UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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Sacramento, California 95814-4700

Effective Date: January 15, 2019

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: 2019 (January 2019 – December 2019) 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 reintroduction to the San Joaquin River (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

[1] NMFS. 2019. Technical Memorandum to Account for Reintroduced San Joaquin River Spring-Run Chinook Salmon per CFR 233.301(b)(5)(ii): 7

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 2019 to identify reintroduced nonessential experimental population (NEP) CV spring-run Chinook salmon from the San Joaquin River and 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 spring-run Chinook salmon release and monitoring plans for 2019.

I. 2018 Tech Memo Implementation Summary

A. Implementation Elements

Elements of the 2018 Tech Memo were implemented as follows:

1. Juvenile Releases-

The San Joaquin River Restoration Program (Program) released 207,848 NEP spring-run Chinook salmon juveniles to the San Joaquin River starting in the early winter of 2017 through the late spring of 2018. All NEP juveniles released by the Program in 2018 were produced by the San Joaquin River Conservation and Research Facility (SCARF); Feather River Fish Hatchery (FRFH) origin juveniles were not utilized for releases in 2018. All juvenile spring-run Chinook salmon released were adipose fin-clipped and coded wire tagged (CWT).

The first group consisted of 1,450 juveniles at the yearling life stage, released December 21, 2017, in Reach 5 at the Hills Ferry Fish Barrier (Table 1; 900 from the SACRF with CWT #: 061419; 550 from the SIRF, CWT #:061420). In addition to the CWTs, these yearlings also received passive integrated transponder (PIT) tags.

Juvenile fish were released in three groups: on January 19, 2018 (CWT# 061439), January 26, 2018 (CWT #061440), and March 2, 2018 (CWT #061437); and consisted of 31,184, 49,549, and 87,115 individuals, respectively. All three groups were released in Reach 5 of the restoration area at the Highway 140 crossing. In addition to adipose fin clips and CWTs, 350 of the March 2 release group were given acoustic tags (JSATS) as part of a movement study undertaken by UC Davis, and an additional 350 juveniles were released downstream on March 15, 2018, at Durham Ferry, also with JSATS. 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.

In addition to the reintroduction releases, approximately 40,000 total juveniles were released in Reach 1 and 2 of the Restoration Area, in batches from January through May 2018 for rotary screw trap (RST) efficiency testing. RST efficiency test juveniles all had their adipose fin clipped, received the same CWT number (CWT# 061438), and were marked with temporary photonic ink on various fins to indicate release batch identity.

Juvenile Detections/Recaptures-
All captured CWTed fish were sacrificed at the point of capture for CWT identification as per protocol, unless there were visible sutures from acoustic tagging surgery, in which case they were released. A total of 271 juveniles or yearlings were detected or recaptured downstream of the release locations as of September 2018. 172 NEP spring-run Chinook salmon were observed at the TFCF, 82 were observed at the SDFPF, 13 were captured in the Mossdale Trawls, and four were captured in beach seines (Figure 1).

The observed count 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 1,382 juvenile or yearling NEP spring-run Chinook salmon were lost to the system in the 2018 reporting year.

Reintroduction yearlings: A total of six yearlings were observed by the Facilities (no other survey method encountered this release group). Four yearlings fell into the winter-run Chinook length at date range used by the Facilities to estimate juvenile run identity (Figures 2 & 3). Because these fish were fin-clipped and CWTed, they were identified as NEP spring-run released by the Program and were not misidentified as winter-run Chinook juveniles.

Yearling NEP spring-run were first captured by the Facilities on January 11, 2018 (two individuals), 21 days after release into Reach 5 (Figures 4 & 6). The last day a yearling was captured at the Facilities was March 27, 2018; 96 days after release (Figure 4). The Facilities estimate that 22 yearlings were lost to the system in the 2018 reporting year (Table 1).

Reintroduction juveniles: Out of a total of 167,848 juveniles released into Reach 5, 254 were captured or detected downstream (Table 2). A total of 248 were captured at the Facilities, 13 were captured in the Mossdale Trawls, and four were captured in beach seines. Juveniles were first observed downstream on February 9, 2018, and the last juveniles were observed on April 13, 2018 (Figure 4). The shortest time between release and downstream capture was 12 days, following the March 2 release, where three individuals where captured either at the TFCF or in the Mossdale Trawl (Figures 5 & 6). The longest time between release and capture was 84 days, those juveniles were recaptured on April 13 from the January 19 release group (Figures 5 & 6).

Reintroduction juveniles captured at the Facilities fell mostly into the spring-run length at date range (Figures 2 & 3). Because they were fin-clipped and CWTed, these individuals were identified as NEP spring-run released by the Program and were not misidentified as Chinook juveniles 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, 11 in total were captured downstream by the Facilities (estimated loss not available). The first RST juvenile was captured on March 30, 2018, and the last was captured April 20, 2018. Minimum and maximum days since release cannot be reliably estimated from this group since all RST release groups share a common CWT, instead, temporary photonic markings were used to identify release groups. However, one fish observed at the Facilities on April 5, 2018 retained its markings, indicating it was released either on February 4th or 5th, and traveled through the Restoration Area to the Delta in approximately 60 days.

No changes in export quantities were experienced as a result of the juvenile spring-run Chinook salmon releases.

2. Adult Releases-

Because of previous release/reintroduction efforts, 2018 was the third year that adult spring-run Chinook salmon had the potential to return to the San Joaquin River. However, due to relatively high flows during the spring period the placement of counting stations was limited and only some monitoring occurred during the anticipated migration period. During the time that the VAKI camera system was monitoring, it did not detect any returning adults. Only adults released as ancillary broodstock were observed during weekly monitoring after flood releases subsided, and, as of September 2018, no unmarked spring-run Chinook (indicating wild origin) were seen in the lower reaches of the river.

A total of 179 adult ancillary spring-run broodstock from the SCARF were released by CDFW at Owl Hollow (30 females and 59 males from June 11-15, 2018) and Ball Ranch (29 females and 61 males from July 31- August 2, 2018) in Reach 1A of the San Joaquin River (Table 3). 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 of wild-spawned offspring. As of November 9, 2018, the signals of all but one fish have been recorded within Reach 1A at least once. As of November 19, 2018, 42 spring-run redds have been detected in Reach 1 of the San Joaquin River, with 23 carcasses recovered.

3. 2017 Adult Release- Juvenile production

For the first time since Program inception, natural production occurred in the San Joaquin River. During the RST monitoring efforts, a total of 888 unmarked NEP spring-run Chinook salmon juveniles were captured. These juveniles were offspring resulting from

in-river spawning of SCARF broodstock adults released in the summer/fall of 2017. They are the result of redds reported in the 2017 Tech Memo. All unmarked wild-spawned offspring captured in the RST 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 December 2, 2018, at the RST closest to Friant Dam with a fork length of 35 mm, and the last smolt was detected on June 23, 2018, at the RST near Highway 99, with a fork length of 106 mm.

B. 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 2019 Tech Memo process was to consolidate the technical information available regarding accounting of naturally-produced San Joaquin River spring-run 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[2] (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 2019, as described in the next section of this document.

1. Juveniles

In 2018, the Program had multiple research and learning opportunities. Some observations from those opportunities are presented here. 2018 was the fifth year the Program released NEP juveniles into the Restoration Area and only the third year that released juveniles were recaptured at the Facilities or detected in other monitoring effort. Four yearlings released by the Program and then salvaged at the Facilities, fell into the winter-run Chinook salmon length at date range (Figure 2). Since all the fish released by the Program were CWTed, they were easily identified as Program yearlings and did not trigger any water delivery curtailments. However, if these fish had not been CWTed they would not have contributed to minimal water curtailments, if at all, because the rapid genetic analysis protocol would have determined that they were not winter-run. Reclamation implemented a rapid genetic analysis protocol for the allotted flow management timing (January 1- June 15) but no fish triggers were met and no spring-run were genetically identified. Genetic identification of salvaged Chinook juveniles at the Facilities has proven to be more accurate than the length-at-date criteria for determining juvenile Chinook race (Harvey, et al. 2014)[3].

UC Davis continued their reach-specific survival and migration conditions in the Lower San Joaquin River and South Delta for juvenile salmonids as planned for 2018. The results from the 2017 release group showed relatively poor survival through the Restoration Area, good survival from the Restoration Area to the Delta, and poor survival

[2] The Guidance Document

[3] 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

from the Delta to the Golden Gate Bridge. There was an initial mortality upon release which contributed the poor survival through the Restoration Area. Cumulative survival from the initial release location to the Golden Gate Bridge was roughly between 3-6%[4]. The continuation of this study should provide the Program with migration timing and through Delta survival for spring-run released into the San Joaquin, filling in an important data gap.

Biologists working for the Program conducted RST monitoring of emigrating juvenile spring-run Chinook salmon in Reaches 1 and 2 (Friant Dam to San Mateo Crossing) of the Program's Restoration Area from December 2017 – June 2018. 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 is necessary to extrapolate from captured fish totals to estimate production. Trap efficiency estimates also permit quantification of percent survival of marked fish released and recaptured at subsequent downstream traps. Varied combinations of marking solution colors and fin tagging locations allowed uniquely identifiable batches of fish as a function of release location (i.e., RST location) and release date. Efficiency experiments were completed at four RSTs: Friant Dam (n = 10), Owl Hollow (n = 13), Highway 99 (n = 9), and San Mateo Crossing (n = 9), resulting in the release of 39,027 externally marked juvenile spring-run Chinook salmon into Reaches 1 and 2 of the Restoration Area. Trap efficiency[5] varied significantly as a function of location with mean (± SD) values at Friant, Owl Hollow, Hwy 99, and San Mateo, of 0.7% (± 0.9), 2.7% (± 3.3), 19.2% (± 8.4), and 5.8% (± 5.6), respectively. Site-specific efficiency was effected by flow (cfs) at release (ANCOVA, $P = 0.05$), but fish length at release had no effect on trap efficiency (ANCOVA, $P > 0.05$). To date, RST capture and efficiency data is being reviewed and analyzed, and, as a result, juvenile spring-run Chinook salmon production and survival estimates are forthcoming.

Trap and haul efforts to move juveniles downstream past the significant barriers in Reaches 2 through 5 did not occur in 2018. Despite these barriers, 11 NEP juveniles released for the RST efficiency test in Reaches 1 and 2 were recaptured at the Facilities.

2. Adults

The 2018 adult broodstock acoustic tracking study aimed to continue studying where spring-run hold and spawn. After the 2017 the Program scientists determined that all acoustic tags would be inserted into the stomach through the mouth. As in other years, all females (59 individuals) were acoustically tagged, while only a subset of males (28 of 120 individuals) were tagged. The tagged fish were monitored with 14 acoustic receivers

[4] Singer, G.P., Hause, C.L., Chapman, E.C., Fangue, N.A., and Rypel, A.L. 2018. Monitoring Juvenile Spring-Run Chinook Salmon in Response to Climate-Driven Flows in the San Joaquin River and South Delta. Report to the Delta Stewardship Council, Agrement :1469. Davis, CA.

[5] For these efforts, trap efficiency was defined as the percentage of externally marked juvenile spring-run Chinook salmon (typically 995-1000/replicate release) released upstream and captured in the nearest downstream trap.

and surveyed with mobile acoustic listening devices (when conditions allowed). The majority of the tagged fish held between Friant Dam and Fort Washington prior to spawning.

In 2018 river temperatures during the holding and spawning period were lower than 2017. Fish were observed to be holding lower in the system than in 2017 and the redds have been observed to be more spread out than previous years. All of the redds are within areas that were expected to be suitable spawning habitat.

II. 2019 Tech Memo Implementation

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.

If unmarked juveniles produced from the Program survive and are: 1) detected at the Facilities, 2) in the same size range of older juvenile Chinook salmon, and 3) happen to contribute to exceeding the loss density triggers in the CVP/SWP Opinion (Reasonable and Prudent Alternative Actions IV.2.3 and IV.3[6]), there is a rapid genetic analysis protocol in place for water year 2019[7] to genetically determine if the Chinook species which contributed to exceeding the loss density trigger are winter-run or spring-run that meet the older juvenile length-at-date criteria and are from Clear, Butte, Deer, or Mill Creek. Since these spring-run populations are genetically distinct, any Chinook determined to be a false positive will not count towards the exceedance of a fish density trigger.

In 2019, 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:

- Continuing to refine and learn from fish recovery and genetic testing at the Facilities.
- 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.

Juvenile San Joaquin River NEP spring-run Chinook salmon migration timing to the Delta will be estimated from the capture of CWTed individuals recovered in 2019 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 salmon released into the Lower San Joaquin River and South Delta in 2019.

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

[7] Rapid Genetic Analysis of the Chinook Salmon Salvaged at the Central Valley Project and State Water Project during Water Year 2019

1. Calculation of incidental take:

    a. Incidental take –

    Incidental take calculations and adjustments to the incidental take estimates pursuant to the CVP/SWP Opinion are unnecessary for 2019 because all of the CV spring-run Chinook salmon released into the San Joaquin River will be adipose fin-clipped and CWTed. In the unlikely event any potential offspring of released broodstock adults survive and emigrate out of the Program Restoration Area, 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 or spring-run from Clear, Butte, Mill, or Deer creeks, and were not false positives caused by a Program spring-run. Also, Program juveniles can be identified based on the genetic markers of their parent.

    b. Operational triggers –

    Adjustment to the operational triggers pursuant to the CVP/SWP Opinion are unnecessary for 2019 because all spring-run Chinook salmon released into the San Joaquin River will be adipose fin-clipped and CWTed. In addition, a rapid genetic analysis protocol will be implemented in 2019 to genetically identify run of all juvenile Chinook that contribute to the exceedance of a fish density trigger.

2. Accounting Methodology:

    a. Physical Marking –

    All juvenile spring-run Chinook salmon released into the San Joaquin River as part of the Program's reintroduction plan will be adipose fin-clipped and CWTed, with a code unique to Program release groups so that 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 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 Mossdale and Chipps Island locations will be processed and reported to

NMFS Program staff. The staff at the Facilities will process CWTed 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

b. 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. Genetic sampling of the San Joaquin River fall-run Chinook salmon population began in 2013. As such, all adult Chinook salmon returning to the Restoration Area in 2018/2019 will be tissue sampled for genetic testing.

In addition, all wild-spawned (unmarked) juvenile Chinook salmon captured in the RSTs or other juvenile traps deployed in 2019 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.

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. With the present operational triggers and length-at-date method to determine Chinook salmon run, the key concern is whether reintroduced Program spring-run Chinook salmon would fall into the older juvenile length-at-date criteria and contribute to an operational trigger.

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 or spring-run Chinook salmon juveniles in order for the operational triggers to be applied correctly. The Program will coordinate with the rapid genetic analysis effort in 2019 at the Facilities to ensure that spring-run from the Program, which are all identifiable by parental-based genetic testing, do not contribute towards any loss density triggers that would warrant operational changes. Currently, all non-adipose clipped Chinook salmon captured at the Facilities are genetically sampled if they are in the winter-run length-at-date size class that would impact water exports.

3. Reintroduction Process:

    a. Release Plans –

    Approximately 200,000 juvenile spring-run Chinook from the SCARF will be released into the San Joaquin River upstream of the Merced River confluence in spring 2019 as part of the Program. There will be no translocation fish from the FRFH. Also, in the summer of 2019, adult broodstock from the SCARF could be released into Reach 1. Although the exact numbers for release are not yet determined, these fish will have external tags, CWTs, acoustic tags, and/or have their adipose fins clipped. Additionally, the Program is planning to again monitor Reach 5 for returning 2- and 3-year-old spring-run Chinook salmon from 2016/2017 juvenile releases, 4-year-olds from 2015 juvenile releases, and 5-year-olds from the 2014 juvenile releases. If such returning adults are captured, they will be marked with a PIT tag or T-bar tag, and genetically sampled. Up to 30 adults will be tagged with an acoustic transmitter, and all captured adults will be released in Reach 1. These adults and the SCARF broodstock releases could spawn naturally in the Restoration Area in 2019, and juveniles would be out migrating as early as January 2020.

    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[8] 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[9].

    b. Monitoring Plan –

    The offspring of adult spring-run Chinook salmon released in 2018 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 40,000 spring-run juveniles will be released throughout the spring to test RST capture efficiency at different flows. Rotary screw trap monitoring will be performed from after November 1, 2018, to the end of June 2019, or until

[8] The San Joaquin River Restoration Program website
[9] The Regional Mark Processing Center website

water temperatures exceed lethal temperatures as defined in the Fisheries Framework[10] or no salmonids are caught for seven days or more. Four locations within the Program Restoration Area were determined based on redd locations and river access (Sycamore Island, Owl Hollow, Highway 99 Bridge, and San Mateo Avenue). Rotary screw traps 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 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 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 for a more detailed explanation).

Adult spring-run returns will be monitored with a VAKI camera in Reach 5 of the Restoration Area. If any adults are detected, they will be captured and moved to Reach 1 of the Restoration Area.

4. Timeline:

   Once final juvenile San Joaquin River CV spring-run Chinook salmon release information is available, this information will be posted to the Program website[6]. Beginning in February 2019, NMFS will hold monthly meetings to discuss implementation of this 2019 Tech Memo and to develop the 2020 Tech Memo. NMFS will also focus the meetings on implementation of the techniques developed in the Guidance Document.

5. Revision:

   NMFS developed this memorandum to govern activities for one year only. As a result, it will not be in effect after January 15, 2020. NMFS intends to prepare a new memorandum by January 15, 2020, to govern activities during 2020.

6. Adjustments to the CVP/SWP Opinion:

   No adjustments are needed in 2019 to the CVP/SWP Opinion because all released juvenile spring-run Chinook salmon will be adipose fin-clipped and CWTed. In the event any natural spring-run juveniles 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 or yearling spring-run from Clear, Butte, Mill, or Deer Creek.

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

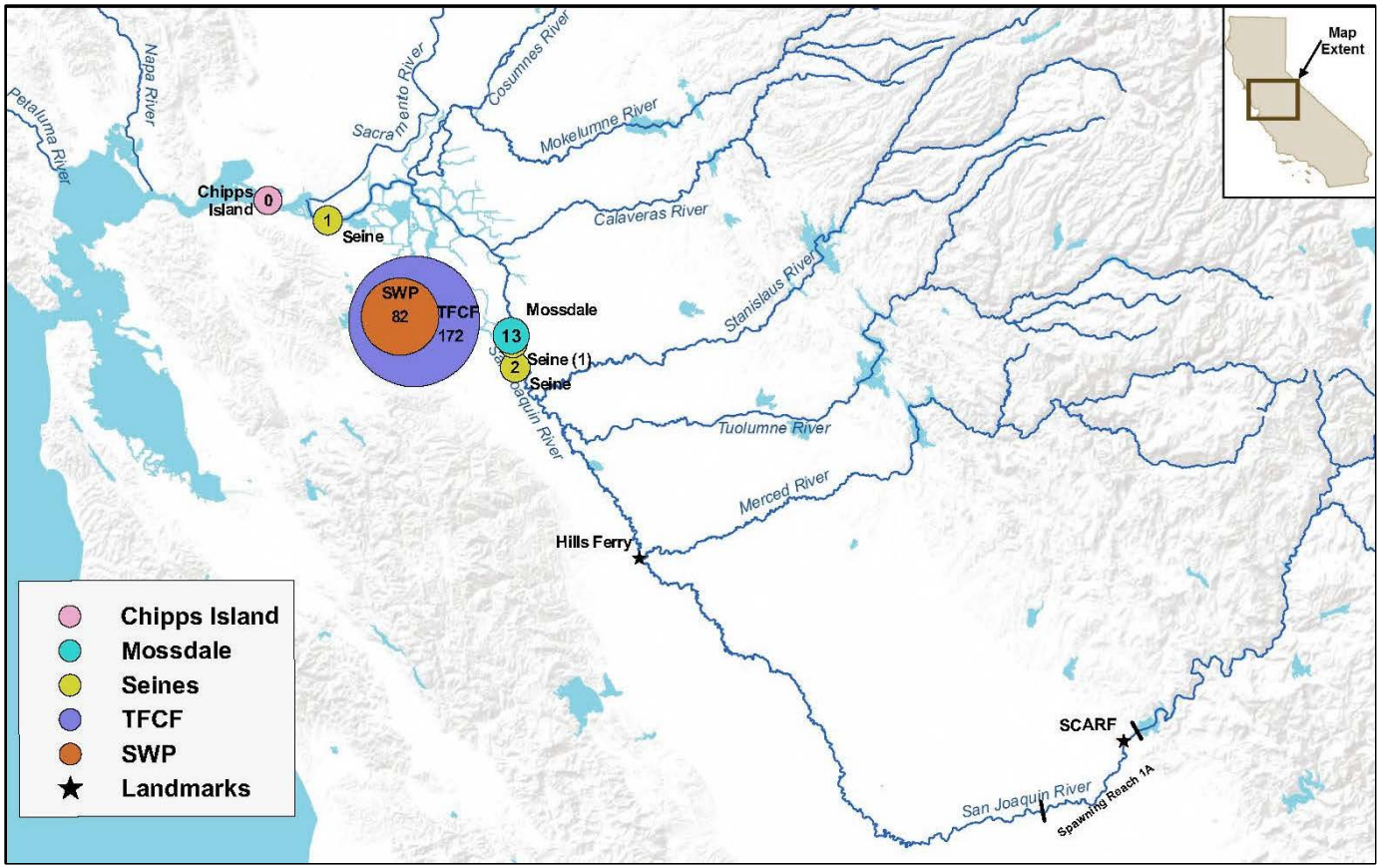

Figure 1. Map of the San Joaquin River Restoration Program Restoration Area and Delta depicting where non-essential experimental population spring-run Chinook salmon yearlings and juveniles were identified downstream in 2018. The number within the bubbles and the size of the bubble denotes the number of coded wire tags recovered. The black stars denotes significant landmarks within the map area. 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 between juveniles (248) and yearlings (6) caught. SCARF refers to the Salmon Conservation and Research Facility run by the San Joaquin River Restoration Program. (Credit: Sheila Greene)

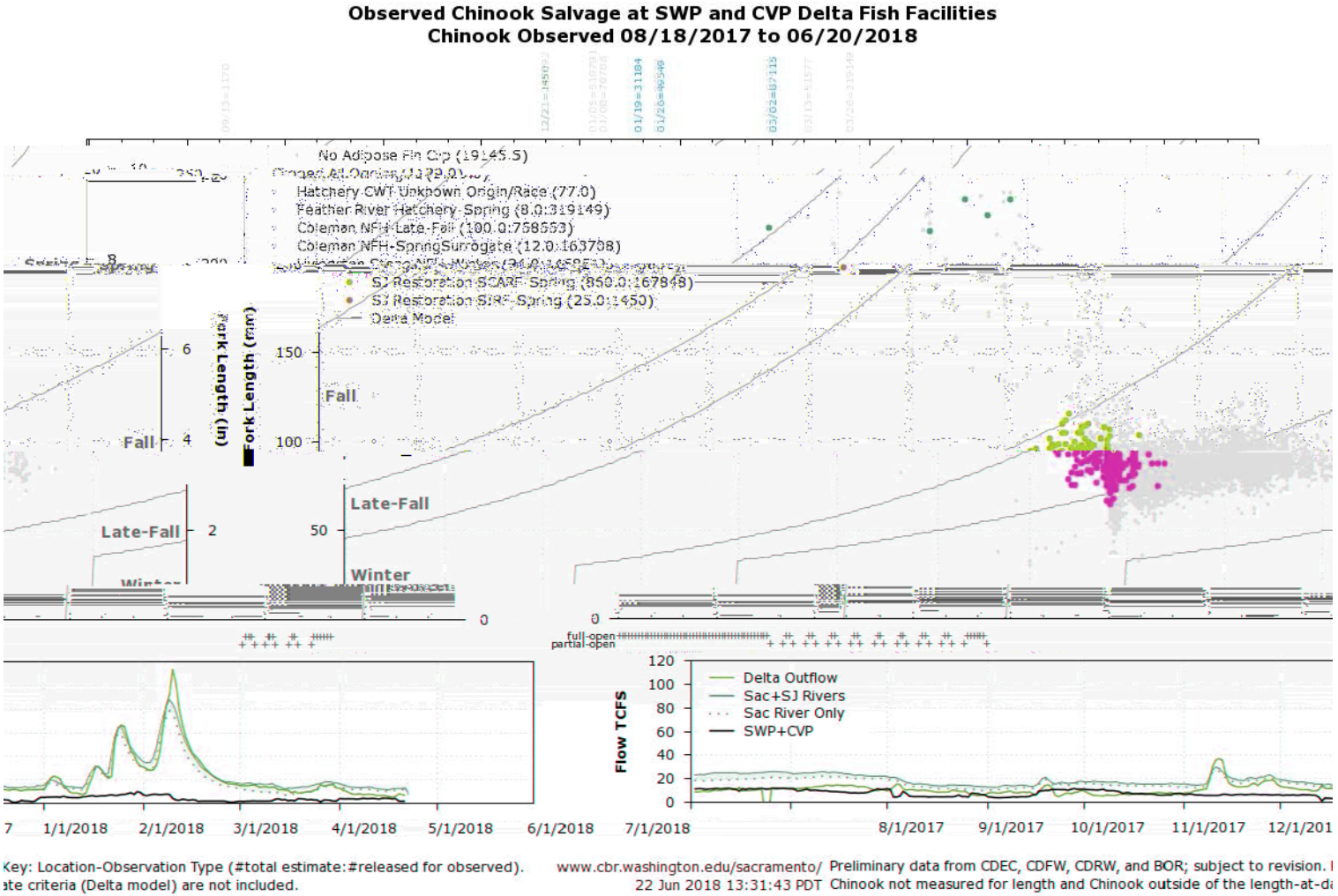

Figure 2. Observed Chinook salvage at SWP (State Water Project; Skinner Delta Fish Protective Facility) and CVP (Central Valley Project; Tracy Fish Collection Facility) Delta Fish Facilities from 8/18/2017 to 6/20/2018. Only juvenile Central Valley Chinook salmon released by the San Joaquin River Restoration 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 (blue dots) in late winter 2018. Satellite Incubation and Rearing Facility (SIRF)-spring-run were also spawned at the SCARF but were raised in the SIRF facility at the base of Friant Dam until they were released as yearlings (green dots) in late December 2017. *Please note some fish fell within the winter-run length at date curve.

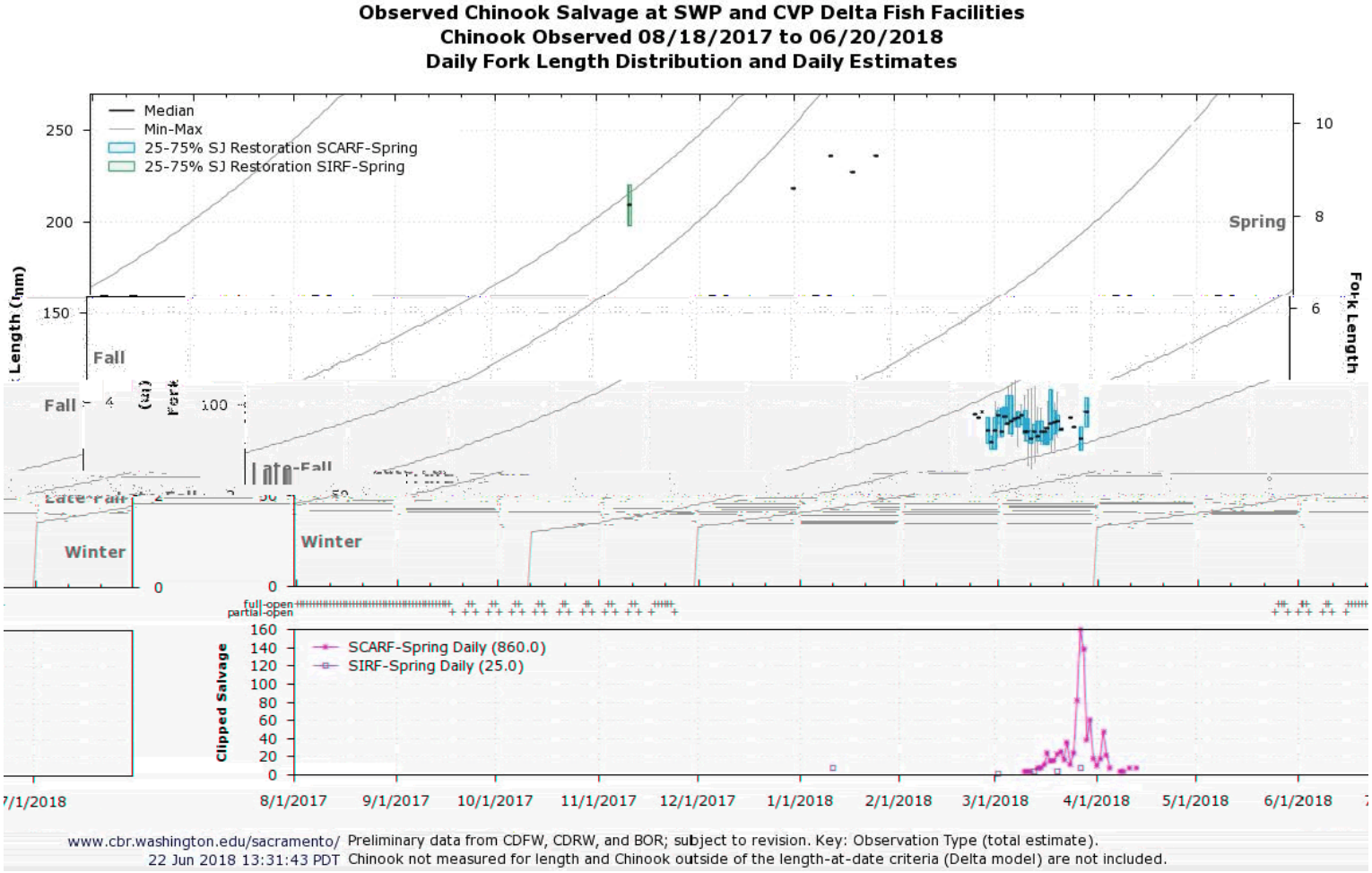

Figure 3. Median sizes (black bars) of recovered nonessential population Chinook salmon salvaged at SWP (State Water Project; Skinner Delta Fish Protective Facility) and CVP (Central Valley Project; Tracy Fish Collection Facility) Delta Fish Facilities from August 18, 2017 to June 20, 2018. Single black 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 (blue) in late winter 2018. Satellite Incubation and Rearing Facility (SIRF) spring-run were also spawned at the SCARF but were raised in the SIRF facility at the base of Friant Dam until they were released at yearling sizes (green) late December 2017. *Please note some fish fell within the winter-run length at date curve.

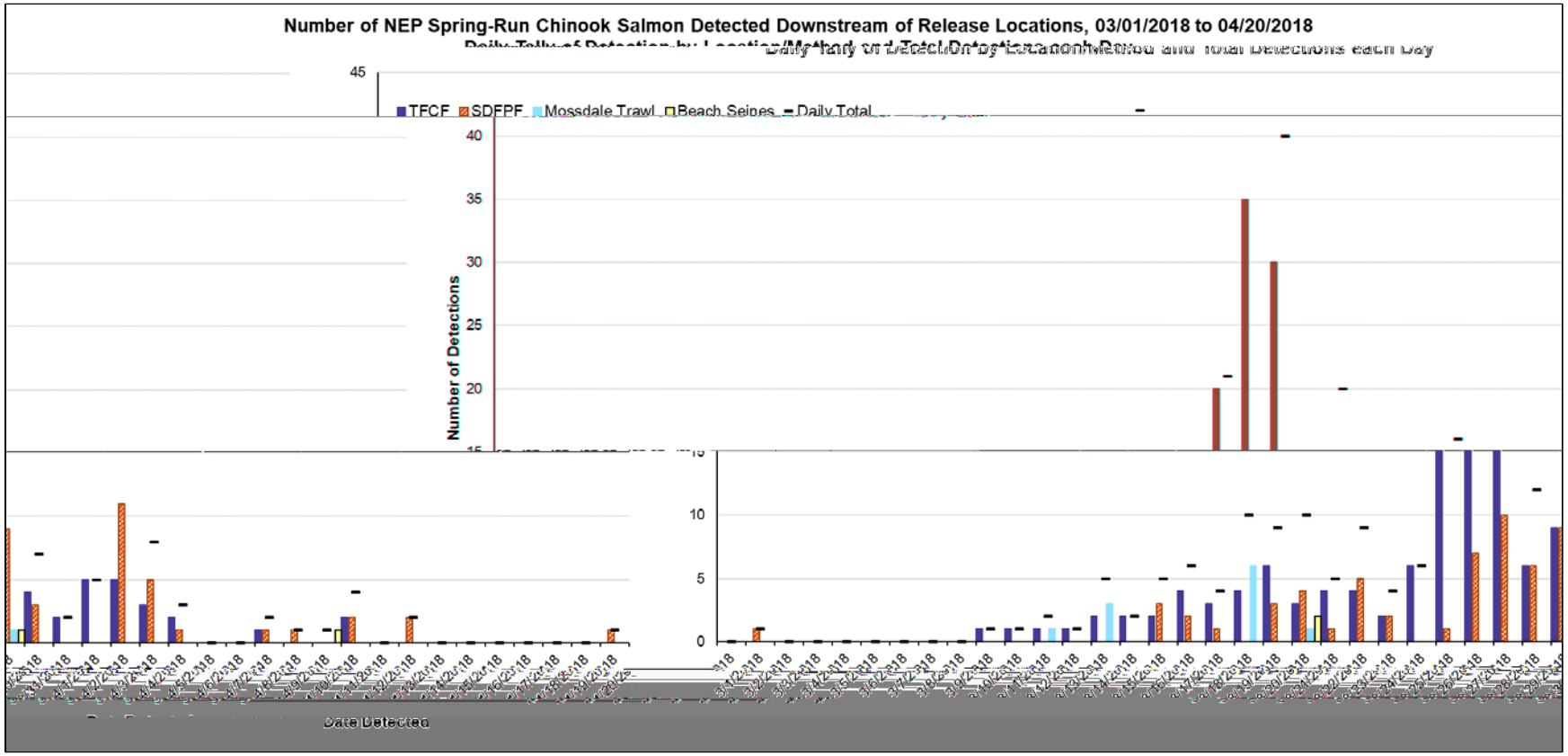

Figure 4. Total daily detections of released NEP (non-essential population) spring-run Chinook salmon (yearlings, juveniles, rotary screw trap efficiency testing fish are summed together) between March 1* and April 20, 2018, grouped by sample location or method.
*The capture of three yearlings before March 1, 2018 was omitted to increase graph readability.

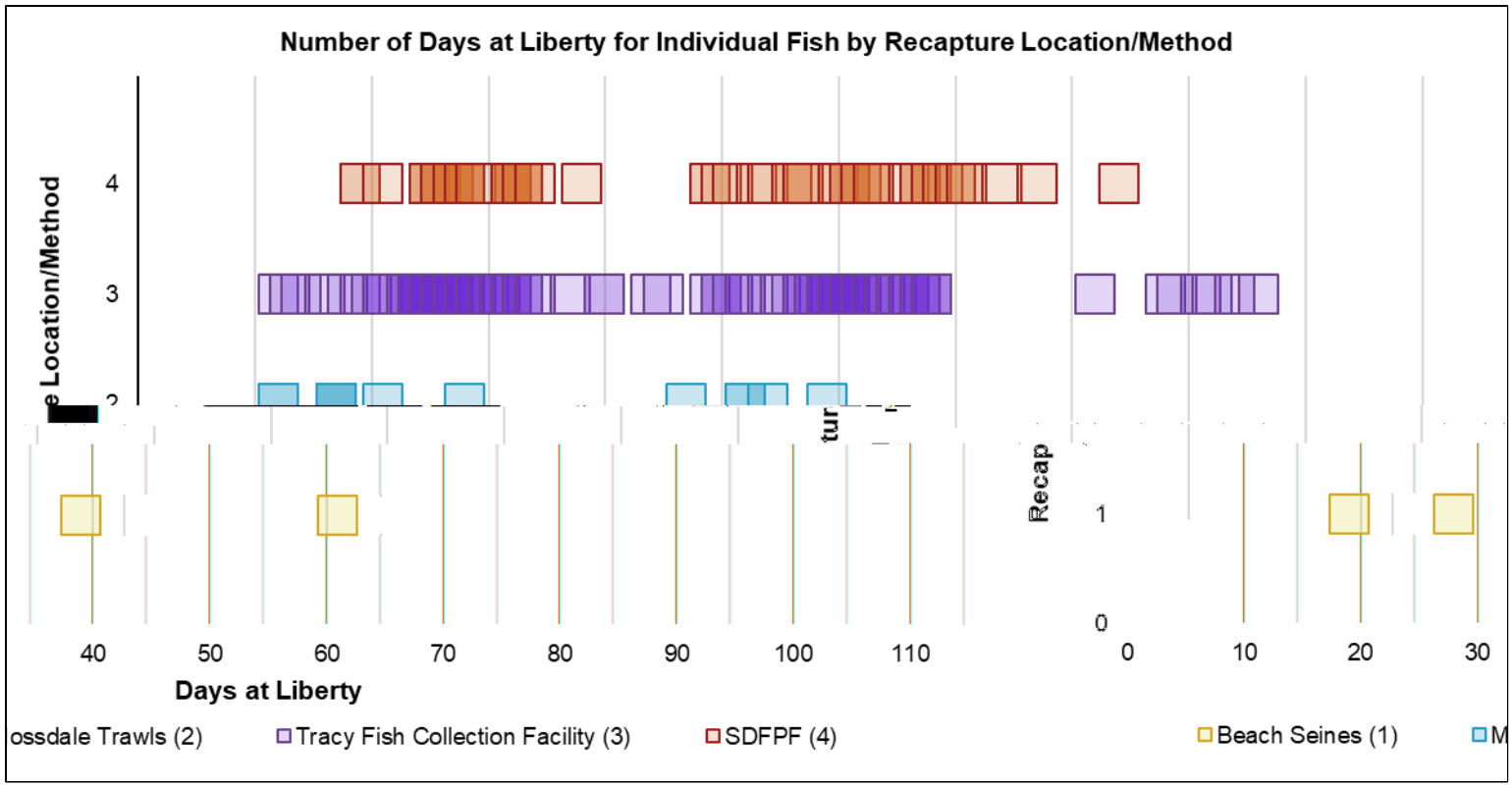

Figure 5. The number of days between release date and detections of spring-run juvenile Chinook salmon in sampling events downstream of the San Joaquin River Restoration Area between March 1 and April 20, 2018. SDFPF refers to the Skinner Delta Fish Protective Facility.

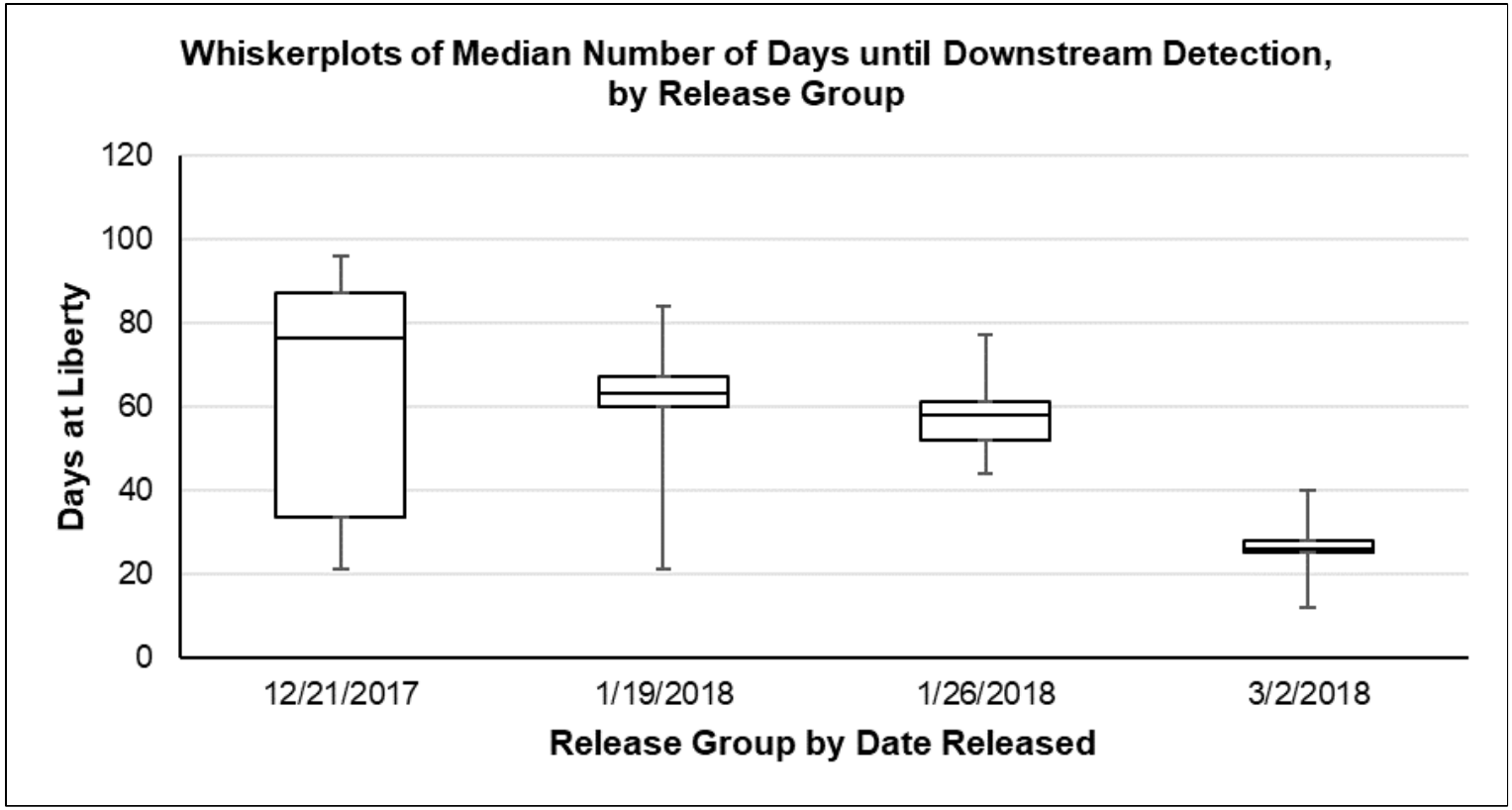

Figure 6. Box and Whisker plots showing the mean spread of the number of days between release and downstream detections for each release group. Upper edge of the box denotes the 3rd quartile, the line inside denotes the median, and the lower edge of the box denotes the 1st quartile range, with the whiskers extending to the minimum and maximum points of the data. The December 21st release group were only yearling (+1 year) age fish and the following three release groups were juveniles (young of year).

Table 1. Release dates, locations, and numbers of Central Valley Spring-run Chinook salmon yearlings released by the San Joaquin River Restoration Program from 2016 to 2018, with associated downstream recaptures/detections, as available.

Release Date	**Release Location**	**Numbers Yearlings Released (CWT)**	**Mossdale Trawl**	**Chipps Island Trawl**	**Beach Seine**	**Facilities* Observed¥**	**Facilities* Estimated Loss^**
Nov 29, 2016	Reach 5, Hills Ferry Barrier	544 (06-05-14)	0	0	0	2	6
December 21, 2017	Reach 5, Hills Ferry Barrier	1,450 (06-14-20/19)	0	0	0	6	22
December 6, 2018	Reach 5, Hwy 140 Crossing	5,200 (06-14-43/44/45)	NA	NA	NA	NA	NA

*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.

Table 2. Release dates, locations, and numbers of Central Valley Spring-run Chinook salmon juveniles released by the San Joaquin River Restoration Program from 2014 to 2018, with associated downstream recaptures/detections.

Release Date	Release Location	No. of Juveniles Releases FRFH (CWT)	No. of Juveniles Releases SCARF (CWT)	Mossdale Trawl	Chipps Island Trawl	Beach Seine	Facilities* Observed¥	Facilities* Estimated Loss^
April 18, 2014	Reach 5, Hills Ferry Barrier	60,114 (06-05-58)	0	2	0	0	0	0
February 26, 2015	Reach 5, Hills Ferry Barrier	54,924 (06-04-60)	0	2	0	0	0	0
March 17, 2016	Reach 5, Hills Ferry Barrier	57,320 (06-05-21)	47,560 (06-86-97)	59 (36 FRFH, 23 SCARF)	1 (SCARF)	2 (1 FRFH, 1 SCARF)	148 (26 FRHF, 122 SCARF)	521 (82 FRFH, 439 SCARF)
March 6, 2017	Eastside Bypass, Near Harmon Road	38, 106 (06-14-06)	51,044 (06-14-23, 06-14-24)	9 (4 FRFH, 5 SCARF)	7 (4/4-4/28) (3 FRFH, 4 SCARF)	0	169 (76 FRHF, 93 SCARF)	1370 (470 FRFH, 900 SCARF)
January 19, 2018	Reach 5, Hwy 140 Crossing	N/A	31,184 (06-14-39)	3	0	1	53	346
January 26, 2018	Reach 5, Hwy 140 Crossing	N/A	49,549 (06-14-40)	3	0	0	44	267
March 2, 2018	Reach 5, Hwy 140 Crossing	N/A	87, 115 (06-14-37)	7	0	3	140	747
Jan-May, 2018ǂ	Reach 1 & 2	N/A	~40,000 (06-14-38) (Released in Reach 1 or 2)	0	0	0	11	N/A

* 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 3. Release dates, locations, and number of excess adult broodstock into the San Joaquin River for natural spawning purposes.

Release Date	Release Location	Number of Females	Number of Males	Total Released
June 30, 2016	Reach 1A, Ledger Island	10	15	25
May 25, 2017	Reach 1A, Owl Hollow	30	30	60
August 8, 2017	Reach 1A, Lost Lake	26	29	55
June 11-15, 2018	Reach 1A, Owl Hollow	30	59	89
July 31-August 2, 2018	Reach 1A, Ball Ranch	29	61	90