charter (Albion & Area 12 Chum)	0	40	180	20	240	0%
SSFSC	0	0	0	0	0	0%
Other Catch***	0	1,100	16,300	70	17,400	3%
UNITED STATES CATCH	0	0	0	0	0	0%
Washington Total	0	0	0	0	0	0%
Commercial catch	0	0	0	0	0	0%
Treaty Tribal	0	0	0	0	0	0%
All Citizen	0	0	0	0	0	0%
Non-commercial Catch	0	0	0	0	0	0%
Ceremonial	0	0	0	0	0	0%
Recreational	0	0	0	0	0	0%
Other Catch***	0	0	0	0	0	0%
Alaska****	0	0	0	0	0	0%
TEST FISHING CATCH	0	1,600	4,000	200	5,800	1%
PSC (Panel Areas)	0	900	2,300	200	3,400	1%
Canada	0	900	2,300	200	3,400	1%
United States	0	0	0	0	0	0%
Canada (non-Panel Areas)	0	600	1,700	40	2,400	0%
TOTAL RUN	600	198,700	430,200	39,000	668,500	100%
Total Catch in All Fisheries	0	2,700	20,500	700	24,000	4%
Adult Spawning Escapement *	30	172,100	269,600	31,900	473,600	71%
Jack Spawning Escapement	300	300	1,500	2,100	4,300	1%
Difference Between Estimates**	300	23,500	138,500	4,200	166,500	25%
Percentage of Total Run	100%	100%	100%	100%	100%	
Total Catch in All Fisheries	0%	1%	5%	2%	4%	
Spawning Escapement	55%	87%	63%	87%	71%	
Difference Between Estimates	44%	12%	32%	11%	25%	

* Spawning escapement estimates include broodstock collection for Early Stuart, Bowron, Late Stuart and Cultus; 2, 9, 165 and 57, respectively.

** Difference between estimates as at the time of the final spawning ground estimates. Also, consistent with Panel advice, positiveDBEs were set to zero for all componenets of management groups.

*** May include unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species

**** Preliminary Alaska catch totals 4,218 Fraser sockeye

Table 7. Catch, escapement, difference between estimates, run size and exploitation rate for Fraser River sockeye (by stock group) salmon in 2024.

Management Group / Stock Group	Catch	Adult Spawning Escapement	Difference Between Estimates[3]	Abundance			Portion of Run	Adult Exploitation Rate
				Adult	Jack[1]	Total		
Fraser Sockeye Salmon								
Early Stuart	**0**	**30**	**300**	**300**	**300**	**600**	**0%**	**0%**
Early Summer-run	**2,700**	**172,100**	**23,500**	**198,300**	**300**	**198,700**	**30%**	**1%**
Chilliwack	100	26,300	500	26,900	0	26,900	4%	0%
Early Miscellaneous	2,300	127,400	18,800	148,500	80	148,500	22%	2%
Early South Thompson	50	1,600	1,200	2,900	200	3,100	0%	2%
North Barriere/Taseko	100	2,100	2,500	4,800	20	4,800	1%	2%
Pitt	100	14,700	400	15,300	0	15,300	2%	1%
Summer-run	**20,500**	**269,600**	**138,500**	**428,600**	**1,500**	**430,200**	**64%**	**5%**
Raft/N.Thompson	800	21,300	1,100	23,200	0	23,200	3%	3%
Chilko	11,100	52,400	94,700	158,200	1,200	159,400	24%	7%
Quesnel	300	11,400	1,400	13,100	0	13,100	2%	2%
Late Stuart/Stellako	7,800	111,600	40,800	160,200	300	160,500	24%	5%
Harrison/Widgeon	500	73,000	500	74,000	40	74,000	11%	1%
Late-run	**700**	**31,900**	**4,200**	**36,900**	**2,100**	**39,000**	**6%**	**2%**
Birkenhead/BigSilver	600	30,500	0	31,100	700	31,800	5%	2%
Late Shuswap/Portage	90	700	700	1,600	1,100	2,700	0%	6%
Weaver/Cultus	30	700 *2*	3,500	4,200	300	4,500	1%	1%
Total	**24,000**	**473,600**	**166,500**	**664,100**	**4,300**	**668,500**	**100%**	**4%**
Portion of Total Run	4%	71%	25%	99%	1%	100%		

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

2 Spawning escapement estimates of Early Stuart, Bowron, Late Stuart and Cultus sockeye include 2, 9, 165 and 57 individuals captured as brood stock, respectively.

3 Difference between estimates as at the time of the final spawning ground estimates. Also, consistent with Panel advice, positive DBEs were set to zero for all componenets of management groups.

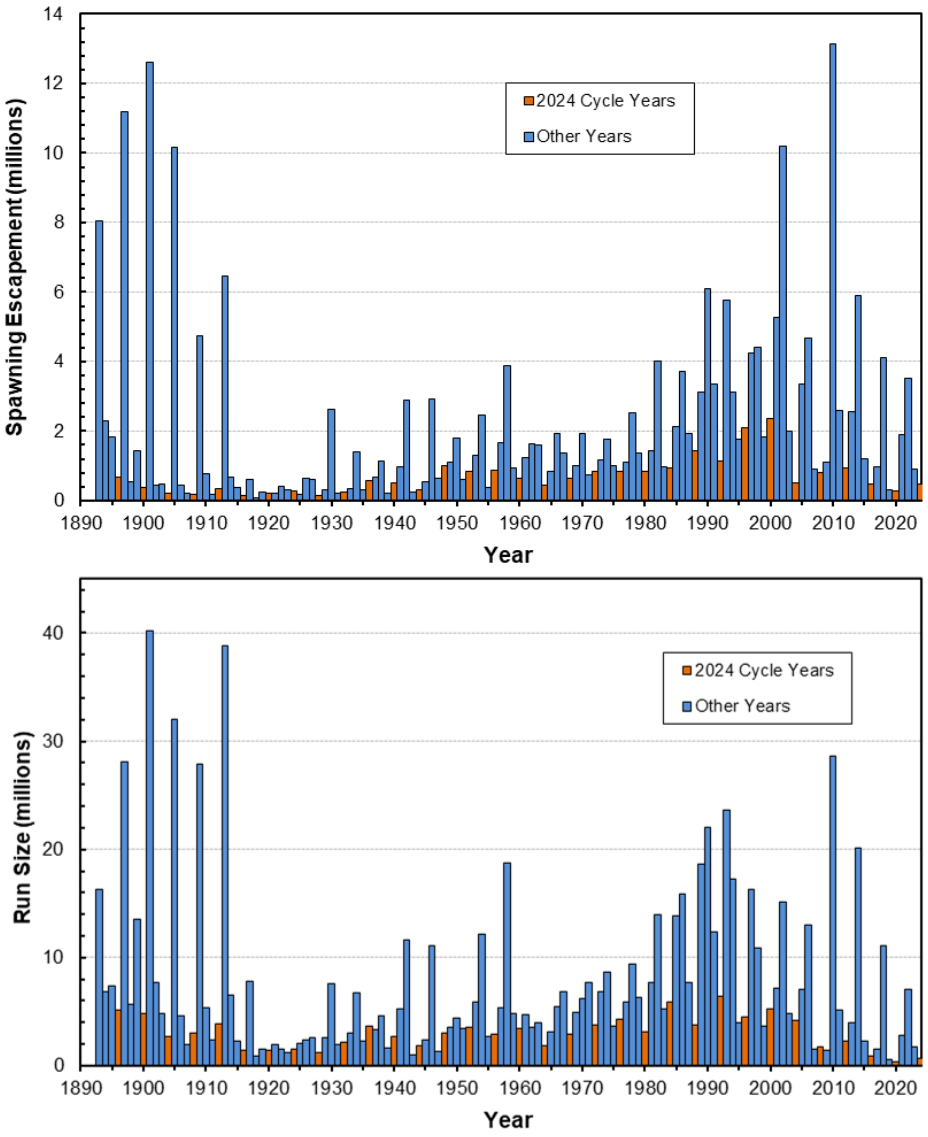

Figure 11. Total run size and spawning escapement of Fraser River sockeye salmon from 1893-2024. Returns on the 2024 cycle are emphasized.

The total sockeye catch of 24,000 represented about 4% of the total return (Tables 6 and 7). This exploitation rate does not include Alaskan District 104 catch and is the second lowest on record (Figure 12). Of the total sockeye catch, 18,200 fish were caught in Canada, no fish in the U.S.A. (Washington) and 5,800 fish in test fisheries (Table 6). Canadian catches included an in-river FSC (Food, Social & Ceremonial) catch of 530, Charter catch of 240 and 'other' catch of 17,400. 'Other' catch relates to unauthorized directed retention or unauthorised bycatch retention in fisheries directed at other species. In Washington State, there was no commercial catch taken. The preliminary Alaska catch of Fraser sockeye from District 104 was 4,218 fish.

DFO annually assesses the spawning ground abundance of sockeye populations in the Fraser watershed (Figure 11 and 13). In 2024, the near-final estimate of adult spawners (primarily age-4 and age-5 fish) totalled 465,300 fish, or 70% of the total run (Table 7). This escapement was 70% greater than the brood year (2020) escapement of 273,800 adults.

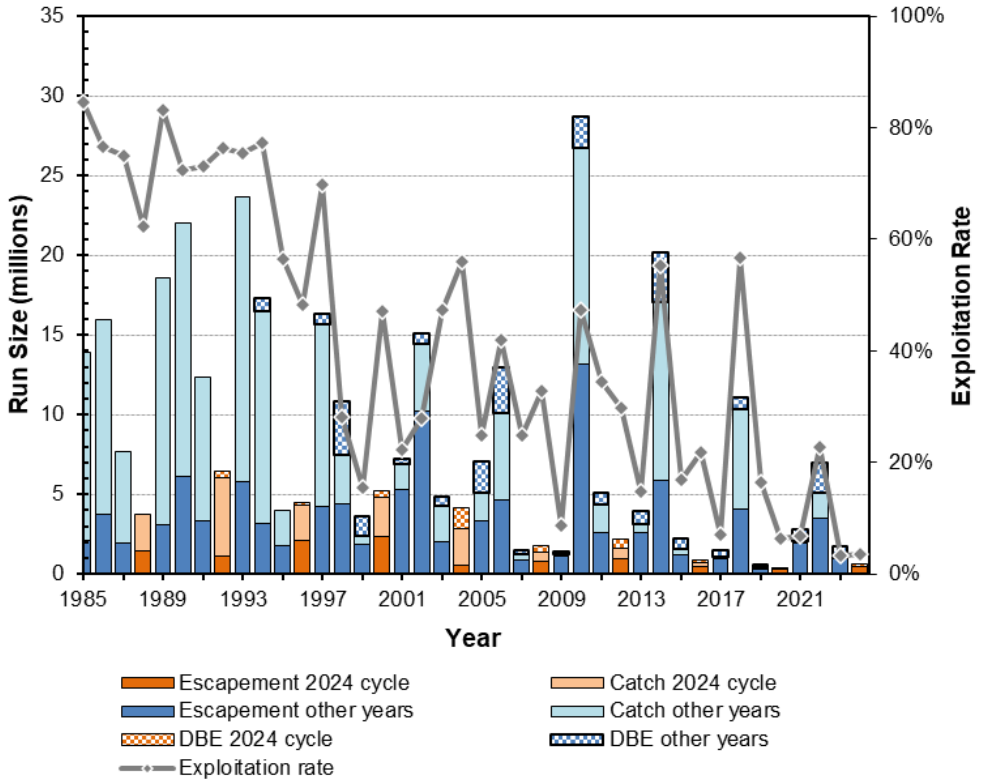

Figure 12. Total catch (excluding Alaska District 104 for 2024), escapement, difference between estimates, run size and exploitation rate for Fraser River sockeye salmon in 1985-2024, with returns on the 2024 cycle emphasized.

Spawner abundances for Early Summer, Summer and Late run were greater than those observed in the brood year (2020, Figure 14). Early Stuart spawning escapements in 2024 was only 1% of the cycle average due to high discharge levels and the Big Bar rockslide in 2020. Two Early Stuart sockeye were taken for broodstock from the natal area. For Early Summer run, the spawning escapement was more than double the brood year escapement and 25% greater than the cycle average escapement. Broodstock were collected from the Upper Bowron River, nine sockeye. For Summer run, spawning escapement was 40% greater than the brood year escapement but only 44% of the cycle average. For Late run, the spawning escapement was almost five times greater than the brood year escapement due to the large escapement of Birkenhead/Big Silver sockeye.

The overall spawning success of adult female sockeye in the Fraser watershed was 81%. The effective female spawning population in 2024 totalled 186,044 fish, which was 21% greater than the number of effective females in 2020. The DBE[17] was 166,500 fish, or 25% of the total return. As a percentage of run size for each management group, excluding Early Stuart, Summer run had the largest DBEs at 32% while the DBE for Early Summer and Late run was 12% and 11%, respectively (Tables 6 and 7). The DBE for Early Stuart was 44%. Due to a lack of in-season data, this DBE estimate is based on the preseason run size forecast instead of the in-season estimate.

Further details regarding sockeye salmon abundances, catches and spawning escapements including comparisons with the previous four-cycle years can be found in Appendix H (Tables H1 and H2).

[17] In estimates of total return, difference between estimates (DBEs) will eventually be replaced by Run-size Adjustments (RSAs) which are revisions to the total run size in cases when there is evidence that more fish returned than were accounted for in catch and escapement, e.g., evidence of en route mortality, evidence of biased or incomplete estimates of catch, Mission escapement or spawning escapement. The focus of RSAs is on providing the best assessments of total returns, i.e., recruitment. Models that relate recruitment and spawning stock are used to develop both pre-season abundance forecasts and escapement policy. The methods used to estimate RSAs are currently under review by PSC and DFO staff and members of the Fraser River Panel Technical Committee.

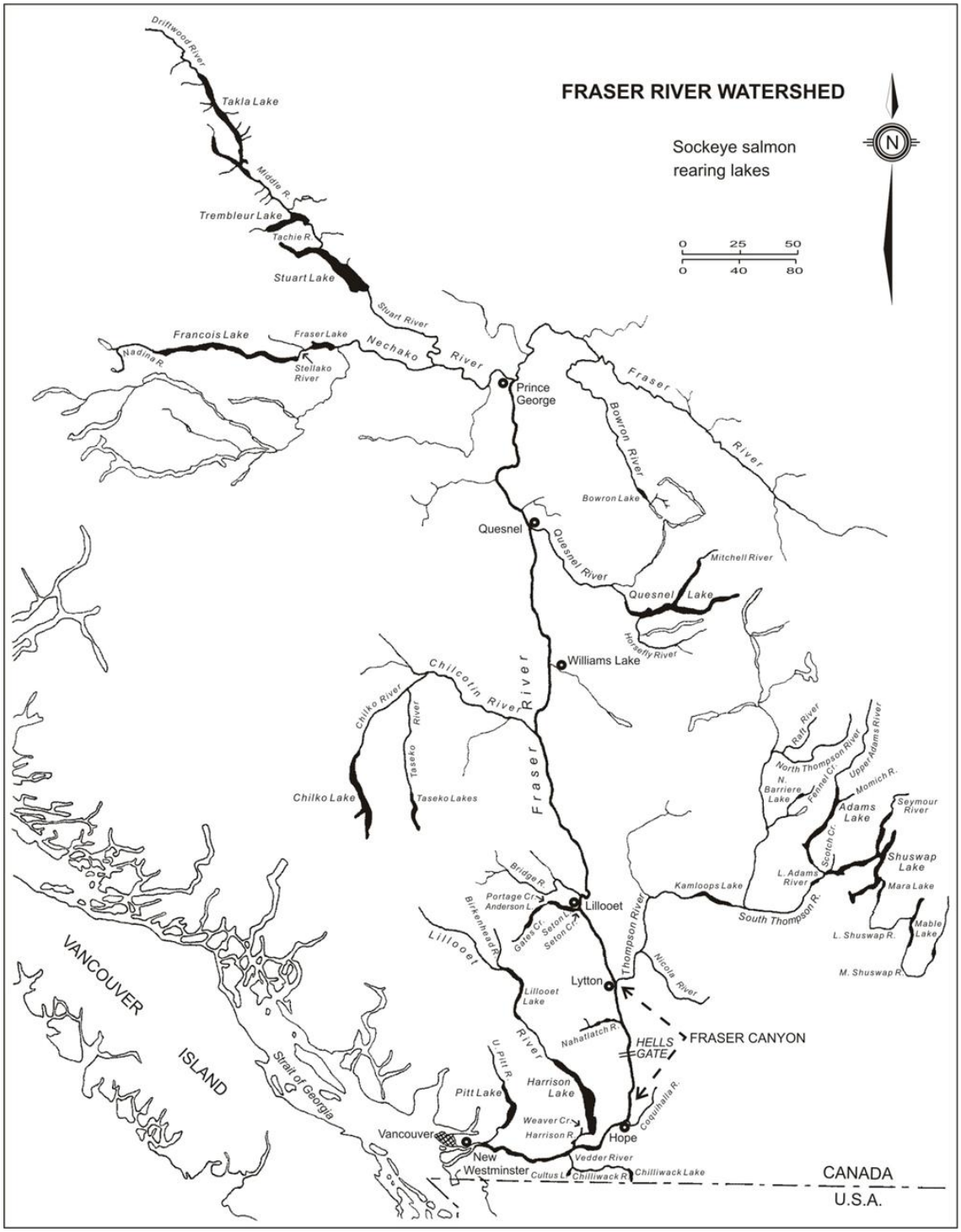

Figure 13. Sockeye salmon spawning areas in the Fraser River watershed.

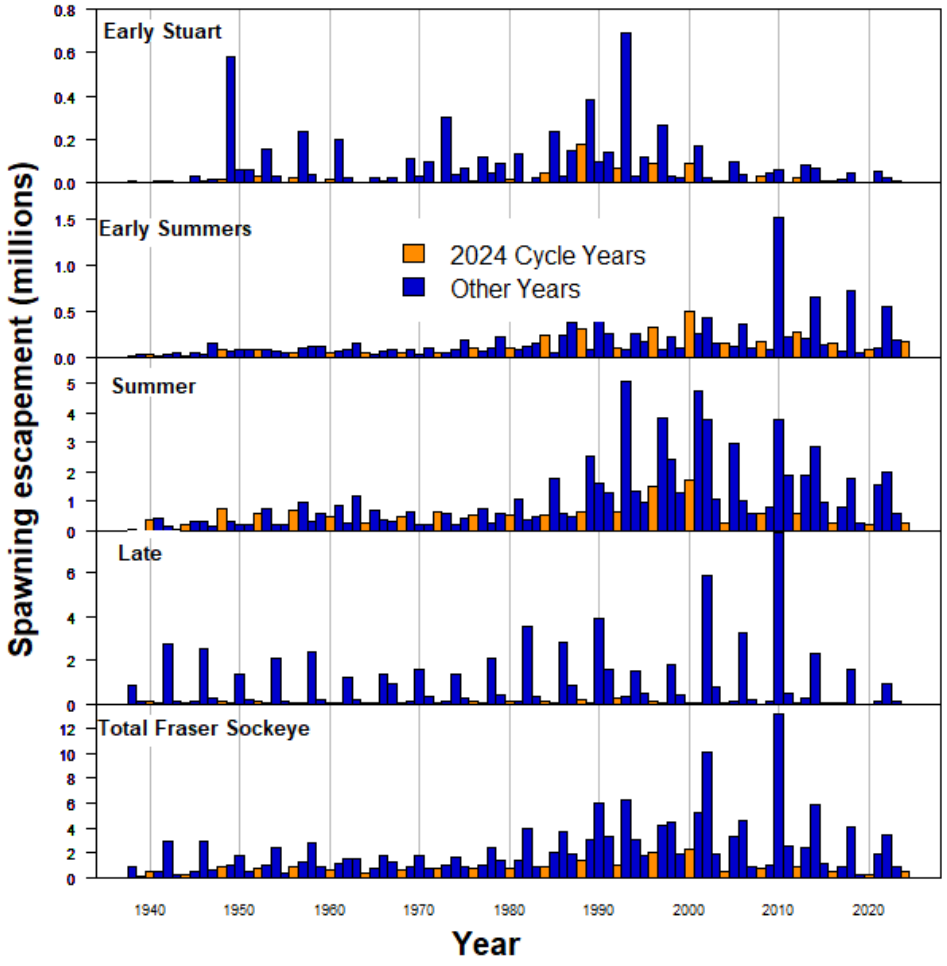

Figure 14. Annual adult spawning escapement of Fraser River sockeye salmon for each management group and for total sockeye in 1938-2024, with escapements on the 2024 cycle emphasized.

VI. ACHIEVEMENT OF OBJECTIVES

The mandate of the Fraser River Panel is to manage commercial fisheries in Panel Area waters to achieve a hierarchy of objectives. In order of importance, the objectives are to: (1) achieve spawning escapement targets for Fraser River sockeye and pink salmon as determined by the schedule provided by Canada; (2) achieve targets for international sharing of the TAC as defined in the Treaty; and (3) achieve domestic allocation goals within each country (Appendix C). In addition, the Treaty instructs the Panel to plan and manage its fisheries consistent with the provisions of other chapters of Annex IV to ensure that the conservation needs and management requirements for other species and other sockeye and pink salmon stocks are taken into account. 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 first to conservation, and then to First Nations Food, Social and Ceremonial (FSC) harvest within Canada's allocation.

A. Escapement

The Panel's first task is to achieve spawning escapement targets by stock or stock grouping. Spawning escapement targets were determined by applying Canada's spawning escapement plan to abundance estimates for each management group. Pre-season, all management groups were constrained by a LAER: 5% for Early Stuart, 7% for Early Summer and 10% each for Summer and Late run. In-season, run size abundances were less than the pre-

season forecast. There were no sockeye-directed fisheries and catches were a result of fisheries directed at other co-migrating stocks or "other" catch which is catch from unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species.

In-season monitoring of the progress toward spawning escapement targets is not directly measurable because in most cases, spawner abundances 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 escapement to-date minus catch above Mission). Final in-season PSE estimates indicate the in-season PSE targets were reached for Early Summer and Summer-run management groups: Early Summer (36% over), Summer run (46% over). For Late run, the PSE was 16% under target (Table 8). While Table 8 also reflects values for Early Stuart management group, they are based on the preseason forecast as the run size was too small for in-season assessment.

Table 8. Comparison of in-season targets and in-season estimates of potential spawning escapement (PSE) for adult Fraser River sockeye salmon in 2024.

	Final	Potential Spawning Escapement (PSE)					
Management Group	In-season Abundance Estimate	Spawning Escapement Target	Management Adjustment **	In-season PSE *** Target	PSE **** Estimate	Difference Fish	Difference %
Adult sockeye	**456,200**	**444,600**	**244,300**	**456,200**	**629,000**	**171,800**	**38%**
Early Stuart*	180	200	400	180	0	-180	-100%
Early Summer	143,000	131,400	73,600	143,000	194,000	51,000	36%
Summer	275,000	275,000	154,000	275,000	402,000	127,000	46%
Late	38,000	38,000	16,300	38,000	32,000	-6,000	-16%

* The estimate for Early Stuart is the preseason p50 forecast of abundance

** Adjustment of spawning escapement targets to achieve spawning escapement goals.

*** Spawning escapement target + MA. If the spawning escapement target + MA exceeds the total abundance, then the target equals the total abundance.

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

In terms of the achievement of post-season objectives, the total spawning ground escapement estimate of Fraser sockeye was 21% below the target (Table 9). The spawning escapement targets for Early Stuart, Summer and Late run equalled their post-season run sizes while the Early Summer-run run size exceeded the target. For Early Stuart, Summer run and Late run, the escapement targets were unattainable given the predicted en-route losses. Terminal spawning ground escapement estimates were above target by 31% for Early Summer run, but were below the target for Early Stuart, Summer, and Late run by 100%, 37% and 18%, respectively (Table 9). While the Early Stuart spawning escapement was well below target, there were a record number of jacks that returned to the area, 300, compared to previous years. The harvest of Fraser sockeye contributed to a limited extent to this failure to meet spawning escapement targets for Summer and Late run as the exploitation rate was substantially below the 10% LAERs: Summer run, 5%, and Late run, 2% (Table 7).

Table 9. Comparison of post-season spawning escapement targets and escapement estimates for adult Fraser River sockeye salmon in 2024. Post-season estimates of sockeye escapement are from spawning ground enumeration programs (DFO).

Management Group	Post-season Run-size Estimate	Spawning Escapement			
		Post-season Target	*Adult Estimate	Difference	
				Fish	%
Sockeye salmon	**668,500**	**601,200**	**473,600**	**-127,600**	**-21%**
Early Stuart	600	600	0	-600	-100%
Early Summer	198,700	131,400	172,100	40,700	31%
Summer	430,200	430,200	269,600	-160,600	-37%
Late	39,000	39,000	31,900	-7,100	-18%

* Escapement estimates include 2, 9, 165 and 57 Early Stuart, Bowron, Late Stuart and Cultus fish kept for broodstock, respectively.

Although the total sockeye return in 2024 was an improvement from 2020, it still marks the second lowest return on record and continues to reflect a decline in productivity.[18] Currently the Committee on the Status of Endangered Wildlife in Canada (COSEWIC considers eight Fraser River sockeye stocks as endangered (Early Stuart, Bowron, Taseko, Late Stuart, Quesnel, Portage, Weaver, Cultus) and two as threatened (Upper Barriere, Widgeon)[19]. Of these stocks, Early Stuart, Bowron, Taseko, Quesnel and Late Stuart all have spawning grounds above Big Bar, which based on river conditions in 2024, likely did not impede migration of any of these stock groups. However, the slide event on the Chilcotin River which substantially delayed Taseko and Chilko sockeye spawning likely impacted the spawning success of these sockeye, and also likely impacted the migration of any stocks migrating in the Fraser after the slide breached as it caused extremely turbid conditions in the Fraser main stem for most of August.

B. International Allocation

The Panel's second priority is to achieve the international allocation goals for Fraser sockeye and pink salmon. In accordance with Annex IV, Chapter 4 of the Pacific Salmon Treaty, the TAC calculations are based on the run sizes, spawning escapement targets and MAs in effect when the Panel last adopted a run size in-season (August 23). This agreement is reflected in the revised 2020 Chapter 4, Annex IV of the Pacific Salmon Treaty. The test fishing catch and Aboriginal Fisheries Exemption deductions used in this calculation are the post-season estimates, however.

Given the low run sizes in 2024, there was no international TAC for Fraser River sockeye in-season (Table 10). In Canada, there was a catch of 17,400 'other' fish, fish caught in unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species. There was also a catch of 500 sockeye largely from First Nations catch, which excludes SSFSC catch. A detailed version of the TAC calculations by management group is presented in Appendix H, Table H3.

[18] DFO. 2020. Recovery Potential Assessment for Fraser River Sockeye Salmon (*Oncorhynchus nerka*) – Nine Designatable Units – Part 1: Probability of Achieving Recovery Targets. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2020/012.

[19] COSEWIC. 2017. COSEWIC assessment and status report on the Sockeye Salmon *Oncorhynchus nerka*, 24 Designatable Units in the Fraser River Drainage Basin, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xli + 179 pp.

Table 10. Total allowable catch (TAC) and achievement of international catch shares for Fraser River sockeye salmon in 2024. TAC calculations use the in-season estimates of run size, spawning escapement target and management adjustment at the time of the last adopted run size at an in-season Panel meeting (August 23), in accordance with the revised Annex IV, Chapter 4 of the Treaty agreed to January 2020.

		Sockeye	
TOTAL ALLOWABLE CATCH			
In-season Total Run Size		**456,200**	
Deductions		**695,200**	
In-season Spawning Escapement Target		444,600	
In-season Management Adjustment		244,300	
Aboriginal Fishery Exemption (AFE)		530	
Post-season Test Fishing Catch		5,800	
Total Allowable Catch	*1, 2*	**0**	
UNITED STATES			
Washington Total Share	*3*	**0**	
Washington Share of TAC	*1*	0	16.5%
Payback		0	
Washington Catch		**0**	
Other Catch		**0**	
Deviation		**0**	
In-season Alaska Catch Estimate		0	
CANADA			
Canadian Share of TAC + U.S. Payback + AFE		**530**	
Canadian Catch (excluding SSFSC & Other Catch)		**770**	
Other Catch	*4*	**17,400**	
Deviation (excluding SSFSC)		**-17,700**	

1 TAC and Washington sockeye share according to Annex IV, Chapter 4 of the Pacific Salmon Treaty.

2 TAC may not equal the total run minus total deductions shown due to adjustments required when the run size of individual management groups is less than the nominal deductions. A more detailed TAC calculation showing these intermediate calculations is shown in the Appendix.

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).
Pink: 25.7% of the TAC - payback (maximum 5% of share).

4 May include unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species

C. Domestic Allocation

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

In the U.S., there was no sockeye catch in Washington, but 4,200 Fraser sockeye were caught in Alaska. In Canada, First Nations catch and 'other' sockeye catch (unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species) accounted for 500 and 17,400 fish, respectively. An additional 200 Fraser River sockeye salmon were caught in domestic Chinook and chum test fisheries.

D. Conservation of Other Stocks and Species

Non-target stocks and species are caught in Panel Area fisheries directed at Fraser River sockeye and pink salmon. The conservation needs and management requirements for these stocks and species caught incidentally in fisheries regulated by the Fraser Panel are taken into account through a variety of bilateral and domestic processes associated with the implementation of Chapter 4 (Fraser River sockeye and pink salmon) and other Chapters of Annex IV. A comprehensive summary of all the methods in which bycatch impacts are taken into account is beyond the scope of this report, but we provide a few examples below. In the U.S., the Pacific Fishery Management Council takes into account modelled bycatch of Chinook and coho salmon in Fraser Panel regulated sockeye and pink-directed fisheries to ensure consistency with Chapters 3 (Chinook) and 5 (coho) of Annex IV. Similarly, Canada, through its Integrated Fisheries Management Plan for South Coast salmon fisheries, specifies window closures for sockeye and pink-directed fisheries in the Fraser River and these closures are regularly implemented to protect Chinook and coho salmon. As there were no directed commercial Fraser sockeye fisheries, there was no bycatch of non-Fraser sockeye salmon or pink salmon or other salmon species.

VII. ALLOCATION STATUS

Annex IV, Chapter 4, (paragraph 8 (c)(iv)) specifies that *the U.S. share will not be adjusted for an overage resulting from TAC reductions after the scheduling of the last Fraser River Panel approved U.S. fishery of the season.* The resulting calculations indicate that while there was no sockeye catch in 2024, there still remained a payback of 2,770 sockeye resulting from the pink-directed fisheries in 2023 (Table 11). As there were no directed commercial fisheries in the 2024 season, the Panel agreed that the 2,770 landed sockeye in Panel regulated fisheries directed at Fraser River pink salmon in 2023 would be carried over as payback to 2025.

Table 11. Allocation status for Fraser River sockeye salmon in 2020-2024.

	2020 (Sep 1)	2021 (Sep 28)	2022 (Aug 18)	2023 (Sept 27)	2024 (August 23)
TOTAL ALLOWABLE CATCH					
Total Run Size	293,000	2,553,000	7,274,000	1,652,000	456,200
Escapement and other deductions	293,000	2,377,260	4,940,480	1,652,000	456,200
Total Allowable Catch:	0	175,740	2,333,520	0	0
UNITED STATES					
Washington Catch	0	20	352,310	2,770	0
Washington Share (excldspayback)	0	29,000	385,030	0	0
Deviation:	0	-28,980	-32,720	2,770	0
Cumulative Allocation Status:	**470****	**470****	**0****	**2,770****	**2,770**
CANADA					
Catch	11,360	80,230	1,082,410	24,450	18,190
Share + Aboriginal Exemption	11,290	546,740	2,053,737	0	530
Deviation:	70	-466,510	-971,327	24,450	17,660

** Washington share of the TAC according to Annex IV of the Pacific Salmon Treaty:

2020: No payback was generated in 2020, but by Panel agreement 470 sockeye were carried forward from the 2019 season

2021: No payback was generated in 2021, but by Panel agreement 470 sockeye were carried forward from the 2019 season

2022: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks. Allocation status based on TAC when Panel made the last decision about U.S. fisheries in 2022 (Aug 18).

2023: Shall not exceed 16.5% for Fraser sockeye and 25.7% for Fraser pinks. As there as no TAC for sockeye salmon, any sockeye caught in pink-directed fishereis generated an overage

2024: Shall not exceed 16.5% for Fraser sockeye

IX. APPENDICES

APPENDIX A: GLOSSARY OF TERMS AND ABBREVIATIONS

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

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

Cycle line: A series of years associated with a cohort of Fraser sockeye assuming spawners are 4 years old. A cycle line of a particular year includes every 4th year (e.g., 2008, 2012, 2016).

Demonstration fishery: A Canadian commercial fishery designed to test particular gear configurations or explore the feasibility of harvests either in non-traditional areas or by non-traditional gear. A limited number of licenses are typically granted to permit the conduct of such fisheries.

Difference between estimates (DBE): Difference between estimates of spawning escapement (PSE) and potential spawning escapement (SE) (DBE=SE-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. The proportional DBE (pDBE) is estimated by dividing the difference between estimates by the potential spawning escapement (pDBE = DBE/PSE) and is often shown as a percentage, such that %DBE = 100 * pDBE. The formulas pDBE = (1/(1+pMA))-1, and pMA= (1/(1+pDBE)-1 can be used to convert between pDBEs and pMAs.

Northern 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.

Effective Female Spawners: The total number of female spawners multiplied by a measure of spawning success that relates to the fraction of females subsampled in a population that either died with all of their eggs (0% spawning), none of their eggs (100% spawning success) or with an intermediate fraction of their eggs (50% spawning success). Carcass surveys conducted on the spawning grounds endeavour to representatively sample a portion of the available carcasses and assign them to one of the above three categories.

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

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

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

Low Abundance Exploitation Rate (LAER): The purpose of managing a sockeye management group in a LAER situation is to permit bycatch of that stock group in fisheries directed at other management groups or species with available surpluses (e.g., Summer-run sockeye, 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-run, Summer-run, 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, defined by when half the total Mission escapement (usually identified by individual stock or stock group) is estimated to have passed Mission.

Reconstructed Mission date: An index of in-river migration timing based on when half of the total reconstructed run to Mission (Mission escapements plus catches seaward of Mission) is estimated to have been available to pass 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 Escapement or 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 estimated by dividing the CPUE by catchability using data from in-river test fisheries.

Non-retention: In fisheries where one species is targeted but bycatch 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 2015 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. Non-target species that are released are assigned gear-specific fishing induced mortality rates (FIMs; see above), that are accounted for along with landed catches in estimates of total exploitation rates.

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 escapement estimate minus in-river catch upstream of Mission. If there were no en-route mortalities or estimation errors in Mission escapement, 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): Adjustments to the total return in cases when there is evidence that the number of fish returning deviate from that 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.

Single Stock FSC (SSFSC): FSC fisheries for individual Fraser sockeye spawning populations that may be considered if the projected number of spawners is expected to exceed the freshwater productive capacity of the system.

Spawning Escapement (SE)

Spawning escapement or Net escapement: Spawning escapement of adult male and female spawners and jack spawners (precocious age 3 males) as estimated through assessment programs conducted on the spawning grounds, or projected from other data when such programs are not conducted in all areas (e.g., a portion of Quesnel spawners was not assessed on the spawning grounds in 2002). Such escapement numbers include losses from pre-spawn mortality on the spawning grounds, however, pre-spawn mortality (fraction of females which die but retain some portion of their eggs) 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	MA: Management Adjustment
ARIS: Adaptive Resolution Imaging Sonar	pDBE: Proportional difference between estimates
BC: British Columbia	pMA: Proportional Management Adjustment
COSEWIC: Committee on the Status of Endangered Wildlife in Canada	PSC: Pacific Salmon Commission
CPUE: Catch per Unit Effort	PSE: Potential Spawning Escapement
DBE: Difference Between Estimates	RAMP: Reflex Action Mortality Predictors
DFO: Fisheries and Oceans Canada	RSA: Run Size Adjustment
DIDSON: Dual-frequency IDentification SONar	SE: Spawning Escapement
EO: Economic Opportunity	SET: Spawning Escapement Target
FRP: Fraser River Panel	SSFSC: Single Stock Food, Social and Ceremonial
FRPTC: Fraser River Panel Technical Committee	TAC: Total Allowable Catch
FRSSI: Fraser River Sockeye Spawning Initiative	TAM: Total Allowable Mortality
FSC: Food, Social and Ceremonial	TNG: Tŝilhqot'in National Government
IFMP: Integrated Fisheries Management Plan	UFFCA: Upper Fraser Fisheries Conservation Alliance
JS: Johnstone Strait	WDFW: Washington Department of Fish and Wildlife

APPENDIX B: 2024 PRE-SEASON FORECASTS AND SPAWNING ESCAPEMENT TARGETS FOR FRASER RIVER SOCKEYE SALMON

Table B1. Pre-season forecasts for Fraser River sockeye salmon in 2024. (Provided to the Panel by Fisheries and Oceans Canada).

Run timing group	Forecast	Probability that Return will be at/or Below Specified Run Size				
Stocks	Model	10%	25%	50%	75%	90%
Early Stuart	*Ricker (Ei)*	80	100	200*	300	400
Early Stuart Hatchery*		500	800	1,000	2,000	2,000
Early Summer Total		58,000	93,000	159,000	281,000	465,000
Total excluding misc. stocks		37,000	66,000	121,000	226,000	379,000
Bowron	*RickerCyc*	400	700	1,000*	2,000	4,000
Upper Barriere (Fennell)	*PowerBasic4Sibling5*	1,000	3,000	5,000	12,000	23,000
Gates	*Ricker (Pi)*	9,000	15,000	27,000	47,000	76,000
Nadina	*Ricker(FrDpeak)4 Sibling5*	18,000	33,000	65,000	127,000	216,000
Pitt	*LarkinBasicCyc*	7,000	10,000	16,000	24,000	36,000
Scotch	*Larkin*	1,000	3,000	5,000	10,000	18,000
Seymour	*Ricker (Pi)*	700	1,000	2,000	4,000	7,000
Misc (EShu)	*R/S*	100	100	700*	1,000	2,000
Misc (Taseko)	*R/S*	10	20	70*	90	100
Misc (Chilliwack)	*Ricker4Sibling5*	20,000	26,000	34,000	48,000	71,000
Misc (Nahatlatch)	*R/S*	500	900	3,000	6,000	12,000
Summer Total		101,000	192,000	379,000	774,000	1,554,000
Total excluding misc. stocks		101,000	192,000	379,000	772,000	1,551,000
Chilko	*RickerCyc4Sibling5*	51,000	96,000	176,000	317,000	564,000
Late Stuart	*R1C*	2,000	5,000	12,000	33,000	80,000
Quesnel	*R2C*	300	900	3,000	9,000	26,000
Stellako	*R2C4Sibling5*	25,000	39,000	65,000	107,000	169,000
Harrison	*TSA3Sibling4*	17,000	41,000	106,000	277,000	663,000
Raft	*PowerBasicCyc*	6,000	10,000	17,000	29,000	51,000
Misc (N. Thomp. Tribs)	*R/S*	50	80	200*	500	700
Misc (N. Thomp River)	*R/S*	50	80	200*	500	700
Misc (Widgeon)	*R/S*	20	60	80*	1,100	1,600
Late Total		8,000	15,000	29,000	66,000	154,000
Total excluding misc. stocks		8,000	15,000	29,000	63,000	150,000
Cultus	*PowerJuv(Pi)*	40	70	100*	300	600
Late Shuswap	*Ricker(Pi)4Sibling5*	100	500	2,000	10,000	42,000
Portage	*Ricker (Pi)*	30	80	200*	600	1,000
Weaver	*RickerCyc*	400	700	2,000	5,000	19,000
Birkenhead	*Ricker (Ei)*	7,000	13,000	24,000	46,000	87,000
Misc Harrison/Lillooet	*R/S*	50	100	200*	3,000	4,000
TOTAL SOCKEYE SALMON		167,000	299,000	567,000	1,121,000	2,173,000
Total Sockeye excluding misc. stocks		147,000	272,000	529,000	1,061,000	2,081,000

Table B2. Spawning escapement plan* for Fraser River sockeye and pink salmon in 2024. (Provided to the Panel by Fisheries and Oceans Canada and based on Fraser River Sockeye Spawning Initiative (FRSSI) guidelines with input from domestic consultations including the Fraser Salmon Management Board Joint Technical Committee).

Management Unit		Pre-season Forecast Return				
		p10	p25	p50	p75	p90
	lower ref. pt. (w misc)	108,000	108,000	**108,000**	108,000	108,000
	upper ref. pt. (w misc)	135,000	135,000	**135,000**	135,000	135,000
Early Stuart	forecast	570	940	**1,567**	2,220	2,696
	TAM Rule (%)	0%	0%	**0%**	0%	0%
	Escapement Target	570	940	**1,567**	2,220	2,696
	MA	700	1,100	**1,800**	2,600	3,200
	Esc. Target + MA	1,270	2,040	**3,367**	4,820	5,896
	LAER	5%	5%	**5%**	5%	5%
	Available ER at Return	0%	0%	**0%**	0%	0%
	Max. Allowable ER	5%	5%	**5%**	5%	5%
	Max. Allowable Harvest	29	47	**78**	111	135
	2024 Performance					
	Projected S (after MA)	200	400	**700**	1,000	1,200
	BY Spawners	30	30	**30**	30	30
	Proj. S as % BY S	667%	1333%	**2333%**	3333%	4000%
	cycle avg S	42,694	42,694	**42,694**	42,694	42,694
	Proj. S as % cycle S	0%	1%	**2%**	2%	3%

Management Unit		Pre-season Forecast Return				
		p10	p25	p50	p75	p90
Early Summer (w/o RNT)	*lower ref. pt. (w misc)*	154,800	140,400	**131,200**	124,300	122,500
	upper ref. pt. (w misc)	309,600	280,700	**262,300**	248,600	245,000
	forecast (incl. misc)	57,795	92,596	**158,950**	281,036	464,523
	TAM Rule (%)	0%	0%	**17%**	50%	50%
	Escapement Target	57,795	92,596	**131,200**	140,518	232,262
	MA	34,100	51,900	**73,500**	78,700	137,000
	Esc. Target + MA	91,895	144,496	**204,700**	219,218	369,262
	LAER	7%	7%	**7%**	7%	7%
	Available ER at Return	0%	0%	**0%**	22%	21%
	Max. Allowable ER	7%	7%	**7%**	22%	21%
	Max. Allowable Harvest	4,000	6,500	**11,100**	61,800	95,300
	2024 Performance					
	Projected S (after MA)	34,100	54,700	**94,000**	139,200	234,300
	BY Spawners	80,300	80,300	**80,300**	80,300	80,300
	Proj. S as % BY S	42%	68%	**117%**	173%	292%
	cycle avg S	144,327	144,327	**144,327**	144,327	144,327
	Proj. S as % cycle S	24%	38%	**65%**	96%	162%

*The spawning escapement target for Early Stuart includes the hatchery component. For the purposes of this report only the forecast component is referenced in the tables and figures.

Table B2, continued on next page

Table B2, continued.

Management Unit		Pre-season Forecast Return				
		p10	p25	p50	p75	p90
Summer	*lower ref. pt. (w misc)*	769,600	814,000	**891,400**	1,001,700	1,119,400
(w. RNT & Har)	*upper ref. pt. (w misc)*	1,539,300	1,628,000	**1,782,800**	2,003,300	2,238,700
	forecast	101,268	191,874	**379,247**	774,186	1,554,481
	TAM Rule (%)	0%	0%	**0%**	0%	28%
	Escapement Target	101,268	191,874	**379,247**	774,186	1,119,400
	MA	9,100	17,300	**34,100**	69,700	100,700
	Esc. Target + MA	110,368	209,174	**413,347**	843,886	1,220,100
	LAER	10%	10%	**10%**	10%	10%
	Available ER at Return	0%	0%	**0%**	0%	22%
	Max. Allowable ER	10%	10%	**10%**	10%	22%
	Max. Allowable Harvest	10,127	19,187	**37,925**	77,419	334,381
	2024 Performance					
	Projected S (after MA)	80,800	151,500	**294,800**	590,900	1,018,200
	BY Spawners	186,916	186,916	**186,916**	186,916	186,916
	Proj. S as % BY S	43%	81%	**158%**	316%	545%
	cycle avg S	667,166	667,166	**667,166**	667,166	667,166
	Proj. S as % cycle S	12%	23%	**44%**	89%	153%

Management Unit		Pre-season Forecast Return				
		p10	p25	p50	p75	p90
Late	*lower ref. pt. (w misc)*	302,000	302,000	**302,000**	302,000	302,000
(w/o Har)	*upper ref. pt. (w misc)*	604,000	604,000	**604,000**	604,000	604,000
	forecast	8,060	14,666	**28,958**	65,541	154,011
	TAM Rule (%)	0%	0%	**0%**	0%	0%
	Escapement Target	8,060	14,666	**28,958**	65,541	154,011
	MA	3,600	6,900	**15,600**	41,900	130,900
	Esc. Target + MA	11,660	21,566	**44,558**	107,441	284,911
	LAER	10%	10%	**10%**	10%	10%
	Available ER at Return	0%	0%	**0%**	0%	0%
	Max. Allowable ER	10%	10%	**10%**	10%	10%
	Max. Allowable Harvest	806	1,467	**2,896**	6,554	15,401
	2024 Performance					
	Projected S (after MA)	5,000	8,900	**17,000**	35,800	74,300
	BY Spawners	6,563	6,563	**6,563**	6,563	6,563
	Proj. S as % BY S	76%	136%	**259%**	545%	1132%
	cycle avg S	445,337	445,337	**445,337**	445,337	445,337
	Proj. S as % cycle S	1%	2%	**4%**	8%	17%
Allowable Harvest (TF, US, CDN)		14,961	27,201	**51,999**	145,884	445,217
Total projected spawners		120,100	215,500	**406,500**	766,900	1,328,000

2024 Fraser River Panel Management Plan

Agreed July 12, 2024[1]

The Fraser River Panel has adopted the 2024 Fraser River Management Plan (Management Plan) as per the Pacific Salmon Treaty (PST), Annex IV, Chapter 4, paragraph 5.

> *"To support Fraser River Panel decisions including those related to fishery management, the Panel shall develop test fishing plans, fishing plans, and in-season decision rules as may be necessary to implement this Chapter. …"*

The Management Plan documents the Fraser River Panel's bilateral management objectives and key pre-season information regarding run size forecasts and escapement plans. The Management Plan also documents the Panel's bilateral pre-season decisions about test fishing plans, fishing plans, and in-season decision rules.

Objective

1. The Fraser River Panel recalls our bilateral management objectives in Chapter 4, paragraph 10:

   "The Parties agree that Panel management actions should meet the following objectives, listed in order of priority:
   (a) obtain spawning escapement goals by stock or stock grouping;
   (b) meet Treaty defined international allocation; and
   (c) achieve domestic objectives."

Information shared bilaterally pre-season

Run Size Forecast

2. Canada has provided the Fraser River Panel with run-size forecasts for Fraser River Sockeye salmon (Fisheries and Oceans Canada, 2024. *Pre-Season Run Size Forecast for Fraser River Sockeye Salmon in 2024.* 5a_KD_2024Forecast_FRP Presentation Feb 13.pdf).
3. The median forecast for the total Fraser Sockeye return is 567,000 fish, which is less than 18 per cent of the 30-year average run size. There is a one in ten chance that the actual number of returning Sockeye will be at or below 167,000 fish, and there is a one in ten chance that the actual number of returning Sockeye will be at or larger than 2,173,000 fish. The 2024 total run size forecast is the lowest forecast on record.
4. The median forecasts for the four different Stock Management Groups described in Table 1.

Table 1. Fraser River Sockeye Salmon forecast. The first column reports median (50% probability) forecasted run size by Stock Management Group. The forecasted run size for the 10th and 90th percentiles is also reported.

Stock Management Group	Median (p50)	10th percentile (p10)	90th percentile (p90)
Early Stuart	200	80	400
Early Summer	159,000	58,000	465,000

[1] Panel Chair, Mickey Agha, and Vice-Chair, Adam Keizer agreed to the 2024 Fraser River Panel Management Plan for 2024 season.

Stock Management Group	Median (p50)	10th percentile (p10)	90th percentile (p90)
Summer	379,000	101,000	1,554,000
Late Run	29,000	8,000	154,000

5. Forecast parameters of note that informed management scenarios include:
    - Chilko and Harrison sockeye represent 50% of the total Fraser sockeye return and 74% of the Summer-run return at the median forecast.
    - 10 of the 28 forecasted stocks have a median forecast equal to or less than 1,000 sockeye.

Escapement Plan

6. Pursuant to Chapter 4, paragraph 4, Canada established the annual Fraser River Sockeye and Pink salmon spawning escapement targets for the purpose of calculating the annual Total Allowable Catch (TAC). The harvest rule parameters of the escapement plan are described in the Integrated Fishery Management Plan for Southern B.C. Salmon published by Fisheries and Oceans Canada (Fisheries and Oceans Canada. 2024. Southern Salmon Integrated Fisheries Management Plan 2024/2025. 23-2367: 628p.) and Table 2.

Table 2. Fraser River Sockeye Salmon Escapement Plan Parameters.

Stock Management Group	Low Abundance Exploitation Rate (LAER)	Total Allowable Mortality (TAM) Cap	Lower Fishery Reference Point	Upper Fishery Reference Point
Early Stuart	5%	20%	108,000	135,000
Early Summer (without misc)	7%	50%	100,000	200,000
Summer (without misc)	10%	50%	640,000	1,280,000
Late Run (without misc)	10%	50%	300,000	600,00

7. Low Abundance Exploitation Rates (LAER) are not intended to create directed harvest opportunities in mixed-stock areas, do not contribute to international TACs, and represent maximum allowable fishing-related impacts (including test fisheries and release mortalities).

Pre-season Agreement

Test Fishing Plan

8. The Fraser River Panel adopted a test fishing plan that considers information needs, run size and timing forecasts, and program operating costs. Further details are noted in Appendix A.
9. The Fraser River Panel agrees to the test fishing plan in Table 3.

Table 3. Fraser River Panel Test Fishing Plan noting test fishery commencement and conclusion.

Test Fishery	Start Date	End Date
Area 20 gillnet	Not operated in 2024	
Area 20 purse seine	July 15	August 5

Test Fishery	Start Date	End Date
Area 4b, 5 gillnet	Not operated in 2024	
Brownsville Bar	July 8	August 25
Whonnock gillnet	June 28	September 10
Area 7 reefnet	10 observation days	-
Area 12 Round Island gillnet	Not operated in 2024	
Area 12 Blinkhorn purse seine	July 14	August 4
Area 13 purse seine	Not operated in 2024	
Qualark gillnet	July 18	September 6

Pre-season Fishing Plan

10. The Fraser River Panel recalls the methodology for calculating the TAC, pursuant to Chapter 4, paragraph 3, where the TAC is the remaining portion of the "*…aggregate Fraser sockeye run after the spawning escapement targets established, … by applying Canada's pre-season escapement plan (subject to any adjustments made pursuant to paragraph 3(b)), the agreed Fraser River Aboriginal Exemption (AFE), and the retained catch in Panel-authorized test fisheries are deducted."*
11. The Fraser River Panel agrees to use the proportional Management Adjustments (pMA), by Stock Management Group, for Sockeye salmon in Table 5. The pMAs are based on pre-season assumptions about Sockeye marine migration timing, recent late run delay behavior, and an anticipated en-route mortality due to predicted warm water temperatures which will be exacerbated by low discharge.

Table 4. Fraser River Panel Adopted Pre-season pMAs for Fraser River Sockeye.

Stock Management Group	Adopted pre-season pMA
Early Stuart	1.17
Early Summer	0.56
Summer	0.28
Late Run	0.49

12. Pursuant to Chapter 4, paragraph 13(a), the Fraser River Panel agrees to adopted median run size (i.e., p50) forecast provided by Canada for management purposes until in-season updates of run size become available.
13. At the median run size forecast, no TAC is available and no directed harvest of Sockeye is planned. In the event that international TAC becomes available, fisheries plans will be discussed by the Fraser River Panel. Fisheries will be based on in-season information and will be conducted respecting the conservation concerns for both Parties on co-migrating stocks and species.

In-season Decision Rules

14. The Fraser River Panel agrees on the following in-season decision rules:
    a. Proportional Management Adjustments may be adjusted in season, as necessary, using the process described by Secretariat staff and noted in Table 6 (PSC, 2024. *2024 Management Adjustments*. 3f_2024 Management Adjustments.pdf). A Threshold

Approach will be utilized for Early Stuart and Summer run, should extreme in-season environmental conditions occur.

Table 5. Methodology to change pMAs In-season for Fraser River Sockeye salmon.

Stock Management Group	In-season adjustment methodology
Early Stuart	Threshold Approach
Early Summer	All-years Median (1977-2023)
Summer	Threshold Approach
Late Run	Non-Dominant Years Median (1996-2023)

b. The Secretariat will make recommendations for in-season run size to the Panel.
c. Harvestable surplus and international TAC will be calculated pursuant to Chapter 4, paragraph 3.
d. Given the primary objective of obtaining spawning escapement goals by stock or Stock Management Group, the Fraser River Panel, to the extent practical, shall strive to concentrate harvest on the management group (or groups) that have the most harvestable surplus.
    i. It is understood that a small but acceptable (SBA) rate of incidental harvest on one or more overlapping management groups, with little or no TAC, may occur.
        1. Should harvestable surplus materialize in season, both National Sections of the Fraser River Panel agree to have discussions around SBA parameters and associated PST-guided notification process in-season.
e. During the 2024 season and into the 2025 pre-season, the National Sections of the Fraser River Panel each agree to develop a framework for reaching agreement on annual "small but acceptable" (pursuant to Chapter 4, paragraphs 3(e) and 3(g)) levels of incidental catch in Fraser River Panel fisheries targeting harvestable surpluses of Fraser River Sockeye and Pink salmon.
    i. For clarity, paragraph (e) is consistent with the *Fraser River Panel Bilateral Response to "PSC Secretariat Report – Review of August 18 and 25, 2023 Fraser River Panel fisheries proposals, decisions and subsequent consequences"* tabled by the Fraser River Panel in February 2024 (Appendix B)
f. National Sections of the Fraser River Panel each agreed to adopt the *p50 (base case) modeling scenario* (PSC, 2024. *p50_June.* Model Summary Handout_p50_June.pdf) to begin the 2024 season. This scenario includes: the median run size forecasts, by Stock Management Group; the 2024 escapement objectives by Stock Management Group and adjusted for the agreed-to pre-season pMAs; the agreed-to test fishery deductions; and does not include any planned fisheries by either National Section.

Summary of April FRP meeting test fishing decisions for the 2024 season

May 9, 2024

Test fishing schedule:

Panel approved test fishing schedule for 2024:

	Agreed Schedule	
Test Fishery	**Start**	**End**
Area 20 gillnet	Not operated for 2024	
Area 20 purse seine	July 15	August 5
Brownsville Bar	July 8	August 25
Whonnock gillnet	June 28	September 10
Area 7 reefnet	10 observation days	
Area 12 round island gillnet	Not operated for 2024	
Area 12 Blinkhorn purse seine	July 14	August 4
Qualark gillnet	July 18	September 6

Live Sampling

Schedule

- PSC Staff are planning to run an experimental trial of live-sampling and releasing sockeye in the Area 20 purse seine test fishery. The schedule is subject to change, but the most likely scenario is:
    - July 15-16: Sample and land sockeye (targeting 120 sockeye per day) in Port Renfrew.
    - July 17-20: Live sample (targeting 120 sockeye per day) and release all sockeye caught.
    - July 21 onward: Return to sampling and landing 120 sockeye per day in Port Renfrew.
    - Assess the success of the live-sampling trial and determine whether a second, 4-day live-sampling period can occur prior to the end of the test fishery. PSC Staff cannot guarantee that a second live-sampling period will occur as it will depend on the success of the initial trial and the availability of personnel required.
- There will be no live sampling in Area 12 or in any of the in-river test fisheries.

Associated Costs

- Live sampling will require a one-time startup cost (purchase of sampling and fish care equipment) of up to $5,000.
- Each day of live sampling will increase daily program costs by up to $1,500, and $1,000 in program revenue per day will be foregone as sampled sockeye will be released[1].

Reduction to Sockeye Mortality

- Each day of live sampling will result in an expectation of approximately 96 additional Fraser sockeye reaching the lower Fraser River, assuming a test fishing catch of 120 sockeye[1]. This

[1] Estimates of foregone revenue and reduction in fishing related mortality are dependant on the Area 20 purse seine's ability to reach its sample target of 120 sockeye per day. Daily sockeye catch and release estimates of 120 pieces (due to higher abundances or catchability) would result in a increase to the lost revenue estimate. Estimates assume an average of $3.00 per pound for sockeye and a 5.3 pound average per fish.

assumes a mortality of 20% associated with the live sampling, but does not take into account additional en route mortality that is expected to occur.

Loss of Information

- Lengths, weights, and sex ratio cannot be obtained during the live-sampling periods in Area 20. Sex ratio and length information will still be obtained in Area 12 during the live sampling period. Loss of this data in Area 20 will reduce the quality of the PSC's biological data time-series but is not expected to impact the ability of the Panel to make in-season fisheries management decisions.

Summary

- For the 2024 season, the PSC will not operate the marine gill nets. A four-day live sampling program will be conducted during the Area 20 purse seine program. The 4-day live sampling trial results in an increase to the expected test fishing program financial deficit by $15,000. A second 4-day live-sampling period would increase the deficit by an additional $14,000. In addition, the number of Fraser sockeye, live sampled, expected to reach the lower Fraser River will be increased by up to 384 individuals assuming 120 sockeye are caught daily during the 4-day live sampling.

Appendix B

Fraser River Panel Bilateral Response to "PSC Secretariat Report – Review of August 18 and 25, 2023 Fraser River Panel fisheries proposals, decisions and subsequent consequences"

Introduction

In response to fishery decisions made at the August 18 and August 25 meetings of the Fraser River Panel (the Panel), the Canadian National Section requested that the Pacific Salmon Commission (PSC) Secretariat prepare a report on the circumstances of the decisions and their consequences. This report, pursuant to Chapter 4, section 13(e) of the Pacific Salmon Treaty (PST), was submitted to the Panel on December 21, 2023. PSC staff presented the report at a January 9, 2023 PSC meeting in Seattle. The Canadian and United States (U.S.) National Sections offer the following comments about the report "Review of August 18 and 25, 2023 Fraser River Panel fisheries proposal, decisions, and subsequent consequences."

Both the Canadian and U.S. Sections appreciate the work of the PSC Secretariat to provide a detailed review to the August 2023 fishery decisions. The Report provides some helpful context and makes some useful recommendations to move forward.

Both National Sections of the Panel recognize the complexities of Fraser River sockeye management and rely on the PST to guide decision-making processes and resolve disagreements between the two National Sections.

Disagreement

In 2023, Canada and the U.S. disagreed on the interpretation of the PST, Chapter 4, section 3(g), in particular reference to "small but acceptable" and "to the extent practical." This resulted in the Panel approving two U.S. pink salmon fishery proposal on August 18 and 25, with the Canadian National Section dissenting.

The U.S. interpretation of Chapter 4 language is that incidental harvest of sockeye, in instances where there is no international sockeye Total Allowable Catch (TAC), is contemplated in section 3 (g). That the use of the term "harvest" is a purposeful acknowledgment of the expectation that bycatch of sockeye, when small enough, is allowed. The U.S. stated in their August 18 rationale letter, supporting retention of incidental sockeye salmon for tribal Ceremonial and Subsistence use, that U.S. tribes have cultural beliefs, enshrined in their traditional laws and fishing regulations that require their fishers to retain all catch, including bycatch, for sampling and to prevent wastage of the resource. Further, the U.S. considered the incidental harvest rate of sockeye small but acceptable in accordance with the PST. Following the August 25 Panel meeting, the US provided a rationale letter and prosecuted a pink-directed fishery Treaty Tribal and All Citizen fishery with no sockeye retention. The U.S. stated that U.S. fisheries would result in a low level of sockeye encounters and fishing-induced mortalities (FIMs) given the sockeye marine run timing and low U.S. fishery effort. The U.S. considered the incidental harvest rate (catch and release) of sockeye small but acceptable in accordance with the PST. Ultimately, the total sockeye mortality from decisions on August 18 and 25 resulted in 3,243 fish (including 872 FIMs), representing a sockeye exploitation rate of 0.19%. The U.S. also interprets the term "to the extent practical", in reference to planning fisheries to minimize incidental harvest of sockeye, to mean the

proposal, as evaluated by the PSC staff, results in very low incidental impacts (for consideration of acceptability) while remaining within available TAC on the target species or management group.

As discussed in our 2023 pre-season meetings, both Parties agree that the definitions depend on the context of a fishery proposal. Two key contextual considerations for the Canadian National Section are (1) stock abundance relative to escapement goals, and (2) that fishery proposals, to the extent practical, are designed to minimize incidental harvest. The Canadian National Section's view of the 2023 fishery decision is summarized:

- Canada's view of "small but acceptable" incidental harvest in the events referenced is that a small amount of Fraser sockeye mortality will occur in U.S. Fraser pink-directed fisheries in the absence of sockeye TAC, and that the parties must negotiate what is considered 'small'.
- When fisheries are designed, that they be designed to the extent practical, to minimize mortality to align with what is deemed acceptable.
- Choices of fishery area, gear, effort, and bycatch release could be considered to minimize impacts to Fraser River sockeye by reducing encounters and/or minimizing mortalities during the development of U.S. Fraser River pink directed fishery proposals These measures should prioritize meeting escapement targets for sockeye salmon, and not incur unnecessary sockeye mortalities.
- On August 18, the U.S. fishery proposal was three days earlier than pre-season planning process identified, there was significant uncertainty in the run size, and the return was experiencing unprecedent migration conditions. Given this Canada felt more conservative approach was necessary.
- In Canada's view, insufficient efforts, to the extent practical, were made to minimize impacts of U.S. pink-directed fisheries on sockeye salmon.
- As a result, the incidental harvest of sockeye salmon, caught and retained in the proposed August 18 fisheries as well as the FIMs in the proposed August 25 fisheries, were not acceptable to Canada.

The Report describes a number of other factors relevant to sound fisheries management decisions (e.g., catchability, effort, release mortality, stock composition), but suggests that the "bottom line" for the recent Panel disagreements is incidental Sockeye mortality, suggesting that this metric integrates across a number of important factors. However this approach presumes an equal weighting across factors and may not fully consider management tradeoffs. This conclusion underpins the Report's subsequent recommendations. However this approach presumes an equal weighting across factors and may not fully consider management tradeoffs.

Moving Forward

The National Sections recognize and appreciate the Staff's development of recommendations that the Panel should consider implementing to reduce the likelihood that Chapter 4, paragraph 13(d)(iii) needs to be initiated by a Party in future fishing seasons.

The National Sections recognize that each annual circumstance is unique and implementing any sort of framework would need to allow for flexibility in management. There is also recognition that the Panel coming to agreement about "small but acceptable" and "to the extent practical" during the pre-season planning process would lessen the likelihood of in-season disputes.

The recommendations may be broadly categorized as (1) means to quantify and evaluate "small but acceptable" [Recommendations 1, 2, 4, 7, 8]; (2) fishery objective refinement and prioritization [3, 5, 6]; and (3) improved monitoring and reporting [10, 11, 12].

The National Sections agree that the annual pre-season planning process should seek agreement about “small but acceptable” and “to the extent practical”, noting that an annual process will be required given that the management context may change significantly from fishing season to season. The Secretariat identified candidate metrics to consider during a pre-season planning process: fixed rates of harvest mortality, variable rates of harvest mortality based on sockeye run size, fixed total mortality rate (including fishing induce mortalities).

In general, the National Sections are in agreement about the benefits of refining fishery objectives and priorities. In general, the National Sections agree with the recommendations regarding improved monitoring and reporting.

The National Sections are committed to documenting a revised pre-season planning process that comprehensively identifies fishery planning scenarios where parties agree on scenario-specific “small but acceptable” sockeye mortality by management unit. The parties will also develop an approach to address in-season fishery proposals that deviate from a pre-season agreement. The Panel will complete this workplan by June 2024.

The National Sections acknowledge that the current chapter language in the PST was drafted at a time when Sockeye scarcity was the exception, not the rule. The differing interpretation of PST language is not a new schism among the parties, but rather a pre-existing divergence that has been exposed by an absence of fish and an uncertain future. Frequent scarcity has left the Panel negotiating fisheries using an agreement where the Parties’ interpretation differs. Given that both Parties' fundamental principles have not changed (namely our priority objective of achieving escapement targets), and given that both Canada and the U.S. have clearly articulated their commitment to work together collaboratively, resolution over the coming year is possible.

APPENDIX D: 2024 REGULATIONS

The Fraser River Panel approved regulations for the management of the Fraser River sockeye salmon fishery in Fraser River 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 24, 2024.

Canadian Fraser River Panel Area

In accordance with Article VI, Paragraph 5 of the Pacific Salmon Treaty, the Commission recommends Canada adopt the following fishing regime developed by the Fraser River Panel, namely:

1. a) No person shall commercially fish for sockeye salmon in Pacific Fishery Management Area 20-1, 3 and 4 with nets from the 30th day of June 2024, to the 7th day of September 2024, both dates inclusive.

   b) No person shall troll commercially for sockeye salmon in Pacific Fishery Management Area 20-1, 3 and 4 from the 30th day of June 2024, to the 7th day of September 2024, both dates inclusive.

2. a) No person shall commercially fish for sockeye salmon in Pacific Fishery Management Areas 17 and 18 with nets from the 30th day of June 2024, to the 28th day of September 2024, both dates inclusive.

   b) No person shall troll commercially for sockeye salmon in Pacific Fishery Management Area 18-1, 4 and 11 from the 30th day of June 2024, to the 28th day of September 2024, both dates inclusive.

3. a) No person shall commercially fish for sockeye salmon with nets in Pacific Fishery Management Area 29 from the 30th day of June 2024, to the 12th day of October 2024, both dates inclusive.

   b) No person shall troll commercially for sockeye salmon in Pacific Fishery Management Area 29 from the 30th day of June 2024, to the 12th day of October 2024, 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.

   d) The Fraser River and the tributary streams and lakes above the train bridge at Mission.

During the 2024 season, the Fraser River Panel will adopt orders establishing open fishing periods based on a 2024 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 the United States adopt the following fishing regime developed by the Fraser River Panel, namely:

U.S. Tribal Fisheries:

1. No person shall commercially fish for sockeye 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 2024 to the 7th day of September 2024, both dates inclusive.

2. No person shall commercially fish for sockeye salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from the 30th day of June 2024, to the 14th day of September 2024, both dates inclusive.

3. No person shall commercially fish for sockeye 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 15th day of September 2024, to the 28th day of September 2024, both dates inclusive.

All-Citizen Fisheries:

1. No person shall commercially fish for sockeye salmon in Puget Sound Salmon Management and Catch Reporting Areas 4B, 5, and 6C with nets from the 30th day of June 2024, to the 7th day of September 2024, both dates inclusive.

2. No person shall commercially fish for sockeye salmon in Puget Sound Salmon Management and Catch Reporting Areas 6, 6A, 7 and 7A with nets from the 30th day of June 2024, to the 14th day of September 2024, both dates inclusive.

3. No person shall commercially fish for sockeye 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 15th day of September 2024 to the 28th day of September 2024, both dates inclusive.

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

U.S. Tribal and All-Citizen Fisheries:

1. High Seas westerly of the Bonilla-Tatoosh Line.

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

During the 2024 season, the Fraser River Panel will adopt orders establishing open fishing periods basedon a 2024 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: 2024 FRASER RIVER PANEL IN-SEASON ORDERS

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

August 30, 2024

Treaty Tribal Fishery

Areas 4B, 5, 6C

Relinquish regulatory control effective 11:59 p.m., Monday, September 2, 2024.

Treaty Tribal Fishery and All Citizens Fishery

Areas 6, 7, and 7A

Relinquish regulatory control effective 11:59 p.m., Wednesday, September 4, 2024

Fraser River Panel control of Canadian Panel Areas was relinquished in accordance with the pre-season Regulations (Appendix D) as follows: Area 20 on September 7; Areas 17 and 18 on September 28; and Area 29 on October 12. Fraser River Panel control of United States Panel Areas were relinquished as follows: Areas 4B, 5, and 6C on September 2 by in-season order; Areas 6, 7, and 7A on September 4 by in-season order and the remaining areas were relinquished in accordance with the pre-season Regulations (Appendix D); Area 6A on September 14 and the remaining portions of Area 7A on September 28.

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 routes. 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. Stock composition information from the Stock Identification Group is used to apportion total estimates to sockeye stocks or stock groups and Fraser and non-Fraser origin pink salmon. 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 migration of Fraser River sockeye and pink salmon.[20] The catch-per-unit-effort (CPUE) data and collected biological samples from the test fisheries are used to generate abundance and stock composition estimates. Table F1 in the main body of the report summarizes the locations of Panel-approved test fisheries. Table F1 summarizes more detailed information about the nets and sampling strategies used in 2024.

Table F1. Sampling details for Panel-approved test fisheries conducted in 2024.

			2024						
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.	Purse Seine	1	549	875	95	3 3/4	6	20
29-14	Fraser R. (Brownsville Bar)	Gillnet	1	220	Variable	Variable		2	20
29-16	Fraser R. (Whonnock)	Gillnet	1	320	Variable	Variable		2	20
Canadian Non-Panel Areas									
12	Johnstone Str. (Blinkhorn)	Purse Seine	1	397	575	95	3 3/4	6	20
	Fraser R. (Qualark)	Gillnet	1	30	Variable	Variable		6	5

Information pertaining to the migration of Fraser River sockeye and pink salmon through marine areas is primarily obtained from the test fisheries in Area 20 (Juan de Fuca Strait) and Area 12 (upper Johnstone Strait) but may be augmented in some years by test fisheries in Area 13 (lower Johnstone Strait), U.S. Area 5 (Juan de Fuca Strait), and U.S. Area 7 (San Juan Islands). Test fisheries in Area 29 (lower Fraser River) are used to assess in-river species and stock composition for application to Mission passage estimates. When the Mission hydroacoustics program is not in operation, test fisheries in Area 29 provide passage estimates for sockeye salmon using CPUE models. The Qualark (Fraser River canyon) gillnet test fishery provides information on salmon species and stock composition for the Qualark hydroacoustics program.

In 2024, the Fraser River Panel (FRP) aimed to minimize the financial costs of Panel-approved test fisheries as well as the impacts on successful escapement of sockeye salmon to spawning grounds within the Fraser River watershed. As 2024 was forecast to have a low return of Fraser River sockeye, the U.S. Area 5 gillnet, Area 29 Gulf troll, the Areas 12 and 20 marine gillnets, and the Area 13 purse seine test fisheries were not scheduled to operate.

[20] Taylor, E. 2022. PSC test fisheries. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 66-70 p.

The U.S. Area 7 reefnet test fishery was scheduled for ten observations days, but did not operate in 2024. Table F2 summarizes the Panel approved pre-season test fishing schedule compared to the in-season start and end dates.

Table F 2. Pre-season and in-season start and end dates for the Panel approved test fisheries in 2024.

			2024			
Area	Name	Gear	Pre-season Start Date	In-season Start Date	Pre-Season End Date	In-season End Date
Canadian Panel Areas						
20	Juan de Fuca Str.	Purse Seine	15-Jul	15-Jul	05-Aug	04-Aug
29-14	Fraser R. (Brownsville Bar)	Gillnet	18-Jul	18-Jul	25-Aug	25-Aug
29-16	Fraser R. (Whonnock)	Gillnet	28-Jun	28-Jun	10-Sep	08-Sep
Canadian Non-Panel Areas						
12	Johnstone Str. (Blinkhorn)	Purse Seine	14-Jul	14-Jul	04-Aug	04-Aug
	Fraser R. (Qualark)	Gillnet	18-Jul	18-Jul	04-Sep	06-Sep

The Whonnock gillnet test fishery ended two days earlier than the pre-season schedule as no sockeye were captured for three consecutive days. The Qualark gillnet test fishery was in operation two days later than planned to provide species composition information for the Qualark hydroacoustics program. The Area 20 purse seine test fishery ceased operations two days earlier than scheduled due to mechanical breakdown.

The 2024 test fishing season was the first season that the Brownsville Bar test fishery was operated in place of the Cottonwood test fishery. Additionally, a live-sampling trial was conducted at the Area 20 purse seine test fishery over four days, as directed by the Panel due to conservation concerns, from July 17 to July 20. More information on live sampling can be found in Appendix G. Fish Passage Counters were present at Hells Gate seven days per week from July 3 to August 28, with a few exceptions due to illness, transportation issues, and safety concerns from the Chilcotin landslide.

Marine purse seine daily catches of sockeye in Area 20 were similar to the brood year catches and lower than the cycle-year average throughout the season. Sockeye catches in the Area 12 purse seine were similar to the brood year, but lower than the cycle-year average throughout the season. Sockeye catches remained low in both the Area 12 and 20 purse seines throughout the season.

Sockeye catches at Whonnock were higher than the brood year but lower than the cycle-year average (1990-2024) throughout most of the season apart from August 5 and 29 when catches were slightly higher than the cycle-year average. The Whonnock test fishery did not operate August 7 because of heavy debris in the river from the Chilcotin landslide breach. The catches at Brownsville Bar can not be compared to a historical cycle-year average as the Brownsville Bar test fishery had not operated in its current capacity prior to 2021, but compared to Cottonwood, the catches were greater than the brood year. Sockeye catches in the Qualark test fishery were similar to the brood year for most of the season but were higher later in the season after August 19. The Qualark test fishery did not operate on August 6 due to safety concerns from the Chilcotin landslide breach.

Under the direction of the FRP, PSC staff evaluated the impact of completing fewer than six sets in the marine purse seine test fishery on in-season run size assessments. Relative to previous years, 2024 had lower than average set completion rate. Missed sets occurred in 2024 due to crew illness, inclement weather, or the inability to use sets for assessment purposes due to issues with the set, making it unrepresentative. Missing sets are more impactful in Area 12 than in Area 20 as catchability tends to be more variable across set locations. During periods of low abundance, a minimum of four sets are required for an adequate sample in Area 12. Table F3 illustrates the adjusted R^2 values when using CPUE of 1 to 5 sets to predict final CPUE across a full 6-set assessment.

Table F 3. Adjusted R^2 values when using CPUE based on 1 to 5 sets to predict final CPUE across a full six set assessment.

2024				
	Adjusted R2 on all days		Adjusted R2 on days with <120 sockeye caught	
Set	Area 12	Area 20	Area 12	Area 20
1	0.69	0.4	0.11	0.47
2	0.78	0.58	0.21	0.66
3	0.88	0.64	0.43	0.79
4	0.94	0.73	0.61	0.88
5	0.96	0.92	0.78	0.94
6	1	1	1	1

Only sockeye that were required for scientific samples were retained in the test fisheries. Fish sales were unable to offset program costs and the 2024 program deficit of $465,000 was paid for by the Test Fish Revolving Fund.

B. Mission Hydroacoustics

Pacific Salmon Commission Secretariat staff operate a seasonal hydroacoustics monitoring program on the Fraser River, approximately 2 km upstream of the Mission Railway Bridge and 80 km upstream of the river mouth. The purpose of the site is to provide accurate and timely estimates of sockeye and pink salmon passage through the lower Fraser River.

A combination of split-beam and imaging sonars have been used at Mission to quantify upstream salmon passage since 2011.[21] In 2024, daily nearshore salmon passage was estimated using a side-looking split-beam sonar (S1, left bank of river) and two side-looking Adaptive Resolution Imaging Sonars (ARIS; A1 on left bank, A2 on right bank). A downward-oriented ARIS (M2) deployed with GPS from a transecting, mobile vessel was used to enumerate offshore salmon passage (Figure F1), as well as to quantify fish behaviour (i.e., swim direction, milling, holding).[22]

The shore-based sonars operate 24 hours per day to collect data on target counts and density, direction of travel, speed, and size distribution.[23] In contrast, the M2 system consists of a down-looking 15°x30° elliptical imaging sonar (Soundmetrics Corporation), deployed within a custom tow body from a mobile vessel that transects 18 hours per day.[20] The M2 system directly provides a downstream ratio to apply to offshore density data. However, processing of M2 data is time-intensive and requires an 8-hour sampling scheme, in which one half hour file is processed for approximately every 1.5 hours, to provide timely offshore passage estimates of salmon-sized targets. For days in which there are offshore data gaps (e.g., due to Food, Social, and Ceremonial (FSC) drift net fishing at Mission), alternative hours or the full day of available data are processed depending on gap duration.

Left bank (A1, S1) and mobile (M2) systems were operational from July 5 to September 2, and the right bank system (A2) was operational beginning July 8. To produce estimates of total daily salmon escapement at Mission, passage estimates from each system are spatially stratified (i.e., areas of overlap are removed) and re-combined. In 2024, most official estimates used the standard four-system combination (A1+S1+M2+A2), in which A1 and A2 were used to estimate the 0 to 40-metre range on their respective banks, S1 was used for the 40 to 50-metre range on left bank, and M2 was used for the remaining width of the river. Shore-based systems were preferentially used at

[21] Lagasse, C.R. and Xie, Y. 2022. Daily Estimation of Salmon Passage at the Mission Site. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 116-120 p.

[22] Bartel-Sawatzky, M. and Hornsby, R.L. 2022. Improved estimation of offshore fish passage at Mission by replacing split-beam system with imaging sonar: A final project to the Southern Boundary Restoration and Enhancement Fund. Pacific Salmon Commission, March 2022.

[23] Lagasse, C.R. , Xie, Y., Bartel-Sawatzky, M., and PSC Hydroacoustics Staff. In-season Assessments: Hydroacoustic Information. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 121-139 p.

overlap regions of shore-based and M2 systems due to the lower sampling intensity of the M2 system and its vulnerability to avoidance behaviour, which could contribute to negative bias.[24] In 2024, the majority (51.5%) of the passage occurred on the left bank, the right bank accounted for 35.9%, and the mid-channel (offshore) accounted for 12.6% of the upstream salmon passage at Mission.

Between August 7 and 21, alternative approaches to the standard four-system estimate were required to adapt to environmental factors (e.g., high water turbidity, debris) related to the Chilcotin landslide, which limited visibility of the hydroacoustic systems. For August 7, the A2 system was unusable, and thus, projected using a mean ratio of A2:A1 based on August 1 to 4 data (pre-landslide dates); and on August 8, a 3-system estimate (S1+M2+A2) was used due to compromised A1 visibility. From August 9 – 21, a four system estimate was back in place, but depending on system visibility, ranges 20 m beyond shore (A1, S1, A2) were either projected based on available data from the same system (i.e., mean ratio of available: unavailable ranges based on pre-landslide dates) or replaced by data from another, overlapping system (e.g., S1 used for 30-50 m on left bank when A1 unavailable, M2 used for 30-40 m on right bank when A2 unavailable).

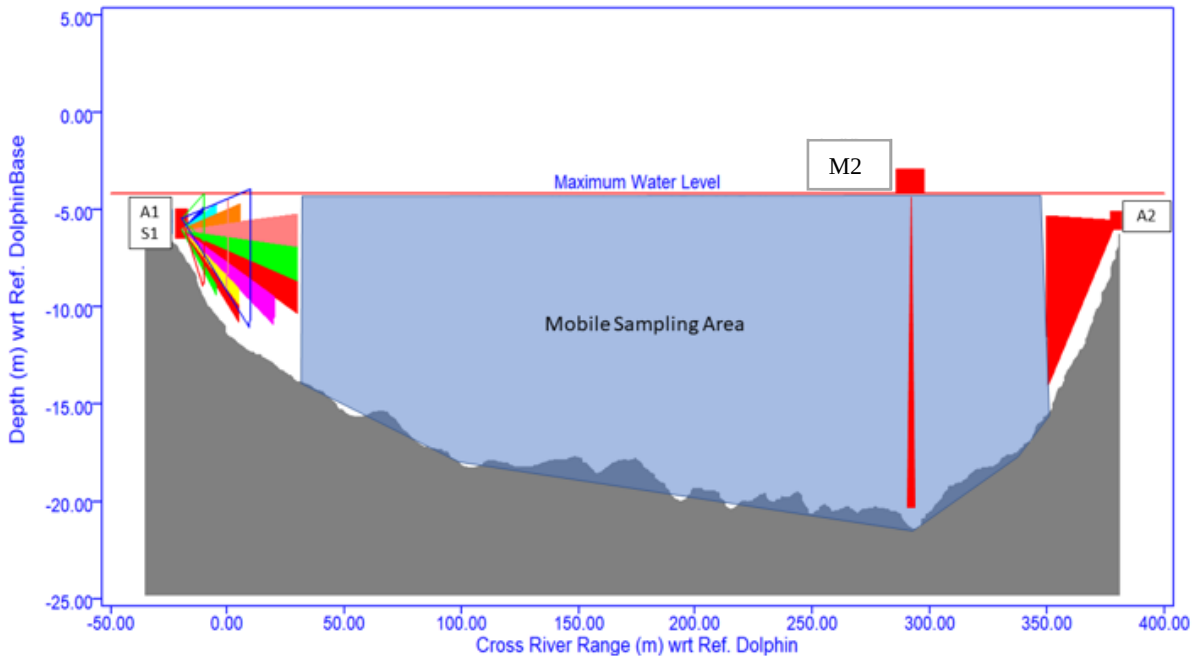

Figure F 1. Cross-river sampling geometry of the systems operated at the Mission hydroacoustics site. The four systems shown are the left bank split-beam (S1), the left bank ARIS (A1), the mobile ARIS (M2), and the right bank ARIS (A2). The beam geometries of A1 are represented by hollow triangles, which overlap with the S1 beam geometries represented by coloured triangles. The blue-filled offshore area represents the cross-river region sampled by M2. The beam coverage of A2 and the river bottom are represented by the red-filled triangle and the gray-filled area, respectively. Note that the cross-river range scale on the x-axis is compressed relative to the vertical depth scale on the y-axis.

In accordance with a signed protocol between the PSC, Fisheries and Oceans Canada, and Semá:th First Nation, the PSC docked its mobile, transecting vessel during FSC drift net fisheries at Mission. As these fisheries naturally produce an offshore data gap and potentially bias shore-based sonars, data imputations[25] were performed to address data quality concerns. This data imputation method was also used (i.e., linear and non-linear interpolation over a

[24] Xie, Y., C.G.J. Michielsens, A.P. Gray, F.J. Martens, and J.L. Boffey. 2008. Observations of avoidance reactions of migrating salmon to a mobile survey vessel in a riverine environment. Can. J. Fish. Aqua. Sci. 65 2178-2190.

[25] Bzonek, P., Hornsby, R.L, Xie, Y., Nelitz, J., Bartel Sawatzky, M., Martens, F., and Michielsens, C.G.J. 2022. Mission Data Imputation During Fishery Openings: A report to the Southern Boundary Restoration and Enhancement Fund. Pacific Salmon Commission, March 2022.

selected period) to address other missing data scenarios (e.g., gaps due to landslide effects), and was used for a total of 14 dates during the 2024 season.

Species Composition

Lower river hydroacoustics estimates of total fish passage are first apportioned into salmonid and non-salmonid (i.e. resident fish) using length-based mixture models.[26] While multiple Pacific salmon species co-migrate up the Fraser River, the main focus of assessments is on enumerating sockeye and pink salmon. Species-specific salmon estimates are derived using information from multiple sources, including: species proportions or catch-per-unit effort (CPUE) from the Whonnock and Albion gill net test fisheries, modelled forecasts of daily Chinook salmon abundance, and length-based model estimates using ARIS fork length frequency distributions.[27,28] When sockeye salmon are the dominant species and the Mission hydroacoustic program is operational, sockeye abundance is primarily estimated by subtracting estimates of Chinook and pink salmon from the total hydroacoustic estimate. For species such as pink salmon, which concentrate in near shore areas, a stratified approach is applied using a combination of methods. Where available, comparisons are also made in other upriver assessment programs, such as fish wheels.

Sockeye salmon were the main species of interest in 2024. Sockeye were the dominant species from July 1 – September 8, and it was estimated by subtracting estimates of other salmon from the total hydroacoustic estimate. During this period, Chinook salmon abundance was estimated using a stratified method which included the length-based estimates from the near shore at Mission and Whonnock CPUE estimates for the mid-channel. A revision to the estimated total run size was made post-season resulting in an increase to the total sockeye passage at Mission to 647,700 from 468,000. This was made as species composition information collected at Mission highlighted an underestimation of sockeye and over estimation of Chinook salmon in the 2024 season. The Mission estimate was updated in June 2025.

For periods when the Mission hydroacoustic site is not operational and/or pink salmon are the dominant species, sockeye abundance is primarily estimated using Whonnock test fishery CPUE data.

Stock Identification

PSC staff conduct sampling programs designed to identify stock proportions of Fraser River sockeye salmon in commercial, test, First Nations and recreational catches.[29] Stock identification data are used to account for Fraser sockeye salmon wherever they are caught, and to apportion the daily estimates of sockeye escapement past Mission into discrete stock groups. Stock identification methods for sockeye salmon in 2024 used DNA analyses from fish caught in marine and in-river fisheries.[30] Additionally, scale pattern analysis was used to supplement DNA information for sockeye, particularly when genetic results were less certain.[31] Other sources of information such as fish age, fish size, timing and location of catch may supplement DNA information. For sockeye salmon, a multinomial extrapolation procedure was used for predicting stock composition estimates in catches that had not yet occurred or had not yet been analyzed. This projection approach assumes recent trends in stock composition are carried forward, and similar patterns occur in both migration routes around Vancouver Island.

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[26] Michielsens, C.G.J. 2022. Species Information: Overview. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, p. 145-150.
[27] Grant, S., M. Townsend, B. White, and M. Lapointe. 2014. Fraser River Pink Salmon (*Oncorhynchus gorbuscha*) Data Review: Inputs for Biological Status and Escapement Goals. Report prepared for Pacific Salmon Commission. May, 2014.
[28] Conrad, B., A. Dufault, M. Hawkshaw, A. Huang, E. Jenkins, C. Lagasse, M. Lapointe, M. Litz, F. Martens, C. Michielsens, J. Scroggie, M. Staley, T. Whitehouse, C. Wor, and Y. Xie. 2019. Hydroacoustics Review Technical Summary. Pacific Salmon Comm. Tech. Rep. No. 41: 369 p.
[29] Phung, A. and Brkic, D. 2022. Sampling Protocol. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 89-93 p.
[30] Samarasin, P. and Latham, S. 2022. DNA-based Stock ID Method. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 109-115 p.
[31] Gable, J. and S. Cox-Rogers. 1993. Stock identification of Fraser River sockeye salmon: methodology and management application. PSC Tech. Rep. No. 5.

A. Sockeye Salmon

Both DNA and scale pattern analyses 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")[32]. Samples from test fishery catches were analyzed daily, beginning in early July and continuing to early September. PSC staff sampled sockeye from test fishery catches (Port Renfrew and locations within the lower Fraser River, B.C.). Additionally, DFO provided samples from test fisheries in Johnstone Strait and in-river test fisheries at Albion and Qualark. Alaska's Department of Fish and Game collected samples for the PSC from District 104 purse seine landings in Ketchikan, Petersburg and Wrangell, and Langara Fishing Adventures provided samples from recreational catches near Haida Gwaii. DFO and First Nations personnel obtained samples from Fraser River First Nations catches when available.

Catches in District 104 totaled 135,000 sockeye. Extracted DNA of fish putatively originating from Fraser stocks (as determined by examination of Single Nucleotide Polymorphisms[33] by the US National Oceanic and Atmospheric Administration laboratory in Auke Bay, Alaska) was obtained and analyzed with methods consistent with other DNA results reported here and to the Fraser Panel. The preliminary catch of Fraser River sockeye in Alaska was estimated to be 4,200.

During each management season, DNA estimates, scale measurements (including age), sex, and length information are compiled at the individual level to assist data interpretations and assess possible sampling issues if the combined data appear incongruent. Table F4 summarizes the age composition (based on scale readings by PSC Staff) of sockeye catches compared to the pre-season forecast. The overall proportion of age-four fish observed for total Fraser sockeye exceeded the proportion of age-four fish expected in the forecast. Lower proportions of age-four fish were forecast for Pitt, Harrison and most Late run stocks; however, these groups had a substantially higher proportion of age-four fish in their returns compared to the forecast. Generally, this was due to a higher-than-expected return of age-four fish, and a lower-than-expected return of age-five fish. Only a few stocks in the Early Summer run group had an observed age-four proportion that was smaller than the forecast. These stocks were Nahatlatch, Taseko and Early South Thompson which had smaller returns. Discrepancies between the forecast and in-season estimates of age composition of these stocks could in part be due to low sample sizes.

[32] Samarasin, P. and Latham, S. 2022. Stock Composition Estimates Based on Scale Pattern Analyses. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 103-108 p.

[33] Guthrie III, C.M., Nguyen, H. and J.R. Guyon. Northern Boundary Area Sockeye Salmon Genetic Stock Identification For Year 2015 District 101 Gillnet and District 104 Purse Seine Fisheries. A project report to Northern boundary restoration and enhancement fund. Pacific Salmon Commission, Vancouver, British Columbia. April 10, 2017.

Table F 4: Summary of the 2024 forecast and in-season age composition estimates of sockeye sampled from fisheries. Scale-based ages of individuals with probabilities of origin greater than 67% (determined via genetic stock identification) to a stock aggregate are included here.

Sockeye stock/timing group	2024 Fraser Sockeye Forecasts			2024 In-season	
	Median Age-4 Forecast	Total Median Forecast	% Age-4	Sample size	% Age-4
Early Stuart	**160**	**200**	**80%**	**2**	**100%**
Chilliwack	32,600	33,000	99%	76	91%
Pitt	2,000	16,000	13%	89	73%
Nadina	59,000	65,000	91%	502	94%
Bowron	900	1,000	90%	11	91%
Nahatlatch	2,600	3,000	87%	26	69%
Gates	21,000	27,000	78%	102	97%
Taseko	70	70	100%	12	92%
North Barriere	4,100	5,000	82%	16	81%
Early S. Thompson	6,200	7,700	81%	13	77%
Early Summer	**128,400**	**157,700**	**81%**	**847**	**91%**
Harrison	42,000	106,000	40%	276	89%
Widgeon	50	80	63%	2	100%
Late Stuart/Stellako	57,000	77,000	74%	1,052	94%
Chilko	132,000	176,000	75%	735	80%
Quesnel	2,000	3,000	67%	28	61%
Raft/North Thompson	15,310	17,400	88%	153	93%
Summer	**248,300**	**379,400**	**65%**	**2,246**	**88%**
Birkenhead	13,000	24,000	54%	125	86%
Misc. Lillooet-Harrison	190	200	95%	0	NA
Late Shuswap/Portage	110	2,200	5%	10	70%
Weaver	400	2,000	20%	5	40%
Cultus	100	100	NA	0	NA
Late	**13,800**	**28,500**	**48%**	**140**	**83%**
Total	**391,000**	**566,000**	**69%**	**3,235**	**89%**

Stock Assessment

Assessment of Fraser River sockeye salmon abundance by stock group is primarily based on catch, effort, escapement, and stock composition data. Test fishery catch-per-unit-effort (CPUE) data is converted into daily abundances using catchability estimates derived from a hierarchical analysis of historical data. As the season progresses, the catchability coefficients are updated based on observed values for non-delaying stock groups by comparing reconstructed marine abundances derived from Mission hydroacoustic passage estimates and marine catches[34] to CPUE-based abundances. The reconstructed marine abundances derived from in-river hydroacoustic, and marine test fishery data are analysed using Bayesian stock assessment models.[35, 36,37,38] These models compare the reconstructed daily migration pattern to ideal run-timing curves, assuming the run is normally distributed. By

[34]Michielsens, C.G.J. 2023. Marine Catchability Estimates. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, p. 82-88.
[35] 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.
[36] 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.
[37]Michielsens, C.G.J. and J.D. Cave. 2018. In-season assessment and management of salmon stocks using a Bayesian time-density model. CJFAS. https://doi.org/10.1139/cjfas-2018-0213.
[38]Michielsens, C.G.J. 2023. In-season time-density model. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, p. 160-166.

assuming the run follows this idealized pattern, the run size can be estimated by doubling the abundance up to the observed 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). Prior to the peak of the run, run size and timing estimates are confounded and there is considerable uncertainty as to whether the run is earlier and smaller than forecast, or later and larger than forecast. Once more than 50% of the run has been observed at the Mission hydroacoustics site, a hybrid approach is applied whereby the run size can be estimated by adding the Bayesian estimate of the tail of the normal distribution to the cumulative observed reconstructed abundances.

Bayesian methodology is used to quantify the uncertainty in run size and timing estimates. A Bayesian cumulative normal model is informed by additional forecasted and historical information, including (1) pre-season forecasts of run size based on historic stock-recruit data, (2) pre-season forecasts of timing, (3) expected duration of the run, (4) average historical expansion line (inverse catchability) estimates, and (5) pre-season forecasts of diversion rate, to reduce the uncertainty and keep the run size estimates within realistic bounds. This prior information is incorporated within the Bayesian model using 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 likely than others. Theoretically, the Bayesian version of the cumulative normal model should provide more stable estimates since it relies on both in-season observations as well as historical data. Retrospective analyses have confirmed that incorporating prior knowledge is especially informative prior to, and immediately after, the 50% migration date. Once more than 50% of the run has been observed at the Mission hydroacoustics site, the run size can be estimated by adding the Bayesian estimate of the tail of the normal distribution to the accounted run-to-date.

For Late-run stocks, which delay and redistribute prior to migration into the Fraser River, it is not possible to replace the daily estimates from test fishing with daily hydroacoustic-based estimates. Thus, only marine CPUE can be used in the Bayesian cumulative normal model to assess run size, resulting in larger uncertainty in run size compared to stocks that also rely on marine reconstructed data.

Figures F2 a, b, and c provide an overview of the run size estimates from the different stock assessment models and the accounted run size at various dates during the season (median estimate and 80% probability intervals, if calculated). 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 2024, pre-season forecasts overestimated the run size for all sockeye management groups except for the Early Stuart run, for which an in-season run size assessment was not possible due to extreme low abundances. As a result, the pre-season forecast was used as a proxy for Early Stuart run size.

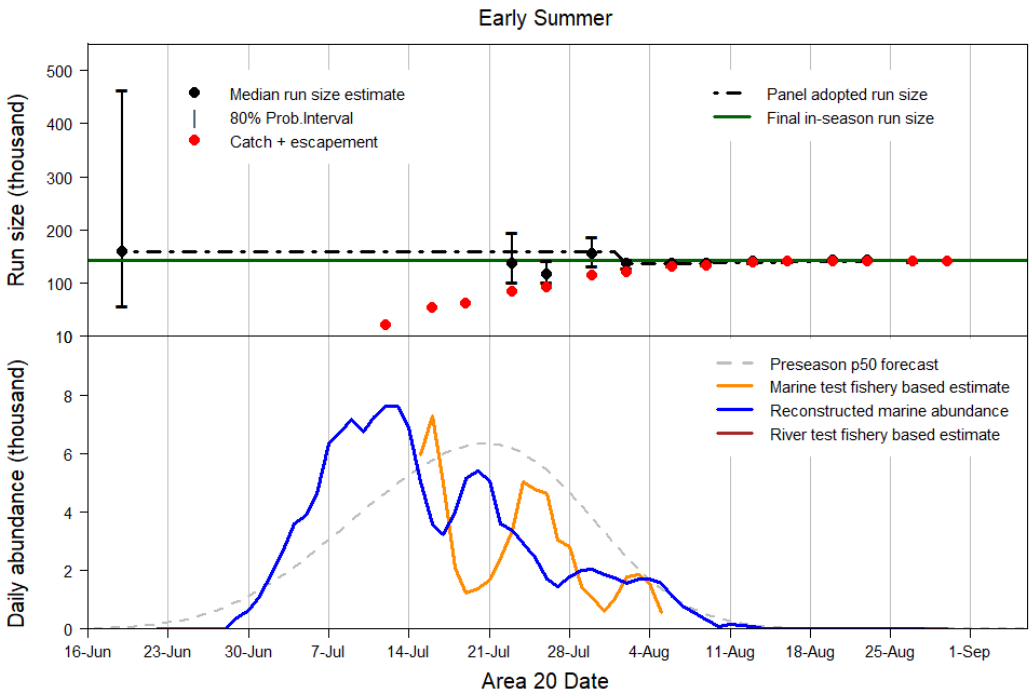

Figure F 2a: Daily reconstructed abundance estimates for Early Summer-run salmon and corresponding run size estimates at different times during the season.

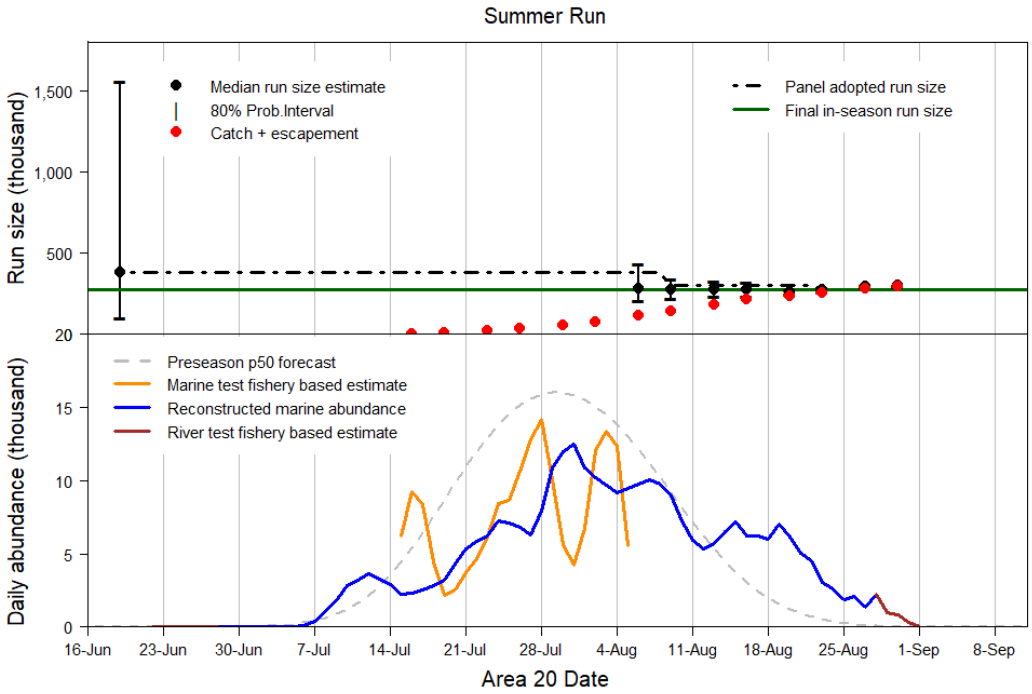

Figure F 2b: Daily reconstructed abundance estimates for Summer-run salmon and corresponding run size estimates at different times during the season.

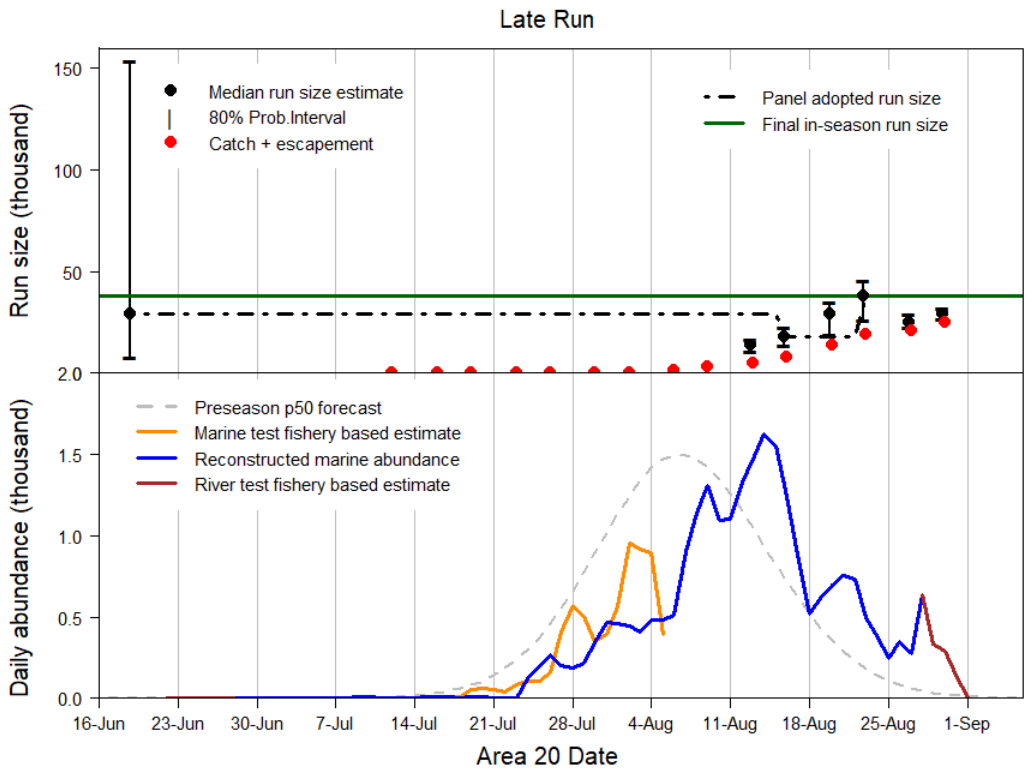

Figure F 2c: Daily reconstructed abundance estimates for Late-run salmon and corresponding run size estimates at different times during the season.

Management Adjustment and DBE

Pre-season, the Environmental Watch (E-Watch) program at Fisheries and Oceans Canada presents a long-range forecast of Fraser River environmental conditions. The long-range (3-month) forecast provides lower Fraser River summer temperature and flow conditions using relationships between winter snowpack accumulation, summer air temperatures and river environmental conditions. The forecast was for below average discharge and above average water temperature. The environmental forecast was applied to Environmental Management Adjustment (MA) models and, where applicable, to alternative pDBE forecast methods to forecast the proportional difference between estimates (pDBEs). Based on the preliminary pDBE predictions, it is possible to predict how many additional sockeye should be allowed to escape to achieve spawning escapement objectives.[39]

Pre-season the Panel chose to adopt the proportional Management Adjustments (pMAs) based on the best pre-season pDBE forecast method identified in the retrospective analysis (Table 3). This resulted in the following, Management Adjustments (MAs; Table 1): 200 Early Stuart, 73,500 Early Summer, 106,200 Summer and 14,200 Late-run sockeye. These were added to the spawning escapement targets (SET) for pre-season planning purposes. For Early Stuart, Summer and Late run, the spawning escapement target (SET) equalled the run size at the median forecast abundance level. For Early Summer run, the run size exceeded the SET but when including the MA, it resulted in a lack of harvestable surplus. This meant that spawning escapement targets for all four management groups were unlikely to be reached, given the expected en-route losses and the proportional management adjustment (pMA) (Table 4). As a result of the low preseason run size forecasts and the adopted MAs, all the management groups were in a Low Abundance Exploitation Rate (LAER) situation.

[39] Forrest, M.R. and Hague, M.J. 2022. Management Adjustments. In: Michielsens, C.G.J. and Martens, F.J. Editors. Overview of pre-season and in-season assessment methods for Fraser River sockeye salmon. Pacific Salmon Comm. Tech. Rep. No. 49, 179-184 p

In-season, the Panel was presented with pDBE estimates for each management group (Table F5) based on the best performing in-season pDBE forecast method (Table 3) identified in the retrospective analysis. For Early Stuart sockeye, the best performing pDBE forecast method was the Threshold Approach that predicted larger en-route losses if the 19-day mean river temperature exceeded 17°C during their upstream migration. As a result of higher-than-average temperatures and a 19-day mean temperature of 18.5°C, the Panel adopted the higher pMA of 1.94 (pDBE: -0.66; Table 4) associated with historical years when the temperature exceeded 17°C. During the Early Summer run sockeye migration, river temperatures were near the plus one standard deviation and reaching the maxima, however, the retrospective analysis identified that staying with the median of all years, even in extreme environmental conditions was the best approach for Early Summer run. Additionally, a weighted pDBE approach was used for Early Summer run. The weighted pDBE for Early Summer run excluding Pitt and Chilliwack group was -0.37. The pDBEs for Pitt and Chilliwack were -0.27, -0.39, respectively, and were weighted by their respective in-season run size estimates which remained unchanged in-season. The Panel, therefore, stayed with the pre-season adopted pMA of 0.56 (Table 4). For Summer run sockeye, a Threshold Approach was found to be the best performing model. This approach predicted larger en-route losses if the 19-day mean river temperature exceeded 19.4°C during their migration. As a result of a Summer-run 19-day mean temperature of 19.7°C, the Panel adopted the higher pMA of 0.56 (Table 4) that was associated with historical years when temperature exceeded 19.4°C. Late run sockeye also experienced above average migration temperatures for the time of year that reached the maxima for multiple days. The Mission 50% date for Late run was August 24. For the Late run, the best performing in-season pDBE forecast method identified in the retrospective analysis was to stay with the pre-season forecast method of using the historical median of non-dominant years. However, for the Late run, a weighted pDBE approach was used, so the Panel adopted an updated pMA of 0.43 (Table 4) for the Aggregate management group due to the change in relative abundance of the two groups. The weighted pDBE for Late run was based on the pDBE for Late run excluding Birkenhead/Big Silver group (-0.73) and the pDBE for the Birkenhead/Big Silver group (-0.26), weighted by their respective in-season run size estimates.

At Big Bar, discharge levels remained near the historical minima (1991-2020) throughout the sockeye migration. There were no upstream migration problems observed at the Big Bar slide site. However, in the Chilcotin River, the impact of the landslide on July 30, 2024 caused significant migration delays and migration stress that impacted the successful migration of the Chilko River and Chilko Lake sockeye.

Spawning ground adult escapement estimate of Fraser sockeye abundance totalled 465,330 sockeye, which implied a total Fraser observed %DBE of (-25%). The Early Summer run was the only management group to exceed its SET. The Early Stuart, Early Summer, Summer and Late run sockeye SET was 200, 131,400, 275,000 and 38,000 sockeye, respectively. High temperatures and the Chilcotin Landslide in 2024 during the Fraser sockeye migration likely contributed to the observed DBEs and the failure to achieve escapement goals.

See Table F6 for a detailed summary of the Management Adjustment approaches by stock group.

Table F 5. Summary of the pre-season and in-season MA model predictions of %DBE for Early Stuart, Early Summer, Summer and Late-run management groups.

	Pre-season Best Performing Model Predictions[1]		In-season Best Performing Model Predictions[1]		Pre-season 31-day DBE Model Predictions[2]		19-Day DBE Model Predictions		In-season 31-day Model Predictions		In-season run-timing Model Predicitons[3]	
	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA	%DBE	pMA
Early Stuart	-54%	1.17	-66%	1.94	-53%	1.13	-64%	1.78	-73%	2.70	NA	NA
Early Summer run[3]	-36%	0.56	-36%	0.56	-39%	0.64	-43%	0.75	-47%	0.89	NA	NA
Summer run	-22%	0.28	-36%	0.56	-22%	0.28	-43%	0.75	-57%	1.33	NA	NA
Late run[3]	-33%	0.49	-30%	0.43	NA	NA	NA	NA	NA	NA	-31%	0.45

1 See Table (best performing model)

2 Pre-season MA Model Predictions use the Pre-season Forecast of Fraser River Temperature and Discharge from DFO's E-watch Program.

3 The pDBE for both the Early Summer run and Late run is based on a weighted pDBE approach at the p50 forecast level of abundances.

4 Mission 50% date is the final in-season hydroacoustic estimate of August 24.

Table F 6. Summary of the pre-season and in-season Management Adjustment (MA) models and assumptions used during the 2024 management season across management groups, based on retrospective analysis.

Management Group	Pre-season Predictor Variables	In-season Predictor Variables	Cycle lines Used	Excluded Years
Early Stuart	Historical Median (1995-2023)	Threshold Approach: If Temperature >17°C or Discharge >8000m3/, use median of relevant historical years versus median of years with more benign Temperature and Discharge	All	1977, 1980, 1982, 1984, 1986, 2006, 2012, 2019, 2020
Early Summer run	Historical Median (1977-2023)	Historical Median (1977-2023)	All	1993, 2006,2019
Summer run	Pre-season 31-day model	Threshold Approach: If Temperature > 19.4°C, use the median of High Temperature (>19.4°C) years versus Pre-season 31-day model.	All	2002, 2006
Late run	Non-Dominant years median (1996-2023)	Non-Dominant years median (1996-2023)	2020, 2021,2023	Dominant Cycle years (2022)

APPENDIX G: LIVE SAMPLING PILOT STUDY

The Pacific Salmon Commission (PSC) manages a series of in-river and marine test fisheries to monitor and assess in-season Fraser River sockeye and pink salmon abundances to inform bi-lateral fisheries management decisions. A pre-determined number of sockeye are retained at the various test fisheries for lethal sampling purposes to obtain the necessary biological and morphological data for assessments. In 2024, the pre-season forecast for returning Fraser River sockeye was 567,000, the lowest forecast on record. To reduce the impacts of the PSC test fisheries on the returning sockeye, the Fraser River Panel (FRP) requested that PSC staff investigate the feasibility of live sampling sockeye salmon onboard the purse seine test fisheries in Areas 12 and 20. With the exception of tagging projects, live sampling had not previously been a part of the PSC test fisheries. As a result, a shorter pilot study was proposed to assess the potential implications on the in-season assessments.

In March 2024, PSC staff held a live sampling workshop to gather input and develop a strategy for the trial that minimized mortality, cost, and data quality loss. Based on workshop input, the plan for a four-day live-sampling trial was developed for the Area 20 purse seine test fishery. The Area 12 test fishery was excluded from the trial due to operational challenges in completing sampling before shipping deadlines, as well as budgetary constraints, which would have required chartering an additional vessel because the test fishing vessel lacked adequate deck space for sampling.

The live-sampling trial was conducted at the Area 20 purse seine test fishery from July 17 to July 20 with technical support from Pacheedaht Fishing Company and the Pacific Salmon Ecology and Conservation Lab at UBC. During this trial, all sockeye required for sampling were captured, sampled, and released to continue their migration, with an expected survival rate of 80% to the mouth of the Fraser River[40]. A total of 218 sockeye were encountered during this trial. Of the 218 sockeye encountered, 167 were brought on board, sampled, and released from the purse seine. The remainder were released due to a lack of holding capacity on the vessel.

The condition of the fish upon release was determined using a modified reflex action mortality predictors (RAMP) scoring system. The three factors assessed for the scoring system were fish exhibiting body flexing upon handling, regular ventilating, and positive re-orientation after being rolled onto their side. The fish were then assigned a numerical score between 1 and 3, with a score of 3 being ‘good’, 2 being ‘fair’, and 1 being ‘poor’ condition. Approximately 98% of the live-sampled sockeye were released in good condition, with the remaining sockeye noted in fair condition. Of the 167 sampled sockeye, 37 were identified as Early Summer-run sockeye, 125 were identified as Summer-run sockeye, and 5 remained unidentified (Table G1). No Early Stuart or Late run sockeye were caught.

[40] Martin, E.G., S. G. Hinch, D. A. Patterson, M. J. Hague, S. J. Cook, K. M. Miller, M. F. Lapointe, K. K. English, and A. P. Farrell. 2011. Effects of river temperature and climate warming on stock-specific survival of adult migrating Fraser River sockeye salmon (Oncorhynchus nerka). Global Change Biology 12. 99-114p.

Table G 1. Stock-specific Fraser sockeye releases during live-sampling trial at the Area 20 purse seine test fishery from July 17-20, 2024.

Early Summer		Summer	
Chilliwack	0	Harrison	30
Pitt/Alouette/Coquitlam	7	Widgeon	0
Nadina/Bowron	25	Late Stuart	11
Gates/Nahatlatch	2	Stellako	72
Taseko	2	Chilko	6
North Barriere	1	Horsefly	0
Early South Thompson	0	Mitchell	0
		Raft/North Thompson	6
Total:	37		125

The cost to operate and staff the four-day live sampling program was $8,500, with approximately $3,250 in expected foregone revenue, due to loss of fish sales, for a total net cost to the test fishing program of approximately $11,750.

APPENDIX H: HISTORICAL CATCH, ESCAPEMENT AND PRODUCTION DATA

Table H 1. Catch by user group, spawning escapement, difference between estimates and run size of Fraser River sockeye salmon for cycle years 2012-2024.

	Fraser Sockeye Salmon			
	2012	**2016**	**2020**	**2024**
CANADIAN CATCH	**510,300**	**149,200**	**11,400**	**18,200**
Commercial Catch	**0**	**0**	**0**	**0**
Panel Area	0	0	0	0
Non-Panel Areas	0	0	0	0
First Nations Catch	**508,100**	**148,400**	**11,300**	**530**
Marine FSC	53,200	32,300	0	0
Fraser River FSC	454,900	116,100	11,300	530
Economic Opportunity	0	0	0	0
Non-commercial Catch	**2,250**	**820**	**70**	**240**
Marine Recreational	0	0	20	0
Fraser Recreational	0	0	0	0
Charter	2,250	820	50	240
SSFSC	0	0	0	0
Other Catch	**0**	**0**	**0**	**17,400**
UNITED STATES CATCH	**111,300**	**1,670**	**0**	**0**
Washington Total	**105,200**	**830**	**0**	**0**
Commercial catch	**72,800**	**830**	**0**	**0**
Treaty Tribal	32,300	0	0	0
All Citizens	6,140	840	0	0
Non-commercial Catch	**6,140**	**840**	**0**	**0**
Ceremonial	0	0	0	0
Recreational	6,780	35,400	9,270	0
Other	0	0	0	0
Alaska*	**0**	**0**	**0**	**0**
TEST FISHING CATCH	**26,200**	**6,400**	**2,690**	**5,790**
PSC (Panel Areas)	**17,000**	**6,400**	**2,690**	**3,430**
Canada	9,180	0	0	3,430
United States	7,680	2,440	1,920	0
Canada (non-Panel Areas)	**0**	**0**	**0**	**2,360**
TOTAL RUN	**2,219,200**	**893,700**	**365,200**	**668,500**
Total Catch in All Fisheries	662,323	195,157	25,252	24,000
Adult Spawning Escapement	920,415	484,541	272,758	473,621
Jack Spawning Escapement	4,332	2,347	1,450	4,309
Difference between estimates	632,085	211,685	65,737	166,544
Percentage of Total Run	**100%**	**100%**	**100%**	**100%**
Total Catch in All Fisheries	30%	22%	7%	4%
Adult Spawning Escapement	41%	54%	75%	71%
Jack Spawning Escapement	0%	0%	0%	1%
Difference between estimates	28%	24%	18%	25%

*The preliminary 2024 Alaska catch of Fraser sockeye in D104 is estimated to be 4,200

Table H2. Escapements of sockeye salmon to Fraser River spawning areas for cycle years 2012-2024*

DISTRICT / Stock Group / Stream/Lake	Year 2012	2016	2020	2024
NORTHEAST				
Upper Bowron R.	59	143	344	616
STUART				
Early Stuart				
Driftwood R.	234	38	0	0
Takla L. Streams	4,218	1,203	2	8
Middle R. Streams	18,020	6,060	22	4
Trembleur L. Streams	3,758	1,269	6	14
Miscellaneous	0	38	0	0
Late Stuart				
Kazchek Cr.	241	43	11	88
Kuzkwa Cr.	5,630	1,147	1,339	2,950
Middle R.	13,147	2,071	891	14,509
Tachie R.	68,557	5,197	1,755	28,033
Miscellaneous	5,544	949	745	666
NECHAKO				
Nadina R. (Late)	22,840	16,671	13,438	89,321
Nadina Channel	8,102	9,961	15,907	30,030
Stellako R.	137,992	30,119	44,371	65,160
QUESNEL				
Horsefly R.	536	519	746	8,653
Horsefly Channel	0	0	0	0
McKinley Cr.	0	0	0	0
Mitchell R.	58	264	58	571
Miscellaneous	11	132	9	2,134
CHILCOTIN				
Chilko R. & L.	245,525	154,918	54,513	52,130
Chilko Channel	0	0	0	0
Taseko L.	100	164	60	227
SETON-ANDERSON				
Gates Cr.	12,600	4,914	6,174	5,557
Gates Channel	15,884	3,674	0	0
Portage Cr.	25	41	20	328
NORTH THOMPSON				
North Thompson R.	1,096	6,437	480	8,389
Raft R.	10,003	8,147	5,099	12,861
Fennell Cr.	1,967	1,152	981	1,896
SOUTH THOMPSON				
Early Summer-run				
Scotch Cr.	2,005	961	1,410	726
Seymour R.	822	374	920	707
Upper Adams / Momich / Cayenne	256	42	27	15
Miscellaneous	411	159	202	174
Late-run				
Adams R.	0	36	22	354
Little R.	2	2	2	20
Lower Shuswap R.	9	7	0	11
Miscellaneous	1	4	3	25
HARRISON-LILLOOET				
Birkenhead R.	56,282	36,402	5,308	28,036
Big Silver Cr. & misc. Birk. types	3,722	4,640	822	2,465
Harrison R.	70,904	65,758	75,537	72,814
Weaver Cr.	345	15	37	283
Weaver Channel	573	259	47	252 1
LOWER FRASER				
Nahatlatch R. & L.	4,065	1,896	2,096	1,856
Cultus L.	1,082 1	2,591 1	209 1	151 1
Upper Pitt R.	78,038	57,832	6,783	14,698
Chilliwack L./Chilliwack R., upper	126,164	57,928	31,766	26,245
MISCELLANEOUS 2	551	301	315	439
ADULTS	921,379	484,478	272,477	473,416
JACKS	4,335	2,347	1,450	4,309
TOTAL NET ESCAPEMENT	925,714	486,825	273,927	477,725

* Estimates are from DFO.

1 Cultus estimates include 247 adults in 2012, 204 adults in 2016, 99 in 2020 and 54 in 2024.

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

Table H 3. Detailed calculation of total allowable catch (TAC) and achievement of international catch shares for Fraser sockeye (by management group) salmon in 2024. Calculations are based on the in-season estimates of abundance, spawning escapement target and Management Adjustment at the time the Panel adopted the last in-season run size (August 23), in accordance with Annex IV, Chapter 4 of the Pacific Salmon Treaty.

	Fraser Sockeye					
	Early Stuart	Early Summer	Summer	Late	Total	
RUN STATUS, ESCAPEMENT NEEDS & AVAILABLE SURPLUS						
In-season Abundance Estimate	**180**	**143,000**	**275,000**	**38,000**	**456,200**	
Adjusted Spawning Escapement Target *	**180**	**143,000**	**275,000**	**38,000**	**456,200**	
Spawning Escapement Target (SET)	200	131,400	275,000	38,000	444,600	
%SET from TAM rules	*111%*	*92%*	*100%*	*100%*		
Management Adjustment (MA)	390	73,600	154,000	16,300	244,300	
Proportional MA (pMA)	*1.94*	*0.56*	*0.56*	*0.43*		
Test Fishing Catch (TF, post-seas. est.)	0	1,590	3,990	210	5,790	
Surplus above Adjusted SET & TF *	**0**	**0**	**0**	**0**	**0**	
DEDUCTIONS & TAC FOR INTERNATIONAL SHARING						
Aboriginal Fishery Exemption (AFE)	**0**	**50**	**60**	**420**	**530**	
Total Deductions (Adj.SET + TF + AFE)	180	144,600	279,000	38,600	462,500	
Available TAC (Abundance - Deductions)	**0**	**0**	**0**	**0**	**0**	
UNITED STATES (Washington) TAC						
Propor. distrib. TAC - Payback	**0**	**0**	**0**	**0**	**0**	
Proportionally distributed TAC **	0	0	0	0	0	16.5%
U.S. Payback	0	0	0	0	0	
Washington Catch	0	0	0	0	0	
Other Catch***	0	0	0	0	0	
Deviation from TAC - Payback	**0**	**0**	**0**	**0**	**0**	
CANADIAN TAC						
Propor. distrib. TAC + Payback + AFE	**0**	**50**	**60**	**420**	**530**	
Propor. distrib. TAC + U.S. Payback	0	0	0	0	0	83.5%
AFE	0	50	60	420	530	
Other Catch***	0	1,050	16,300	80	17,430	
Canadian Catch excluding SSFSC Catch	0	1,140	16,500	510	18,200	
Deviation from TAC + Payback + AFE	**0**	**-1,090**	**-16,480**	**-90**	**-17,660**	
TOTAL						
Available TAC + U.S. Payback + AFE	**0**	**50**	**60**	**420**	**530**	
Total Catch excluding SSFSC Catch	0	1,140	16,500	510	18,200	
Deviation from TAC + U.S. Payback + AFE	**0**	**-1,090**	**-16,480**	**-90**	**-17,660**	

* The surplus cannot exceed the estimated abundance.

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

*** May include unauthorized directed retention or unauthorized bycatch retention in fisheries directed at other species

APPENDIX I: MEMBERS OF THE FRASER RIVER PANEL TECHNICAL COMMITTEE IN 2024

Canada	United States
S. Decker, Co-Chair *Fisheries and Oceans Canada*	G. Rose, Co-Chair *Northwest Indian Fisheries Commission*
K. Campbell *First Nations Advisor*	M. Bogaard *Washington Department of Fish and Wildlife*
C. Schwindt *Fisheries and Oceans Canada*	T. Siniscal *National Marine Fisheries Service*
M. Staley *First Nations Advisor*	
M. Veilleux *Fisheries and Oceans Canada*	

APPENDIX J: STAFF OF THE PACIFIC SALMON COMMISSION IN 2024

EXECUTIVE OFFICE

John Field, Executive Secretary

John Son, Information Technology Manager

Angela Xu, Administrative Assistant

Julie Ehrmantraut, Publications & Web Content Manager

Kim Bartlett, Meeting Planner

FINANCE AND ADMINISTRATION

Ilinca Manisali, Director of Finance

Witty Lam, Senior Accountant

Jessy Yang, Accountant (Term)

Sascha Bendt, Grant Program Manager, Restoration & Enhancement Funds

Victor Keong, Program Assistant, Restoration & Enhancement Funds

Christina Langlois, Administrative Assistant, Restoration & Enhancement Funds

FISHERIES MANAGEMENT DIVISION STAFF

Fiona Martens, Director Fisheries Management Programs

Catherine Michielsens, Director Fisheries Management Science

Stock Assessment Group

Merran Hague, Stock Assessment Biologist

Serena Wong, Stock Assessment Assistant

Mark McMillan, Database Manager

Sai Madduri, Database Developer (Term)

Aimee Liu, Salmon Coordinator

Stock Identification Group

Maxine Forrest, Environmental Salmon Biologist

Steve Latham, Manager, Stock Identification

Julie Sellars, Senior Scale Analyst

Catherine Ball, Scale Lab Technician

Angela Phung, Stock Identification Biologist

Dejan Brkic, Assistant Quantitative Fisheries Biologist

Stock Monitoring Group

Eric Taylor, Quantitative Fisheries Biologist

Tosh Sutherland, Manager, Test Fishing Operations

Rachael Hornsby, Manager, Hydroacoustic Fisheries Biologist

Jacqueline Nelitz, Senior Hydroacoustic Technician

Jordan Maguire, Fisheries Technician

Kristen Hayward, Assistant Fisheries Biologist