LIMIT REFERENCE POINTS AND WILD SALMON POLICY RAPID STATUS SUMMARY: 2024 FRASER –SPRING 1.2 CHINOOK STOCK MANAGEMENT UNIT

Context

A key recommendation from a CSAS peer review process on Pacific Salmon Limit Reference Points (LRPs) is 'CU [conservation-unit] status-based LRPs' be used to meet the Fish Stocks provisions of the *Fisheries Act* (DFO, 2022; Carrie. A. Holt et al., 2023; K. Holt et al., 2023)**, which was supported nationally** (DFO, 2023)**.** LRP's are assessed for Stock Management Units (SMUs), which can include one or more conservation units (CUs) (i.e., CUs are nested within SMUs). Using this approach, serious harm to a SMU is identified when any component CU zone drops into the Wild Salmon Policy (WSP) *Red* zone. Under this definition, the CU status-LRP is '100% of CUs with statuses above *Red* status'. The implications are that if a single CU is the *Red* status zone, the SMU is assessed as being below its LRP, which in turn triggers a DFO rebuilding plan for the SMU.

Forewords

Expert reviewers expressed concerns that the Wild Salmon Policy Rapid Status Algorithm does not account for changes in spawner distribution within CUs. Because the scanner only uses total CU spawner abundances and/or trends in abundances, it assumes that CUs with even versus uneven spawner distributions relative to the productivity of each component population are equally healthy. Declining evenness in spawner distribution within a CU may signal a productivity decline, but relatively large and productive populations can temporarily mask a decline when solely using total CU abundance to estimate status.

Indigenous Knowledge

The data used in the current stock productivity analyses underlying the calculation of biological benchmarks for the WSP Rapid Status Approach do not include spawner abundance observations prior to colonization of Indigenous land. Significant modifications to the landscape, climate, and fishing practices occurred before the development of high precision spawner-escapement surveys for this SMU.

Data

The Spring 1.2 Chinook SMU contains two CUs (Lower Thompson SP 1.2; South Thompson – Bessette Creek SU 1.2). These two CUs comprise of a total of 11 systems, 8 of which are included in this assessment (Table 1). The data used in this assessment were described in detail in Dionne et al. (2023). The last integrated status assessment for the CUs in this SMU occurred for return year 2012 (DFO, 2016). Some of the data were also recently used in the Fraser Chinook Recovery Potential Assessments (Dionne et al., 2023). For the Lower Thompson CU, the Nicola River was previously excluded from the 2023 assessment due to high hatchery influence, but a natural origin escapement time-series has been produced for the 2024 assessment that includes Nicola spawner counts in the benchmark calculations

(see narrative section for details).

The primary forms of spawner enumeration surveys vary across the CUs within this SMU. There is also variation in enumeration methods throughout the time series for some CUs within this SMU. South Thompson – Bessette Creek data were collected by visual surveys with a peak live count expansion factor applied. Visual survey coverage ranged from moderate effort (1-4 surveys) to high effort (> 5 surveys) from 1995-2024. Lower Thompson data were collected using a combination of visual survey methods and high precision methods. Deadman River within the Lower Thompson CU was enumerated primarily by a fixed-site census from 1985-2024. A resistivity counter was added to supplement fence counts in 2000. Louis Creek was enumerated by visual survey methods using a peak live count expansion factor between 2005-2024 and by a fixed-site census using a weir from 1998-2004. Bonaparte River data were collected using a resistivity counter supplemented with downstream visual counts from 1996-2024. Nicola River data were collected using a Mark-recapture from 1995-2024 and historical data (1975-1995) have since been calibrated to become equivalent to the mark recapture method.

Key steps in the data processing of this dataset include assessing data quality, which are described in detail in Pestal et al. (2023). Data quality is assessed based on the number and completeness of surveys, coverage of the spawning period, visibility and reliability records, and methodology.

Spawner data quality were moderate to high on average, with high quality data available in the last couple of decades for the Lower Thompson CU. For the South Thompson-Bessette CU, data quality remained moderate for recent years in the time series. South Thompson-Bessette CU data are relative indices, but given the expert reviewers' high confidence in spawner returns being consistently less than 1500 fish, they were assessed against relative and absolute abundance metrics. Lower Thompson data are absolute abundances and were also assessed against absolute and relative abundance metrics.

Relative Abundance Benchmarks:

Relative abundance-based benchmarks for the two CUs in this SMU were developed by applying additional watershed area (due to the addition of the Nicola River) to the methods from Parken et al. (2006), changing the metric used for the lower biological benchmarks, and incorporating Ricker curve parameters from a recent stock-recruit analysis on the Nicola River Indicator Stock into the benchmark calculations (these changes are recorded in the Fraser Spring 1.2 FSRR which is currently under review). During the recent CSAS process for the Yukon Chinook Fish Science Response Report (June 2025), authors and reviewers advocated for using 20% of the carrying capacity (S_{max}) as the lower biological benchmark instead of S_{gen}. 20% of S_{max} is an ecologically-based objective that is derived from the carrying capacity of a CU rather than a harvest-based objective, and is generally more conservative than S_{gen}, which aligns with the precautionary principle. Previous CSAS publications have also suggested using 20% S_{max} as an alternative to S_{gen} for spawner abundances, especially when there is limited stock-recruit data available (Holt et al. 2009). The median lower benchmark values are presented for each CU (Table 2).

Table 1. Conservation Units (CUs) included in this Stock Management Unit (SMU) and lists of the streams/populations within each CU used in the Rapid Status Assessment. Streams have their NuSEDS population identifications in brackets.

CU No#	CU Name	Streams (Population ID)	Timeseries

CK-16	South Thompson – Bessette Creek SU 1.2	Bessette Creek (46548) Creighton Creek (812) Duteau Creek (46568) Harris Creek (46578)	1995-2024
CK-17	Lower Thompson SP 1.2	Bonaparte River (46206) Louis Creek (46598) Deadman River (46216) Nicola River (46176)	1986-2024

Table 2. Relative abundance-based benchmarks by Conservation Unit (CU). The upper benchmarks are 85% S_{MSY} and the lower benchmarks are 20% S_{max}. Upper Benchmarks are multiplied by 1.1 in the algorithm.

CU Name	Benchmark	p50
South Thompson – Bessette Creek SU 1.2	85% S_{MSY}	103
South Thompson – Bessette Creek SU 1.2	S_{gen}	75
South Thompson – Bessette Creek SU 1.2	20% S_{max}	77
Lower Thompson SP 1.2	85% S_{MSY}	3,604
Lower Thompson SP 1.2	S_{gen}	2,614
Lower Thompson SP 1.2	20% S_{max}	2,662

WSP Rapid Status Summary

Stock Management Unit (SMU) Limit Reference Point (LRP) status and narrative based on expert consensus[1]

There are two CUs in the Spring 1.2 Chinook SMU and they are designated as **1 Red and 1 Amber**, placing this SMU **below the LRP** in terms of WSP rapid status (Figures 1-2 & Table 3). South-Thompson Bessette was originally classified as data-deficient because of a missing data point in 2020 that prevented calculation of a generational average value, but the missing data point was infilled to allow the assignment of *Red* status.

CK-16 South Thompson Bessette Creek SU 1.2

During the January 2025 expert review meeting it was agreed that the South Thompson Bessette CU data should be treated as absolute abundance and changed to *Red* status because of high confidence

[1] Consensus: general agreement of group as a whole, or absence of evidence-based opposition to conclusions. Determined by the "weight of evidence" (scientific data, information, and analysis) where multiple results are reported. In the event of disagreements, equally plausible conclusions can be reported. Dissenting views must be clearly described in the narrative.

that there were less than 1500 spawners in the population. The 2020 survey year had zero counts early in the survey period and counts later in the period were difficult to discern from Middle Shuswap Summer 0.3 Chinook, thus a final estimate was not generated. However, the 2020 escapement value was infilled using the geometric average of the previous generation (2016-2019). This enabled the calculation of a generational average so that absolute abundance metrics could be used for the rapid status assessment algorithm.

During the July 2025 expert review meeting, concern was expressed surrounding low benchmark values for the South-Thompson Bessette Creek CU, which may not accurately reflect the potential productivity and carrying capacity of the system. In addition, improving the genetic baseline for South-Thompson Bessette Creek to better distinguish Bessette fish from Middle Shuswap Summer 0.3 Chinook was suggested. Another research priority identified was to investigate and quantify sources of mortality by life stage.

CK-17 Lower Thompson SP 1.2

During the January 2025 expert review meeting, participants expressed a desire to examine the spawner distribution trends for the most recent generation of spawners in the Bonaparte, Deadman, and Louis systems. Reviewers also noted that there are habitat threats to the system due to recent high intensity wildfires and flood events.

During the July 2025 expert review meeting, participants expressed desire to include data related to sub-adult marine mortality due to recreational and groundfish fisheries. Incidental mortality from recreational fisheries is estimated but not highly accurate, and bycatch from non-salmon fisheries is not represented.

Work Completed Since January 2025 Review

The 2023 assessment for Lower Thompson SP 1.2 Chinook excluded the Nicola River population due to high hatchery influence. For the 2024 assessment, a natural origin spawner time series for the Nicola River coded-wire tag indicator population was developed. Natural origin spawner data were calculated beginning in the 1992 brood year. Additionally, the lower biological benchmarks for both CU's were adjusted from S_{gen} to 20% S_{max} as described previously (Table 2).

Table 3. Wild Salmon Policy (WSP) Rapid Statuses for 2024. For background, refer to Appendix 1.

CU #	**CU Name**	**WSP Rapid Status (YYYY)**	**WSP Rapid Status Node and Pathway**
CK-16	**South Thompson – Bessette Creek SU 1.2**	**RED, HIGH**	The recent year's status (2024) is designated *as Red* with a *high* confidence based on the algorithm (Figure 1). The recent generational average is 1.36 spawners, and is well-below the absolute lower abundance (Node 3; Figure 2, Table 4). This *Red* status has been consistent throughout the status time series from 1998 to 2024 (Figure 1). The 2024 WSP rapid status of *Red* matches the WSP integrated status from 2012 (DFO 2020).

CK-17	**Lower Thompson SP 1.2**	**AMBER, HIGH**	The recent year's status (2024) is designated *Amber with a high* confidence based on the algorithm (Figure 3). The data could be assessed as Absolute Abundance. The recent generational average is 5,122 spawners, and is above the relative abundance lower benchmark (Node 22 Figure 4, Table 5). This *Amber* has been consistent throughout the time series from 2007-2024 (Figure 2). The 2024 WSP rapid status of Amber does not match the Red WSP integrated status from 2012 (DFO, 2016).

CK-16 South Thompson – Bessette Creek SU 1.2

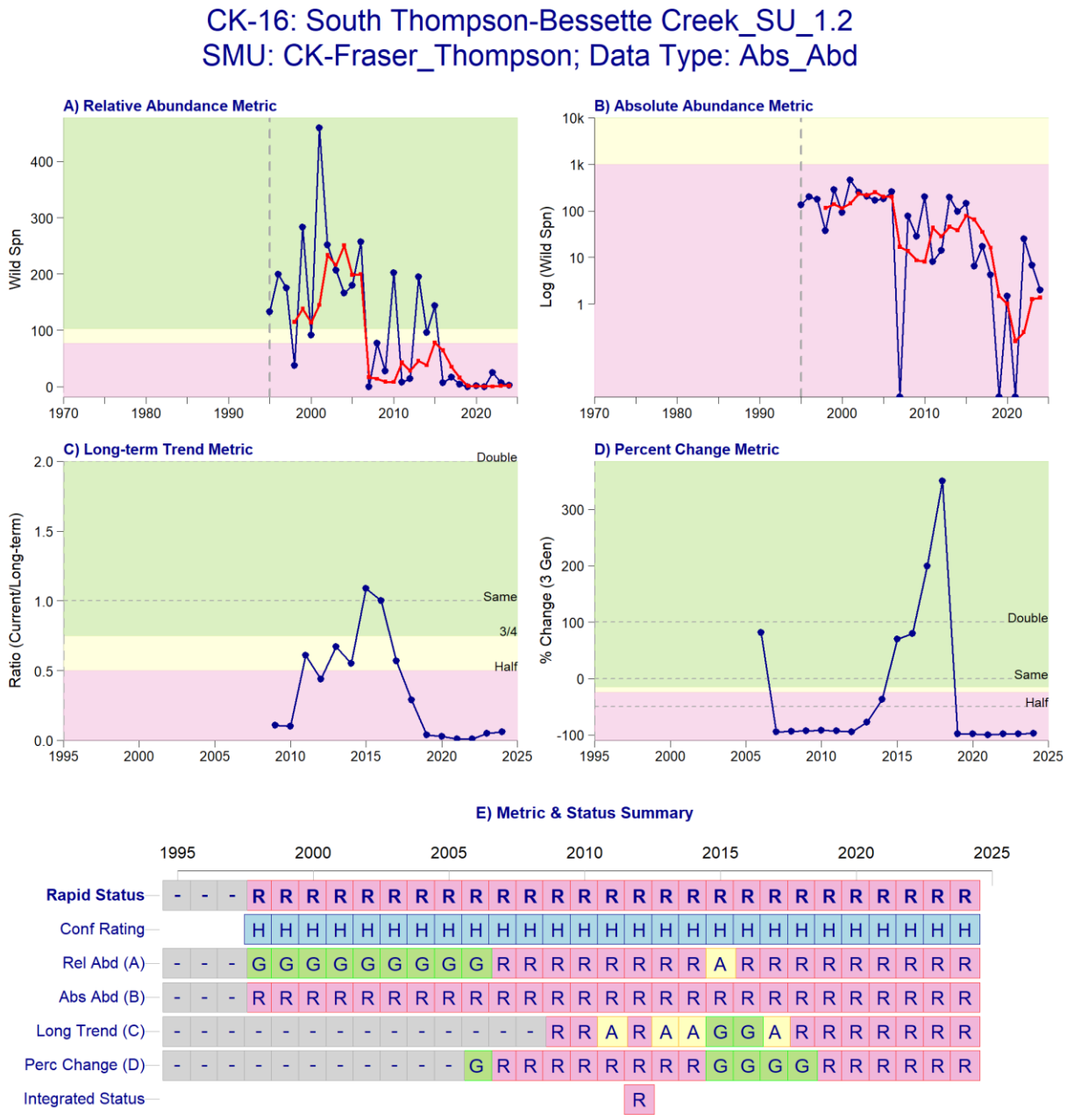

Figure 1: Metrics and Status for South Thompson Bessette-Creek SU 1.2 (CK-16). Panels on top show the four standard WSP metrics, calculated based on the available time series of spawner abundances. The bottom panel summarizes the status for each individual metric and shows the resulting WSP rapid status. Note that metric benchmarks may differ from algorithm thresholds, since thresholds

approximate the status determination process from past WSP integrated status assessments (see Figure 2 and Table 4).

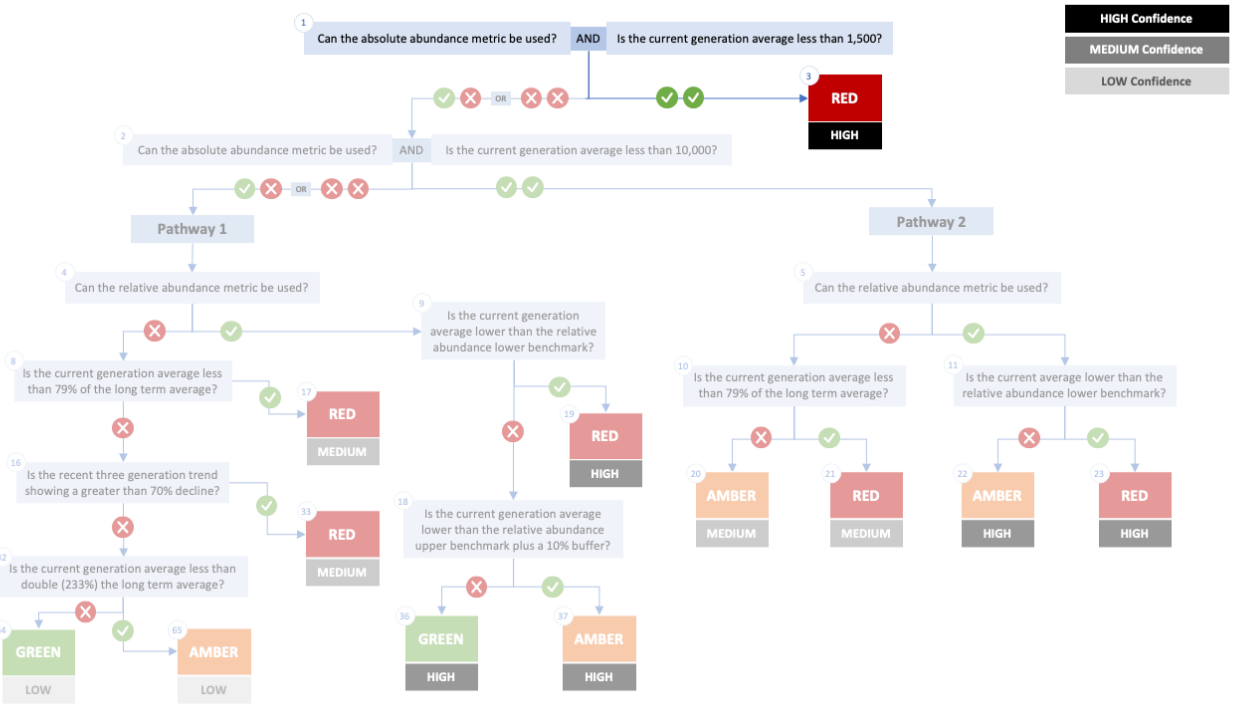

Figure 2. Algorithm pathway taken to assess status for the South Thompson Bessette-Creek SU 1.2 in 2024. The recent generational average falls below the *absolute abundance* lower (1,500) threshold (node 1). Status for this CU is therefore designated as *Red* with *High* confidence at Node 3.

Table 4: Decision tree path given data and metric values for the South Thompson Bessette-Creek SU 1.2 in 2024; this aligns with Figure 2 above. For each node, the algorithm decision is made by comparing the CUs current metric value to the metric threshold and answering Yes or No, running through sequential nodes and decisions until the final WSP rapid status for that CU and year is reached.

Node	Metric	Metric Threshold	CUs Current Value	Decision
1	Absolute Abundance	<1,500	1.36	YES, YES
3	FINAL STATUS NODE			RED, HIGH

CK-17 Lower Thompson SP 1.2

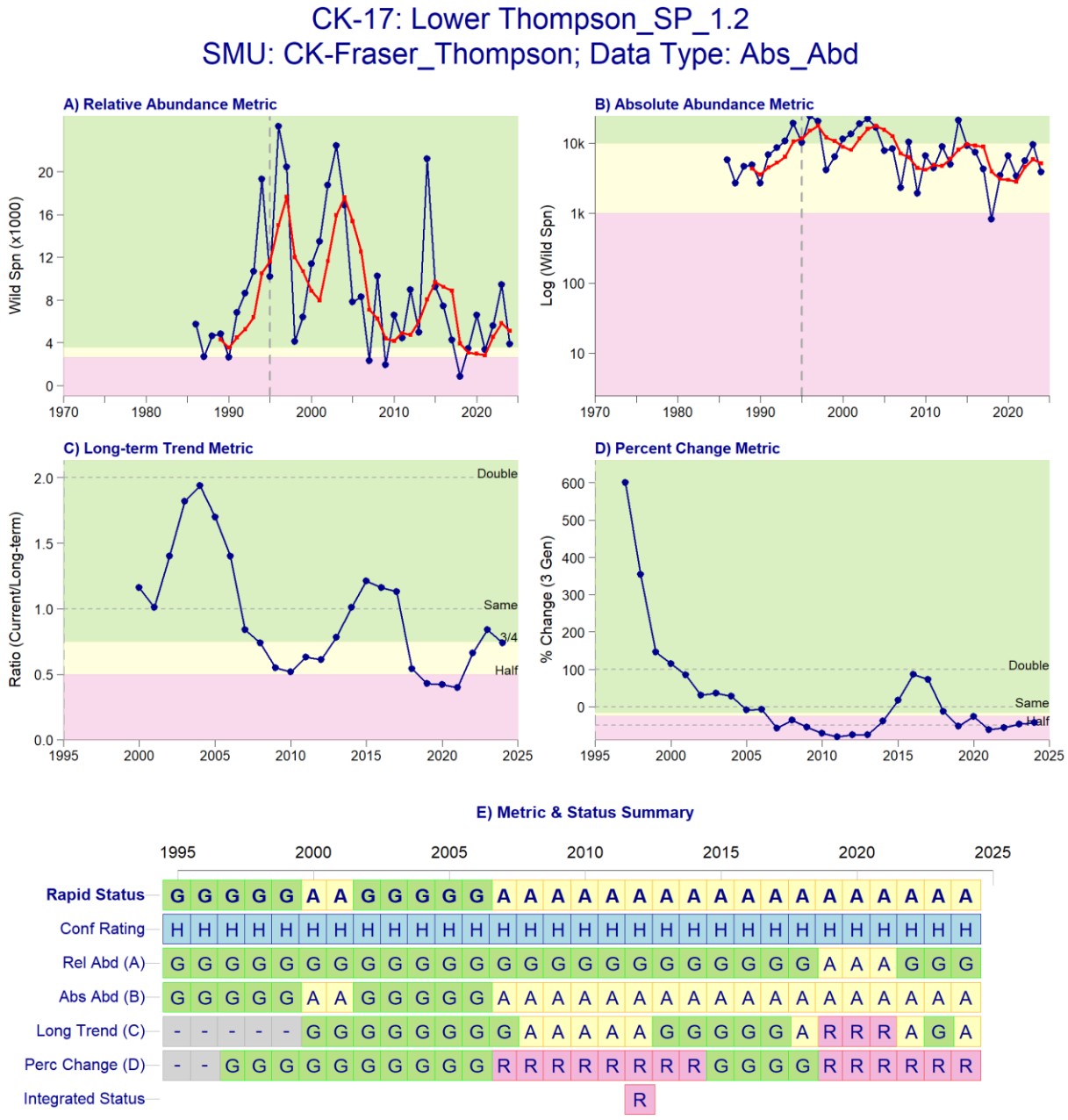

Figure 3: Metrics and Status for Lower Thompson SP 1.2 (CK-17). Panels on top show the four standard WSP metrics, calculated based on the available time series of spawner abundances. Bottom panel summarizes the status for each individual metric and shows the resulting WSP rapid status for the CU with a confidence rating. If integrated WSP status assessments have been completed for this CU, they are shown on the last row (IntStatus). Note that metric benchmarks may differ from algorithm

thresholds, since thresholds approximate the status determination process from past WSP integrated status assessments (see Figure 3 and Table 5).

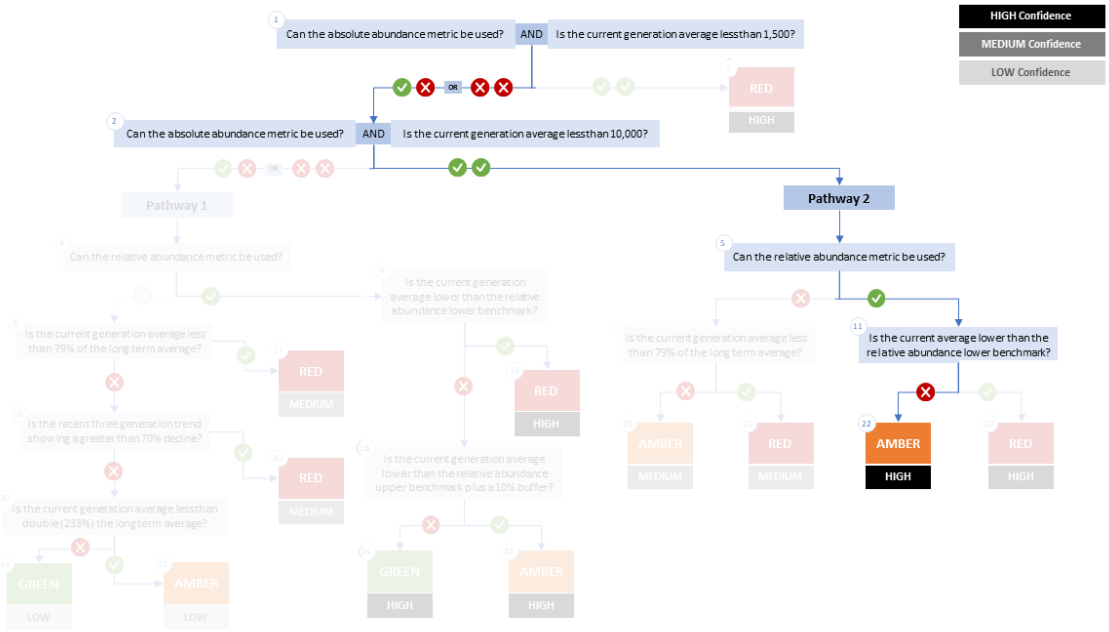

Figure 4. Algorithm pathway taken to assess status for Lower Thompson SP 1.2. The recent generational average falls above the absolute abundance lower (1,500) threshold (node 1) but below the absolute abundance upper (10,000) threshold (node 2). Following algorithm Pathway 2, we do have a relative abundance metric for this CU (node 5) and the recent generational average falls above the lower benchmark (20% S_{max}) (node 11). Status for this CU is therefore designated as Amber with High confidence at node 22 (see (DFO, 2024) for definition of each node).

Table 5: Decision tree path given data and metric values for Lower Thompson SP 1.2; this aligns with Figure 4 above. For each node, the algorithm decision is made by comparing the CUs current metric value to the metric threshold and answering Yes or No, running through sequential nodes and decisions until the final WSP rapid status for that CU and year is reached.

Node	Metric	Metric Threshold	CU Current Value	Decision
1	Absolute Abundance	<1,500	5,122	NO, NO
2	Absolute Abundance	< 10,000	5,122	YES, YES
5	Relative Abundance	Available?		YES
11	Relative Abundance	< 2,662	5,122	NO
22	FINAL STATUS NODE			AMBER, HIGH

Cited and other Key References

DFO. (2016). *Integrated biological status of Southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) under the Wild Salmon Policy*.

DFO. (2022). *Methodologies and guidelines for defining limit reference points for Pacific Salmon. CSAS SAR 2022/030. pp. 16*.

DFO. (2023). Science advice on guidance for limit reference points under the fish stocks provisions. *Canadian Science Advisory Secretariat Science Advisory Report*, *2023/009*(February).

DFO. (2024). Rapid status approximations for Pacific salmon derived from integrated status assessments under DFO's Wild Salmon Policy. *Can. Sci. Advis. Sec. Sci. Resp.*, *2024/004*, 1–42. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41207890.pdf

Dionne, K., Parken, C., Weir, L., Doutaz, D., Bailey, R., Jenewein, B., Miller-saunders, K., Labelle, M., Welch, P., Trouton, N., Mozin, P., & Walsh, M. (2023). *Recovery Potential Assessment for Southern British Columbian Chinook Populations , Fraser and Southern Mainland Chinook* (Issue 2023/042).

Holt, Carrie. A., Holt, K., Wor, C., Warkentin, L., Connors, B., Grant, S. C. H., & Huang, A.-M. (2023). Guidelines for Defining Limit Reference Points for Pacific Salmon Stock Management Units. *Can. Sci. Adv. Sec. Res. Doc.*, *2023/009*, iv + 66.

Holt, K., Holt, C. A., Warkentin, L., Wor, C., Davis, B., Arbeider, M., Bokvist, J., Crowley, S., Grant, S. C. H., Luedke, W., McHugh, D., Picco, C., & Will, P. Van. (2023). Case Study Applications of LRP Estimation Methods to Pacific Salmon Stock Management Units. *Can. Sci. Advis. Sec. Res. Doc.*, *2023/010*, iv + 129.

Holt, C.A. (2009). Evaluation of benchmarks for conservation units in Canada's Wild Salmon Policy: Technical documentation. *DFO Can. Sci. Sec. Res. Doc. 2009/059. X + 50 p.*

Parken, C. K., McNichol, R. E., & Irvine, J. R. (2006). Habitat-based methods to estimate escapement goals for data limited Chinook salmon stocks in British Columbia, 2004. *Canadian Science Advisory Secretariat*, *083*, vii+1-67.

Pestal, G., Macdonald, B. L., Grant, S. C. H., & Holt, C. A. (2023). State of The Salmon: Rapid status assessment approach for Pacific salmon under Canada's Wild Salmon Policy. *Can. Tech. Rep. Fish. Aquat. Sci.*, *3570*, 1–200.

Appendix A: WSP rapid status approach details

The decision tree sequence is as follows (see Figure A1; Table A1, A2):

1. The first question is whether or not a CU has a current absolute abundance value, and if so, whether or not this value falls below the lower threshold of 1,500 (which adds a buffer to Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Criterion D1 for small

population size of 1,000). If the answer to this question is Yes, then the CU is assigned Red (node 3), with *High confidence*.

2. If the answer to the first question is No, then the second question is whether or not the CU has a current absolute abundance value, and if so, whether or not the current abundance is below the upper threshold of 10,000, which is COSEWIC's Criterion C upper benchmark. This second question splits the decision nodes into two Pathways: Pathway 1 (No to this question) and Pathway 2 (Yes to this question).
    - **Pathway 1:** is where a CU either does not have a current absolute abundance value, or has these data, and it falls above the upper threshold for this metric. This pathway is split with the question: can this CU be assessed with a relative abundance metric. If the answer is Yes, a Red (nodes 19), Amber (nodes 37) or Green (node 36) WSP rapid status is assigned, with High confidence, depending on where the current abundance value falls relative to this metric's lower and upper thresholds. If the answer is NO, then comparisons are made between the CU's current abundances and percent change to thresholds for these metrics, which assign a Red with Medium confidence, or Green or Amber with Low confidence status.
    - **Pathway 2:** is where a CU has absolute abundance data, and these abundances fall between the lower and upper thresholds. In this pathway, absolute abundances restrict WSP rapid statuses to only Amber or Red. This pathway is split with the question: can this CU be assessed with a relative abundance metric. If the answer is Yes, an Amber (node 22) with Medium confidence, or Red (node 23) with High confidence, is assigned, depending on whether the CU's current abundance value falls above the relative abundance metric lower threshold or below. If the CU cannot be assessed with a relative abundance metric, then it is compared to the lower threshold of the Long-Term trend metric and assigned Amber (node 20) with Medium confidence if above, or Red (node 21) with Medium confidence if below.

Table A1. Biological status zones under the Wild Salmon Policy (WSP).

Status		Definition
	Red	Poor status CU facing an imminent threat of extinction [revised definition, given alignment with COSEWIC *Endangered* statuses]
	Amber	"While a CU in the *Amber* zone should be at low risk of loss, there will be a degree of lost production. Still, this situation may results when CUs share risk factors with other, more productive units". Aligns with COSEWIC *Threatened and Special Concern* statuses.
	Green	"identif[ies] whether harvest are greater than the level expected to provide on an average annual basis, the maximum annual catch for a CU, given existing

		conditions…there would not be a high probability of losing the CU". Aligns with COSEWIC *Not at Risk* statuses.
	DD	**Data deficient**. CUs have been designated as DD if there is no data available, or if the available data is insufficient for calculating status metrics (after quality control).

Table A2. WSP rapid status *Learning Tree 3* status assignments by node (see Figure 1). This table presents the decisions in *Learning Tree 3* that led to *Red* or *Amber* or *Green* status assignments; status outcomes depend on the pathway and decisions made. The final node that corresponds to the status assignment is presented below (see Figure 1).

Node	Status	Rule
Node3	*Red*	Data Type is Absolute Abundance AND *Absolute Abundance* < 1,500
Node17	*Red*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Relative Index OR *Absolute Abundance* ≥ 10,000; then no *Relative Abundance* lower benchmark; then *Long Term Trend* < 79%
Node19	*Red*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Relative Index OR *Absolute Abundance* ≥ 10,000 then have *Relative Abundance* lower benchmark*;* then *Relative Abundance < Relative Abundance* lower benchmark
Node20	*Amber*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Absolute Abundance AND *Absolute Abundance<10,000;* then no *Relative Abundance* lower benchmark; then *Long Term Trend* ≥ 79%
Node21	*Red*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Absolute Abundance AND *Absolute Abundance<10,000;* then no *Relative Abundance* lower benchmark; then *Long Term Trend* < 79%
Node22	*Amber*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Absolute Abundance AND *Absolute Abundance<10,000;* then have *Relative Abundance lower benchmark;* then *Relative Abundance* ≥ *Relative Abundance* lower benchmark
Node23	*Red*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Absolute Abundance AND *Absolute Abundance<10,000;* then have *Relative Abundance lower benchmark;* then *Relative Abundance < Relative Abundance* lower benchmark
Node33	*Red*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Relative Index OR *Absolute Abundance* ≥ 10,000; then no *Relative Abundance* lower benchmark; then *Long Term Trend* ≥ 79%; then Percent Change < -70
Node36	*Green*	Data Type is Relative Index OR Absolute Abundance ≥ 1,500; then Data Type is Relative Index OR Absolute Abundance ≥ 10,000 then have Relative Abundance lower benchmark; then Relative Abundance ≥ Relative Abundance lower benchmark; then Relative Abundance ≥ Relative Abundance upper benchmark x 1.1
Node37	*Amber*	Data Type is Relative Index OR Absolute Abundance ≥ 1,500; then Data Type is Relative Index OR Absolute Abundance ≥ 10,000 then have Relative Abundance lower benchmark;

		then Relative Abundance ≥ Relative Abundance lower benchmark; then Relative Abundance < Relative Abundance upper benchmark x 1.1
Node64	*Green*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Relative Index OR *Absolute Abundance* ≥ 10,000; then no *Relative Abundance* lower benchmark; then *Long Term Trend* ≥ 79%; then Percent Change < -70 then *Long Term Trend* ≥ 233
Node65	*Amber*	Data Type is Relative Index OR *Absolute Abundance* ≥ 1,500; then Data Type is Relative Index OR *Absolute Abundance* ≥ 10,000; then no *Relative Abundance* lower benchmark; then *Long Term Trend* ≥ 79%; then Percent Change < -70 then *Long Term Trend* < 233

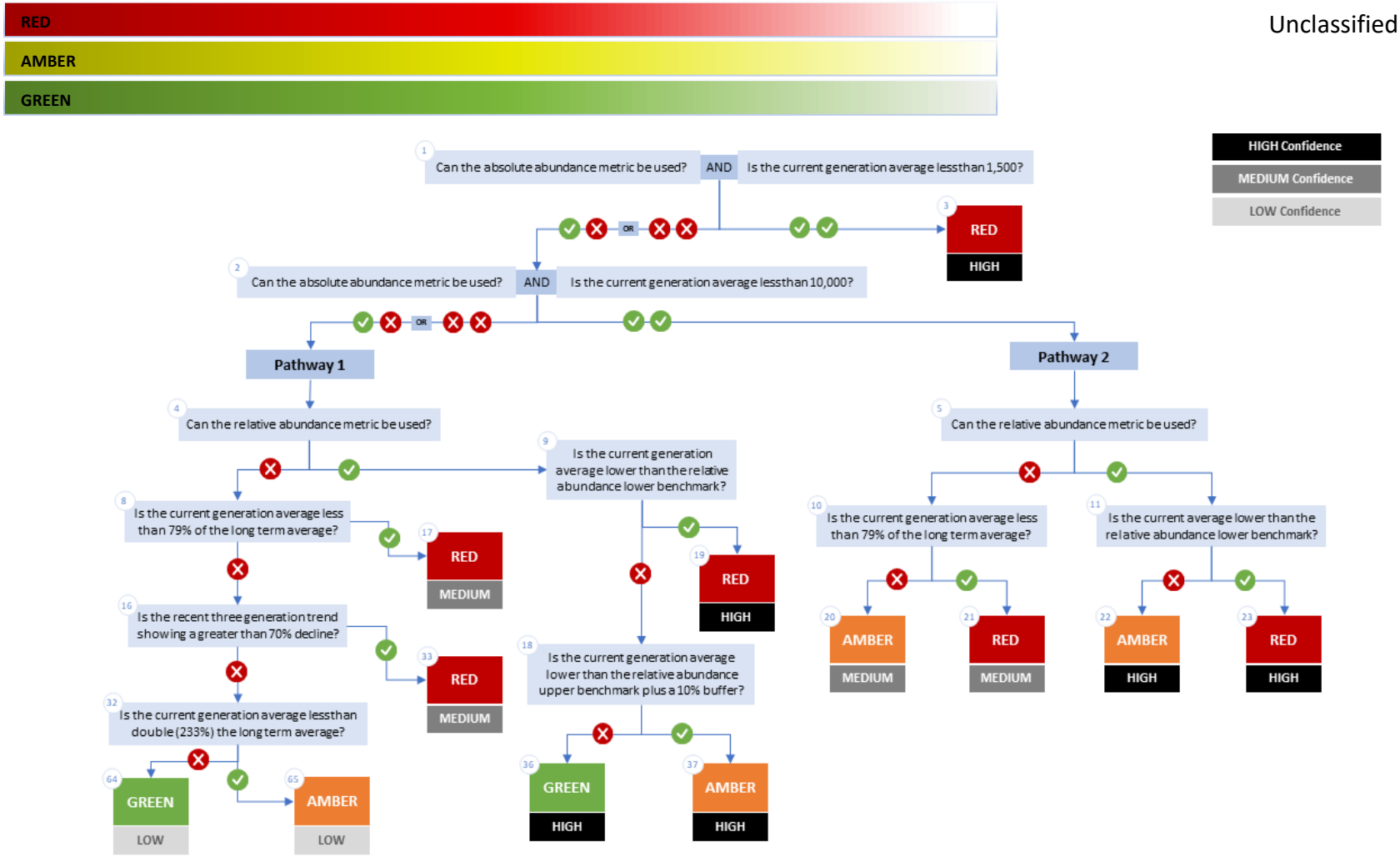

Figure A1. WSP rapid status decision tree (Table 2 includes written descriptions). To assess a CU, metric values are compared to thresholds presented at each decision point. Yes or No answers split each path of the decision tree, terminating at WSP rapid status assignments. The different splits are identified as nodes: 1 to 65. **Pathway 1** is taken when the CU has no absolute abundance data, or these data exist, but fall above its upper threshold of 10,000. **Pathway 2** is taken when the CU has absolute abundance data and these fall under its upper benchmark of 10,000.

Appendix B: Meeting History and Participants

Tables and summaries of meetings and participants, specifically participants who identified as a subject matter expert for one or more CUs.

Table B1. Participants for the expert review of Fraser Interior Area Chinook held January 31, 2025 1:00-4:30pm PST

Attendee	Affiliation
Chuck Parken	DFO
Colin Bailey	DFO
Morgan Dunne	DFO
Nicole Trouton	DFO
Amber Messmer	DFO
Sue Grant	DFO
Bronwyn MacDonald	DFO
Simon-Luc Noel	DFO
Isabella Borea	DFO
Marissa Glavas	DFO
Elinor McGrath	Okanagan Nation Alliance
Peter Nicklin	Tŝilhqot'in National Government
Kelsey Campbell	A'Tlegay Fisheries
Michelle Walsh	Shuswap Nation

Table B2. Participants for the expert review of Spring 1.2 Fraser Interior Area Chinook held July 2nd, 2025 1:00-3:00pm PST

Attendee	Affiliation
Elinor McGrath	Okanagan Nation Alliance
Michelle Walsh	Shuswap Nation
Nathan Lustig	Scw'exmx Tribal Council
Chuck Parken	DFO
Colin Bailey	DFO
Isabella Borea	DFO