UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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Effective Date: January 15, 2023

MEMORANDUM FOR:	Administrative Record for the Designation of a Nonessential Population of Central Valley Spring-run Chinook Salmon Below 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:	2023 (January 2023 – December 2023) 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. 2023. 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 2022 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 minimus* 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 2023.

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 2022

No changes in water export quantities were experienced during the 2022 calendar year 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 the documentation of the proportionate contribution of the NEP CV spring-run Chinook salmon that originated from the Restoration Area. 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 2023

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 the 2009 Opinion. 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 ROD, recent reinitation of consultation for the Long-term Operations of the CVP and SWP, and the development of a proposed Interim Operations Plan for the reinitiation period, upon finalization of operations for 2023, NMFS will evaluate whether issuance of a revised 2023 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 Delta[3] (herein referred to as the 2020 ITP). The SWP will operate under the terms and conditions of both the 2019 Opinion (and/or current Interim Operation Plan) and the 2020 ITP (or subsequent interim ITPs).

Neither the 2019 Opinion, 2020 ITP, or current 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 the potential for unmarked fish to be mis-identified as SR winter-run Chinook salmon based on length-at-date criteria. If unmarked juvenile 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, then there is the potential for unmarked 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:

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 Sacramento River (SR) winter-run Chinook salmon at the time of capture; and
3) Contribute to exceeding a daily loss threshold, 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 the 2023 calendar year will be shared with NMFS.

[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

In 2023, 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 recovery and genetic testing at the CVP/SWP Facilities; and
2) Identifying and resolving (to the extent of the SJRRP's control) potential logistic issues with using genetic identification (i.e., 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 (SCARF[4]) 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 that these fish can be distinguished from all other CV Chinook salmon release groups. In addition to an adipose fin-clip and CWT, yearling fish produced and released by the hatchery may be tagged with a passive integrated transponder (PIT) tag, depending on funding. SJRRP fish released and marked with an adipose fin-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, annual, or daily loss thresholds from any applicable ESA section 7 consultations or section 10 research 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 being used to create a database of genotypes for future parentage assignment of their progeny. As such, all adult Chinook salmon captured in Reach 5 of the Restoration Area or recovered as a carcass returning to the Restoration Area in 2023 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 the 2023 calendar year. 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.

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

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 the NEP CV spring-run Chinook salmon would fall into the length-at-date criteria and inadvertently contribute to an operational trigger for juvenile winter-run Chinook salmon. The SJRRP will coordinate with the genetic analysis effort at the CVP/SWP Facilities in 2023 to ensure that NEP CV spring-run Chinook salmon do not result in more than *de minimus* 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. Due to the active litigation of the ROD, the reinitiation of the biological opinion for the Long-term Operations of the CVP and SWP, and the proposed Interim Operations Plan for the reinitiation period, 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 fish 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 2016-2021[5] 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 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 Memo[5] contained detailed information on the pilot analyses for juvenile outmigration timing to the CVP/SWP Facilities. Table A2 in Appendix A within this 2023 Tech Memo, provides a summary of SCARF juveniles captured at the CVP/SWP Facilities. It can be seen in Table A2 that the majority of hatchery juveniles were observed from March through April 2022. 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 2023.

[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

Appendix C within the 2022 Tech Memo[5] 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 exit the Restoration Area and be observed at the CVP/SWP Facilities in 2022. Appendix B within the 2023 Tech Memo builds upon last year's analyses, and contains information on the conceptual methods and calculations for estimating the number of YOY CV spring-run Chinook salmon that may exit the Restoration Area and be observed at the CVP/SWP Facilities in 2023. Appendix B also contains a preliminary retrospective analysis of the 2022 conceptual methods and calculations. 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 2023 (see Table B2).

Annual circumstances influence juvenile production that may not be fully captured in the analyses presented in Appendix B. For example, annual variations in environmental factors, especially drier water years, low flows, and high-water temperatures, as occurred in 2021 and 2022, significantly reduce juvenile production due to poor habitat conditions. In some drier years, the San Joaquin River can become disconnected downstream of Reach 3 of the Restoration Area and run dry as a result of water deliveries, primarily for irrigation. In years when CVP water deliveries from the Delta to the southern San Joaquin valley are inadequate to meet contract terms, water is delivered from Millerton Reservoir through Reaches 1 and 2 of the Restoration Area, and are then diverted at Mendota Pool (currently unscreened; also known as "a call on Friant"). In years when this occurs, such as in the spring of 2022, Restoration flows are halted and the river becomes disconnected at the end of Reach 3. Under these circumstances, there is an extremely low probability that naturally-produced juvenile CV spring-run Chinook salmon would survive past Mendota Dam, which likely results in zero juveniles exiting the Restoration Area.

Additionally, a call on Friant impacts adult salmon returns and migration to Reach 5 of the Restoration Area. If there are no Restoration flows in Reach 5, then there are no attraction flows for adult salmon migrating back from the ocean. Any adults that are captured in Reach 5 and transported to Reach 1 or 2 of the Restoration Area, plus adult bloodstock released from the SCARF, must then hold over summer while flows from a call on Friant are being delivered to Mendota Pool for diversion. The impacts to adult salmon during these circumstances are still being studied and are not well understood at the moment.

If any adult salmon survive over summer and successfully spawn, then the impacts of a call on Friant continue to extend to their progeny. A call on Friant results in the cold-water storage in

Millerton Reservoir to be prematurely exhausted. Water temperatures during the sensitive egg incubation period are more likely to be higher than optimal if the cold-water storage is depleted earlier in the Fall. However, the impacts to the early life stages of salmon under these particular flow and temperature circumstances require additional studies to be fully understood.

The combination of zero attractant Restoration flows in Reach 5 for returning adult salmon in spring 2022, and the early exhaustion of cold-water storage in Millerton Reservoir, likely significantly decreases the potential for naturally-produced juveniles to be created, and to survive and exit the Restoration Area in spring 2023.

In summary, when naturally-produced YOY CV spring-run Chinook salmon exit the Restoration Area, we expect them to be observed at the CVP/SWP Facilities primarily from March to April. However, due to drought conditions and "a call on Friant" in 2022, the overall anticipated risk of naturally-produced YOY CV spring-run Chinook salmon from the Restoration Area entering CVP/SWP Facilities is estimated to be near zero in 2023.

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

2023 Planned Releases

Marked juvenile CV spring-run Chinook salmon from the SCARF are planned to be released into the Restoration Area in spring 2023 as part of the SJRRP's reintroduction efforts.

In the summer of 2023, adult broodstock from the SCARF may be released into Reach 1. Although the exact numbers of adults released are undetermined, these fish will have external tags, CWTs, adipose fin clips, and some may be acoustically tagged. The exact release location, date, number of release groups, and numbers of fish per release group are dependent on the number of returning adults, water year type, and physical river conditions within the Restoration Area. Fish availability and size will not be known until early spring 2023. 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/).

Monitoring Plans and Additional Studies for 2023

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 will be marked with a PIT tag and/or Floy tag and will be genetically sampled prior to release. Up to 30 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 2023, and any resulting juveniles would out-migrate as early as January 2024. Naturally-produced juveniles would not be physically marked.

The SJRRP may conduct carcass and redd surveys in the fall/winter of 2023/2024 to estimate the number of adult fish in Reaches 1 and 2 and to estimate the number of redds. Results from these efforts would be presented in the 2024 Tech Memo.

Juveniles

Naturally-produced juvenile spring-run Chinook salmon may be monitored through Reach 1 to Reach 2 with RSTs to determine migration timing, lifestage diversity, survival, and size. However, RST monitoring for the 2022-2023 field season will not occur due to funding constraints and uncertainties about the spawning success of adults that held over-summer during and after "a call on Friant". It is uncertain at this time if RST monitoring will occur for the 2023-2024 season.

If RST monitoring occurs in Fall of 2023, then approximately 200,000 juvenile CV spring-run Chinook salmon from the SCARF may be released throughout the winter/spring of 2023-2024 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 would be operated when sufficient water velocities allow for adequate cone rotation and operations are safe for field personnel. NMFS has determined (based on previous discussions with participants of the Tech Memo group) that tracking the migration of juvenile spring-run Chinook salmon through the lower San Joaquin River, beyond the current monitoring efforts, has considerable value. Depending on funding priorities, studies may be proposed to continue to track juvenile spring-run Chinook salmon movement from Reach 5 of the Restoration Area to the south Delta.

Timeline

Flow and temperature conditions within the Restoration Area will inform the 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 is available on the SacPAS website[6]. NMFS will hold monthly Tech Memo meetings starting February 2023 to discuss implementation of the 2023 Tech Memo and to develop the 2024 Tech Memo.

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.

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

Appendix A: Accounting for Nonessential Experimental Population (NEP) of Central Valley spring-run Chinook salmon during 2022

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) were marked with an adipose fin clip and a coded wire tag (CWT) with numbers distinct to each release group. Table A1 provides a summary of the juvenile NEP CV spring-run Chinook salmon releases by the San Joaquin River Restoration Program (SJRRP), as well as recaptures for each release group at downstream monitoring sites and the CVP/SWP Facilities.

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 at the point of capture 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.

There was one yearling captured at the CVP/SWP Facilities that fell into the Sacramento River (SR) winter-run Chinook salmon length-at-date (LAD) range, while all young-of-year (YOY) juveniles fell into the CV spring-run Chinook salmon LAD range (Figure A1). Note the one yearling that fell into the SR winter-run Chinook salmon LAD was identified as a YOY, SCARF fish released in March 2021, and reared for a year in the main-stem San Joaquin River between Reach 5 and the CVP/SWP Facilities before being caught in the facilities in March 2022. Since all yearlings and juveniles from SCARF were adipose fin-clipped and CWT'ed, 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.

Table A1. Summary of juvenile NEP CV spring-run Chinook salmon releases made by the SJRRP in 2021-2022, and recaptures from each release group (YOY = Young-of-year; CWT = Coded wire tag; CVP/SWP Facilities= Central Valley Project and State Water Project Sacramento-San Joaquin Delta Fish Collection Facilities; SJR = San Joaquin River)

Release Date	Lifestage	Release Location	No. Released/ CWT #	Mossdale Trawl	Beach Seines	Chipps Island Trawl	No. Observed at CVP/ SWP Facilities	Notes
12/7/2021	Yearling	SJR at Hwy 140	3,712/ 61967 or 68002 or 61810	0	0	0	1	
2/14/2022	YOY	SJR at Hwy 140	57,478/ 61555	2	1	0	8	Sturgeon Bend beach seine location
3/15/2022	YOY	SJR at Hwy 140	108,810/ 61867	1	2	0	6	Sturgeon Bend beach seine location

12/2021 to 2/2022	YOY	Reach 1 & 2	7,600/ 0501040609	0	0	0	0	RST efficiency releases
2/2022 to 5/2022	YOY	Reach 1 & 2	22,184/ 62943	0	0	0	0	RST efficiency releases

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 2021-2022. (CWT = coded wire tag; YOY = young of year; SJR = San Joaquin River)

Dates Observed	Facility	Release Lifestage	Release date	Release location	CWT #	Total Observed	Days from Release Date to Salvage	Length at Salvage
3/1/2022	CVP	YOY	2/14/2022	SJR at HWY 140	61555	1	15	88
3/16/2022	CVP	YOY	2/14/2022	SJR at HWY 140	61555	1	30	100
3/26/2022	CVP	YOY	2/14/2022	SJR at HWY 140	61555	1	40	111
3/26/2022	CVP	YOY	3/16/2022	SJR at HWY 140	61867	1	10	92
3/28/2022	CVP	YOY	2/14/2022	SJR at HWY 140	61555	1	42	103
3/29/2022	CVP	YOY	2/14/2022	SJR at HWY 140	61555	1	43	99
3/30/2022	SWP	Yearling	12/7/2021	SJR at HWY 140	61810	1	113	246
3/30/2022	SWP	YOY	3/2/2021	SJR at HWY 140	61810	1	393	246
3/30/2022	SWP	YOY	2/14/2022	SJR at HWY 140	61555	1	44	108
4/4/2022	SWP	YOY	3/16/2022	SJR at HWY 140	61867	1	19	96
4/11/2022	SWP	YOY	2/14/2022	SJR at HWY 140	61555	1	56	114
4/12/2022	CVP	YOY	3/16/2022	SJR at HWY 140	61867	1	27	98
4/12/2022	SWP	YOY	3/16/2022	SJR at HWY 140	61867	1	27	102
4/17/2022	CVP	YOY	3/16/2022	SJR at HWY 140	61867	1	32	92
4/29/2022	SWP	YOY	3/16/2022	SJR at HWY 140	61867	1	44	107
5/15/2022	SWP	YOY	2/14/2022	SJR at HWY 140	61555	1	90	130

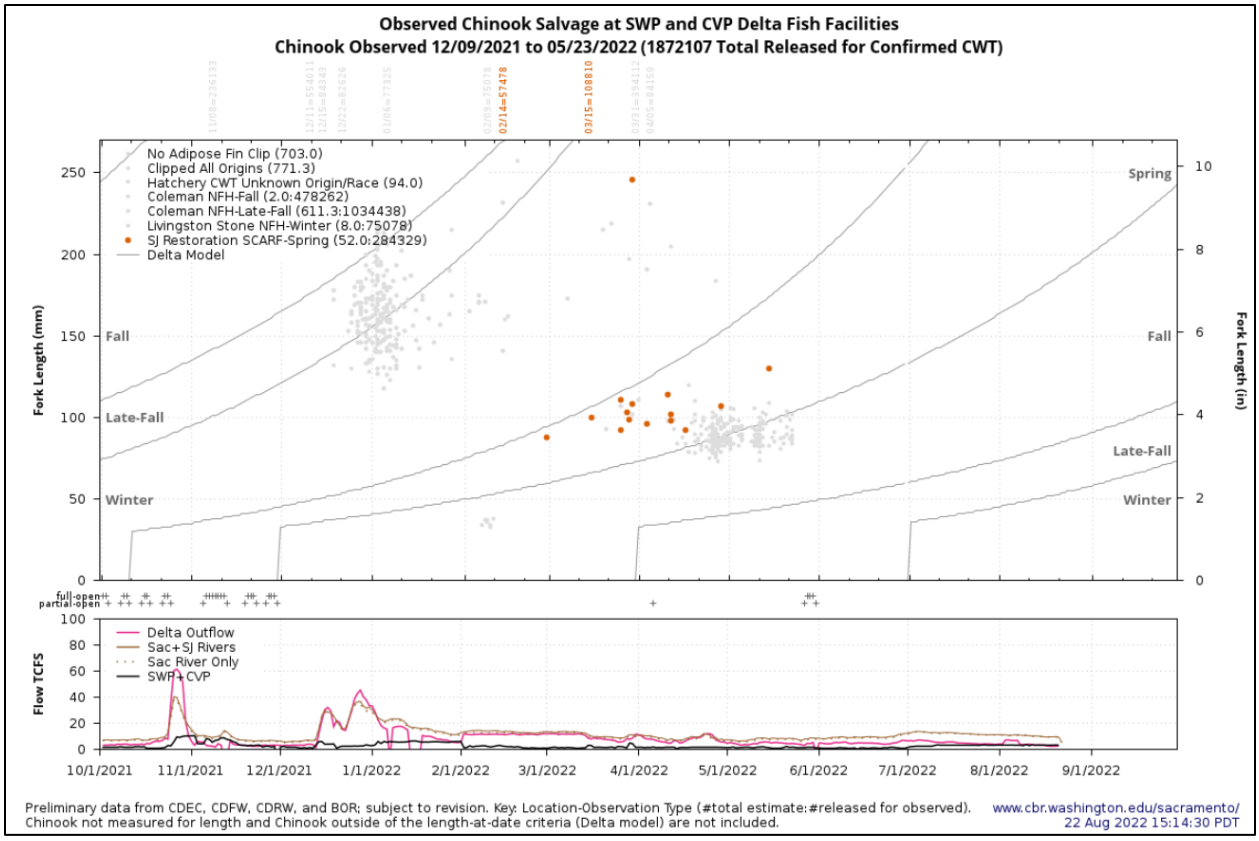

Figure A1. Observed Chinook salmon at SWP (Skinner Delta Fish Protective Facility) and CVP (Tracy Fish Collection Facility) Facilities from 12/09/2021 to 5/23/2022 from SCARF releases.

2021-2022 Rotary Screw Trap Monitoring Results

The SJRRP conducted rotary screw trap (RST) monitoring of juvenile Chinook salmon in the Restoration Area from November 8, 2021, through May 29, 2022.

RSTs were located at four locations in Reaches 1 and 2 (refer to Figure A2 for a map of locations):

1) Owl Hollow (river mile [RM] 258.6);
2) Scout Island (RM.250.17);
3) Highway 99 (Hwy 99; RM 243.1); and
4) Gravelly Ford (RM 227.4).

Monitoring for Owl Hollow, Scout Island, and Highway 99 began on November 8, 2021, while monitoring at Gravelly Ford RST began on January 7, 2022. Increased levels of periphyton, coinciding with increased flows in February, and continuing the remainder of the sampling season, caused some issues at the Owl Hollow RST. These issues included clogged pores of the perforated plate on the cone and live well screen, resulting in intermittent trap operation. Eventually, increased levels of periphyton led to the cessation of trap operation after March 17, 2022. For the same reason, the Scout Island RST operation was stopped March 28, 2022. The Highway 99 and Gravelly Ford RSTs were operated until May 29, 2022, after several consecutive days of non-capture occurred.

Figure A2. Map showing the RST monitoring locations (indicated by green circles) within Reaches 1 and 2 of the SJRRP Restoration Area. Figure produced by Reclamation.

Captured Chinook salmon were identified to lifestage, measured to length (fork length and total length, millimeters [mm]) and weighed (nearest 0.1 gram, and only for fish >45mm fork length), and a tissue sample collected for genetic analyses. After processing, fish were released approximately 20–30 meters downstream from the RST. In the event that capture at any one RST location exceeded 60 Chinook salmon within a single period, only the first 60 were processed in the aforementioned manner, and the remainder enumerated—this only happened on three occasions during December at the Owl Hollow RST. A total of 1,578 salmon were captured in RSTs during the 2021–22 sampling season; however, based on length-at-date regressions, developed from genetic analyses of fish captured during three seasons of RST efforts from 2017–2020, 138 of these fish were not considered spring-run Chinook salmon. During past RST seasons, fish outside the predication band were often determined to be juvenile fall-run Chinook salmon, likely released after hatching from eggs from the Classroom Aquarium Education Program (https://wildlife.ca.gov/CAEP). Verification of run-type and parentage will be assessed through genetic analyses. Once genetic results are available from the fin clips, these numbers may be adjusted accordingly. Table A3 summarizes the RST catches by location and lifestage.

Table A3. Summary of RST catches from November 8, 2021, through May 29, 2022 by sampling location and lifestage.

Lifestage	Owl Hollow RST	Scout Island RST	Hwy 99 RST	Gravelly Ford RST	Total fish captured per lifestage
Fry	1,060	19	1	0	1,080
Parr	88	12	4	0	104
Smolts	62	40	152	2	256
Yearlings	0	0	0	0	0
Total fish per RST location	1,210	71	157	2	1,440

In conjunction with daily monitoring efforts, mark and recapture RST efficiency studies were completed to quantify juvenile salmon population and survival estimates through sampled reaches. Rotary screw traps sample a portion of the river and do not capture all downstream moving fish. Therefore, trap efficiency estimates are necessary to extrapolate captured fish totals for population estimates. Efficiency estimates also allow quantification of survival of marked fish released and recaptured at subsequent downstream traps. Unique combinations of ink colors and fin-tag locations permitted recaptured fish to be assigned to individual releases by location. These salmon were marked using a needleless injection gun and tattoo ink to mark the upper dermal layer of the selected fin. By varying the combination of ink color and fin location, each release group can be assigned to a specific release date and RST. Multiple release groups occurred across the RST sampling season to account for varying river conditions and fish growth throughout the emigration period: Owl Hollow (n = 12 groups), Scout Island (n = 11 groups), Hwy 99 (n = 9 groups), and Gravelly Ford (n = 8 groups), though not all of these release groups were considered for evaluating trap efficiency. Both the Owl Hollow and Scout Island RSTs were removed before the end of the sampling period, while fish were still released at those locations to evaluate downstream survival.

Both half-size (0.5 mm long) and full-size (1.0 mm long) CWTs were used during the 2021–2022 RST season. Half-size CWTs permitted tagging smaller-fish for release at the two upstream RST locations. The ability to tag smaller fish allows evaluation of RST efficiency during periods of high fry capture at upstream locations. Four efficiency groups of fry were released at both upstream RSTs (Owl Hollow and Scout Island), and an additional four groups were released near Friant Dam. These groups were released in December 2021 and January 2022. Those fish released near Friant Dam were intended to provide an estimate of survival from the spawning grounds in upstream areas of Reach 1 to the nearest downstream RSTs where fry were most frequently encountered. The remaining efficiency evaluations were completed at all four RSTs from late January onwards. Trap efficiency varied as a function of location with mean (± standard deviation) values as follows: Owl Hollow, 10.1 percent (± 2.7 percent); Scout Island, 12.6 percent (± 6.1 percent); Highway 99, 8.8 percent (± 6.2 percent); and Gravelly Ford, 4.4 percent (± 3.4 percent). Trap efficiency at Gravelly Ford appeared to be impacted to a greater degree by elevated flows April–May 2022. Trap efficiency prior to this averaged 7.0 percent but decreased to an average of 1.7 percent thereafter; especially when compared to Highway 99 efficiency, which only decreased from an average of 10.6 to 7.3 percent for the concurrent

periods. Currently, RST capture and efficiency data are being reviewed and analyzed. Therefore, these data should be considered as preliminary.

2021-2022 Telemetry Monitoring Results

A subset of juvenile CV spring-run Chinook salmon from SCARF were implanted with Juvenile Salmon Acoustic Telemetry (JSAT) acoustic tags as part of a movement study by UC Davis. The goal of the study was to pair habitat data with telemetry data to evaluate the link between broad scale habitat variability and survival of juvenile CV spring-run Chinook salmon in the San Joaquin River and Delta. Specifically, the study goals include: 1) understanding survival and routing dynamics of fish during a range of water year types; and 2) conducting pilot work on survivorship and routing of naturally-produced smolts. Results from 2021-2022 study are still being processed, however, updates are provided on the CalFish Track website[1].

Adult Broodstock Releases in 2022

A total of 74 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 A4 summarizes the adult broodstock releases. All fish received external color-coded Floy tags with individual identification numbers, and all female and a subset of male fish were fitted with acoustic tags to track fine-scale movement. Genetic tissue samples of all broodstock adults were taken at the SCARF for use in the parentage database.

Table A4. Summary of adult NEP CV spring-run Chinook salmon released by the SCARF in 2022.

Release Date	Release Location	Number of Females	Number of Males	Total Released per Date
6/1/2022	Friant Bridge	10	41	51
6/2/2022	Friant Bridge	0	13	13
6/2/2022	Skaggs Park	4	6	10
Total Released		14	60	74

Adult NEP CV Spring-run Chinook Salmon Returns in 2022

Trap and haul of adult CV spring-run Chinook salmon in Reach 5 were conducted from the weeks of April 1, 2022 to May 15, 2022. In total, 11 fish were caught, and of those, 10 were released into Reach 1, and one was a recovered carcass in Reach 5. A full report of the effort will be available on the SJRRP website.

Redd and carcass surveys began on August 29, 2022. Preliminary data for redd/carcass surveys show that as of November 12, 2022, a total of five redds have been observed, and seven carcasses (two translocated from Reach 5 and five broodstock) have been observed.

[1] CalFish Track website: https://oceanview.pfeg.noaa.gov/CalFishTrack/index.html

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 spring-run Chinook salmon originating from the San Joaquin River Restoration Program (SJRRP) Area 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 estimated number of naturally-produced YOY spring-run Chinook salmon that could be observed during the spring of each year. In the future, this conceptual juvenile production estimate (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 estimate of production will be refined and updated each year as new data are available. The method used to calculate the conceptual JPE for NEP fish is loosely based on the methods used to calculate the Sacramento River (SR) winter-run Chinook salmon JPE[1]. The development of a conceptual JPE sooner rather than later helps to identify 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 contains the components, numbers used, and associated notes for each component for the conceptual JPE within the 2022 Tech Memo. In addition, Table B1 includes a preliminary retrospective analysis of the 2022 conceptual JPE using updated data from the 2021-2022 field season, which was not available when the 2022 Tech Memo was issued. Within Table B1, under the Fry Production Estimate (FPE) component in the column titled "Updated Numbers for 2022", it should be noted that the SJRRP is currently investigating different methods to estimate egg-to-fry survival as well as overall fry production on an annual basis. While methods are being investigated, the FPE component that was used in the 2022 Tech Memo has not been updated in the retrospective analysis.

Table B2 outlines the components, numbers used, and associated notes for each component for the 2023 conceptual JPE. Based on the results of the conceptual JPE calculations, the estimated number of naturally-produced YOY spring-run Chinook salmon that may be observed at the CVP/SWP Facilities in the spring of 2023 is anticipated to be low.

The results of the conceptual JPE for NEP fish are dependent on annual variations of environmental conditions, including water year type, flows, water temperatures, and water management decisions, such as releasing water delivery flows from Millerton Reservoir that require SJRRP Restoration flows to be halted. 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

[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

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.

Table B1. Table outlining the conceptual Juvenile Production Estimate (JPE) method and components, numbers used for 2022, and associated notes to explain the component and/or the number used. Notes in cells within the column titled "Notes for Updated Numbers for 2022" indicate those were numbers that were re-evaluated based on updated 2021-2022 fisheries monitoring data.

JPE Component	Numbers for 2022	Notes	Updated Numbers for 2022	Notes for updated numbers
Reach 5 to Reach 1 Trap & Haul numbers	74	74 fish transported to Reach 1 (includes 9 post transport mortalities).	74	
SCARF Broodstock number	200	50 females	200	
Total known spawners	265	Trap & haul numbers + broodstock *(*subtracts 9 known post-transport mortalities from T&H*)*	265	
Estimated volitional returns to Reach 1	0	Estimated from carcass survey data from Aug-Dec 2021. Due to extreme drought conditions, there was no volitional passage to Reach 1; also the river was disconnected between Reach 5 and Reach 1 from July through early December 2021.	0	
Total known + Estimated volitional returns	265	Trap & haul +broodstock + volitional return estimate	265	
Adult female estimate (AFE)	87	Trap & haul (~50% or 37) + broodstock (50) + volitional return estimate (0) · AFE of trap & haul fish is based on target estimate from the 2018 Fisheries Framework. Will be revised as monitoring data become available.	87	Based on combination of known females (via genetic ID) that survived post-transport (32), and estimate of sex ratio from fish with unknown sex ID (estimated to be 50%). To estimate females from unknowns: Used the sex ratio of all knowns for 2021 adults. Of the 79 fish that could be identified to sex (inclusive of mortalities) 42 were identified as female (53%) and 37 were identified as male (47%). So, 53% of the 10 unknowns = 5.3 fish that were females. Rounding down to 5 females and add that to the 32 to get 37. Then Add 37 to 50 = 87 AFE
AFE minus pre-spawn mortality (AFE-spawned)	74	- Used 15% target objective from the 2018 Fisheries Framework. Will be revised as monitoring data become available. · - AFE-spawned = AFE –(0.15*AFE)	74	Results from 2021 carcass surveys: 1 out of 25 Broodstock; 5 out of 15 Trap & haul prespawn. Then 6/40 * 100 = 15% ; 87- (87*0.15)= 74

JPE Component	Numbers for 2022	Notes	Updated Numbers for 2022	Notes for updated numbers
Average annual fecundity	2,418	Average annual fecundity of SCARF broodstock fish used as a surrogate for natural returns; usually known by Oct of each year.	2,418	
Total viable eggs	178,932	Total viable eggs= AFE-spawned* annual fecundity	178,932	
Estimated egg-to-fry survival: Fry Production Estimate (FPE)	89,466	Based on 50% target objective from the 2018 Fisheries Framework (Table 7). May be revised as data becomes available, however, preliminary data suggests the survival rate to be lower than 50%.	89,466	
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 becomes available.	0.05	
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.	0.05	
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.	0.23	
JPE= (FPE)*(SurvR2)*(SurvR5)* SurvDelta)	51	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. Also, given drought conditions in 2021 (i.e., very low flows, and high water temperatures	51	The river below Sack Dam (end of Reach 3) was disconnected in late spring of 2022. This was due to drought conditions across California which resulted in the halting of Restoration flows to allow for water deliveries to be released from Millerton Reservoir to fulfill water diversions at Mendota Pool (Reach 2). Under these circumstances it is estimated that close to

JPE Component	Numbers for 2022	Notes	Updated Numbers for 2022	Notes for updated numbers
		during adult holding, spawning, and egg incubation), the estimate is anticipated to be lower.		zero naturally-produced fish exited the SJRRP Restoration Area. Specifically, it is estimated that both "SurvR5" and "SurvDelta" were likely close to zero.

Table B2. Table outlining the conceptual Juvenile Production Estimate (JPE) method and components, numbers used for 2023, and associated notes to explain the component and/or the number used.

JPE Component	Numbers for 2023	Notes
Reach 5 to Reach 1 Trap & Haul numbers	10	10 Fish transported to Reach 1
SCARF Broodstock number	74	14 females
Total known spawners	84	Trap & haul numbers + broodstock
Estimated volitional returns to Reach 1	0	Due to drought conditions and the halting of Restoration flows to allow for water delivery flows, there was no volitional passage to Reach 1 during the primary adult migration timeframe.
Total known + Estimated volitional returns	84	Trap & haul +broodstock + volitional return estimate
Adult female estimate (AFE)	19	- Trap & haul (~50% or 5) + broodstock (14) + volitional return estimate (0). - AFE of trap & haul fish is based on target estimate from the 2018 Fisheries Framework. Will be revised as monitoring data become available.
AFE minus pre-spawn mortality (AFE-spawned)	16	- Used 15% target objective from the 2018 Fisheries Framework. Will be revised as monitoring data become available. - AFE-spawned = AFE – (0.15*AFE)
Average annual fecundity	2,600	Average annual fecundity of SCARF broodstock fish used as a surrogate for natural returns; usually known by Oct of each year.
Total viable eggs	41,600	Total viable eggs= AFE-spawned* annual fecundity
Estimated egg-to-fry survival: Fry Production Estimate (FPE)	20,800	Based on 50% target objective from the 2018 Fisheries Framework (Table 7). May be revised as data become available, however, preliminary data suggests 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 becomes 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)	12	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. Also, given drought conditions in 2022 (i.e., very low flows, and high water temperatures during adult holding, spawning, and egg incubation), the estimate is anticipated to be lower.