



FRASER SUMMER 1.3 (5₂) CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) STOCK ASSESSMENT IN 2024

CONTEXT

This Science Response Report results from the regional peer review of April 29–May 3, 2024 on the Fraser Summer 5-2 Chinook Salmon (*Oncorhynchus tshawytscha*) Stock Assessment in 2024.

BACKGROUND

The Fisheries Management Branch of Fisheries and Oceans Canada (DFO) has requested that the Fraser Summer 1.3 (5₂) Chinook Salmon (*Oncorhynchus tshawytscha*) Stock Management Unit (SMU) be assessed relative to reference points that are consistent with the DFO Precautionary Approach (PA) and provide science advice to inform management objectives for this SMU.

ANALYSIS AND RESPONSE

Fraser Summer 1.3 Chinook SMU spawner escapements were analyzed using the Wild Salmon Policy (WSP) Rapid Status Scanner Approach to assign an SMU and CU-specific statuses. The WSP Rapid Status Scanner Approach approximates the WSP Integrated Status process by using a binary decision-tree algorithm. The statuses were provisional as they did not undergo expert review, which is a critical step in the Rapid Status Approach process.

The remaining analyses for the Fraser Summer 1.3 Chinook SMU estimated CU-specific U_{MSY} , $0.85 S_{MSY}$ for the SMU, and plotted SMU-level trends in aggregate catch, aggregate relative spawner abundance, aggregate fishery impact, and aggregate pre-fishery abundance. Habitat-based estimates of Ricker stock-recruit model parameters (Parken et al., 2006) were used to estimate CU-specific U_{MSY} and $0.85 S_{MSY}$, for which the lowest U_{MSY} may be used as the Removal Reference for the SMU, and the sum of the $0.85 S_{MSY}$ s is used for the SMU Upper Stock Reference Point. Confidence in the above metrics and trends was very low for several reasons:

1. CU- and SMU-level escapements are indices of absolute abundance;
2. There are insufficient coded wire tag (CWT) releases to estimate CWT-based calendar year exploitation rates (CYERs), thus catch and fisheries mortality are based on genetic stock identification (GSI) and the Fisheries Mortality Index (FMI) which are less precise and less accurate;
3. Ricker stock-recruit curve parameters could not be fit due to data deficiency and/or low-precision methods of estimating spawner escapements, recruits, fisheries mortality, and smolt-to-adult survival, thus estimates of U_{MSY} and S_{MSY} are based on models that approximate these metrics based on information available from other data-rich stocks.

Indicators of the Stock Status

*Table 1. List of Conservation Units (CUs) within the Fraser Summer 1.3 (5₂) Chinook Stock Management Unit with corresponding Designatable Units (DUs), most recent WSP Integrated stock statuses, and provisional statuses from the WSP Rapid Status Scanner Approach. *Data sources: Dionne et al. (2023); Doutaz et al. (2021); Weir et al. (2022).*

CU name	CTC indicator	CU	DU	WSP Integrated Assessment (2016)*	COSEWIC (2018/2020)	WSP Provisional Rapid Status (2024)
Lower Fraser River-Upper Pitt SU 1.3	None	CK-05	DU4	DATA DEFICIENT	Endangered	RED, Medium Confidence
Lower Fraser River SU 1.3	None	CK-06	DU5	DATA DEFICIENT	Threatened	DATA DEFICIENT
Middle Fraser River-Portage FA 1.3	None	CK-09	DU8	RED	Endangered	RED, Medium Confidence
Middle Fraser River SU 1.3	Chilko River	CK-11	DU10	AMBER	Threatened	RED, Medium Confidence
South Thompson SU 1.3	None	CK-14	DU13	RED/AMBER	Endangered	AMBER, Low Confidence
North Thompson SU 1.3	None	CK-19	DU17	RED	Endangered	RED, Medium Confidence

CONCLUSIONS

The analysis conducted was considered insufficient by participants and reviewers to provide an effective stock assessment. Some objectives in the Terms of Reference (TOR) were not effectively met, and the advice that resulted from the meeting and subsequent reviews are that the paper be rejected, and a new analysis be conducted using a new set of Terms of Reference objectives, different and additional models, and updated data. Specifically, Objectives 3-7 were not met for this SMU. The essential elements of Objective 5 could be met by paraphrasing and referencing Fraser Chinook Recovery Potential Assessments (Dionne et al., 2023; Doutaz et al., 2021; Weir et al., 2022), and Objective 6 could be developed relatively easily by setting a natural disaster trigger (Table A1, Appendix A). However, Objectives 3, 4, and 7 cannot be met using previously developed documents and methods due to the data-limited nature of the Fraser Summer 1.3 Chinook SMU. Thus, this SMU requires a research document to develop data-limited methods to assess the stock and provide the information DFO managers require (Table A1, Appendix A).

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SOURCES OF INFORMATION

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APPENDIX A

Table A1. Breakdown of success relative to the Terms of Reference for the Fraser Summer 1.3 (5₂) Chinook SMU FSRR from Salmon Sprint Week, April 29 – May 3, 2024. Terms of Reference Objectives and details are listed in the second column, success (met/not met) in the third, and an assessment of whether a given Objective could or could not be met using established methods and previous work or not is provided in the fourth column.

#	Terms of Reference Objective	Met/Not Met	Can be Met using established methods and previous work
1	<p>Stock status and trends, taking into account assumptions regarding stock structure and distribution. Include the historical and recent trajectory of both stock and fishing indicators.</p> <ul style="list-style-type: none"> • Stock structure and distribution: Describe the component populations (including hatchery contribution), Conservation Units (CUs), and Designatable Units (DUs) as applicable and demographic features (e.g., age structure, body size, sex ratio, genetics, distribution, and any associated trends). • Stock status and trends: include the historical and recent trajectory of stock abundance (spawners and catch) with respect to the stock's reference points (i.e., relative to established Precautionary Approach [PA] references or the candidate PA references). <ul style="list-style-type: none"> ○ Stock status considering both status as identified under the Wild Salmon Policy (WSP) for each component CU and aggregate abundance-based approaches for the stock management unit (SMU) when evaluating the limit reference point (LRP, as applicable and/or required). ○ Committee on the Status of Endangered Wildlife in Canada (COSEWIC)-assessed status of DU(s) if applicable. 	Met	Yes

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#	Terms of Reference Objective	Met/Not Met	Can be Met using established methods and previous work
2	Ecosystem and climate change considerations affecting the stock. Describe how environmental and climate considerations were considered in the assessment (e.g., parameterizing stock-recruit models, simulations, outcome uncertainties, etc.).	Met	Yes
3	Evaluate or provide estimates of candidate reference points (e.g., Upper Stock Reference [USR], Target Reference Point [TRP], Removal Reference [RR]) for the stock, including the aggregate abundance component of the LRP for the SMU as requested. <ul style="list-style-type: none"> The candidate reference points should be relevant to the assessment and management framework (i.e., are consistent with the scale and type of information that is collected and how the assessment is used to support decision making) 	Not Met - aggregate LRP not provided. Based on reviews of the IFC FSRR, aggregate FRP-Ls need to be developed to meet this Objective.	No - Aggregate FRP-Ls cannot be developed using simulation methods described by Holt et al. 2023 without estimates of ER and smolt-to-adult survival
4	Evaluate or provide estimates of the impact of candidate harvest and/or other management options on the stock. Work with clients to collaboratively identify specific scenarios to evaluate (e.g., "status quo", "no fishing", etc.). Provide advice on the potential impact of the scenarios on the SMU and CU(s) through quantitative or qualitative scenario evaluations. <ul style="list-style-type: none"> Evaluate the effect of management actions relative to PA reference points (e.g., on probabilities of dropping below LRP; exceeding RR; meeting USR and TRP) Evaluate the effect of management actions on other objectives/values of interest (e.g., potential catch, catch stability, abundance that allows for unrestricted food, social, and ceremonial (FSC) fisheries, spawner distribution, proportion natural index (PNI) values, demographic values, etc.). 	Not Met - no management actions evaluated against probability of meeting/exceeding/failing any reference points. Based on IFC, need to evaluate effect of different exploitation rates on likelihood of exceeding FRP-Ls across a range of marine survival scenarios	No - Exploitation rate information is missing, and a relationship between FMI and CWT-based CYER need to be developed before management scenarios can be evaluated. Additionally, smolt-to-adult survival information is missing for these CUs

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#	Terms of Reference Objective	Met/Not Met	Can be Met using established methods and previous work
5	<p>If the SMU is below the LRP:</p> <ul style="list-style-type: none"> Review CU components contributing to SMU status below the LRP Review factors driving (or limiting) production across the species life history and evaluate the potential future impact of climate on those factors and/or succinctly describe gaps in knowledge If applicable, associate limiting factors with anthropogenic threats and provide general recommendations for prioritizing potential mitigation actions and/or succinctly describe gaps in knowledge <i>If possible</i>, evaluate the effect of management actions on probabilities of reaching candidate rebuilding targets (e.g., how does increasing/decreasing exploitation rate affect the probability of the SMU reaching the candidate rebuilding target (e.g., some specified % above the aggregate abundance component of the LRP) in three generations and/or the projected timeframe needed to reach the target) 	Not Met - The first 3 components of Objective 5 can be met by porting over information from the FIA CN RPAs. The 4th component is "if possible", which was not feasible because new methods would need to be developed to meet the objective.	Yes, with the exception of the 4 th component of the objective. To meet the 4th component, new methods are required to translate the Fisheries Mortality Index into a coded wire tag (CWT) Calendar Year Exploitation Rate equivalent that can be used for simulating future CU and SMU spawner abundances under varying exploitation rates. In addition, new methods are required because SAS information is not available, and there is not enough data to parameterize a Ricker curve using traditional methods, which is needed for simulating future population abundances.
6	Describe any exceptional circumstances or assessment triggers for the stock	Not Met - but could easily be met with a smolt-to-adult survival change threshold or a natural disaster trigger	Yes
7	<p>Specific objectives for this SMU, in addition to general objectives #1–6 above include:</p> <ul style="list-style-type: none"> Develop the aggregate abundance reference point component of LRP, USR and RR if possible, taking into account habitat-based approaches and coverage of existing spawner escapement programs 	Not Met - aggregate LRP not provided. Based on IFC FSRR, aggregate FRP-Ls need to be developed and aggregate RR set to CU with lowest RR.	No - Aggregate FRP-Ls cannot be developed using simulation methods described by Holt et al. 2023 without estimates of ER and smolt-to-adult survival

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