SALMON TECHNICAL TEAM REPORT ON 2025 SALMON METHODOLOGY REVIEW

The Salmon Technical Team (STT) and the Scientific and Statistical Committee Salmon Subcommittee (SSC-SSC) held the Salmon Methodology Review meeting on October 4, 2024, and discussed the two topics slated for review:

1. Derivation of proxy S_{MSY}/S_{MSP} ratio and F_{MSY} value suitable for use for Sacramento River fall Chinook
2. Sacramento River fall Chinook cohort reconstruction and comparison to the Sacramento Index

Derivation of proxy S_{MSY}/S_{MSP} ratio and F_{MSY} value suitable for use for Sacramento River fall Chinook

Dr. Will Satterthwaite (SSC / Sacramento River Fall Chinook Workgroup [SRWG]) presented work focused on updating the F_{MSY}[1] value used for Sacramento River fall Chinook (SRFC). Because not all salmon stocks have direct estimates of F_{MSY} based on stock-specific data, a proxy value was developed in 2011. That Chinook F_{MSY} proxy was based on an average of F_{MSY} values estimated for 20 stocks distributed across the U.S. West Coast, resulting in the F_{MSY} proxy of 0.78. Since the development of the proxy, additional information has become available. The STT supports the effort to create a new proxy for SRFC based on more recent data from Chinook stocks that are more similar geographically and in life history characteristics.

The SRWG recommended an F_{MSY} proxy for SRFC of 0.58 based on the mean of F_{MSY} estimates for Klamath River fall Chinook (KRFC) and Rogue River fall Chinook. Criteria were provided by the SRWG for selecting these two stocks from the range of other stocks that had independent estimates of F_{MSY}. For example, stocks with a more northerly distribution than SRFC and/or stocks for which the majority of brood years were from before the late 1970s were omitted from the proxy. The STT and the SSC-SSC discussed whether other stocks should be included in the proxy but ultimately determined that the KRFC and Rogue River fall Chinook stocks were the most representative of SRFC.

STT Recommendation: The STT supports updating the F_{MSY} proxy value for SRFC from 0.78 to 0.58, consistent with the recommendation of the SRWG, beginning in 2025.

Sacramento River fall Chinook cohort reconstruction

Dr. Emily Chen provided a presentation on a new SRFC cohort reconstruction (detailed in Chen et al. 2024)[2] that could replace the current Sacramento Index (SI) of abundance. The SI is vital to planning ocean fisheries in the area south of Cape Falcon, Oregon because it informs both the Sacramento Harvest Model (SHM) and the Harvest Control Rule used in designing ocean salmon

[1] F_{MSY} is the exploitation (fishing mortality) rate corresponding to maximum sustainable yield
[2] Dr. Michael O'Farrell recused himself from decisions on this item as he was a co-author on the Chen et al. 2024 paper

fishery seasons. The SI is the sum of ocean harvest south of Cape Falcon, recreational river harvest, and escapement. Estimates of the SI are available going back to 1983. The STT and SSC-SSC both agreed that the proposed cohort reconstruction is an improvement over the SI because it includes age structure, natural mortality, non-retention fishing mortality, and age-specific maturation rates. This should result in more accurate estimates of ocean abundance, exploitation rates, and projected escapement to better inform the preseason fishery planning process. However, new data streams and model inputs would need to be in place prior to annual implementation.

The recommendations for the new SRFC cohort reconstruction analysis differ from current status quo management practices and from the KRFC cohort reconstruction in two notable ways, listed below. While these recommendations have technical merit, logistical and policy implications should be weighed to determine if they are suitable for incorporation into management at this time.

1. Incorporating SRFC harvest and impacts from fisheries that occur north of Cape Falcon.

   The SI does not account for harvest and fishing related mortality that occurs in fisheries north of Cape Falcon, Oregon (NOF) because prior assessments determined that the mean proportion of SRFC harvest to overall ocean harvest in fisheries occurring NOF was minimal (O'Farrell et al 2013). The Chen et al. (2024) cohort reconstruction found that including ocean harvest in fisheries NOF increased SRFC ocean harvest estimates by a mean of 4.8 percent. Accounting for SRFC harvest in NOF fisheries would result in more accurate estimates of ocean abundance and provide a more complete characterization of harvest estimates and exploitation rates of this stock.

   A decision to incorporate impacts to SRFC in NOF fisheries would require subsequent changes to current modeling methods and management frameworks. Both the abundance forecast and SHM would need to be modified to account for the impacts that occur in NOF fisheries. Further consideration/direction would be needed to determine how to estimate and account for these additional impacts during the preseason planning process and in postseason assessments.

2. Modify the calculation for Spawner Reduction Rate and the potential escapement absent fishing.

   Potential escapement absent fishing is the projected number of spawners expected to return if no fishing were to occur. This value is used in the calculation of the Spawner Reduction Rate, or the reduction in overall spawning abundance due to all fishing impacts. For the SI and in the cohort reconstruction for KRFC, this metric is calculated for the current year only, meaning the potential escapement absent fishing is the projected number of spawners expected to return had no fishing occurred in the current year. In the SRFC cohort reconstruction, Chen et al. (2024) recommends modifying the calculation to include any additional spawners that may have escaped had there not been any fishing on the entire cohort (i.e. no fishing in current year or in prior years that would have impacted the returning cohorts). This method ultimately increases the estimate of the exploitation rate (i.e., the Spawner Reduction Rate).

   Chen et al. (2024) defines the Spawner Reduction Rate for the current year as SRR_y and the Spawner Reduction Rate accounting for fishing mortality incurred in the current and prior

years as SRR. The STT would like to acknowledge that the SRR may be better suited for postseason estimation of exploitation and for use in stock status determinations, but it would not be the most appropriate measure of exploitation from a preseason planning perspective. SRR_y would be better suited for planning ocean fisheries and informing the harvest control rule, because the use of the exploitation rate in this scenario is to project the current year fishing impacts and resulting escapement following execution of current year fisheries.

STT Recommendation: The STT supports the use of the new SRFC cohort reconstruction and considers it an improvement over status quo. The STT recognizes that a stepwise approach to achieving the full potential of a cohort run reconstruction will require time and coordination. If the Council decides to adopt this method for SRFC run reconstruction and agrees to implement this concept beginning in 2025, then components of this method would have to be introduced over time.

The STT would recommend using post-season exploitation rates derived from the cohort reconstruction, as available, for stock status determinations beginning in 2025.

The STT acknowledges that accounting for harvest of SRFC in NOF fisheries results in a more complete characterization of overall mortality of SRFC, however, current SRFC abundance forecast and harvest models are not currently set up to accommodate this. Accounting for SRFC impacts in NOF fisheries would not be ready for implementation in 2025, but the STT would recommend incorporating it into the modeling and assessment of SRFC in the near future.

A cohort reconstruction model will need to be updated annually with recent data in order to incorporate it into the annual assessment and management of SRFC. This will require substantial changes to existing data streams, workload, and commitments from responsible agencies, primarily the California Department of Fish and Wildlife. Should the requisite data streams become available, the STT would suggest that future work focuses on using results of the cohort reconstruction to (1) re-parameterize the SHM and (2) develop an age-based forecast for SRFC.

Additionally, the STT recommends using the SRR for calculating the postseason assessment of exploitation and for use in status determinations, but using SRR_y for calculating preseason exploitation rates applied to the harvest control rule. Given there are different applications better suited for either SRR or SRR_y this necessitates adopting two ways of estimating this measure of exploitation. Careful consideration needs to also be given when applying these calculations to a preseason forecast and postseason assessment of exploitation, because improper application or comparison of these slightly different metrics would give conflicting results.

PFMC
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