

Orientation Document for the Sacramento River fall Chinook SMSY Peer Review

The purpose of this document is to provide the peer review panel with: **(1)** a high-level overview of Pacific Fishery Management Council (Council) peer review policies and procedures, **(2)** salmon management advisory bodies, **(3)** background on the Sacramento River fall Chinook (SRFC) salmon stock and Council management, **(4)** recent Council activities related to SRFC, and **(4)** an orientation to the Publicly Accessible Materials (PAM) site that will be used for document distribution during the peer review process.

This document is not intended to serve as a comprehensive overview of Council salmon management activities. Additional information, including details related to tribal and international management coordination, Endangered Species Act (ESA) obligations, and broader salmon management processes, can be found in recent [salmon management documents](#), the Pacific Salmon Fishery Management Plan (FMP) ([PFMC 2024](#)), and other Council materials available on the Council's [website](#).

The roles and responsibilities of the peer review panel are described in detail in the Terms of Reference (TOR) previously provided to the panel and posted to the [PAM](#) site.

1. Peer Review Policies and Procedures and Development of this Peer Review Process

National Standard 2 Guidelines of the Magnuson-Stevens Act (MSA) dictate that the Council shall develop conservation and management measures based on the best scientific information available (BSIA) ([50 C.F.R. § 600.315](#)). While the Council's Scientific and Statistical Committee (SSC) makes determinations regarding BSIA, the Council has a role in helping ensure the development and quality of that information. One such role is in the development of processes and procedures that are considered "peer review".

Several sections of the MSA, as well as National Oceanic and Atmospheric Administration (NOAA) and Office of Management and Budget (OMB) Policies, outline what is necessary for a peer review process. These include:

- [OMB Peer Review Bulletin \(M-05-03\) \(2004\)](#): The Bulletin requires peer review for influential assessments (such as stock assessments). In addition, it requires agencies to publish peer review agendas, make reports public, and explain how peer review was conducted. It also requires independent, expert peer review, with clear separation from those who conducted the work.
- [MSA National Standard 2 Guidelines \(50 C.F.R. § 600.315\)](#): National Standard 2 Guidelines reinforce that FMPs and their amendments must be based on BSIA. It clarifies that peer review is a part of identifying BSIA and recognizes SSCs and approved peer review processes as the vehicles for doing so.

- [NOAA Fisheries Framework for Determining that Stock Status Determinations and Catch Specifications are Based on the Best Scientific Information Available \(NMFS Procedure 01-101-10\) \(2019\)](#): The NMFS Procedural directive provides a national framework for following the steps in the BSIA process and complements the requirements of the MSA and National Standard 2 Guidelines.
- [West Coast Best Scientific Information Available Regional Framework \(2022\)](#): The Regional BSIA Framework outlines the process for ensuring that management decisions are based on BSIA and is deemed to satisfy the requirements of the OMB Peer Review Bulletin. [Attachment 2](#) referenced in the Regional Framework describes the roles and responsibilities of partner organizations (the Council’s advisory bodies and SSC and the NOAA Fisheries Science Center and Regional Office) for each step in the policy directive. The Regional Framework describes that peer review may differ by assessment type or species group and may be conducted by the SSC alone, or with relevant FMP subcommittees and independent expert panelists serving as part of peer review panels.
- [NOAA Administrative Order 216-105B \(2017\)](#): This policy implements the OMB requirements within NOAA and does so by requiring independent peer review for scientific products that inform management, establishing standards for objectivity, transparency, and timeliness, and directing line offices (like NMFS) to develop peer review procedures tailored to their fields.

Together, the above policies and statutes mean that Councils don’t run their own peer review independently; instead, Councils coordinate with NMFS to ensure reviews meet NOAA and OMB standards. In practical terms, this means that SSCs are the statutory peer review bodies, but when assessments or other scientific works are “highly influential,” independent external review must occur.

One peer review process built into the annual salmon management framework is the annual salmon methodology review. At these reviews, the Council’s SSC and Salmon Technical Team (STT) review current and proposed salmon methodologies. However, this process occurs on a short time scale, typically during the interim period between salmon preseason planning cycles (April through October) and is intended “*to provide peer review of the technical estimation and modeling procedures, to ensure the best and most objective technical analyses possible, to minimize confusion during the preseason option development process, and to resolve disputes over methodology*” ([Council Operating Procedure \(COP\) 15](#)). In other words, the design of the methodology review process is most appropriate for evaluating technical tools, model updates, or general model refinements, but is less suitable for reviews of scientific works that may result in highly influential or substantial changes.

Previous Council discussions regarding potential updates to the SRFC S_{MSY} (provided in detail in Section 4 of this document) emphasized the need for a deliberate and transparent peer review process to accompany any re-estimation effort. SRFC is a major contributor to Pacific Coast

salmon fisheries, supporting ocean harvest opportunities off California and contributing substantially to fisheries off Oregon. Because revisions to the S_{MSY} could significantly influence conservation objectives, harvest management, and future policy decisions, the Council determined that any proposed update to the S_{MSY} should undergo a high level of independent scientific review.

In consultation with NMFS, the Council therefore established this novel peer review process to occur prior to any BSIA determination by the Council's SSC. Drawing on approaches used by other Council FMPs and scientific review bodies outside of the Council, the framework was designed to provide an independent, rigorous, and transparent evaluation of salmon science. The process was developed consistent with the policies and procedures listed above and is intended to ensure that any revisions to the SRFC S_{MSY} are thoroughly evaluated before being incorporated into annual salmon management and further Council decision-making.

2. Council Management Advisory Groups

The Council leverages advisory bodies and management and technical teams to develop and review information and provide input to aid the Council in decision making. The following three groups support the Council on topics related to salmon management, and a representative from each group will be participating in the peer review process in an advisory capacity.

The **Scientific and Statistical Committee** provides the Council with expert scientific and technical advice (see [COP 4](#) for SSC rules and procedures). Non at-large Federal, state, and tribal agency SSC members are appointed by the Council to serve indefinite terms, whereas at-large members are appointed for three-year terms, and may be reappointed at the conclusion of the term. General duties include, but are not limited to, providing evaluations and recommendations on FMPs, stock assessments, rebuilding plans, and other documents to ensure the Council is basing their decisions on the best available science.

The SSC has a salmon subcommittee that meets to discuss salmon specific issues prior to full SSC discussion, when necessary. Salmon subcommittee duties include participation in the annual salmon methodology review and preparation of post-meeting reports that provide summary information and recommendations for consideration by the full SSC.

The [West Coast BSIA Regional Framework, Attachment 2](#) outlines the SSC's roles and responsibilities for ensuring Council salmon management decisions are based on the BSIA. These are:

- Recommending topics for, participating in, and reporting out on the results of the annual salmon methodology review meetings (also as described in [COP 15](#));
- Reviewing preseason forecast model outputs and exploitation rate and escapement estimates used for status determination criteria; and
- Evaluating acceptable biological catches (ABCs) for stocks or stock complexes not managed under international agreement, listed under the ESA, or designated as hatchery

stocks through their annual review of stock abundance forecasts presented annually by the STT in Preseason Report I (also as described in Salmon FMP, [Section 3.3.3](#)).

As noted in the [NMFS Procedural Directive 01-101-10](#), these responsibilities are in complement to the description of the peer review process described in National Standard 2.

After the conclusion of this peer review process, the SSC will review the peer review panel's final report and recommendations. The SSC will advise the Council on an approach that represents the BSIA for updating the S_{MSY} value, if applicable.

The **Salmon Technical Team** assists the Council by summarizing salmon data from the previous season, estimating the number of salmon in the coming season, and analyzing the effects of Council's recommendations and amendments. The STT is guided by [operational procedures](#), and is comprised of state, Federal, and tribal fisheries management agencies, all of whom have technical expertise in salmon management. STT members are appointed by the Council and may serve an indefinite number of terms. STT responsibilities outlined in the [West Coast BSIA Regional Framework](#) are:

- Synthesizing and compiling fishery performance, escapement estimates, and stock-specific forecasts for the Council's preseason and postseason analytical documents, and updating information as new data become available;
- Evaluating stock status indicators and management reference points, including spawning escapements, exploitation rates, annual catch limits, and overfishing limits for applicable stocks, and identifying any changes in overfished or overfishing status; and
- Along with the SSC, recommending topics for, participating in, and reporting out on the results of the annual salmon methodology review meetings (also as described in [COP 15](#)).

The **Salmon Advisory Subpanel** (SAS) is made up of 16 members who represent commercial, recreational, and tribal interests, as well as a conservation representative. The SAS is guided by [operational procedures](#), and members are appointed by the Council for three-year terms and may be reappointed after the conclusion of a term. These advisors play a large role in developing the Council's annual salmon management options in March and April, and the regional knowledge and sector-specific perspectives advisors bring help to guide the Council's decision-making process. SAS representatives help to ensure industry perspectives are communicated clearly and provide contextual background.

3. Sacramento River fall Chinook background Council management overview

3.1. Location and geography

The Sacramento River Basin comprises approximately 26,000 square miles between the Sierra Nevada and Cascade Ranges to the east and the Coast Range to the west. The headwaters of the Sacramento River lie in the Cascade Range, near Mount Shasta. The river flows south to the Sacramento-San Joaquin River Delta, which begins just downstream of the city of Sacramento,

then into San Pablo and San Francisco bays and ultimately into the Pacific Ocean (Figure 1). Major tributaries to the Sacramento River include the Feather River, Yuba River (which itself is a tributary of the Feather River), and the American River. Numerous smaller tributaries flow from the Sierra Nevada, and to a lesser extent, from the Coast Range into the Sacramento River. Many of these tributaries are important spawning and rearing areas for SRFC.

Four runs of Chinook salmon, named after the season in which mature fish enter the river to spawn, are present in the Sacramento River and its tributaries. These runs include SRFC, late-fall run, winter run, and spring run. Yoshiyama et al. (1998) notes that each run features a somewhat protracted run timing that can lead to substantial temporal overlap in the Sacramento Basin. As such, the Sacramento River is known to have adult Chinook salmon present in the system throughout the year. Two of the runs that utilize the Sacramento River are listed under the ESA: spring run are listed as Threatened and winter run are listed as Endangered. These listings are in large part due to extensive loss of the cold headwater habitats that these runs require. SRFC, and to a lesser degree late-fall run, are not as dependent on high-elevation and/or spring-fed habitats as spring and winter Chinook.

The Sacramento River and its tributaries have been heavily modified over time by a variety of actions, including dam construction, flood control efforts, and water diversions for agricultural and domestic uses. Keswick Dam, near the city of Redding and approximately nine miles downstream of Shasta Dam, is the upstream terminus of anadromy for the Sacramento River. Dams are also present on the Feather, Yuba, and American rivers, as well as many of the smaller tributaries, eliminating a substantial amount of Chinook spawning habitat. Hatcheries are used to mitigate for the lost production of salmon due to impassable dams. Historical accounts of salmon abundance in the Sacramento Basin, and descriptions of the physical changes to the Sacramento River and its tributaries can be found in Fisher (1994) and Yoshiyama et al. (1998).

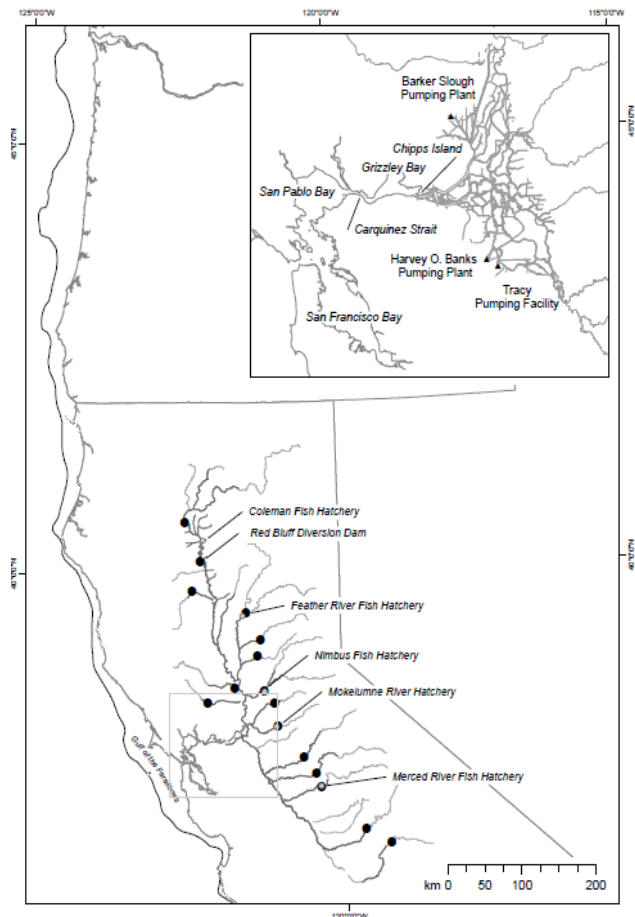


Figure 1. Map of the Sacramento River Basin, Delta, and coastal ocean. Black dots indicate dams, most of which are impassable. Coleman, Feather River, and Nimbus fish hatcheries produce SRFC. Figure reproduced from Lindley et al. (2009).

3.2. Stock composition

Mature SRFC return to hatcheries and natural spawning areas. Although a portion of the spawning stock every year consists of age-2 fish, primarily males referred to as “jacks,” only age-3 and older fish are considered adults and thus used to assess stock status. From 1970-2025, natural-area escapement (which includes both natural- and hatchery-origin fish) has represented on average 79 percent of the total adult escapement in the Sacramento Basin ([PFMC 2026a](#), Table II-1). However, this percentage has greatly fluctuated over time, in general there has been a decreasing trend. For almost every decade, the average percentage of adult escapement occurring in natural areas has declined, beginning with 92 percent in the 1970s, 85 percent in the 1980s, 81 percent in the 1990s, 75 percent in the 2000s, and 66 percent in the 2010s. However, from 2020-2025, the average has slightly increased to 71 percent.

Even among the natural-area spawners, analyses utilizing coded-wire tags (CWTs) collected during the 2010-2013 escapements indicated high levels of hatchery-origin SRFC (Kormos et al. 2012, Palmer-Zwahlen and Kormos 2013, Palmer-Zwahlen and Kormos 2015, Palmer-Zwahlen et al. 2018). The SRFC Rebuilding Plan showed this was especially true in the Feather and American rivers, where hatchery-origin SRFC composed as high as 90 percent and 73 percent, respectively, of the natural-area escapement ([PFMC 2019](#), Table 3.1.8.b).

SRFC spawn in the fall and the fry emerge during winter through early spring. Juveniles enter the ocean from spring through mid-summer, spending little time in the estuary. Ocean harvest data indicates that SRFC are primarily caught from the coast of northern Oregon to southcentral California, which in terms of fishery management translates to Cape Falcon, OR to the U.S./Mexico border. Within this ocean range, SRFC generally compose larger portions of the overall harvest in areas closer to San Francisco Bay. These fish typically spend around a year and a half to three years in the ocean before returning to freshwater, although waiting four, and to a lesser extent five, years to mature is not uncommon. SRFC that spend less than two years in the ocean are considered age-2 when they return and, as mentioned above, are not considered adults.

Hatchery production of SRFC comes from Coleman National Fish Hatchery (CNFH), operated by the U.S. Fish and Wildlife Service (USFWS), and from Feather River Hatchery (FRH) and Nimbus Fish Hatchery (NFH), operated by the California Department of Fish and Wildlife (CDFW). CNFH is located on Battle Creek, a tributary near the upper limit of anadromy in the Sacramento mainstem, and smolts are typically released directly into the creek. However, during severe drought conditions in the Sacramento River, smolts are trucked to the delta and released into net pens. The Feather River is located downstream of Battle Creek, and almost all fall-run production from FRH is trucked and released into net pens in the delta and San Pablo/San Francisco Bay, as well as coastal net pens located in Half Moon Bay and Santa Cruz. The American River, where NFH is located, is even further downstream and flows through the city of Sacramento. While a portion of the production at NFH is always trucked to the delta or bay and released into net pens, brood years 2013 and 2014 were entirely trucked, due to extreme drought conditions in-river.

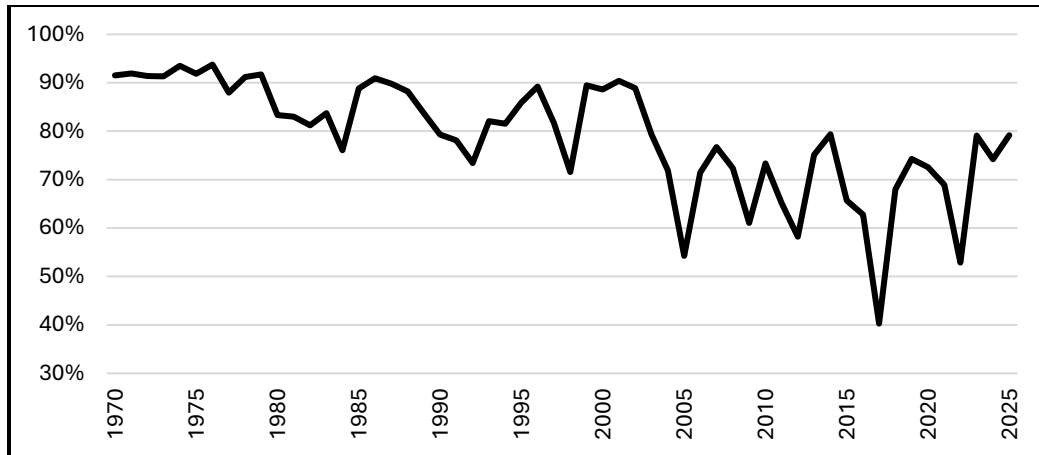


Figure 2. Historical percentages of the adult Sacramento River fall Chinook escapement that consisted of natural area spawners, as opposed to hatchery spawners. (Note that 2025 data is preliminary).

3.3. Conservation objectives

Note that while this section provides an overview of the current conservation objective, the Council will be reconsidering the SRFC conservation objective and evaluating potential alternatives after the completion of the peer review process.

Table 3-1 in the Salmon FMP ([PFMC 2024](#)) defines the conservation objective for SRFC as:

“122,000-180,000 natural and hatchery adult spawners (MSY proxy adopted 1984).” Justification for this conservation objective and citations for supporting documents are also found in Table 3-1.

Prior to 2012, the conservation objective guided annual fisheries management for this stock. Fisheries were planned so as to achieve hatchery and natural-area adult escapement levels within the goal range, when possible. Upon adoption of Amendment 16 to the FMP in 2012 ([PFMC 2011](#)), annual fishery management of the SRFC stock has been guided by a harvest control rule that incorporates some aspects of the conservation objective.

3.4. Management strategy

As with the current conservation objective, the Council will be reconsidering and evaluating potential alternative harvest strategies after the peer review process concludes.

Current management of SRFC is guided by a control rule that specifies the maximum allowable exploitation rate based on a forecast of potential spawner abundance, which is the hatchery and natural-area adult escapement in the absence of fisheries (Figure 3). The exploitation rate cap specified by the control rule includes harvest impacts of both ocean and river fisheries.

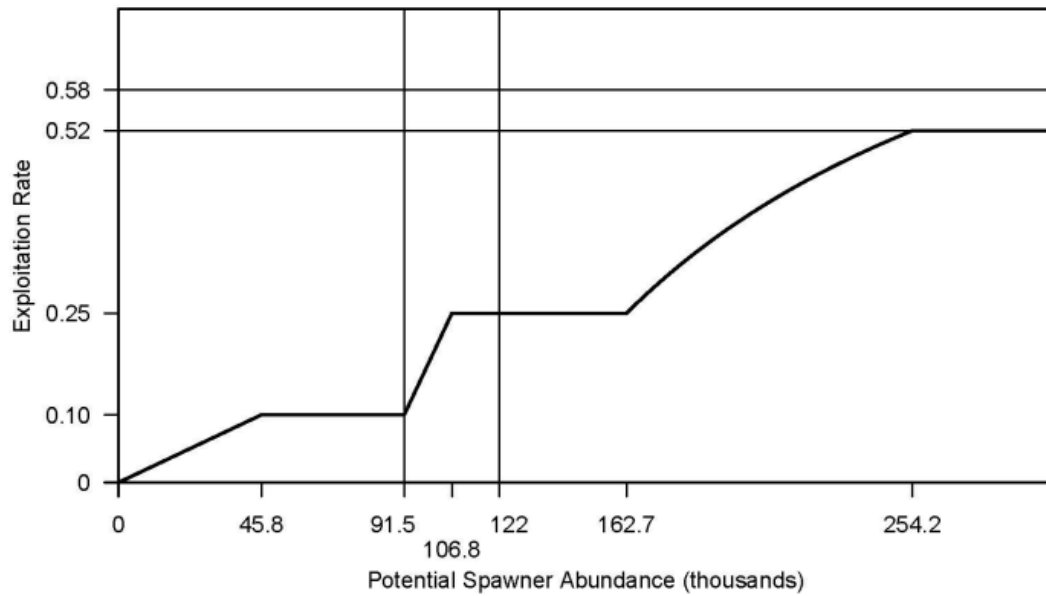


Figure 3. Sacramento River fall Chinook control rule. Potential spawner abundance is the predicted hatchery and natural area adult spawners in the absence of fisheries, which is equivalent to the Sacramento Index. See the salmon FMP, Section 3.3.6, for control rule details.

For SRFC, potential spawner abundance is represented by the forecast of the Sacramento Index (SI), the aggregate-age (> age-2) abundance index for this stock. The SI in year t is the sum of (1) adult SRFC ocean fishery harvest south of Cape Falcon, OR between September 1 ($t - 1$) and August 31 (t), (2) adult SRFC impacts from non-retention ocean fisheries when they occur, (3) the year t recreational harvest of adult SRFC in the Sacramento River Basin, and (4) the year t SRFC adult spawner escapement. A forecast of the SI is made annually, and the methods used to forecast this index have changed over time. A detailed description of the SI and the estimation of its components can be found in [O'Farrell et al., 2013](#).

Since 2014, the SI has been forecast using a log-log model relating jacks ($t-1$) to the SI (t) with lag-1 autoregressive errors fitted to SI data from 1983-forward. A description of this approach can be found in PFMC (2014), Appendix E, and in annual versions of Preseason Report I (Stock Abundance Analysis and Environmental Assessment Part 1 for Ocean Salmon Fishery Regulations) since 2014.

At high levels of potential spawner abundance, the control rule specifies a maximum allowable exploitation rate of 0.52, the fishing mortality rate associated with the acceptable biological catch (F_{ABC}). At moderate abundance, the control rule specifies an allowable exploitation rate that results in an expected escapement of $S_{MSY} = 122,000$ hatchery and natural-area adults (the curved portion of the control rule). At low levels of abundance the control rule specifies *de minimis* exploitation rates that allow for some fishing opportunity but result in the expected escapement falling below 122,000 adults.

3.5. Recent Stock Status

In 2018, SRFC met the criteria for overfished status. The Salmon FMP states that “*a stock will be considered overfished if the three-year geometric mean of the annual spawning escapements fall below the minimum stock size threshold (MSST).*” The three-year geometric mean from 2015-2017 was 76,714, which was below the MSST of 91,500. Factors contributing to the overfished status identified in the rebuilding plan adopted by the Council ([PFMC 2019](#)) included poor ocean environment, drought, water management, poor freshwater conditions (temperature, flow, etc.) have contributed to its poor status.

In 2021 NMFS determined the stock to be rebuilt ([NMFS 2021](#)). The Salmon FMP states “*the default criterion for determining that an overfished stock is rebuilt is when the three-year geometric mean spawning escapement exceed S_{MSY} .*” The three-year geometric mean of spawning escapement from 2018-2020 was 133,549, which exceeds the SRFC current S_{MSY} of 122,000. As of 2026 Preseason Report 1 ([PFMC 2026b](#)), the stock continues to be rebuilt.

4. Recent Council Activities Related to Sacramento River fall Chinook Management

In 2018, SRFC were declared overfished and subsequently determined to be rebuilt in 2021. Included in the rebuild plan was a recommendation to reconsider the conservation objective ([PFMC 2019](#)).

In April 2022, a review of the basis behind the SRFC conservation objective was included as a topic for the salmon methodology review, and the analysis was completed ([Satterthwaite 2022](#)) for the October 2022 methodology review meeting. [Satterthwaite 2022](#) detailed the origins of the current SRFC conservation objective, which was established in the 1980s using data from the 1950s through the 1980s, and found that the conservation objective was difficult to reproduce using historical documents and available data.

At the **November 2022** Council meeting, the STT and SSC ([STT 2022](#); [SSC 2022](#)) supported prioritizing work toward developing a new conservation objective for SRFC, given the conservation concerns and importance of this stock to salmon fisheries south of Cape Falcon. Additional components of SRFC management were also discussed, such as development of cohort reconstruction models that incorporate age structure.

In April 2023, the Council requested that the NMFS, California Department of Fish and Wildlife (CDFW), and Council staff develop a scoping report outlining the potential pathways forward on a reevaluation of the SRFC conservation objectives. The scoping report¹ was presented to the Council in June 2023 ([PFMC, NMFS, & CDFW 2023](#)). The Council formed the ad-hoc Sacramento River Fall Chinook workgroup (SRWG) and adopted draft [Terms of Reference](#).

In June 2024, the SRWG provided their first report to the Council ([SRWG 2024a](#)). The report included an evaluation of the current reference points (F_{MSY} , S_{MSY} , MSST), conservation objective,

¹ The paper also includes an outline of coordinated effort surrounding Klamath River salmon recovery following dam removal.

and harvest control rule as well as a preliminary identification of potential management measure alternatives to each of those.

At the **November 2024** Council meeting, the results of the October 2024 salmon methodology review were presented to the Council. Two topics proposed by the SRWG ([SRWG 2024b](#)) were included as a part of that review: (1) *Derivation of proxy S_{MSY}/S_{MSP} ratio and F_{MSY} value suitable for use for SRFC* ([Satterthwaite 2024](#)) and (2) *Sacramento River Fall Chinook cohort reconstruction (CR) and comparison to the Sacramento Index (SI)* ([Chen et al., 2024](#)).

Both the SSC ([SSC 2024a](#)) and STT ([STT 2024a](#)) reports supported updating the F_{MSY} proxy for SRFC to 0.58, the result of the first SRWG methodology review topic. The SSC and STT also both supported the new cohort reconstruction, the second SRWG topic. The STT noted cohort reconstruction differs from current practices and implementation would require changes in data inputs and modeling. The Council adopted the new F_{MSY} proxy value (with a planned review scheduled for 2028) and approved the use of the cohort reconstruction method, allowing phased implementation starting in 2025.

The SRWG also provided their second report to the Council at the November 2024 meeting ([SRWG 2024c](#)) which included, among other items, additional discussion on the methodology review topics, issues the Council should consider when developing an updated conservation objective, and a recommendation to reparametrize the harvest control rule in terms of the conservation objective rather than S_{MSY} .

In **April 2025**, the Council preliminarily selected two of the topics proposed by the SRWG ([SRWG 2025a](#)) for the 2025 salmon methodology review: (1) *Derivation of natural-area S_{MSY} for SRFC* and (2) *Methods for deriving total (natural areas plus hatchery) escapement objective based on consideration of natural production and hatchery needs* and directed Council staff to develop a document outlining the appropriate steps and sequence for a comprehensive review of the SRWG's recommendations for evaluating the SRFC management framework (reference points, conservation objective, and harvest control rule).

In **September 2025**, the Council received an update from the SRWG ([SRWG 2025b](#)) and a report developed by Council staff ([PFMC 2025a](#)) in response to the Council's April tasking. The Council opted not to move the preliminarily selected topics forward for methodology review and discussed a desire to further explore updating the SRFC management framework through a comprehensive amendment to the Salmon FMP.

In **November 2025**, the Council reviewed a report and appendices developed by the SRWG ([SRWG 2025c](#); [SRWG 2025d](#)) on their progress to date and a report developed by Council staff that outlined the expertise needed for the development of a SRFC FMP amendment ([PFMC 2025b](#)). [PFMC 2025b](#) also described that scientific elements of the FMP amendment will require peer review and described different kinds of peer review processes the Council could consider.

The Council expressed support for an independent peer review process focused on determining an updated S_{MSY} value. It provided guidance to staff on the expertise and structure of the peer review process at the November 2025 and March 2026 Council meetings. The Council requested staff develop a draft TOR for the peer review body for Council review and a future meeting.

In **April 2026**, the Council provided additional input on the peer review process and adopted the final peer review panel Terms of Reference.

5. Orientation to the Publicly Accessible Materials site

All materials associated with the peer review will be made available on the Council's [Publicly Accessible Materials](#) (PAM) site for this peer review meeting. Preparatory materials, including agendas, rosters, and review documents, will be posted by the previously agreed-upon deadline, while materials developed during the peer review process will be added to the site as soon as they become available. Peer review panelists will receive email notifications from the Council's Salmon Staff Officer whenever additional materials are posted. Please note that materials on the PAM site are temporary, and finalized versions will ultimately be included in the briefing book for the respective Council meeting.

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