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, 2020

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: 151422SWR2010SA00361) and the Biological and Conference Opinion on the Long-term Operations of the Central Valley Project and State Water Project (CVP/SWP Opinion); ARN: 151422SWR2006SA00268)[1]

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

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

FROM: Erin Strange, San Joaquin Branch Chief, CCVO, West Coast Region

SUBJECT: 2020 (January 2020 – December 2020) 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

NMFS has prepared this Technical Memorandum (Tech Memo) to fulfill the following three purposes:

1) Fulfill 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

[1] Please cite as: NMFS. 2020. Technical Memorandum to Account for Reintroduced San Joaquin River Spring-Run Chinook Salmon per CFR 233.301(b)(5)(ii): 7.

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 the methodology that will be employed in 2020 to identify reintroduced nonessential experimental population (NEP) CV spring-run Chinook salmon from the San Joaquin River when encountered outside the NEP reintroduction area and outline the deduction or adjustment for such reintroduced spring-run Chinook salmon in the operations of the Central Valley Project (CVP) and State Water Project (SWP) such that the reintroduction 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 spring-run Chinook salmon release and monitoring plans for 2020.

1. 2019 Tech Memo Implementation Summary

1.1 2019 NEP CV Spring-run Chinook Salmon Reintroduction Implementation

1.1.1 Juvenile Releases

Young-of-Year Juveniles (broodyear 2018):

The San Joaquin River Restoration Program (Program) released 211,025 NEP spring-run Chinook salmon young-of-year juveniles to the San Joaquin River from January 2019 through May 2019. The majority of NEP juveniles released by the Program in 2019 were produced by the San Joaquin River Conservation and Research Facility (SCARF); Feather River Fish Hatchery (FRFH) origin juveniles were utilized for one release group in April 2019. All juvenile spring-run Chinook salmon released were marked with an adipose fin-clip and an internal coded wire tag (CWT) with numbers distinct to each release group.

Juvenile fish were released in four groups (Table 1):

Group 1) 50,000 on January 31, 2019 (CWT No. 061409);
Group 2) 31,295 on February 8, 2019 (CWT No. 061410);
Group 3) 87,200 on February 28, 2019 (CWT No. 061964); and
Group 4) 2,530 on April 5, 2019 (CWT No. 061446).

Juveniles were also released into the upper San Joaquin River in groups of 600 from January through May for rotary screw trap (RST) efficiency testing (CWT No. 061408). All of the release groups had an additional photonic tag to indicate batch release group, except the last group which did not receive photonic tags. RSTs could not effectively and safely continue fishing during flood flows and the remaining RST efficiency test fish

were released as a group of about 8,000 fish into Reach 1 on May 29, 2019. The total amount of RST efficiency test fish released was roughly 40,000 fish.

A subset of juveniles were implanted with JSAT acoustic tags as part of a movement study by UC Davis: 350 juveniles from the February 28, 2019, release group and an additional 350 juveniles released downstream at Durham Ferry on March 13, 2019. All of the downstream monitoring efforts and south Delta fish salvage at the Tracy Fish Collection Facility (TFCF) and Skinner Delta Fish Protective Facility (SDFPF; collectively the Facilities) were informed of the presence of these fish and their CWT identifiers.

Yearlings (broodyear 2017, 2018):

A broodyear 2017 group of 1,451 yearling fish (CWT No. 061242) were released on March 28, 2019, in Reach 5 at the Highway 140 crossing (Table 2). A group of approximately 9,000 broodyear 2018 yearlings were released on November 5, 2019 (CWT No. 061447, 060554, and 061964).

Juvenile Downstream Detections/Recaptures:

All adipose fin-clipped fish were sacrificed at the point of capture for CWT identification per protocol, unless there were visible sutures from acoustic tagging surgery, in which case they were released alive. A total of 401 juveniles and yearlings were detected or recaptured downstream of the release locations as of December 2019. Fifty-nine NEP spring-run Chinook salmon were observed at the TFCF, 326 were observed at the SDFPF, 5 were captured in the Mossdale Trawls, and 11 were captured in the Chipps Island Trawls (Figure 1 & 5, Table 1).

The observed total count of juveniles reported above for the TFCF and the SDFPF is the number of fish actually handled by biologists at the Facilities. Fish loss is an estimate of the number of fish that are lost to the system, typically in the form of mortality, and includes pre-screen loss and those fish that go through the louvers. Loss is calculated based on the expanded salvage at each Facility, the size of the observed fishes, and the water export rate. Using these expansion factors, the Facilities reported that an estimated total of 4,006 juvenile/yearling NEP spring-run Chinook salmon were lost to the system in the 2019 tech memo reporting year (Tables 1 & 2).

Reintroduction yearlings: A total of eight yearlings were observed by the Facilities (no other survey method encountered this release group). Yearling NEP spring-run Chinook salmon were first captured by the Facilities on December 17, 2018, 11 days after release into Reach 5 (Figures 4 & 6). The last day a yearling was captured at the Facilities was December 27, 2018, 21 days after release (Figure 4). One yearling fell into the winter-run Chinook salmon length-at-date range used by the Facilities to estimate juvenile run identity (Figures 2 & 3). Because all fish released by the Program were fin-clipped and CWT'ed, they were identified as NEP spring-run Chinook salmon and were not misidentified as juvenile winter-run Chinook salmon. Using the same expansion factors

explained in the paragraph above, the Facilities estimated that 21 yearlings were lost to the system in the 2019 tech memo reporting year (Table 2).

Reintroduction young-of-year juveniles: Juveniles were first observed downstream on February 7, 2019, and the last juveniles were observed on May 27, 2019 (Figure 5). The shortest time between release and downstream capture was 4 days, following the February 8 release (Figure 6). The longest time between release and capture was 81 days, those juveniles were recaptured on April 22 from the January 31 release group (Figures 5 & 6).

Juveniles captured at the Facilities were mostly in the spring-run Chinook salmon length-at-date range, but 53 individuals fell into the winter-run Chinook salmon length-at-date range (Figures 2 & 3). Because they were fin-clipped and CWT'ed, these individuals were identified as NEP spring-run Chinook salmon released by the Program and were not misidentified as juvenile Chinook salmon from other sources.

RST efficiency test juveniles: Of the approximately 40,000 juveniles released from January through May into Reach 1 and 2 for RST efficiency testing, four were captured downstream at the Facilities. The first RST juvenile was captured on April 8, 2019, and the last was captured May 27, 2019. Minimum and maximum days since release cannot be reliably estimated from this group since all RST release groups share a common CWT and the temporary photonic markings did not persist long enough to identify release groups when they arrived at the Facilities.

No changes in water export quantities were experienced as a result of the juvenile NEP spring-run Chinook salmon released by the Program.

1.2 Adult Releases

A total of 114 adult spring-run Chinook salmon broodstock cultivated at the SCARF were released by CDFW into Reach 1A of the San Joaquin River. Two separate releases occurred (Table 5), the first at Owl Hollow (30 females and 48 males from May 21-23, 2019) and the second at Ball Ranch (7 females and 29 males from August 6-8, 2019). 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 later parentage analysis.

1.3 Juvenile production from 2018 Adult Release

During the RST monitoring efforts by Program scientists, a total of 448 unmarked NEP spring-run Chinook salmon juveniles were captured in the RSTs in Reach 1 and 2. These juveniles resulted from in-river spawning of SCARF broodstock adults released in the spring/summer of 2018, whose redds were reported in the 2018 Tech Memo.

All unmarked naturally-spawned offspring captured in the RSTs were measured at capture, and a genetic sample was taken from most fish for parentage analyses before release. The first unmarked fry was captured on November 21, 2018, at the Owl Hollow

location with a fork length of 33 mm, and the last smolt was detected on May 18, 2019, at the RST near Highway 99, with a fork length of 134 mm. RST sampling ended early due to flood flows from Friant Dam because they could no longer fish safely and effectively.

1.4 Ocean Fishery Detections

In 2018, a total of 30 Program spring-run Chinook salmon were caught in the ocean fishery (Table 3). A query search was run within the Regional Mark Information System[2] (RMIS) for CWT numbers of NEP spring-run Chinook juveniles that were released as part of the Program. The results indicated that one adult fish, which was released as a juvenile in March 2016 in Reach 5, was caught in the California ocean sport fishery offshore of the San Francisco Bay. The other 29 adult fish that were caught, were released as juveniles in March 2017 in the San Joaquin River near Harmon Road in the Eastside Bypass. Of those 29 adult fish, two were caught off the coast of Oregon as part of the sport fishery there. The remaining 27 adult fish were caught in the California ocean sport fishery or ocean troll, either offshore of the San Francisco Bay or Mendocino County coast.

1.5 Adult Chinook Salmon Returns

On April 9, 2019, the Program caught its first adult spring-run Chinook salmon in Reach 5 of the Restoration Area (Table 4), with a fyke trap below the Eastside Bypass Control Structure. That fish was successfully transported into Reach 1. On April 19, 2019, two more adult fish were caught at the same location. One died in transport to Reach 1, and Program scientists subsequently extracted the CWT. This was the first confirmed returning adult spring-run Chinook salmon in the Program's history. 20 additional adults were later captured: 19 at the Eastside Bypass Control Structure fyke trap, and one at a fyke net below Sack Dam. All translocated fish were acoustically and externally tagged with Floy tags. Unfortunately, two more fish died in transit and a fourth carcass washed downstream shortly after being released in poor condition. A total of 19 returning adult spring-run Chinook salmon were successfully captured and transported from Reach 5 into Reach 1 in good condition. A full report of the effort is available on the Program website[3].

FishBio also collected a total of 10 adult Chinook salmon in fyke traps in the mainstem San Joaquin River below the confluence with Stanislaus River. The first fish was caught on May 1, 2019, and the last on June 19, 2019. These adults were not confirmed as the Program's NEP spring-run Chinook salmon nor could FishBio transport these fish.

1.6 Research and Monitoring Findings

NMFS has committed to developing this Tech Memo in coordination with interested parties, to the greatest extent possible, and has formed a working group for this purpose. The focus of the 2020 Tech Memo process was to consolidate the technical information available regarding accounting of naturally-produced San Joaquin River spring-run

[2] The Regional Mark Processing Center website
[3] 2019 Adult Spring-run Trap and Haul Report

Chinook salmon and implement the Guidance Document for Methods to Assess San Joaquin River Spring-Run Chinook Salmon in Relation to Facility Operational Triggers and Incidental Take Limits[4] (Guidance Document). NMFS and the Program used the Phase 2 approach within the Guidance Document to determine which methodology or combination of methodologies will be implemented in 2020, as described in the next section of this document. In 2019, the Program had multiple research and learning opportunities. Some observations from those opportunities are presented here.

1.6.1 Juveniles

2019 was the sixth year the Program released NEP juveniles into the Restoration Area and the fourth year that released juveniles were recaptured at the Facilities or detected in other monitoring effort.

Take at the Facilities

One yearling released by the Program that was salvaged at the Facilities was in the winter-run Chinook salmon length-at-date range (Figure 2). Since all the fish released by the Program were CWT'ed, it was easily identified as a Program NEP yearling and did not trigger any water delivery curtailments.

Genetic identification of salvaged juvenile Chinook salmon at the Facilities has proven to be more accurate than the length-at-date criteria for determining juvenile Chinook race (Harvey, et al. 2014)[5]. Reclamation implemented a rapid genetic analysis protocol for water year 2019. The older juvenile Chinook salmon loss density trigger (2009 NMFS BiOp RPA Action IV.2.3) was exceeded a few times during Water Year 2019. However, Old and Middle River (OMR) flow was already more positive than the resulting action response when the older juvenile Chinook salmon loss density trigger was exceeded. Therefore in these instances, it was not necessary to implement the rapid genetic analysis protocol because even though the trigger was exceeded it did not result in any changes to water exports (see Delta Operations for Salmonids and Sturgeon Annual Report: Water Year 2019 for more information[6]).

Lower San Joaquin River Survival Study (UC Davis)

UC Davis continued their investigation of reach-specific juvenile survival and migration conditions in the Lower San Joaquin River and South Delta for juvenile spring-run Chinook salmon as planned for 2019. Preliminary results indicate that there was relatively high initial mortality at release, which contributed to poor survival through the Restoration Area (survival from Fremont Ford to Hills Ferry was 60%). This result was consistent with the previous two years of study. Survival from Durham Ferry to Chipps Island (i.e. through-Delta survival) was less than 10%. Cumulative survival from the initial release location to Chipps Island was 4%. The continuation of this study should

[4] The Guidance Document
[5] Harvey, B.N., D.P. Jacobson, and M.A. Banks. 2014. Quantifying the Uncertainty of a Juvenile Chinook Salmon Race Identification Method for a Mixed-Race Stock. North American Journal of Fisheries Management 34(6: 1177-1186, DOI: 10.1080/02755947.2014.951804
[6] Delta Operations for Salmonids and Sturgeon Annual Reports

provide the Program with migration timing and through-Delta survival for juvenile spring-run Chinook salmon released into the San Joaquin River, filling in an important data gap necessary for understanding the results of the reintroduction efforts (personal communication, Gabe Singer, UC Davis).

Rotary Screw Trap Monitoring in Reaches 1 and 2

Biologists working for the Program conducted RST monitoring of emigrating juvenile spring-run Chinook salmon in Reaches 1 and 2 (Owl Hollow to San Mateo Crossing) in the Program's Restoration Area. Sampling was initiated at the three most upstream traps (Owl Hollow, Sycamore Island, and Hwy 99) in mid-November 2018 and in mid-December for the most downstream trap at San Mateo Ave. Sampling continued through mid-March at the two most upstream locations, and through mid-May and late-April at the Highway 99 and San Mateo Crossing locations, respectively.

In conjunction with daily monitoring efforts, mark and capture/recapture trap efficiency experiments were completed to quantify juvenile salmon production and survival through sampled reaches. RSTs only sample a portion of the river, and thus a portion of downstream moving fish; therefore, trap efficiency estimates are necessary to extrapolate from captured fish totals to estimate total production. Trap efficiency estimates also permit quantification of percent survival of marked fish released and recaptured at subsequent downstream traps. Varied combinations of photonic marking colors and fin tagging locations allowed uniquely identifiable batches of fish to be matched with release location (i.e., RST location) and release date, despite having the same CWT number.

Efficiency experiments were completed at all four RSTs: Owl Hollow (n = 12), Sycamore Island (n = 12), Highway 99 (n = 15), and San Mateo Crossing (n = 11), resulting in the release of 30,956 externally marked juvenile spring-run Chinook salmon into Reaches 1 and 2 of the Restoration Area. Trap efficiency varied as a function of location with mean (± SD) values of 11.1% (± 7.5) at Owl Hollow, 8.3% (± 5.0) at Sycamore Island, 8.8% (± 6.7) at Highway 99, and 0.9% (± 0.7) at San Mateo Crossing. To date, RST capture and efficiency data are being reviewed and analyzed, and, as a result, these data should be considered preliminary. Additionally, traps were removed and monitoring ceased prior to the end of the salmon emigration season due to flood flows from Friant Dam (> 3,500 cfs) which resulted in reduced gear efficiency and unsafe working conditions. As a result, production and survival estimates will be calculated from the truncated data set.

1.6.2 Adults

The 2019 adult broodstock acoustic tracking efforts continued examining where NEP spring-run Chinook salmon hold and spawn in the Program Restoration Area. After 2017, Program scientists determined that all acoustic tags would be inserted into the stomach through the mouth. As in previous years, all females (37 individuals) were acoustically tagged, while only a subset of males (14 of 77 individuals) were also tagged. The tagged fish were monitored with 18 stationary acoustic receivers and surveyed weekly using mobile acoustic listening devices (when conditions allowed). A majority of the tagged fish appear to have been holding in Reach 1A between Friant Dam and Fort Washington prior to spawning. Through August 22, 2019, 44 of the 51 (86%) acoustically-tagged

broodstock fish were detected at least once within Reach 1A. Additionally, 9 of the 19 (47%) translocated naturally returned adults were detected at least once within Reach 1A. The most detections in a single day was 14 (broodstock and translocated natural returns) at the base of Friant Dam.

In 2019, USFWS and CDFW detected 209 spring-run Chinook salmon redds in Reach 1 and recovered 168 carcasses, during routine redd and carcass surveys. 16 broodstock carcasses and 3 carcasses from adults that were translocated by the Program were recovered and confirmed by the presence of external or internal tags. A large majority of carcasses recovered, 149, had no external Floy tags and no acoustic tags, meaning they were not released broodstock or translocated adults (Table 5). Program scientists, hypothesize that these unmarked adults swam up the Chowchilla Bypass during high flood flows that occurred from late-May to early-July without assistance and have held in the upper Reaches of the river throughout the summer.

2. 2020 Tech Memo Implementation

On October 21, 2019, NMFS issued a new Biological Opinion on the Long-term Operation of the Central Valley Project and the State Water Project (LTO of CVP/SWP) that is intended to replace the current CVP/SWP Opinion. Operations under the LTO of CVP/SWP Biological Opinion have not yet begun and are not anticipated to begin until after this Tech Memo is issued. Once the new LTO of CVO/SWP Biological Opinion is implemented, NMFS will re-evaluate whether issuance of a new Tech Memo is warranted under the new fish trigger methods to account for naturally spawned Program fish and to maintain the *de minimus* requirement.

To contribute to a loss density trigger, an unmarked juvenile produced from the Program must navigate the Restoration area and:

1) be detected at the Facilities;
2) be in the same size range of older juvenile Chinook salmon; and
3) contribute to exceeding the loss density triggers in the 2011 CVP/SWP Opinion (Reasonable and Prudent Alternative Actions IV.2.3 and IV.3[7]).

If an unmarked juvenile meets all three criteria described above, it will be tested at the facilities using a rapid genetic analysis protocol that has been developed for water year 2020[8] to genetically determine if the Chinook salmon run which contributed to exceeding the loss density trigger are winter-run Chinook salmon or other Chinook salmon runs that meet the older juvenile length-at-date criteria and whether any spring-run Chinook salmon identified are from Clear, Butte, Deer, or Mill creeks. Since these spring-run Chinook salmon populations are genetically distinct, any Chinook salmon determined to be a false positive (i.e., not from Clear, Butte, Deer or Mill creeks) will not count towards the exceedance of a fish density trigger.

[7] CVP/SWP Opinion CVP/SWP Opinion 2011: RPA Action IV.2.3 starts on page 74, and RPA Action IV.3 starts on page 79

[8] "Rapid Genetic Analysis of the Chinook Salmon Salvaged at the Central Valley Project and State Water Project during Water Year 2020" Sent from NMFS to Reclamation on December 20, 2019

In 2020, the Program will further investigate the use of genetic identification to account for San Joaquin River spring-run Chinook salmon at the Facilities. Steps of this investigation include:

(1) Continuing to refine and learn from fish recovery and genetic testing at the Facilities.

(2) Identifying and resolving (to the extent of the Program's control) potential issues with using genetic identification for meeting the *de minimus* requirement – process timing, chain of custody, and necessary agencies' commitments.

Current river conditions within the Restoration Area will dictate the implementation of fish releases and fisheries monitoring. The Program will monitor river and climate conditions and may cancel or modify fisheries monitoring and/or fish release activities, depending on expected conditions in the system.

Juvenile San Joaquin River NEP spring-run Chinook salmon migration timing to the Delta will be estimated from the capture of CWT'ed individuals recovered in 2020 in the Mossdale Trawl, Chipps Island trawl, at the Facilities, and through other monitoring efforts. UC Davis will continue the reach-specific survival study for juvenile spring-run Chinook salmon released into the Lower San Joaquin River and South Delta in 2020.

2.1 Calculation of incidental take

2.1.1 Incidental take

Incidental take calculations and adjustments to the incidental take estimates pursuant to the CVP/SWP Opinion are unnecessary for 2020 because all of the juvenile CV spring-run Chinook salmon released into the San Joaquin River will be adipose fin-clipped and CWT'ed. In the event that offspring of naturally-spawned adults survive and emigrate out of the Program Restoration Area unmarked, and contribute to the exceedance of a fish density trigger, the rapid genetic analysis protocol will be implemented by Reclamation.

The rapid genetic analysis protocol will determine more accurately if the juvenile Chinook salmon that contributed to the trigger exceedance were true winter-run Chinook salmon, or spring-run Chinook salmon from Clear, Butte, Mill, or Deer creeks, and was not inadvertently caused by a naturally-produced Program NEP spring-run Chinook salmon.

2.1.2 Operational triggers

Adjustment to the operational triggers pursuant to the CVP/SWP Opinion are unnecessary for 2020 because all spring-run Chinook salmon released into the San Joaquin River will be adipose fin-clipped and CWT'ed. In addition, a rapid genetic analysis protocol will be implemented in 2020 to genetically identify run of all juvenile Chinook salmon that contribute to the exceedance of a fish density trigger.

2.2 Accounting Methodology

2.2.1 Physical Marking

All juvenile spring-run Chinook salmon released into the San Joaquin River as part of the Program's reintroduction plan will be marked with an adipose fin-clip and CWT that contains a code unique to Program release groups so they can be distinguished from all other juvenile Chinook salmon release groups. Because these fish will be adipose fin-clipped, they are exempted from take prohibitions under the 4(d) rule for West Coast threatened salmonids (70 FR 37160, June 28, 2005). As a result, reintroduced NEP spring-run Chinook salmon will not be counted toward any incidental take limits and trigger levels provided under all applicable biological opinions and Endangered Species Act section 10 research permits for operation of any and all facilities of the CVP/SWP.

Biologists at Program monitoring sites, the Mossdale and Chipps Island trawl stations, and the Facilities will record, measure, and sacrifice all adipose fin-clipped fish with a positive CWT detection (as currently undertaken via Facility Standard Operating Procedures). Samples collected at the Program monitoring sites and at Mossdale and Chipps Island fish sampling locations will be processed and reported to NMFS Program staff. The staff at the Facilities will process CWT'ed fish within 24 hours and report the data to the California Department of Fish and Wildlife (CDFW), which will then report the CWT data and associated loss to the Data Assessment Team (DAT) and Delta Operations for Salmonids and Sturgeon (DOSS) group weekly.

Genetic Analysis

The Program has established a parentage based tagging (PBT) procedure for the San Joaquin River 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 returning to the Restoration Area in 2019/2020 will be tissue sampled for genetic testing.

In addition, all naturally-spawned (unmarked) juvenile Chinook salmon captured in the RSTs or other juvenile traps deployed in 2019/2020 will be tissue sampled for genetic analysis as part of the parental inference analysis. Parental inference analysis can include identification of both parents of each individual, estimation of the number of crosses that took place in the river, family line contribution, and identification of crosses not attributable to the Program.

With the present operational triggers and length-at-date method to determine Chinook salmon run, the key concern is whether reintroduced Program NEP spring-run Chinook salmon would fall into the older juvenile Chinook salmon length-at-date criteria and inadvertently contribute to an operational trigger. Genetic analysis of Chinook salmon at the Facilities is a more accurate method than the length-at-date method to distinguish San Joaquin River spring-run Chinook salmon from other runs of Chinook salmon. At this time, genetic testing of larger juvenile Chinook salmon is needed to determine whether the observed fish at the Facilities are genetically winter-run Chinook salmon or other Chinook salmon runs in order for the operational triggers to be applied correctly. The

Program will coordinate with the rapid genetic analysis effort in 2020 at the Facilities to ensure that spring-run Chinook salmon from the Program, which are all identifiable by parental-based genetic testing, do not inadvertently contribute to any loss density trigger exceedances that would warrant operational changes.

2.2.2 Reintroduction Process

Release Plans

Approximately 200,000 juvenile spring-run Chinook salmon from the SCARF will be released into the San Joaquin River upstream of the Merced River confluence in spring 2020 as part of the Program's reintroduction efforts in 2020. There will be no translocation fish from the FRFH. Also, in the summer of 2020, adult broodstock from the SCARF could be released into Reach 1. Although the exact numbers for the adult release are not yet determined, these fish will have external tags, CWTs, have their adipose fins clipped and some will be acoustically tagged. The exact release location, date, number of release groups, and numbers of fish per release group are dependent on water year type, physical river conditions within the Restoration Area (the San Joaquin River from Friant Dam to the Merced River confluence), and fish availability and size, which will not be known until early spring. Target release timing, location, and numbers of fish per release will be identified and posted on the Program website[9] when determined.

The U.S. Fish and Wildlife Service (USFWS) will issue pre-release notifications via email to interested stakeholders and agencies approximately one week prior to fish release. A second notification will be made to the same list immediately after the fish release. A memorandum summarizing the hatchery releases will be prepared for the DOSS group with details regarding the releases, marks, and CWT codes. Release information will also be reported to the Regional Mark Processing Center website[2].

Additionally, the Program is planning to monitor Reach 5 for returning adult spring-run Chinook salmon and capture/translocate them to holding and spawning habitat in Reach 1. If returning adults are captured, they will be marked with a PIT tag or/and Floy tag, and genetically sampled before release. Up to 30 adults will be tagged with an acoustic transmitter, and all translocated adults will be released in Reach 1. These adults and the SCARF broodstock releases are expected to spawn naturally in the Restoration Area in 2020, and juveniles from the natural spawning would be out migrating as early as January 2021.

Monitoring Plan

The offspring of adult spring-run Chinook salmon released or translocated in 2019 will be monitored throughout Reaches 1 and 2 to determine migration timing and life-stage diversity, survival, and size. In addition to natural production, approximately 42,500 juvenile spring-run Chinook salmon will be released throughout the winter/spring to test RST capture efficiency at different flows. RST monitoring will be performed from

[9] The San Joaquin River Restoration Program website

November 8, 2019, to the end of June 2020, or until water temperatures exceed lethal temperatures as defined in Figure 9 (page 2-25) of the Fisheries Framework[10] or no salmonids are caught for seven days or more. Four monitoring locations within the Program Restoration Area were chosen based on redd locations and river access (Owl Hollow, Scout Island, Highway 99 Bridge, and San Mateo Avenue). RSTs at these sites will be operated when sufficient velocities allow for cone rotation and operations are safe for field personnel.

NMFS has determined (based on previous discussions with members of the Tech Memo group) that tracking juvenile Chinook salmon migration through the lower San Joaquin River, beyond the current monitoring efforts, has considerable value. UC Davis will continue to track juvenile spring-run Chinook salmon from Reach 5 of the Program Restoration area into the San Joaquin River and through the south Delta (please see the Research and Monitoring Findings section above for a more detailed explanation).

Depending on river conditions, adult spring-run Chinook salmon returns may be monitored with a VAKI Riverwatcher camera in Reach 5 of the Restoration Area if river conditions allow the installation. If any adults are detected, they will be captured and moved to Reach 1 of the Restoration Area. Also, Reclamation plans to transport any adult spring-run Chinook salmon found during their monthly steelhead monitoring efforts in Reaches 4 and 5 to Reach 1.

Timeline

Once final juvenile San Joaquin River NEP CV spring-run Chinook salmon release information is available, this information will be posted to the Program website[9]. Beginning in February 2020, NMFS will hold monthly meetings to discuss implementation of this 2020 Tech Memo and to develop the 2021 Tech Memo. NMFS will also focus the meetings on implementation of the techniques developed in the Guidance Document.

On October 21, 2019, NMFS issued a new Biological Opinion on the Long-term Operation of the Central Valley Project and the State Water Project (LTO of CVP/SWP) that is intended to replace the current CVP/SWP Opinion. Operations under the LTO of CVP/SWP Biological Opinion have not yet begun and are not anticipated to begin until after this Tech Memo is issued. Once the new LTO of CVO/SWP Biological Opinion is implemented, NMFS will re-evaluate whether issuance of a new Tech Memo is warranted under the new fish trigger methods to account for naturally spawned Program fish and to maintain the *de minimus* requirement.

Revision

NMFS developed this memorandum to govern activities for a period of one year. As a result, this Tech Memo will not be in effect until January 15, 2020. NMFS intends to prepare a new memorandum by January 15, 2021, to govern activities during 2021. Operations under the LTO of CVP/SWP Biological Opinion have not yet begun and are not anticipated to begin until after this Tech Memo is issued. Once the new LTO of CVO/SWP Biological Opinion is implemented, NMFS will issue a new Tech Memo that

[10] Fisheries Framework: Spring-run and Fall-run Chinook Salmon

accommodates for naturally spawned Program fish that could potentially contribute to exceeding new salvage limits at the Facilities; therefore, ensuring the *de minimus* requirements[11] of the Program Settlement continue to be met.

Adjustments to the CVP/SWP Opinion

No adjustments are needed in 2020 to the CVP/SWP Opinion because all released juvenile spring-run Chinook salmon will be adipose fin-clipped and CWT'ed. In the event any natural juvenile spring-run Chinook salmon survive and migrate out of the Program Restoration Area, are observed at the Facilities, and a fish density trigger is exceeded; they will be subject to the rapid genetic analysis protocol, so they are not misidentified as winter-run Chinook salmon or yearling spring-run Chinook salmon from Clear, Butte, Mill, or Deer creeks.

[11] "…reintroductions will not impose more than *de minimus*: water supply reductions, additional storage releases, or bypass flows on unwilling third parties…"(Page 972) Public Law 111-11 San Joaquin River Restoration Settlement

Figure 1. Map of the San Joaquin River Restoration Program Restoration Area and the Delta, depicting where non-essential experimental population (NEP) spring-run Chinook salmon yearlings and juveniles were identified downstream in 2019. The number within the bubbles and the bubble size is relative to the number of coded wire tags recovered at that location. TFCF refers to the Tracy Fish Collection Facility and SWP refers to the Skinner Delta Fish Protective Facility. The totals within the TFCF and SWP bubbles are cumulative young-of-year NEP spring-run Chinook salmon juveniles. SCARF refers to the Salmon Conservation and Research Facility run by the San Joaquin River Restoration Program. (Credit: Sheila Greene)

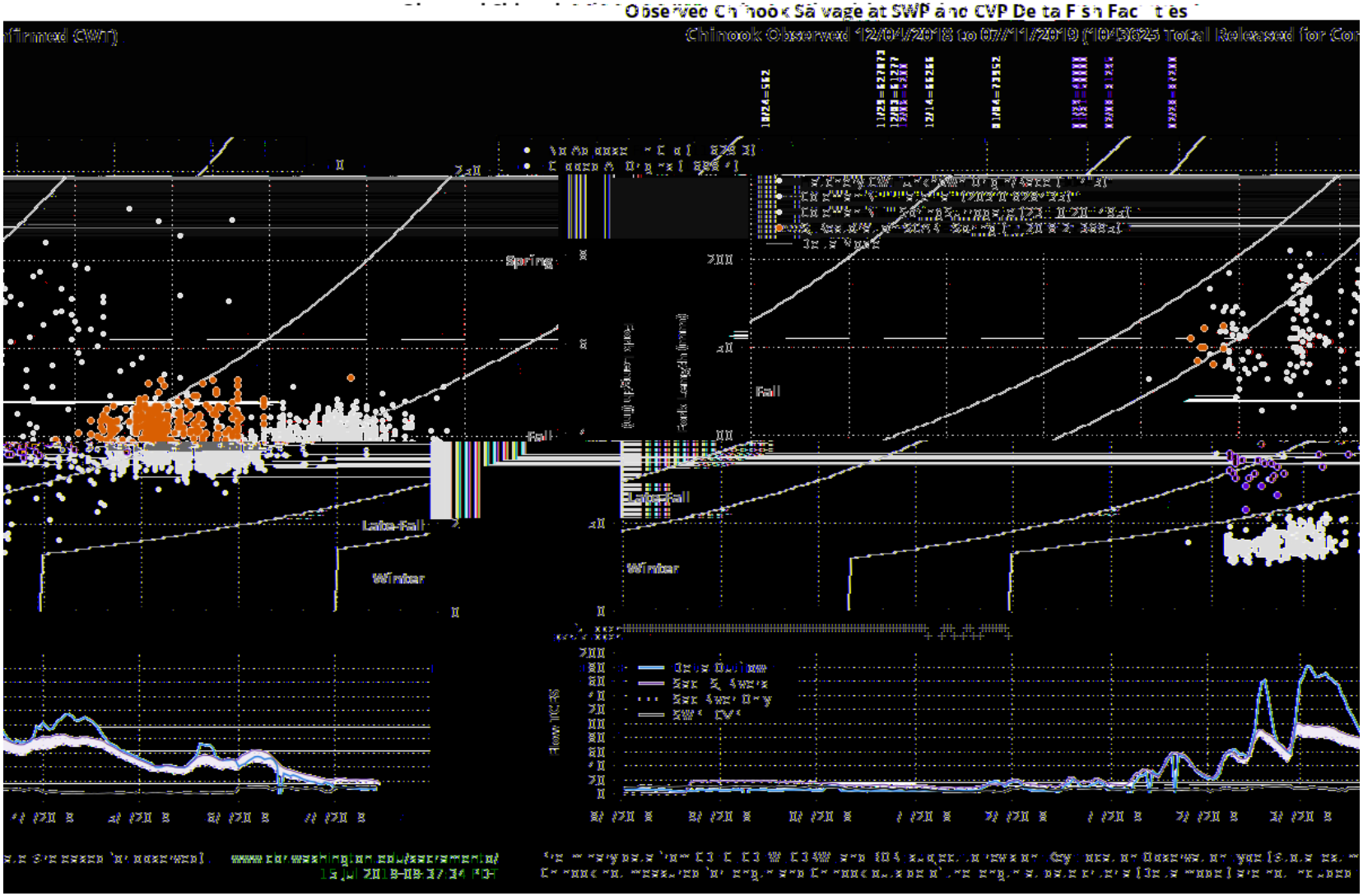

Figure 2. Observed Chinook salvage at SWP (State Water Project; Skinner Delta Fish Protective Facility) and CVP (Central Valley Project; Tracy Fish Collection Facility) Delta Fish Facilities from 8/18/2018 to 7/15/2019. Only juvenile Central Valley Chinook salmon released by the San Joaquin River Restoration Program (SJRRP) are bolded in color, all other salvaged Chinook are in grey. Salmon Conservation and Research Facility (SCARF) spring-run represent juvenile spring-run which were spawned and raised at the SCARF facility in Friant, CA, and were released as juveniles or yearlings in groups from December 2018 to March 2019. *Please note some fish fell within the winter-run length at date curve.

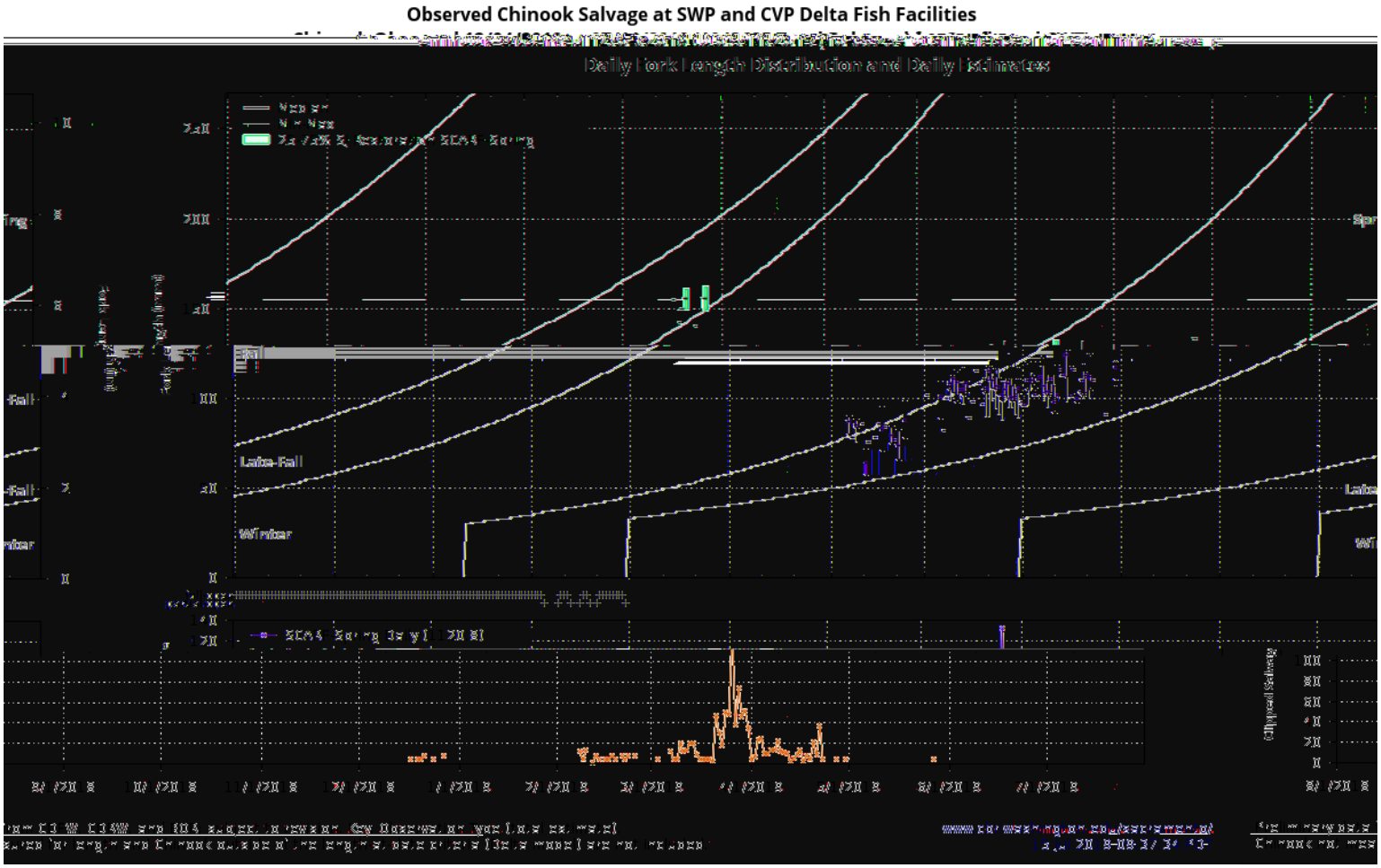

Figure 3. Median sizes (orange bars) of recovered nonessential population Chinook salmon salvaged at SWP (State Water Project; Skinner Delta Fish Protective Facility) and CVP (Central Valley Project; Tracy Fish Collection Facility) Delta Fish Facilities from December 4, 2018 to July 11, 2019. Single black dots indicate sampling events when only one fish was caught, variation in median size could not be estimated for those sampling periods. Salmon Conservation and Research Facility (SCARF)-spring-run represent juvenile spring-run which were spawned and raised at the SCARF facility in Friant, CA and were released as juveniles or yearlings in groups from December 2018 to March 2019. *Please note some fish fell within the winter-run length at date curve.

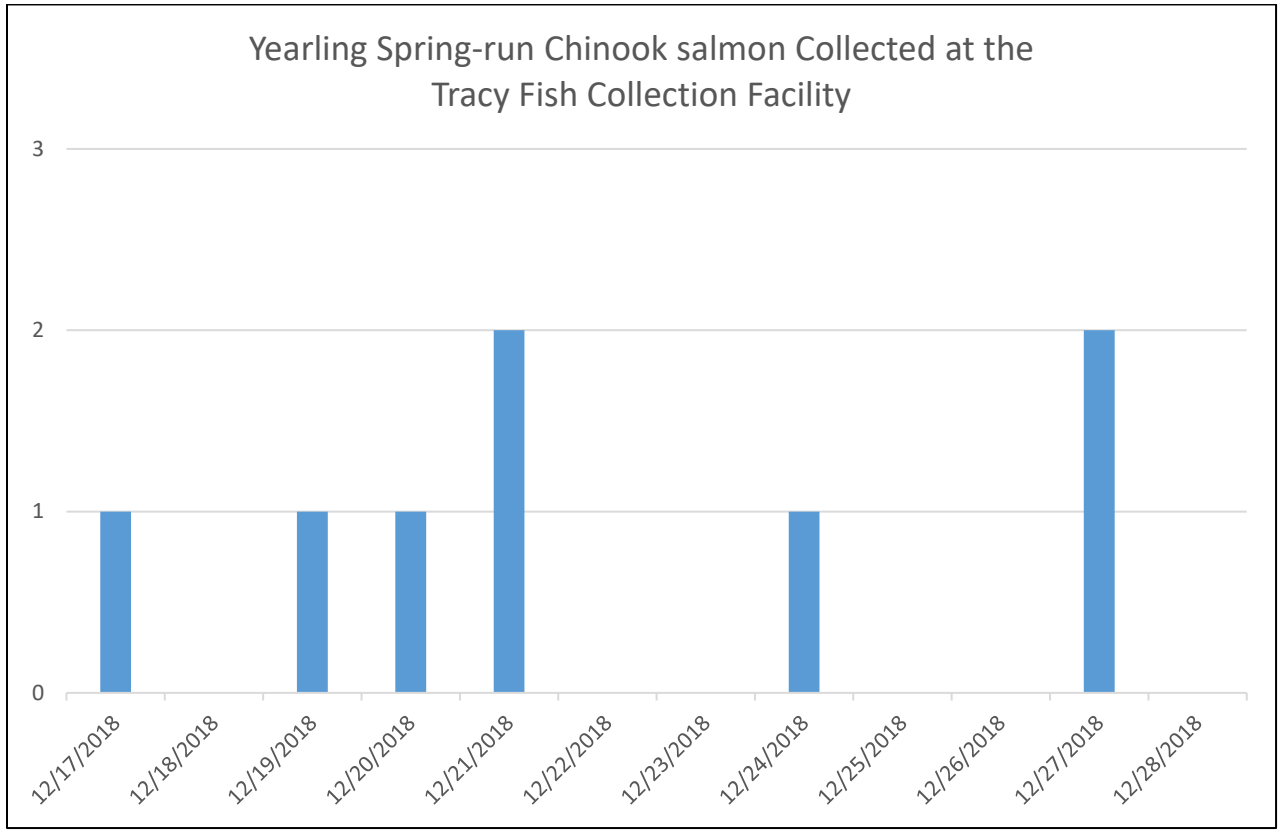

Figure 4. Total daily detections of released NEP (non-essential population) spring-run Chinook salmon yearlings from December 17 to 28, 2018. These fish were released in one group on December 6, 2018.

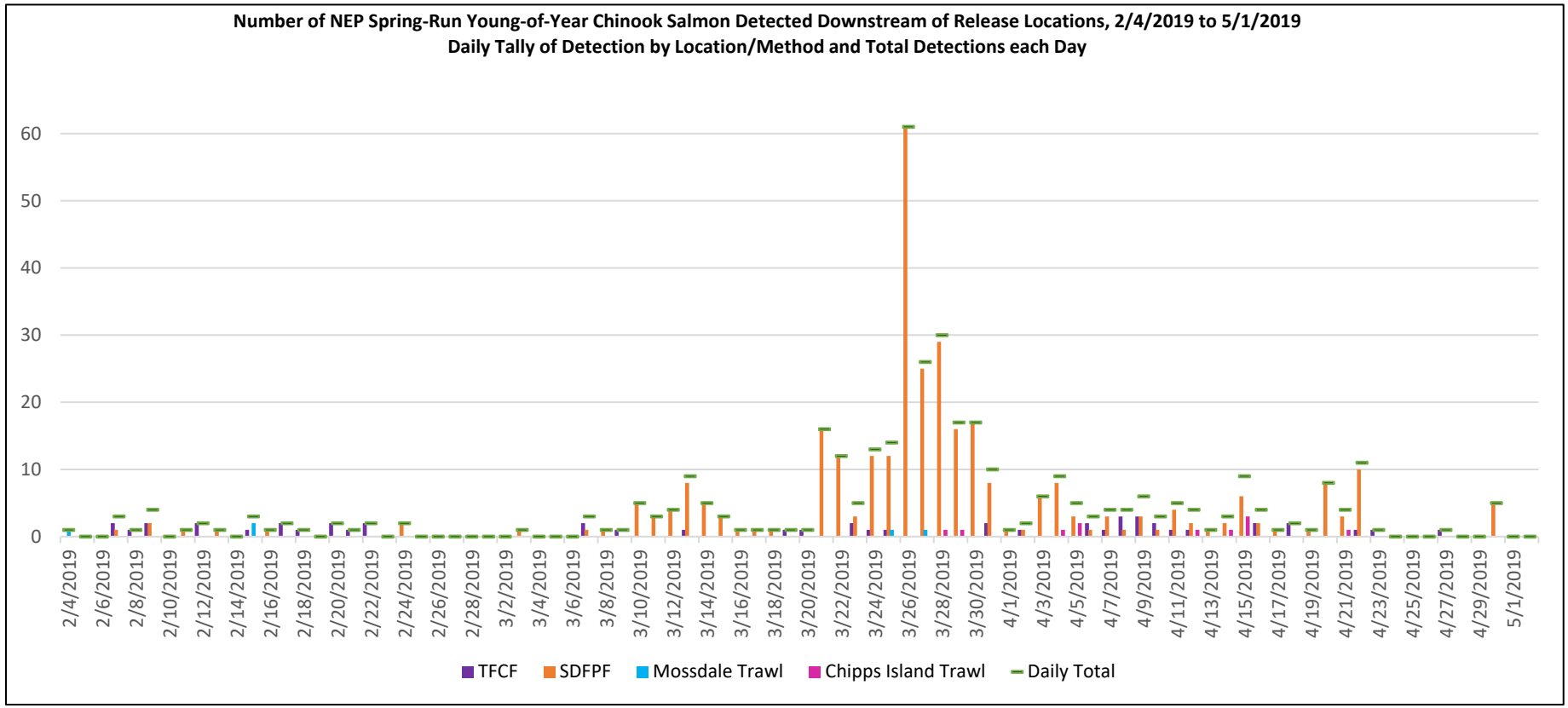

Figure 5. Total daily detections of released NEP (non-essential population) spring-run Chinook salmon young-of-year between February 4 and May 1*, 2019, grouped by sample location or method. These fish were released in groups from January 31 to February 28, 2019.
*The capture of one juvenile on May 27, 2019 was omitted to increase graph readability.

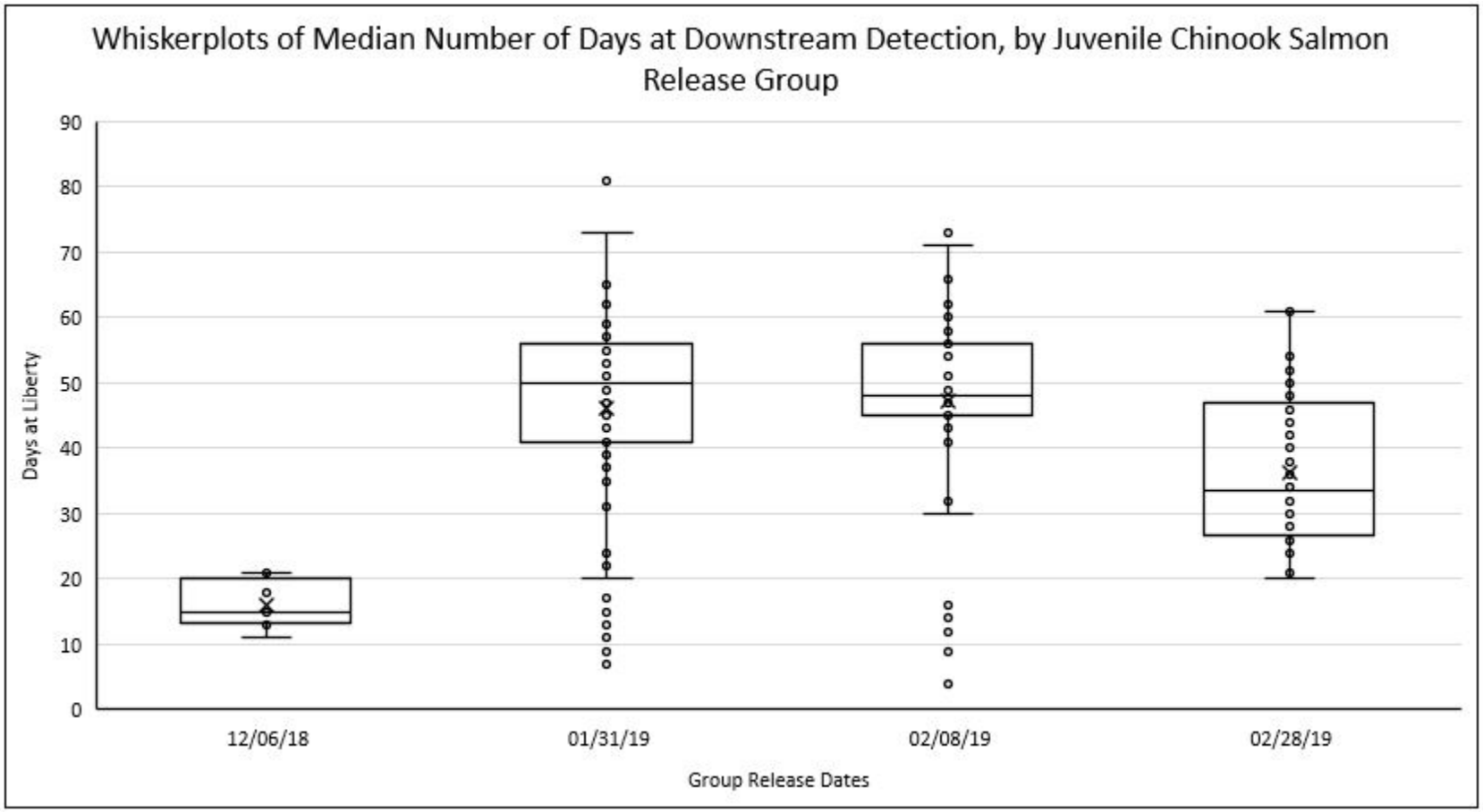

Figure 6. Box and Whisker plots showing the mean spread of the number of days between release and downstream detections for each juvenile spring-run Chinook salmon release group. Upper edge of the box denotes the 3rd quartile, the line inside denotes the median, and the lower edge of the box denotes the 1st quartile range, with the whiskers extending to the minimum and maximum points of the data. The December 6 release group contained only yearling (+1 year) age fish; the following three release groups were juveniles (young-of-year).

Table 1. Release dates, locations, and numbers of Central Valley Spring-run Chinook salmon juveniles released by the San Joaquin River Restoration Program from in 2019, with associated downstream recaptures/detections.

Release Date	Release Location	No. of Juveniles Released FRFH (CWT)	No. of Juveniles Released SCARF (CWT)	Mossdale Trawl	Chipps Island Trawl	Beach Seine	Facilities* Observed¥	Facilities* Estimated Loss^
January 31st, 2019	Reach 5, Hwy 140 Crossing	N/A	50,000 (06-14-09)	3	2	0	145 (20 CVP, 125 SWP)	1750
RST Efficiency Test (Jan-May)	Reach 1 and 2	N/A	~40,000 (06-14-08) (600 per release) (Last release ~8,000 on May 29)	0	0	0	5 (4 CVP, 1 SWP)	14
February 8th, 2019	Reach 5, Hwy 140 Crossing	N/A	31,295 (06-14-10)	1	2	0	79 (10 CVP, 69 SWP)	851
February 28th, 2019	Reach 5, Hwy 140 Crossing	N/A	87,200 (06-19-64)	1	7	0	148 (17 CVP, 131 SWP)	1370
April 5th, 2019	Reach 1, Owl Hollow	2,530 (06-14-46)	N/A	0	0	0	0	0

* Facilities are the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility.

^ Estimated loss is calculated based on the expanded salvage at each Facility, the size of the observed fishes, and the export rate.

¥ The observed loss is the number of fish actually handled by biologists at the Facilities. Estimated loss is an estimate of the number of fish that are lost to the system, typically in the form of mortality, and includes pre-screen loss and those fish that go through the louvers.

ǂ Juveniles released for rotary screw trap efficiency testing that occurred over months; one shared CWT# for all RST releases.

Table 2. Release dates, locations, and numbers of Central Valley Spring-run Chinook salmon yearlings released by the San Joaquin River Restoration Program in 2019, with associated downstream recaptures/detections.

Release Date	Release Location	Numbers Yearlings Released (CWT)	Mossdale Trawl	Chipps Island Trawl	Beach Seine	Facilities* Observed¥	Facilities* Estimated Loss^
December 6, 2018	Reach 5, Hwy 140 Crossing	5,200 (06-14-43/44/45)	0	0	0	8	21
March 28, 2019	Reach 5, Hwy 140 Crossing	1,451 (06-12-42)	0	0	0	0	0

*Facilities are the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility.

^Estimated loss is calculated based on the expanded salvage at each Facility, the size of the observed fishes, and the export rate.

¥The observed loss is the number of fish actually handled by biologists at the Facilities. Estimated loss is an estimate of the number of fish that are lost to the system, typically in the form of mortality, and includes pre-screen loss and those fish that go through the louver

Table 3. Catches of Program spring-run Chinook salmon adults in the ocean fisheries.

CWT Number	Broodyear	Release Year	Juvenile Origin	Juvenile Release site	Year Adult Caught	Ocean Fishery Type (Number Caught)	General Capture Location (Number Caught)
068697	2015	2016	SCARF*	Reach 5, Hill Ferry Barrier	2018	CA^ Ocean Sport(1)	Offshore San Francisco Bay (1)
061406	2016	2017	SIRF**	San Joaquin River near Harmon Rd in Eastside Bypass	2018	CA^ Ocean Sport(8); CA^ Ocean Troll(1)	Offshore San Francisco Bay (8); Offshore Mendocino Coast (1)
061423	2016	2017	SCARF*	San Joaquin River near Harmon Rd in Eastside Bypass	2018	CA^ Ocean Sport(10); CA^ Ocean Troll (4); OR^^ Ocean Sport (2)	Offshore San Francisco Bay (11); Offshore Mendocino Coast (3); Offshore Umpqua River, OR (1); Offshore Newport, OR (1)
061424	2016	2017	SCARF*	San Joaquin River near Harmon Rd in Eastside Bypass	2018	CA^ Ocean Sport(3); CA^ Ocean Troll(1)	Offshore San Francisco Bay (4)

*SCARF is the Salmon Conservation and Research Facility in Friant, California.

**SIRF is the Satellite Incubation and Rearing Facility at the base of Friant Dam.

^CA refers to California.

^^OR refers to Oregon.

Table 4. Adult Chinook salmon that were trapped and hauled from Reach 5 into Reach 1 by San Joaquin River Restoration Program staff. The data is from San Joaquin River Restoration Program scientists from the US Fish and Wildlife Service, California Department of Fish and Wildlife, and Bureau of Reclamation. Each row is represents an individual fish caught.

Capture Date	Capture Location	Coded Wire Tag (if known)	Fork Length (mm)	Mortality
04/09/19	Eastside Bypass	-	730	No
04/19/19	Eastside Bypass	06 14 06	820	Yes
04/19/19	Eastside Bypass	-	700	No
04/23/19	Eastside Bypass	06 14 06	730	Yes
04/24/19	Eastside Bypass	06 14 06	638	Yes
05/05/19	Eastside Bypass	-	721	No
05/05/19	Eastside Bypass	-	750	No
05/07/19	Eastside Bypass	-	670	No
05/13/19	Below Sack Dam	06 14 23	740	No/Pre Spawn Mort
05/14/19	Eastside Bypass	-	730	No
05/17/19	Eastside Bypass	-	735	No
05/17/19	Eastside Bypass	-	621	No
05/17/19	Eastside Bypass	-	680	No

Capture Date	Capture Location	Coded Wire Tag (if known)	Fork Length (mm)	Mortality
05/18/19	Eastside Bypass	-	720	No
05/18/19	Eastside Bypass	-	630	No
05/19/19	Eastside Bypass	-	680	No
05/19/19	Eastside Bypass	-	695	No
05/19/19	Eastside Bypass	-	740	No
05/20/19	Eastside Bypass	-	740	No
05/20/19	Eastside Bypass	-	702	No
05/21/19	Eastside Bypass	-	675	No
05/21/19	Eastside Bypass	-	735	No
05/21/19	Eastside Bypass	-	755	No

Table 5. Summary of the known adult Chinook salmon in the spawning reaches of the Restoration Area. This table is adapted from the Flow Scheduling Call notes put out by Chad Moore from the Bureau of Reclamation once a week. The data is from San Joaquin River Restoration Program scientists from the US Fish and Wildlife Service, California Department of Fish and Wildlife, and Bureau of Reclamation.

Cohort	Females Released	Males Released	Undetermined Sex Released	Release Location	Female Carcasses	Male Carcasses	Unknown Carcasses
May 21-23, 2019 Broodstock Release	30	48	0	Released at Owl Hollow (Reach 1)	5	5	0
August 6-9, 2019 Broodstock Release	7	29	0	Released at Ball Ranch Bridge (Reach 1)	4	2	0
Translocated Adult Returns	14	8	1	Released at Owl Hollow or Camp Pashayan (Reach 1)	1 prespawn mortalities; 2	2 prespawn mortalities; 1	0
Volitionally Returned Adults	NA	NA	NA	Potentially migrated into Reach 1 volitionally during flood flows	1 prespawn mortality found in James Bypass; 105	41	2
Totals	**51**	**85**	**1**		**118**	**51**	**2**