





Effective Date: January 15, 2024

MEMORANDUM FOR: Administrative Record for the Designation of a Nonessential Population of Central Valley Spring-run Chinook Salmon Downstream of Friant Dam in the San Joaquin River, California (ARN: 151422-SWR2010-SA00361) and the Biological Opinion for the Reinitiation of Consultation on the Long-term Operation of the Central Valley Project and State Water Project (CVP/SWP Opinion; ARN: 151422-WCR2016-SA00300)¹

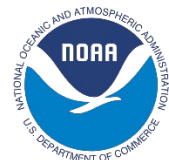
TO: Cathy Marcinkevage, Assistant Regional Administrator, California Central Valley Office (CCVO), West Coast Region

THROUGH: Garwin Yip, Water Operations Branch Chief, CCVO, West Coast Region 

FROM: Jon Ambrose, San Joaquin River Branch Chief, CCVO, West Coast Region 

SUBJECT: 2024 (January 2024 – December 2024) Technical Memorandum Regarding the Accounting of San Joaquin River Spring-run Chinook Salmon at the Central Valley Project and State Water Project Sacramento-San Joaquin Delta Fish Collection Facilities

¹ Please cite as: NMFS. 2024. Technical Memorandum to Account for Reintroduced San Joaquin River Spring-Run Chinook Salmon per CFR 233.301(b)(5)(ii): 7.



Background

NOAA's National Marine Fisheries Service (NMFS) has prepared this Technical Memorandum (Tech Memo) to fulfill the following three purposes:

- 1) Address one of the requirements of the *Designation of a Nonessential Experimental Population of Central Valley Spring-run Chinook Salmon Below Friant Dam in the San Joaquin River, California* (70 FR 79622, December 31, 2013) to release an annual technical memorandum to:

“Calculate and document the proportionate contribution of Central Valley (CV) spring-run Chinook salmon (*Oncorhynchus tshawytscha*) originating from the reintroduction to the San Joaquin River and deduct or otherwise adjust for share of CV spring-run Chinook salmon take when applying the operational triggers and incidental take statements associated with the NMFS 2009 Biological and Conference Opinion on the Long-term Operations of the Central Valley Project and State Water Project (CVP/SWP Opinion) or subsequent future biological opinions, or Section 10 permits.”
- 2) Present (a) methods used in 2023 to identify reintroduced, nonessential experimental population (NEP) CV spring-run Chinook salmon from the San Joaquin River when encountered outside the Restoration Area; and (b) outline the deduction, or adjustment, in the operations of the Central Valley Project (CVP) and State Water Project (SWP). The purpose of the deduction, or adjustment, is to ensure the reintroduced population will not impose more than *de minimis* water supply reductions, additional storage releases, or bypass flows on unwilling third parties as defined in P.L. 111-11, Title X, section 10011(c)(1).
- 3) Outline the NEP CV spring-run Chinook salmon release and monitoring plans for 2024.

In May 2013, a technical working group consisting of fisheries agencies, water management agencies, and water users was first convened to provide input on the annual Tech Memo. In January 2014, NMFS issued the first Tech Memo, which was just prior to the San Joaquin River Restoration Program's (SJRRP) implementation of the reintroduction strategies of NEP CV spring-run Chinook salmon into the SJRRP Restoration Area (Restoration Area refers to the San Joaquin River from Friant Dam downstream to the Merced River confluence). Since the issuance of the first Tech Memo, reintroduction strategies have been successful and CV spring-run Chinook salmon have returned to the San Joaquin River for the first time in over 60 years. As such, monitoring, scientific studies, and hatchery releases of CV spring-run Chinook salmon in the Restoration Area by the SJRRP has grown into a multi-faceted and dynamic effort based on an adaptive management process. As the SJRRP continues into the future, NMFS will continue to re-visit the format, organization, and content of the Tech Memo to ensure readability and purpose fulfillment.

Purpose 1: Accounting for NEP of CV spring-run Chinook salmon at the CVP/SWP Facilities during 2023

No changes in water export quantities were experienced during calendar year 2023 as a result of the juvenile NEP CV spring-run Chinook salmon produced by the SJRRP. In support of this statement, Appendix A contains details of the relevant monitoring results, hatchery releases, calculations made, and documentation of NEP CV spring-run Chinook salmon that originated from the Restoration Area that were salvaged at the CVP/SWP facilities. The information presented in Appendix A was coordinated with Federal and State agencies and other interested parties involved in the implementation of the SJRRP.

Purpose 2: Method for accounting for NEP of CV spring-run Chinook salmon during 2024

On October 21, 2019, NMFS issued the *Biological Opinion on Long Term Operation of the Central Valley and State Water Project*² (herein referred to as the 2019 Opinion) that superseded a 2009 Opinion for the same project. On February 18, 2020, the U.S. Bureau of Reclamation (Reclamation) adopted the 2019 Opinion by issuing its Record of Decision (ROD), which completed the environmental review and initiated operations defined by the ROD. Given litigation on the 2019 Opinion, recent reinitiation of consultation for the Long-term Operations of the CVP and SWP, and development of a proposed Interim Operations Plan for the reinitiation period, NMFS will evaluate whether issuance of a revised 2024 Tech Memo will be warranted.

On March 31, 2020, the California Department of Fish and Wildlife (CDFW) issued an Incidental Take Permit (ITP), pursuant to the California Endangered Species Act, for the Long-Term Operation of the SWP in the Sacramento-San Joaquin Delta³ (herein referred to as the 2020 ITP). The SWP will operate under the terms and conditions of both the 2019 Opinion (and/or Interim Operations Plan) and the 2020 ITP (or subsequent interim ITPs).

Neither the 2019 Opinion, 2020 ITP, or current/proposed Interim Operations Plan have operational restrictions or triggers based on salvage of naturally-produced CV spring-run Chinook salmon. Although there are currently no operational triggers for naturally-produced juvenile CV spring-run Chinook salmon, there is still potential for unmarked yearlings to be mis-identified as Sacramento River (SR) winter-run Chinook salmon based on length-at-date criteria. If unmarked yearling CV spring-run Chinook salmon are mis-identified as SR winter-run Chinook salmon, and an operational trigger is exceeded prior to genetic analysis results being completed, a potential exists for unmarked yearling CV spring-run Chinook salmon to contribute to an operational trigger.

Therefore, to contribute to an operational trigger, an unmarked juvenile CV spring-run Chinook originating from the SJRRP must out-migrate from the Restoration Area and:

² Publicly available at: <https://www.fisheries.noaa.gov/resource/document/biological-opinion-reinitiation-consultation-long-term-operation-central-valley>

³ Publicly available at: <https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/State-Water-Project/Files/ITP-for-Long-Term-SWP-Operations.pdf>

- 1) Be counted at the CVP or SWP Sacramento-San Joaquin Delta Fish Collection Facilities (CVP/SWP Facilities);
- 2) Be in the same size range on the length-at-date table as juvenile SR winter-run Chinook salmon at the time of capture; and
- 3) Contribute to exceeding a single year loss threshold, or a cumulative loss threshold, for SR winter-run Chinook salmon.

Genetic results of any tissue samples taken from fish observed at the CVP/SWP Facilities during calendar year 2024 will be shared with NMFS. In 2024, the SJRRP will continue to investigate the use of genetic identification to account for San Joaquin River CV spring-run Chinook salmon detected at the CVP/SWP Facilities. Steps of this investigation include:

- 1) Continuing to refine and learn from fish sampling and genetic testing at the CVP/SWP Facilities; and
- 2) Identifying and resolving (to the extent within the SJRRP's control) potential logistic issues with using genetic identification (i.e., genetic analysis protocol, sample process timing, chain of custody, and necessary agencies' commitments).

Accounting Methods

Physical Marking

All juvenile CV spring-run Chinook salmon released from the Salmon Conservation and Research Facility (SCARF⁴) into the San Joaquin River as part of the SJRRP's reintroduction efforts will be marked with an adipose fin-clip (ad-clip) and coded wire tag (CWT). The CWT contains a code unique to the SJRRP's release groups so these fish can be distinguished from all other CV spring-run Chinook salmon release groups. In addition to an ad-clip and CWT, yearling fish produced and released by SCARF may be tagged with a passive integrated transponder (PIT) tag, depending on available funding. SJRRP fish released and marked with an ad-clip are exempt from take prohibitions under the final ESA 4(d) protective regulations for West Coast threatened salmonids (70 FR 37160, June 28, 2005; and 78 FR 79622, December 31, 2013). As a result, NEP CV spring-run Chinook salmon released by the SJRRP will not be counted toward any incidental take limits or cumulative or annual loss thresholds from any applicable ESA section 7 consultations or section 10 scientific research and enhancement permits for operation of the CVP/SWP Facilities.

Genetic Analysis

The SJRRP has established a parentage-based tagging (PBT) procedure for the San Joaquin River CV spring-run Chinook salmon populations. PBT involves the annual sampling and genotyping of adult Chinook salmon returning to the Restoration Area; these data are used to create a database of genotypes for future parentage assignment of their progeny. As such, all adult

⁴ The SCARF is located just downstream of Friant Dam in Reach 1 of the SJRRP Restoration Area.

Chinook salmon captured in Reach 5 of the Restoration Area or recovered as a carcass returning to the Restoration Area in 2024, will have tissues sampled for genetic testing.

Efforts will be made to take a tissue sample from all naturally-produced (unmarked) juvenile Chinook salmon captured during monitoring using Rotary Screw Traps (RST) during calendar year 2024. However, there may be several days during the juvenile monitoring season where sample collection for every fish may not be logistically feasible due to varying reasons. In circumstances when it is not feasible to sample every captured salmonid, tissue samples will be taken from a subset of naturally-produced juveniles captured each day of RST monitoring. All tissue samples will be part of the parental inference analysis.

CVP/SWP Facilities

Genetic analysis is a more accurate method than the length-at-date method used to distinguish SJRRP NEP CV spring-run Chinook salmon from other runs of Chinook salmon at the CVP/SWP Facilities. Uncertainty exists with the existing operational triggers and length-at-date method used to distinguish between the various ESUs of Chinook salmon captured at the CVP/SWP Facilities. Specifically, the key concern is whether NEP CV spring-run Chinook salmon would fall into the length-at-date criteria and inadvertently contribute to an operational trigger for juvenile SR winter-run Chinook salmon. The SJRRP will coordinate with the genetic analysis effort at the CVP/SWP Facilities to ensure that NEP CV spring-run Chinook salmon do not result in more than *de minimis* water supply reductions, additional storage releases, or bypass flows on unwilling third parties.

Calculation of Incidental Take and Operational Triggers

All juvenile CV spring-run Chinook salmon released from the SCARF into the San Joaquin River will receive an ad-clip and CWT, which makes them readily identifiable upon capture. Any unmarked offspring of naturally-spawned adults that survive and emigrate out of the SJRRP Restoration Area, and are captured at the CVP/SWP Facilities, will be included in Reclamation's and DWR's genetic analyses and shared with NMFS. NMFS will closely coordinate with Reclamation and DWR throughout the year and will re-evaluate whether issuance of a new Tech Memo is warranted under any new operational triggers.

Continued Pilot Assessment

In addition to the methods described above, NMFS, in coordination with the SJRRP, developed an assessment to estimate the number of naturally-produced young-of-year (YOY) spring-run Chinook salmon that could be observed at the CVP/SWP Facilities. The two primary elements of this assessment are: (1) an analysis on migration timing to the CVP/SWP Facilities, based on SCARF production releases in Reach 5 from 2016-2021⁵ and (2) a conceptual method to calculate the estimated number of naturally-produced YOY CV spring-run Chinook salmon that may be observed at the CVP/SWP Facilities for the current calendar year. The methods for both

⁵ NMFS. 2022. Technical Memorandum to Account for Reintroduced San Joaquin River Spring-Run Chinook Salmon per CFR 233.301(b)(5)(ii): 7. Publicly available here: <https://www.fisheries.noaa.gov/west-coast/habitat-conservation/san-joaquin-river-restoration#san-joaquin-river-spring-run-chinook-salmon-reintroduction>

elements of this assessment will be updated and refined over the years as the SJRRP gathers and synthesizes more fish monitoring data.

Appendix B within the 2022 Tech Memo⁵ contained detailed information on the pilot analyses for juvenile outmigration timing to the CVP/SWP Facilities. Table A2 in Appendix A of this Tech Memo provides a summary of SCARF juveniles captured at the CVP/SWP Facilities. This summary information shows that the majority of hatchery juveniles were observed from March through April 2023, with some observed through May and early June given the high flows in spring 2023. This timeframe aligns with the outmigration timing analysis completed in Appendix B of the 2022 Tech Memo. Therefore, NMFS estimates that the majority of naturally-produced YOY CV spring-run Chinook salmon may be observed at the CVP/SWP Facilities from mid-March through late April 2024.

Appendix C in the 2022 Tech Memo⁵ contained detailed information on the pilot analysis for the conceptual methods and calculations for estimating the number of YOY CV spring-run Chinook salmon that may out-migrate from the Restoration Area and be observed at the CVP/SWP Facilities in 2022. Appendix B of this Tech Memo continues the analyses, and contains information on the conceptual methods and calculations for estimating the number of YOY CV spring-run Chinook salmon that may out-migrate from the Restoration Area and be observed at the CVP/SWP Facilities in 2024. An accurate accounting of SJRRP CV spring-run Chinook salmon is necessary to provide a complete characterization of SJRRP data progress and needs. While incomplete, this conceptual juvenile production estimate (JPE) begins the development of that necessary piece of information.

The estimate of juvenile CV spring-run Chinook salmon exiting the Restoration Area is anticipated to increase once fish passage and screening projects within the Restoration Area are completed and channel capacity is increased to convey more Restoration Flows. This conceptual method to estimate juvenile production is under development and will be updated as monitoring data become available. The estimated number of juveniles observed at the CVP/SWP Facilities should be considered within the context of existing data gaps and annual environmental conditions.

Based on the results of this conceptual method, the estimated number of naturally-produced YOY CV spring-run Chinook salmon that may be observed at the CVP/SWP Facilities is anticipated to be low in the spring of 2024 (see Table B1).

Purpose 3: Planned releases and monitoring for NEP of CV spring-run Chinook salmon

2024 Planned Releases

Approximately 200,000 marked juvenile CV spring-run Chinook salmon from the SCARF are planned for release into the Restoration Area in spring 2024, as part of the SJRRP's reintroduction efforts.

The exact release location, date, number of release groups, and numbers of fish per release group are dependent on a variety of factors, including water year type and physical river conditions within the Restoration Area. Fish availability and size will not be known until early

spring 2024. Target release timing, location, and numbers of fish per release will be identified and posted on the SJRRP's website when determined (<http://www.restoresjr.net/>).

In the summer of 2024, adult broodstock from the SCARF may be released into Reach 1. Although the exact numbers of adults released are undetermined, these fish will have CWTs and ad-clips, and some may be tagged with acoustic transmitters or other external tags.

Monitoring Plans and Additional Studies for 2024

Adults

The SJRRP may plan to monitor Reach 5 for returning adult CV spring-run Chinook salmon and capture/translocate them to holding and spawning habitat in Reach 1 or Reach 2. If returning adults are captured, they may be marked with a PIT tag and/or Floy tag and will be genetically sampled prior to release. Depending on funding, some adults may be tagged with an acoustic transmitter, and all translocated adults will be released in Reach 1 or Reach 2. These adults and the SCARF broodstock releases are expected to spawn naturally in the Restoration Area in 2024, and any resulting juveniles would out-migrate as early as January 2025. Naturally-produced juveniles would not be physically marked.

The SJRRP may conduct redd and carcass surveys in the fall/winter of 2024/2025 to estimate the number of adult CV spring-run Chinook salmon in Reaches 1 and 2 and to estimate the number of redds. Results from these efforts would be presented in the 2025 Tech Memo.

Juveniles

Naturally-produced juvenile CV spring-run Chinook salmon may be monitored through Reach 1 to Reach 2 with RSTs to determine migration timing, lifestage diversity, survival, and size. If RST monitoring occurs in Fall of 2024, then up to 40,000 juvenile CV spring-run Chinook salmon from the SCARF may be released throughout the winter 2024-2025 and through spring 2025 to test RST capture efficiencies. Up to four RST monitoring locations within the Restoration Area may be chosen based on redd locations and river access. RSTs will be operated when sufficient water velocities allow for adequate cone rotation and operations are safe for field personnel.

Timeline

Flow and temperature conditions within the Restoration Area will inform implementation of fish releases and fisheries monitoring. The SJRRP will monitor river and weather conditions and may cancel or modify fisheries monitoring and/or fish release activities, depending on expected conditions in the system, funding priorities, or due to concerns for field staff health and safety.

Final information on releases of juvenile NEP CV spring-run Chinook salmon will be available on the SacPAS website⁶. NMFS will hold monthly Tech Memo meetings as necessary, starting February 2024, to discuss implementation of the 2024 Tech Memo and to develop the 2025 Tech Memo.

⁶ SacPAS: Central Valley Prediction and Assessment of Salmon website is available here: <http://www.cbr.washington.edu/sacramento/>

Acknowledgments

NMFS acknowledges the SJRRP staff from USFWS, CDFW, and Reclamation for their contributions in collecting, summarizing, and providing the data used to produce this Tech Memo. NMFS also acknowledges the participants of the Tech Memo and Fisheries Management Work Group groups for their review and feedback on this document.

Appendix A: Accounting for Nonessential Experimental Population (NEP) of Central Valley spring-run Chinook salmon during 2023

Juvenile Releases and Recapture at Monitoring Sites and Central Valley Project and State Water Project Sacramento-San Joaquin Delta Fish Collection Facilities (CVP/SWP Facilities)

All juvenile Central Valley (CV) spring-run Chinook salmon released from the Salmon Conservation and Research Facility (SCARF) in 2022-2023 were marked with an adipose fin clip and a coded wire tag (CWT) with a code distinct to each release group. Table A1 provides a summary of the juvenile NEP CV spring-run Chinook salmon released. A non-routine release group of yearlings were released into Reach 1 in late August 2023, in order for SCARF to make room for the 2023, young-of-year (YOY) fish. These yearlings were ancillary broodstock that could no longer be housed at the hatchery due to construction delays with the SCARF. Therefore, a decision was made to release them into Reach 1 in late August and it was assumed they would be able to out-migrate during the fall and winter months.

Table A2 provides a summary of juveniles that were observed at the CVP/SWP Facilities. Per protocol at the CVP/SWP Facilities, all adipose fin-clipped fish were sacrificed for CWT identification, unless there were visible sutures from acoustic tagging surgery, or a passive integrated transponder (PIT) tag was detected, in which case they were released alive.

Since all YOY and yearlings from SCARF were adipose fin-clipped and coded wire tagged, these individuals were identified as NEP CV spring-run Chinook salmon released by the SJRRP and were not misidentified as juvenile Chinook salmon from other locations (Figure A1).

Table A1. Summary of juvenile NEP CV spring-run Chinook salmon releases made by the SJRRP in 2022-2023, and downstream recaptures from each release group, where YOY= Young of Year. All yearlings also received a unique Passive Integrated Transponder (PIT) tag.

Release Date	Lifestage	Release Location	No. Released/ CWT Code	No. of recaptures in Chipps Island Trawl	Dates of recapture
12/8/2022	Yearling	SJR at Hwy 140	3,666/ 062944	0	N/A
12/8/2022	Yearling	SJR at Hwy 140	911/ 061968	1	1/5/2023
2/23/2023	YOY	SJR at Hwy 140	50,932/ 063170	11	4/7 - 5/1/2023
3/15/2023	YOY	Eastside Bypass at El Nido Road	139,784/ 063169	12	4/13 – 5/18/2023
8/31/2023	Yearling	Reach 1 at Friant Bridge	2,000/ 062945	TBD	TBD
8/31/2023	Yearling	Reach 1 at Friant Bridge	406/ 062946	TBD	TBD
12/6/2023	Yearling	SJR at Hwy 140	2,477/ 062945	TBD	TBD
12/6/2023	Yearling	SJR at Hwy 140	1,060/ 062946	TBD	TBD

Table A2. Summary of juvenile NEP CV spring-run Chinook salmon that were observed at the CVP/SWP Facilities (Central Valley Project and State Water Project Sacramento-San Joaquin Delta Fish Collection Facilities) in 2022-2023. (CWT = coded wire tag; YOY = young of year; SJR = San Joaquin River)

Dates Observed	Facility	Release Lifestage	Release date	Release location	CWT Code	Total Observed
3/9 - 5/13/2023	CVP/ SWP	YOY	2/23/2023	SJR at Hwy 140	063170	297
4/3 – 6/19/2023	CVP/ SWP	YOY	3/15/2023	Eastside Bypass at El Nido Road	063169	795

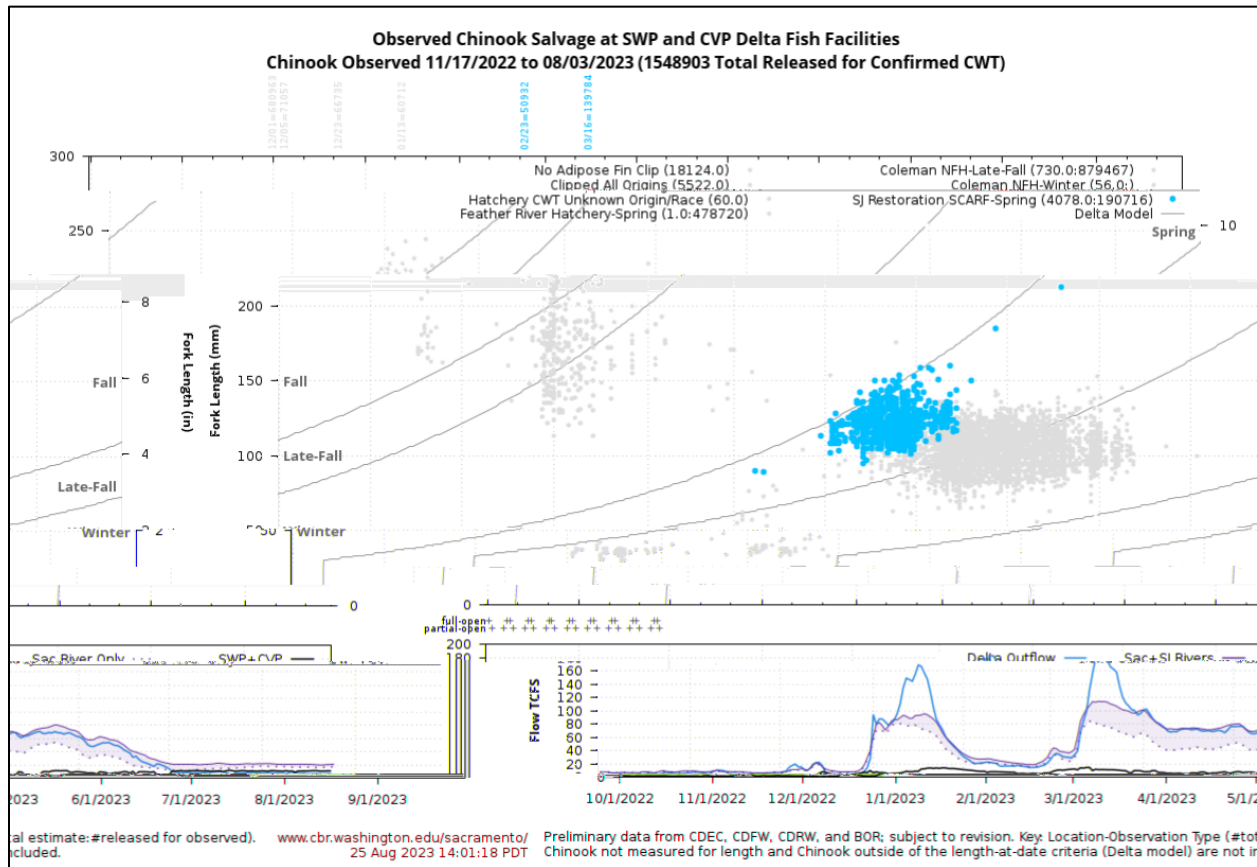


Figure A1. Observed Chinook salmon at SWP (Skinner Delta Fish Protective Facility) and CVP (Tracy Fish Collection Facility) Facilities from 11/17/2022 to 8/03/2023 from SCARF releases.

2022-2023 Rotary Screw Trap Monitoring

No rotary screw trap monitoring occurred during the 2022-2023 field season due to funding constraints and very low volitional adult returns in spring 2022.

Adult Broodstock Releases in 2023

A total of 270 adult CV spring-run Chinook salmon broodstock raised at the SCARF were released by the California Department of Fish and Wildlife (CDFW) into Reach 1 of the San Joaquin River. Table A3 summarizes the adult broodstock releases. Genetic tissue samples of all broodstock adults were taken at the SCARF for use in the parentage database.

Table A3. Summary of adult NEP CV spring-run Chinook salmon released by the SCARF in 2023.

Release Date	Release Location	Number of Females	Number of Males	Total Released
August 9-10, 2023	Friant Bridge	35	235 (40 jacks)	270

Adult NEP CV Spring-run Chinook Salmon Returns in 2023

Trap and haul of adult CV spring-run Chinook salmon in Reach 5 was not conducted during spring 2023 due to high flows that prevented field crews from safely implementing trap and haul monitoring activities. However, it is assumed that high flows likely created volitional passage conditions into Reach 1 during the spring months.

Redd and carcass surveys began on August 21, 2023. Preliminary data for redd/carcass surveys show that as of November 17, 2023, a total of 6 redds have been observed, and 17 carcasses have been observed, 3 of which were estimated to be volitional returns.

Appendix B: Conceptual method to estimate the number of naturally-produced, young-of-year (YOY), nonessential experimental population (NEP) Central Valley (CV) spring-run Chinook salmon from the Restoration Area to the Central Valley Project and State Water Project Sacramento- San Joaquin Delta Fish Collection Facilities (CVP/SWP Facilities)

As part of the continued effort to estimate the number of naturally-produced YOY CV spring-run Chinook salmon originating from the San Joaquin River Restoration Program (SJRRP) Area (juvenile production estimate, JPE) that could be observed at the CVP/SWP Facilities, NMFS, in coordination with the SJRRP, is in the early stages of developing a conceptual method to calculate the JPE. In the future, this conceptual JPE could be used to help determine how many naturally-produced YOY juveniles may be observed at the CVP/SWP Facilities. The data used to produce any annual JPE, including this conceptual approach, will be provided by annual SJRRP monitoring and studies. The annual JPE will be refined and updated each year as new data are available. The method used to calculate the conceptual JPE is loosely based on the methods used to calculate the Sacramento River (SR) winter-run Chinook salmon JPE¹. The development of a conceptual JPE sooner, rather than later, identifies data needed to produce a more robust estimate, and therefore where potential future monitoring efforts could be fruitful in advancing the development of a more accurate JPE.

Table B1 outlines the components, numbers used, and associated notes for each component for the 2024 conceptual JPE. Based on the results of the conceptual JPE calculations, the estimated number of naturally-produced YOY CV spring-run Chinook salmon that may be observed at the CVP/SWP Facilities in the spring of 2024, is anticipated to be low.

The results of the conceptual JPE are dependent on annual variations of environmental conditions, including water year type, flows, water temperatures, and water management decisions. Results should be interpreted within the context of annual environmental conditions that returning adults, their eggs, and juvenile fish experience in a given water year. The estimate of juvenile fish exiting the Restoration Area is generally anticipated to significantly increase once fish passage projects within the Restoration Area are completed. The conceptual method to estimate juvenile production is still under development and is expected to be updated as data become available. Therefore, the estimated number of juveniles observed at the CVP/SWP Facilities should be considered within the context of the numerous data gaps, and will not be used to influence operational thresholds or triggers related to CVP/SWP Facility operations.

¹ Winter-run Chinook salmon JPE letter are publicly available here: <https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/california-central-valley-water-operations-biological>

Table B1. Table outlining the conceptual Juvenile Production Estimate (JPE) method and components, numbers used for 2024, and associated notes to explain the component and/or the number used.

JPE Component	Numbers for 2024	Notes
Reach 5 to Reach 1 Trap & Haul numbers	0	Trap and haul did not occur due to high flows
SCARF Broodstock number	270	35 females, 135 males
Total known spawners	270	Trap & haul numbers (0) + broodstock (270)
Estimated volitional returns to Reach 1	3	Due to high flows, it was assumed there was volitional passage into Reach 1 during the spring months.
Total known + Estimated volitional returns	273	Trap & haul (0) + broodstock (270) + volitional return estimate (3)
Adult female estimate (AFE)	36	Trap & haul (0) + broodstock (35) + volitional return known females (1). If not otherwise known, the proportion of females for volitional returns is estimated to be 50%, until more data become available.
AFE minus pre-spawn mortality (AFE-spawned)	31	- Used 15% target objective for pre-spawn mortality from the 2018 Fisheries Framework. Will be revised as monitoring data become available. - AFE-spawned = 0.85*AFE
Average annual fecundity	3,247	Average annual fecundity of SCARF broodstock fish used as a surrogate for fecundity of natural returns; usually known by Oct of each year.
Total viable eggs	99,358	Total viable eggs= AFE-spawned* annual fecundity
Estimated egg-to-fry survival: Fry Production Estimate (FPE)	0.5	Based on 50% target objective from the 2018 Fisheries Framework (Table 7). May be revised as data become available, however, preliminary data since 2018 suggest the survival rate to be lower than 50%.
Fry-to-smolt survival rate estimate (SurvR2)	0.05	Based on target survival rate from the 2018 Fisheries Framework. Will be revised as monitoring data become available.
Estimated survival term: Reach 2 to Reach 5 (SurvR5)	0.05	Based on target survival rate from the 2018 Fisheries Framework (same estimated as Surv2). Will be revised as monitoring data become available.
Estimated survival term: Reach 5 to Delta (SurvDelta)	0.23	- Average survival rate of UC Davis tagged fish for 3 years (2017-2019) and applied to current year; it should be noted that this survival estimate is for years with higher flows and may not be representative for years with lower flows, as seen in 2020 and 2021. - Will be revised annually as study data become available. For the purposes of this Tech Memo, survival to Delta is defined as fish observed at the CVP/SWP Facilities.

JPE= (FPE)*(SurvR2)*(SurvR5)*(SurvDelta)	29	Final number of naturally-produced YOY NEP spring-run Chinook salmon that may potentially be observed at the CVP/SWP Facilities. Given the numerous data gaps within this initial JPE, there is low confidence associated with this number.
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