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, 2018

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 12/18/17
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
Erin Strange, San Joaquin Branch Chief, CCVO, West Coast Region

SUBJECT: 2018 (January 2018 – December 2018) 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 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 and Conference Opinion on

[1] NMFS. 2018. Technical Memorandum to Account for Reintroduced San Joaquin River Spring-Run Chinook Salmon per CFR 233.301(b)(5)(ii): 7

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 2018 to identify reintroduced CV spring-run Chinook salmon (*Oncorhynchus tshawytscha*) 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 2018.

I. 2017 Tech Memo Implementation Summary

A. Implementation Elements
Elements of the 2017 Tech Memo were implemented as follows:

1. Juveniles:

The San Joaquin River Restoration Program (Program) released 38,106 Feather River Fish Hatchery (FRFH) origin and 51,044 San Joaquin River Conservation and Research Facility (SCARF) spring-run Chinook salmon juveniles to the San Joaquin River near Harmon Road in the Eastside Bypass on March 6, 2017 (Table 1). Acoustic tags (JSATS) were implanted in 350 of the fish released on March 6, 2017, and 350 fish that were released downstream at Durham Ferry on March 23, 2017. All juvenile spring-run Chinook salmon released were adipose fin-clipped and coded wire tagged (CWT, codes 06-14-06, 06-14-23, and 06-14-24). None of the juvenile spring-run Chinook salmon released were implanted with passive integrated transponder (PIT) tags. All of the downstream monitoring efforts and south Delta fish salvage at the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility (SDFPF; collectively the Facilities) were informed of the presence of these fish and their CWT identifiers. Program fish were detected within the San Francisco Estuary from March 10, 2017, until May 30, 2017. The Mossdale trawl captured 4 FRFH and 5 SCARF fish between April 3 and May 23, 2017. The Chipps Island trawl caught 7 Program fish between April 5 and April 29, 2017; 3 from FRFH and 4 from SCARF (Figures A, B, and C). There was an observed count of 79 FRFH and 90 SCARF fish collected and identified at the Facilities, with an estimated loss of 470 FRFH and 900 SCARF fish, through May 30, 2017 (Table 2). The observed count is the number of fish actually handled by biologists at the Facilities. 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. 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, when they were released at the standard Facility release points.

In November 2016, a total of 544 spring-run yearlings from SCARF broodyear 2015 were released into the San Joaquin River (SJR) at Hills Ferry Barrier near Newman, California. All yearlings released were adipose fin-clipped, CWTed (No. 06-05-14) and PIT tagged (Biomark 12.5mm 134.2 kHz ISO FDX-B full duplex tags). One fish was later caught upstream of the release site in Salt Slough during the adult fall-run trap and haul effort and at least 34 additional fish were detected at the SDFPF on the salvage release PIT tag arrays. Once the fish were collected at the SDFPF, they were trucked to one of two release sites in the western Delta away from the export pumps, either: 1) Horseshoe Bend (38.080371°, -121.730236°) or 2) Curtis Landing (38.033093°, -121.736887°). Fish were detected from January 13 to February 22, 2017, a full 12 weeks after their release (Table 2, Figure 4). Based on a salvage expansion factor of four, approximately 25% of the released yearlings were entrained at the SDFPF. The Program intends to continue yearling releases and to monitor the outmigration of these individuals.

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

2. Adults

Genetic tissue samples, of all broodstock adults, were taken at the FRFH and SCARF for use in parentage analysis for all released juveniles.

A total of 115 adult ancillary spring-run broodstock from the SCARF were released by CDFW at Owl Hollow (30 females and 30 males on May 25, 2017) and Lost Lake Recreation Area (25 females and 30 males on August 8, 2017) in Reach 1A of the San Joaquin River. All fish received color coated, external, Peterson disc tags with individual identification numbers, and some fish were fitted with acoustic tags to track fine-scale movement. As of September 21, 2017, the signals of all but one fish have been recorded within Reach 1A at least once. As of October 31, 2017, 15 spring-run redds have been detected in Reach 1 of the San Joaquin River with seventeen carcasses recovered.

Because of previous release/reintroduction efforts, 2017 was the second year that adult spring-run Chinook salmon had the potential to return to the San Joaquin River. However, due to an above average water year that prevent the placement of collection or counting stations, only limited monitoring occurred during the anticipated migration period. Only adults marked with Peterson disc tags (Peterson disc tags indicate they were from the SCARF ancillary broodstock) were observed during weekly monitoring after flood releases subsided, and no unmarked spring-run Chinook (indicating wild origin) were seen in the lower reaches of the river.

In late 2017, the Program released roughly 1,500 spring-run Chinook salmon ancillary broodstock yearlings to Reach 5 of the San Joaquin River (actual release numbers will be reported in the 2019 Tech Memo). The yearlings are from the 2016 brood year and originated from either the SCARF or FRFH. The release occurred in accordance with Section 10(a)1(A) permit number 14778. All fish released are

marked via adipose fin clip and tagged with both PIT tags and CWTs (Numbers FRFH 06-14-20 & SCARF 06-14-19).

B. Research and Monitoring Findings

NMFS has committed to developing this Tech Memo, to the greatest extent possible, in coordination with interested parties and has formed a working group for this purpose. The focus of the 2018 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 2018, as described in the next section of this document.

1. **Juveniles**

In 2017, the Program had multiple research and learning opportunities. Some observations from those opportunities are presented here. 2017 was the fourth year the Program released juveniles into the Restoration Area and only the second year that those juveniles were captured at the Facilities and Chipps Island monitoring trawls (Figures A, B, and C; Table 1). Nine Program fish that were salvaged at the Facilities were on the cusp of the winter-run Chinook salmon length at date curve (Figure 4), but since all juveniles released by the program were CWTed they were easily identified as Program fish and did not trigger any water delivery curtailments. However, if these fish hadn't been CWT'd they would not have contributed to water curtailments because genetic testing would have determined that they were not winter-run. Reclamation implemented a rapid genetic analysis protocol, as they had the two years before (2015 and 2016), but no fish triggers were met and no fish were sent for rapid genetic analysis. 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 initiated a 2-year study in 2017 to calculate reach-specific survival and migration conditions for juvenile salmonids in the Lower San Joaquin River and South Delta. In March 2017, 700 individual Program juveniles were tagged with acoustic JSATS tags and released in two evenly sized groups. The first group was released on March 6, 2017, into the Eastside Bypass near Harmon Road, while the second group was released 17 days later, downstream of the Restoration Area at Durham Ferry. 59 of the first group were detected passing a real time receiver at Hills Ferry from March 10 to April 15, with peak detections on April 4 (30 days after initial release) (Figure 3). The

[2] The Guidance Document can be found at: http://www.restoresjr.net/wp-content/uploads/20151104_Guidance-Document.pdf

[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

data from the second group has not yet been fully analyzed and will be reported at a later date. This information 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.

2. **Adults**

The 2017 adult broodstock acoustic tracking study aimed to examine where spring-run adults will hold and spawn. Of 115 fish released into Reach 1A of the SJR, 95 were acoustically tagged, with 20 males left untagged as controls. To test acoustic tagging methods, fish were split into various treatment groups: 1) tags inserted into gastro-esophageal cavity, 2) tags attached externally through dorsal musculature with a secure harness, and 3) a control group with no acoustic tags (males only). All females were acoustically tagged. The fish that had acoustic tags were monitored with 14 acoustic arrays within Reach 1A, mobile acoustic listening devices, and snorkel surveys (when conditions allowed). Over the 2017 summer holding period, 94 acoustically tagged fish were detected by stationary receivers: 46 fish were detected at locations at or upstream of Lost Lake Park, 38 fish were detected between Lost Lake Park and Owl Hollow, and 10 fish were detected below Owl Hollow.

II. 2018 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.

Trap and haul efforts to move juveniles downstream past the significant barriers in Reaches 2 through 5 are not planned for 2018. Therefore, if the redds are successful in producing spring-run offspring, it is unlikely that the offspring will survive to emigrate out of the Program Restoration Area. If unmarked juveniles produced from the Program do 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[4]), there is a rapid genetic analysis protocol in place for water year 2018[5] to genetically determine if the Chinook species which contributed to exceeding the loss density trigger are or are not winter-run. Since spring-run is genetically distinct from winter-run, any spring-run determined to be a false positive will not count towards the exceedance of a fish density trigger.

[4] RPA Action IV.2.3 starts on page 74, and RPA Action IV.3 starts on page 79, of http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

[5] NMFS's response from December 2018, *NMFS Response to Reclamation's request to implement rapid genetic analysis in WY 2018*, is posted at http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/

In 2018, 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:

- Continue to refine and learn from genetic testing at the Facilities.
- Identify and resolve (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, necessary agencies' commitments.

Juvenile San Joaquin River spring-run Chinook salmon migration timing to the Delta will be estimated from the capture of CWTed individuals in the Mossdale Trawl, Chipps Island trawl, and at the Facilities. 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 2018.

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 2018 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 to determine more accurately if the juvenile Chinook salmon that contributed to the trigger exceedance was or was not a true winter-run and was not a false positive 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 2018 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 2018 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 will be adipose fin-clipped and CWTed, with a code unique to Program fish 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. No operation changes will be recommended by NMFS to Reclamation during the period between collection of the samples and reporting to DOSS or DAT.

b. Genetic Analysis:

The Program has established a parentage based tagging (PBT) program 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 2017/2018 will be tissue sampled for genetic testing.

In addition, all natural origin (unmarked) juvenile Chinook salmon captured in the rotary screw traps or other juvenile traps deployed in 2018 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 once natural production occurs within the San Joaquin River and the adipose fin-clipping of all juvenile spring-run Chinook salmon reintroduced into the San Joaquin River is no longer possible. With the present operational triggers and length-at-date method to determine Chinook salmon run, the key concern is whether reintroduced San Joaquin River spring-run Chinook salmon would be mis-identified as winter-run juveniles encountered at the Facilities.

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 2018 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 200,000-250,000 juvenile spring-run Chinook from the SCARF will be released into the San Joaquin River upstream of the Merced River confluence in spring 2018 as part of the Program. There will be no translocation fish from the FRFH. Also, adult broodstock from the SCARF will 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 have their adipose fins clipped. Additionally, the Program is planning to monitor Reach 5 for returning spring-run Chinook salmon 2-year-olds from 2016 juvenile releases, 3-year-olds from 2015 juvenile releases, and 4-year-olds from the 2014 juvenile releases. If those adults are captured, they will be marked with a PIT tag, Peterson Disc 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 2018, and juveniles would be outmigrating as early as January 2019.

    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[6] 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[7].

[6] http://restoresjr.net
[7] http://www.rmpc.org

b. Monitoring Plan:

The offspring of adult spring-run Chinook salmon released this past summer as a Program study will be monitored throughout Reaches 1 and 2 to determine migration timing and lifestage diversity, survival, and size. In addition to natural production, approximately 40,000 spring-run juveniles will be released throughout the spring to test rotary screw trap capture efficiency at different flows. The scope of monitoring was determined by the relatively few redds (16 as of November, 17 2017), expected low number of emergent fry, volitional downstream passage impediments, and the likelihood of not capturing a statistically significant number of outmigranting juveniles in Reach 5 exiting the Restoration Area. Rotary screw trap monitoring will be performed from November 29, 2017, to end of May 2018, or until water temperatures exceed thermal tolerances for juvenile salmon or catches no longer occur. Four locations within the Program Restoration Area were determined based on redd locations and river access (i.e., Upstream of Lost Lake, 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.

At the time this document was nearly final three rotary screw traps were deployed in Reach 1 (one more will be deployed in Reach 2). By December 11th, 2017 the traps have caught approximately 322 presumably spring-run Chinook juveniles at an average of 35 mm and three yearling size, precocious male Chinook of unknown origin. These juveniles will not be hauled to Reach 5 because of limited funding in the Program and the first two years of studying juvenile capture methods produced too few results for too high a cost. Also, the limited number of redds from this year are not anticipated to produce enough offspring to make the trap and haul effort viable. Tissues for genetic testing were taken from all juveniles and the results will be reported in the 2019 Tech Memo. These fish were, presumably, from the redds produced by the 115 ancillary adult spring-run Chinook salmon broodstock the Program released into Reach 1 this summer. These newly hatched juveniles are unclipped and untagged and could potentially exit the Restoration Area, although survival to Reach 5 is unlikely due to adverse migratory conditions. In the unlikely event any potential offspring of released broodstock adults survive and emigrate out of the Restoration Area, and contribute to the exceedance of a fish density trigger, the rapid genetic analysis protocol will be implemented by Reclamation to determine more accurately if the juvenile Chinook salmon that contributed to the trigger exceedance are winter-run and not a false positive caused by a Program spring-run.

NMFS has determined (based on 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. The two current monitoring efforts are: beach seining conducted by the USFWS and trawling at Mossdale conducted by the CDFW/USFWS. The new monitoring is a proposed study by UC Davis where acoustic telemetry will be used 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 trapped and hauled 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[8]. Beginning in February 2018, NMFS will hold monthly meetings to discuss implementation of this 2018 Tech Memo and to develop the 2019 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, 2018. NMFS intends to prepare a new memorandum by January 15, 2019, to govern activities during 2019.

6. Adjustments to the CVP/SWP Opinion:

   No adjustments are needed in 2018 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 and are observed at the Facilities; they will be subject to the rapid genetic analysis protocol if a fish density trigger is exceeded, so that they are not misidentified as winter-run.

[8] www.restorsjr.net

A. 2014

B. 2015

Figure 1. Maps of the Restoration Area and Delta depicting where San Joaquin River Restoration Program spring-run Chinook salmon juveniles were identified. Detections in 2014 are on Map A, and detections in 2015 are depicted in Map B. The number within the bubble denotes the number of juvenile Central Valley spring-run Chinook salmon observed through coded wire tag recovery. The black stars denotes significant landmarks within the map area (Credit: Sheila Greene)

A. 2016

B. 2017

Figure 2. Maps of the Restoration Area and Delta depicting where San Joaquin River Restoration Program spring-run Chinook salmon juveniles were observed. Observations in 2016 are on Map A, and observations in 2017 are depicted in Map B. The number within the bubble denotes the number of juvenile Central Valley spring-run Chinook salmon observed through coded wire tag recovery. The black stars denotes significant landmarks within the map area (Credit: Sheila Greene)

***The detections at Hills Ferry were from 350 acoustically tagged juveniles that are part of a 2 year study by UC Davis. The study area continues into the main Delta and data collection will not be complete until late 2018. More results from the study will likely be presented in future documents.**

® The SWP was closed for maintenance during the majority of migration season.

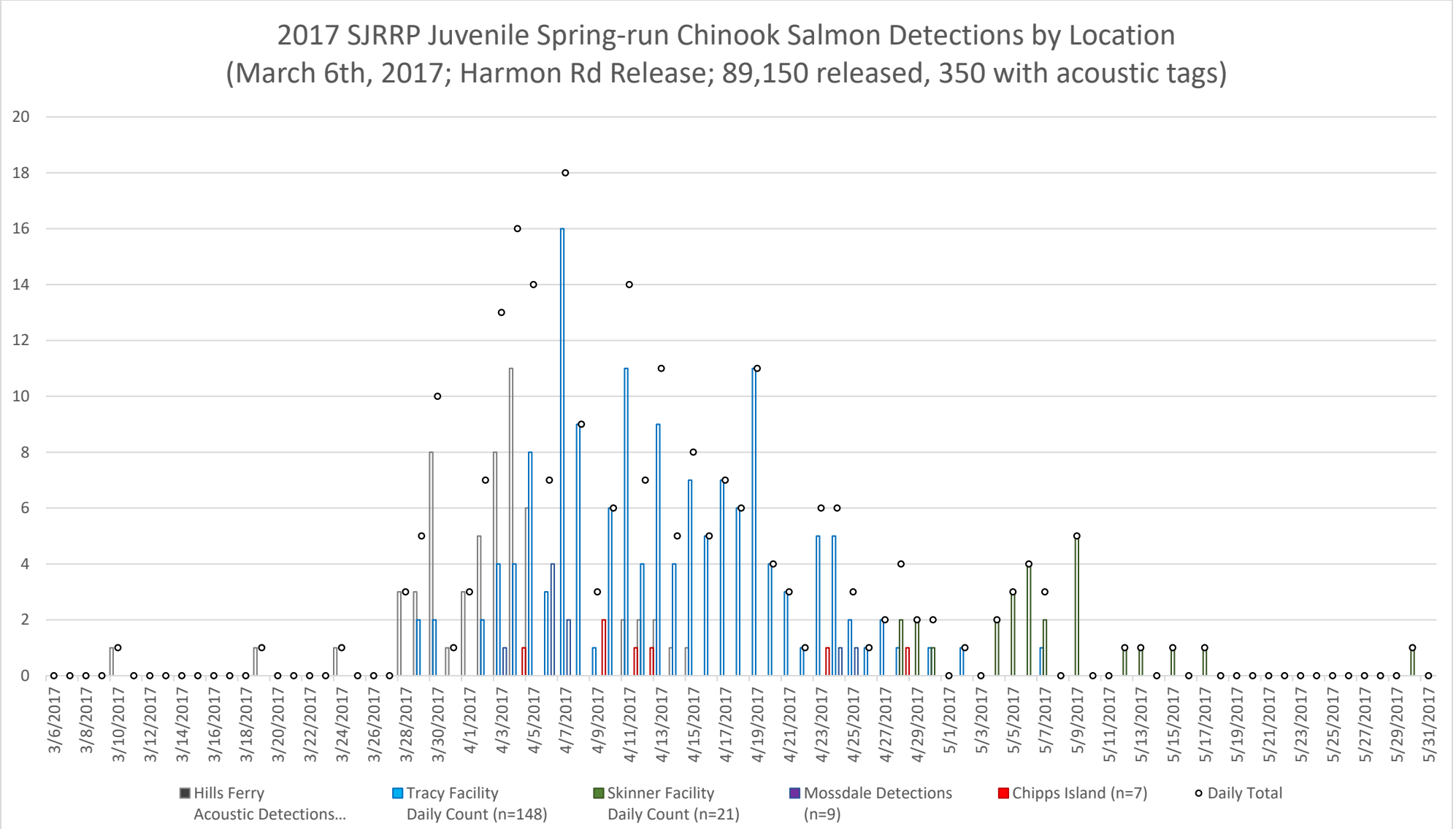

Figure 3. 2017 San Joaquin River Restoration Program (SJRRP) juvenile spring-run Chinook salmon detections in the San Joaquin River and south Delta by location and date. The Hills Ferry data (in grey) were detected through a real time acoustic transmitter as part of a two year study through UC Davis; all other detections were made through reading coded wire tags of fish caught through south Delta monitoring efforts. The Skinner Facility (in green) was closed for maintenance for part of the migration season.

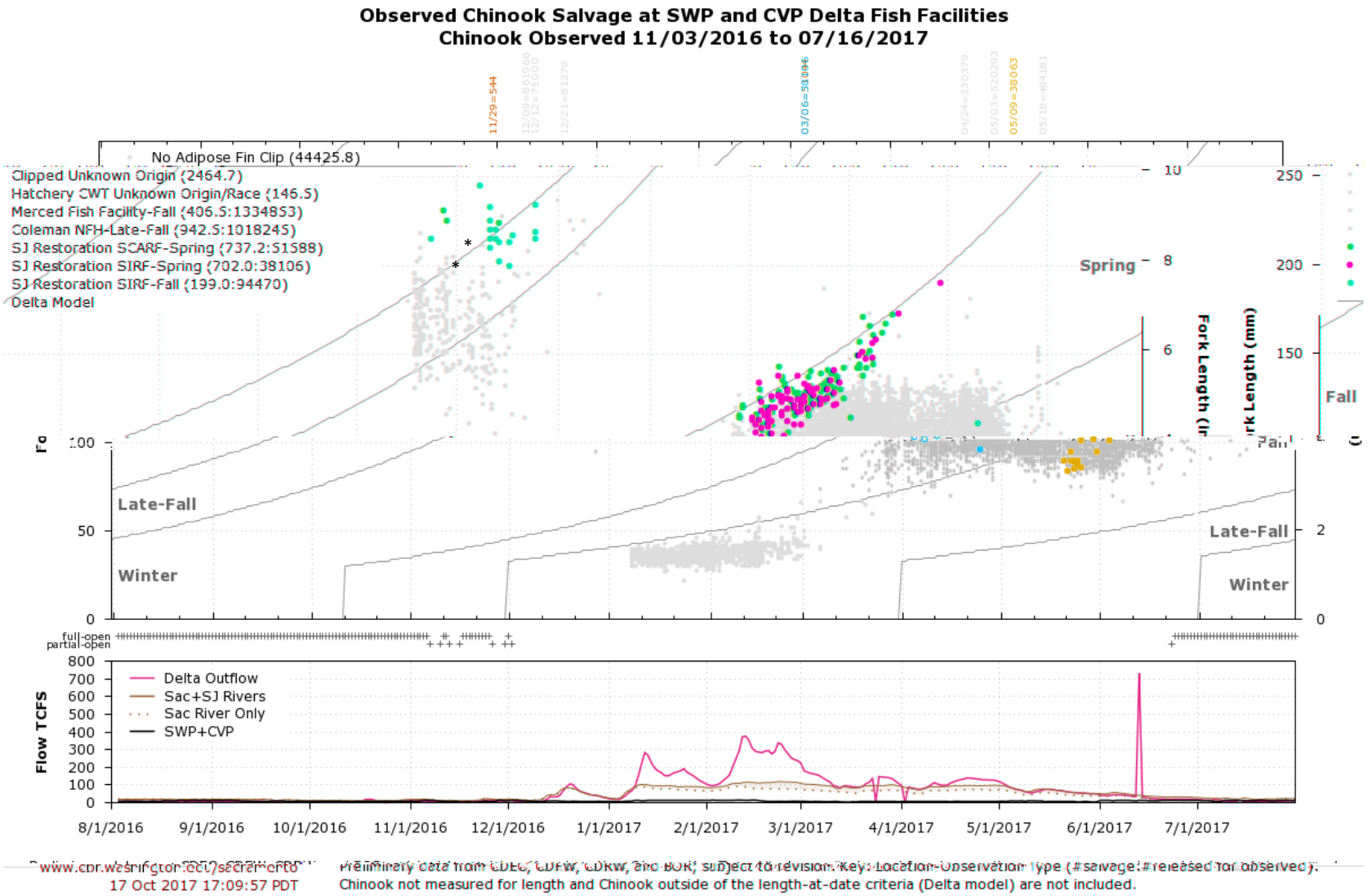

Figure 4. The observed Chinook salvage at SWP and CVP Delta Fish Facilities from 11/03/2016 to 07/16/2017. Only juvenile Central Valley Chinook salmon released by the San Joaquin River Restoration Program (SJRRP) are bolded in color, all other salvaged Chinook are in grey. SCARF-spring-run represent juvenile spring-run which were spawned at the SCARF facility in Friant, CA. Satellite Incubation and Rearing Facility (SIRF)-spring-run were spawned at Feather River Fish Hatchery and translocated to the SIRF facility at the base of Friant Dam. SIRF-fall-run were fish that were caught past Hills Ferry Barrier by SJRRP staff and stream-side spawned. *Please note some fish fell within the winter-run length at date curve.

Table 1. Numbers of spring-run Chinook salmon released by the San Joaquin River Restoration Program and numbers detected in the San Joaquin River and south Delta, by release year.

Tech Memo Year	Release Date	Number of Juveniles Released			Numbers of Juveniles Detected Downstream of Release						Adult Releases and Monitoring	
		FRFH	SCARF	SCARF Yearlings	Mossdale Trawl	Chipps Island Trawl	Facilities; Estimated Loss Juveniles	Facilities; Observed Juveniles	Facilities; Estimated Loss Yearlings	Beach Seine	Broodstock Adults Realeased into Reach 1	Adult Returns to Reach 5
2015	April 18th, 2014	60,114	0	0	2	0	0	0	-	0	0	-
2016	February 26th, 2015	54,924	0	0	2	0	0	0	-	0	0	-
2017	March 17th, 2016	57320 (CWT 06-05-21)	47560 (CWT 06-86-97)	544 (Released on Nov 11th, 2016) (CWT 06-15-14)	59 (36 FRFH, 23 SCARF)	1 (SCARF)	521 (82 FRFH, 439 SCARF)	148 (26 FRHF, 122 SCARF)	6	2 (1 FRFH, 1 SCARF)	25 (15 male, 10 Female)	0 (VAKI)
2018	March 6th, 2017	38, 106 (CWT 06-14-06)	51,044 (CWT 06-14-23 & 06-14-24)	About 1,500 (Released in late December 2017, CWT 06-14-20 & 06-14-19)	9 (4 FRFH, 5 SCARF)	7 (4/4-4/28) (3 FRFH, 4 SCARF)	1370 (470 FRFH, 900 SCARF)	169 (76 FRHF, 93 SCARF)	-	0	115 (30 male, 30 Female; May 25th Release)(29 male, 26 females; August 8th Release)	0 (Limited monitoring due to high flows)

Table 2. Summary of San Joaquin River Restoration Program juvenile spring-run Chinook salmon loss at the Skinner Delta Fish Protective Facility (California Department of Water Resources) and Tracy Fish Collection Facility (Bureau of Reclamation, collectively the Facilities) in late 2016 and 2017.

	Number of Juveniles Released	Release Date	First Loss	Last Loss	Number of Days Present at the Facilities	Number of Days from Release to First Detection	Estimated Loss*	Observed Loss^
SCARF Yearlings (CWT 06-15-14)	544	November 11th, 2016	December 27th, 2016	January 14th, 2017	19	45	6	2
SCARF (CWT 06-14-23 & 06-14-24)	51,044	March 6th, 2017	March 29th, 2017	May 15th, 2017	48	22	900	93
FRFH (CWT 06-14-06)	38, 106	March 6th, 2017	April 2nd, 2017	May 30th, 2017	59	25	470	76

***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.