Spawning Assessment of Central Valley Spring-run Chinook Salmon during 2023 within the San Joaquin River Restoration Area, California

Technical Report

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Assessment of Spring-run Chinook Salmon Spawning during 2023 within the San Joaquin River Restoration Area, California

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The preferred citation for this report is:

Ellsworth, E, Z. Sutphin, and A. Shriver. 2025. Assessment of Spring-run Chinook Salmon Spawning during 2023 within the San Joaquin River, California. San Joaquin River Restoration Program Annual Technical Report. U.S. Bureau of Reclamation, Denver, Colorado.

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Self-Certification of Peer Review

This report has been peer reviewed by the following two individuals, at least one of whom is from outside my work group:

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I certify that, to my best knowledge, these two individuals are qualified to review this work, and that they have peer reviewed this report.

Zachary A. Sutphin

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PI Signature

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Introduction

Fish passage barriers (e.g., Sack Dam, Mendota Dam), in combination with changing ocean and freshwater climates and overfishing, contribute to the decline in Chinook Salmon (*Oncorhynchus tshawytscha*) populations along the west coast of North America (Thompson et al. 2012; Noakes et al. 2000). Dams in particular preclude adult salmon passage to historical suitable spawning grounds and interfere with the natural flow of rivers, vastly altering salmon spawning habitat, further exacerbating population decline for the Central Valley Run (Williams 2006; Moyle et al. 2008; Yoshiyama et al. 2001; Thompson et al. 2012; Noakes et al. 2000). The construction of Friant Dam blocked access to upstream spawning habitat and redistributed water ultimately leading to the extirpation of a previously abundant spring-run Chinook Salmon population on the San Joaquin River by the 1950s (Williams 2006; Yoshiyama et al. 2001; McKenzie et al. 2017).

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit challenging the renewal of long-term water service contracts between the United States and the Central Valley Project Friant Division Long-Term Contractors. After more than 18 years of litigation of this lawsuit, known as NRDC et al. vs. Kirk Rodgers et al., 2006, a stipulation of the settlement (Settlement) was reached. The Settlement establishes two primary goals: (1) Restoration—to restore and maintain fish populations in "good condition" in the mainstem San Joaquin River (SJR) below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish and (2) Water Management—to reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim and Restoration Flows provided for in the Settlement. To satisfy the terms of the Settlement, the San Joaquin River Restoration Program (SJRRP) was developed. The Settlement, though, does not clearly define the process for restoring and maintaining fish populations nor does it define the criteria for "good condition"; thus, the SJRRP developed the Fisheries Management Plan (FMP) that established an Adaptive Management Framework with population and habitat goals to guide the reintroduction and restoration process (SJRRP 2010). The Fisheries Framework further guides the implementation of the Settlement's fisheries components, establishes more specific goals, and provides a plan to reduce or eliminate factors limiting fish production.

Currently, the SJRRP is undertaking multiple strategies to reintroduce, bolster, and monitor populations targeting different life stages of Central Valley spring-run Chinook Salmon. The primary strategy to reintroduce and establish a population in the SJRRP Restoration Area has been annual releases of hatchery reared juvenile spring-run Chinook Salmon (SRCS) below migration barriers. This was initiated after the SJRRP developed an experimental population of SRCS using broodstock from the Feather River Fish Hatchery (SJRRP 2018). Since instream fish passage impediments remain in the SJR, adult SRCS returning to the first 24 River Miles (RMs) below Friant Dam, (Reach 1A) requires transport around barriers via adult trap and haul efforts during most water year types to access suitable over-summer and spawning habitats. In addition, sexually mature SRCS broodstock from the Interim Salmon Conservation and Research Facility (SCARF) are released into Reach 1A, to increase egg production and reduce hatchery selection pressure within the SJR between Friant Dam and the confluence with the Merced (Restoration Area).

Reintroduction efforts resulted in the first observed spawning of adult SRCS broodstock in Reach 1 of the Restoration Area in 2016 (McKenzie et al. 2018). A common fisheries technique to evaluate population size and habitat use of spawning salmon is redd and carcass surveys. Data collected through these efforts will help guide efforts to monitor population fluctuations, guide habitat restoration, and measure progress toward meeting the Restoration Goal of the Settlement. Here, we report our findings from the 2023 redd and carcass surveys and compare our findings with previous years' surveys.

Objectives

Redd and carcass surveys for SRCS in the Restoration Area have been conducted annually since 2016. These surveys aim to provide the SJRRP with information about, spawn timing, and habitat use and availability for SRCS. The following target objectives of this study will support SJRRP management in making informed decisions regarding ongoing restoration activities and developing a long-term plan for adult SRCS spawning:

1) Estimate SRCS spawner abundance in the Restoration Area.

2) Monitor the spatial and temporal distribution of SRCS spawning activity and redd production in Reach 1 of the Restoration Area.

3) Document the habitat type of spawning site selection.

4) Estimate the sex ratio of spawning SRCS.

5) Assess the biological attributes including spawning status and condition (e.g., carcass decay) of SRCS carcasses.

6) Describe the spatial-temporal trends of carcasses recovered within the Restoration Area.

1.0 Materials and Methods

1.1 Study Site and Schedule

Weekly redd and carcass surveys were conducted by crews of three or four individuals along approximately 17 RMs, between Friant Dam (~RM 267.5) and Scout Island (~RM 250.5; Figure 1). Historic surveys in the Restoration Area were often completed to Camp Pashayan (~ RM 243.3; Demarest et al. 2021), however, as a result of elevated temperatures, surveys during the described period stopped at the downstream extent of previously described spawning areas (Scout Island, Demarest et al. 2021).

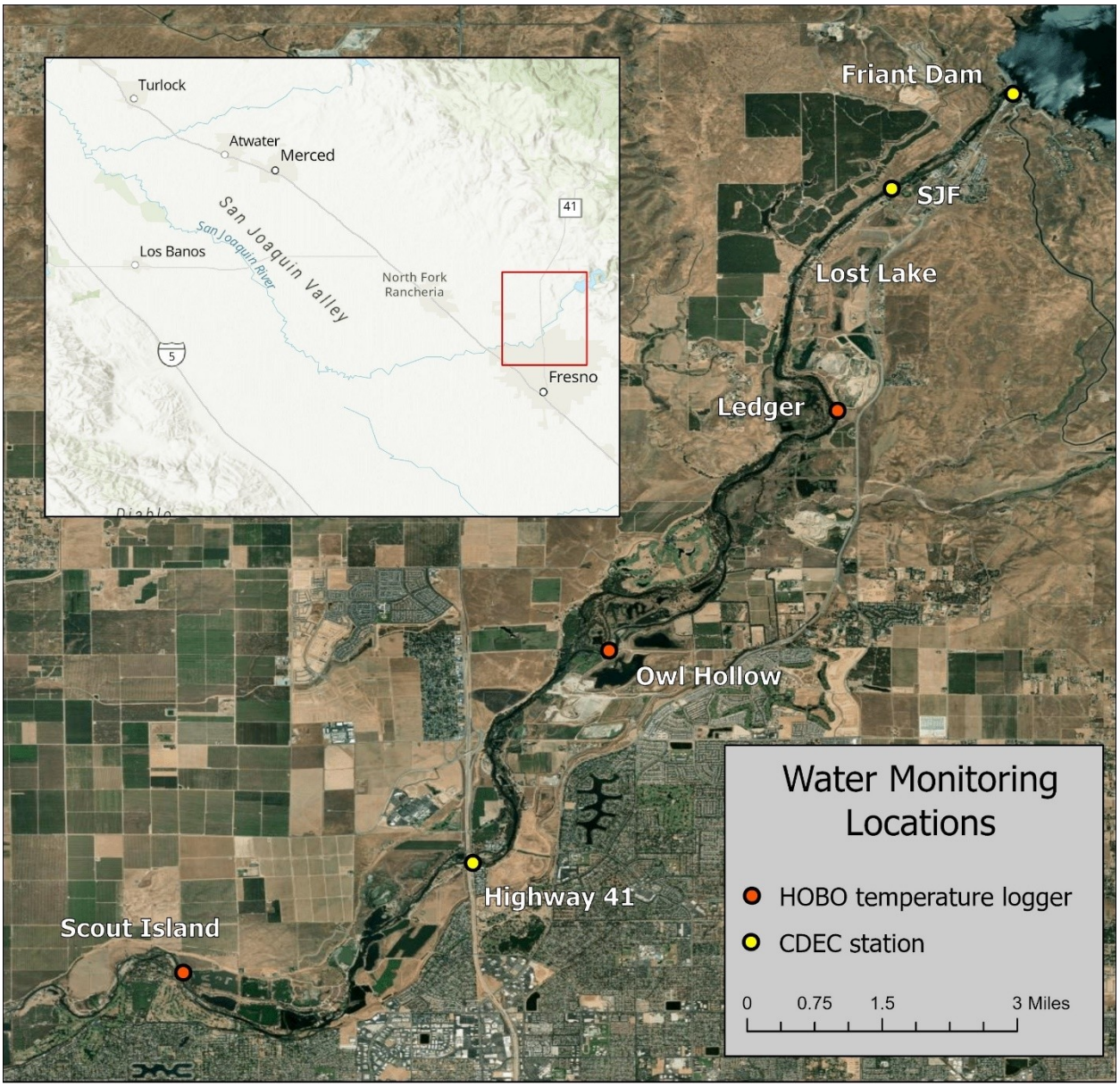

Figure 1. — Map detailing the spring-run Chinook Salmon redd and carcass survey locations in the San Joaquin River Restoration Program's Restoration Area (inset) with California Department of Water Resources (yellow) and HOBO (red) water monitoring locations marked.

Surveys were conducted via kayak over 2–4 days based on extent of spawning activity and available daylight hours. The survey period began August 29 and ceased November 29, when no new redds or carcasses were identified for two successive survey periods. Historic spawning areas, or areas of high flow that are difficult to survey via kayak were surveyed from the bank on foot to maximize redd and carcass detection.

1.2 Redd Surveys

The field crew visually surveyed for redds by identifying areas that were clear of periphyton and debris and had an excavated pit and a tailspill (i.e., a gravel/cobble mound; Gallagher et al. 2007). Presence/absence of fish on each redd, evidence of superimposition, and the number of females and males present were recorded. Sex was identified by visually observing behavior and using sexually dimorphic characteristics typical in a spawning male (e.g., jaw morphology, body shape) and female (eroded caudal fin from redd construction process). Characteristics for each redd such as channel type, channel position, and habitat type were also recorded. Channel type was categorized as either main channel or side channel, where the main channel was defined as the cross-section of the wetted river channel that contained greater than 50 percent of the flow and conversely, the side channel was defined as containing less than 50 percent of flow. Channel position while facing downstream was used to document where each redd was within the river (river right, left, or center). Habitat type was categorized based upon depth, velocity, and water surface turbulence and consisted of five categories (glide, riffle, run, pool, and backwater) derived from McCain (1990). The age of each redd was estimated based on the apparent maintenance of the redd using the following criteria from previous SJRRP redd surveys (Demarest et al. 2022):

Age 1: Clean rocks with no defined pit or tailspill. This would be considered a test redd until well-defined pit and tailspill discernable.

Age 2: Clearly visible with clean substrate and well-defined pit and tailspill.

Age 3: Aged substrate, tailspill flattened, pit with fines, and/or algal growth.

Age 4: Old and difficult to discern. Would the redd be visible without the flagging?

Age 5: No visible traces of a redd; only the flagging is available for redd identification.

Redd locations were identified by securing flagging to an adjacent structure (e.g., tree trunk, branch, riprap) along the riverbank denoting the date of first observance, location relative to flag (distance and compass bearing), and including a unique identification number. Redd locations were recorded using a handheld GPS. The redd identification number consisted of an alphanumeric code starting with “T” or “NR” indicating test redd or natural redd, followed by a sequential redd number (000–999), “SR” for spring-run salmon, and then a date code using “yymmdd” format (e.g., the third natural redd of the season, found on September 15, 2023, would be NR003SR230915). Redds were reevaluated each week until they reached age 5, at which point they were no longer discernable.

1.3 Carcass Surveys

Carcass surveys were conducted concurrently with redd surveys. Upon collection, salmon were scanned with handheld readers for the presence/absence of passive integrated transponder (PIT) tags, coded wire tags (CWTs), and the presence or absence of an adipose fin was noted to determine origin (hatchery return or broodstock). Carcasses were assigned a unique identifier

using an alphanumeric code starting with “BC” or “NC” indicating broodstock carcass or natural carcass, followed by a sequential carcass number, “SR” for spring-run salmon, and the date YYMMDD (e.g., BC010SR231011). If an individual was determined to have a different origin than noted during the time of collection, the ID was not changed to maintain consistency with submitted tissue samples. After visual inspection for tags, morphometrics, state of decomposition, and life history data were collected. Fork length (FL) and post-orbital hypural (POH) length were recorded to the nearest mm (Figure 2). Level of decomposition was noted as fresh, decayed firm, decayed soft, or skeleton. Fresh carcasses were denoted by the presence of at least one clear eye or pink coloration remaining in the gills. Non-fresh fish with cloudy eyes and no blood in the gills were designated as either decayed firm or decayed soft. Decayed firm indicated that the carcass was in the early stage of decomposition, but the body was still firm. A decayed soft designation indicated a soft, decayed carcass that was intact, and FL was still measurable. Fish that were in an advanced state of decay (i.e., covered entirely or nearly entirely with fungus; falling apart; lacking substantial flesh on the bones) were recorded as a skeleton. Sex was determined for all recovered carcasses, if possible. Non-skeletal carcasses were opened from vent to heart to collect cardiac tissue and to determine the spawn status for all females. Spawning status was visually estimated and classified as: spawned (0 to 30 percent of eggs remaining), partially spawned (31 to 70 percent), or unspawned (71 to 100 percent).

The upper snout, dorsal fin clip, and heart tissue were collected from all carcasses if able. The upper snout was removed and transferred to a labeled bag for CWT extraction. To preserve the genetic tissues, the fin clip was placed on tissue paper in an envelope and later dried at 37.8°C for 24 h, and the small sample of cardiac tissue was preserved in 95 percent ethanol in a 2 mL screw-cap vial. The fin clip and heart tissue were stored until submission to the Southwest Fisheries Science Center for genetic analyses. Any additional requested samples (e.g., otoliths, eyeballs) were retained by California Department of Fish and Wildlife (CDFW) as needed. All tissue samples were labeled with the collection date, location, ID code, species, and run.

Figure 2. — An example of a recovered salmon carcass.

Carcass Mark-Recapture
Uniquely numbered aluminum tags were secured on the lower maxilla of carcasses using direct band tag (Figure 3) to collect mark/ recapture data. Tagged carcasses were returned to the river and released in the thalweg near the location of discovery to simulate natural carcass downstream dispersal (Grimes and Galinat 2021). The caudal fin (at the caudal peduncle) was removed from all carcasses not included in the study (too decayed) or from carcasses recovered on subsequent sampling events from a previous marking period so that they were not counted in subsequent surveys. A modified Cormack-Jolly-Seber (CJS) model was planned to estimate escapement using the mark-recapture data.

1.4 Environmental Data

Water temperatures and flow data were collected as they play a role in the success and health of returning adult salmon, egg incubation, and juveniles (Brannon et al. 2004; Richter et al. 2005). Temperature loggers (HOBO Water Temperature Pro v2 Data Logger) were deployed at Friant Dam, Ledger Island, Owl Hollow, Highway 41, and Scout Island to monitor hourly water temperatures. Additionally, dissolved oxygen, water temperature, and weather conditions were collected daily (YSI, Yellow Springs, OH) at the survey input location. Other environmental data, flow and turbidity, were acquired from the California Data Exchange Center (CDEC;

cdec.water.ca.gov) at gages located near Friant Dam (FWQ), the SCARF facility (SJF) and where Highway 41 (H41) crosses the SJR (Figure 1).

Figure 3. — An example of the aluminum jaw tag that was affixed to carcasses prior to release.

2.0 Results

2.1 Environmental Data

During the beginning of the study period, water temperatures were lowest at the upstream extent of the survey area, near Friant Dam, and increased downstream towards Scout Island (Figure 4). However, later in the survey period, water was warmer below Friant Dam and cooled as it reached the lower extent of our survey area. The highest recorded temperature (21.6 ˚C) was measured at the furthest downstream extent of the survey site, Scout Island. Temperatures at

Friant Dam remained the most consistent, near 14°C throughout the spawning period.

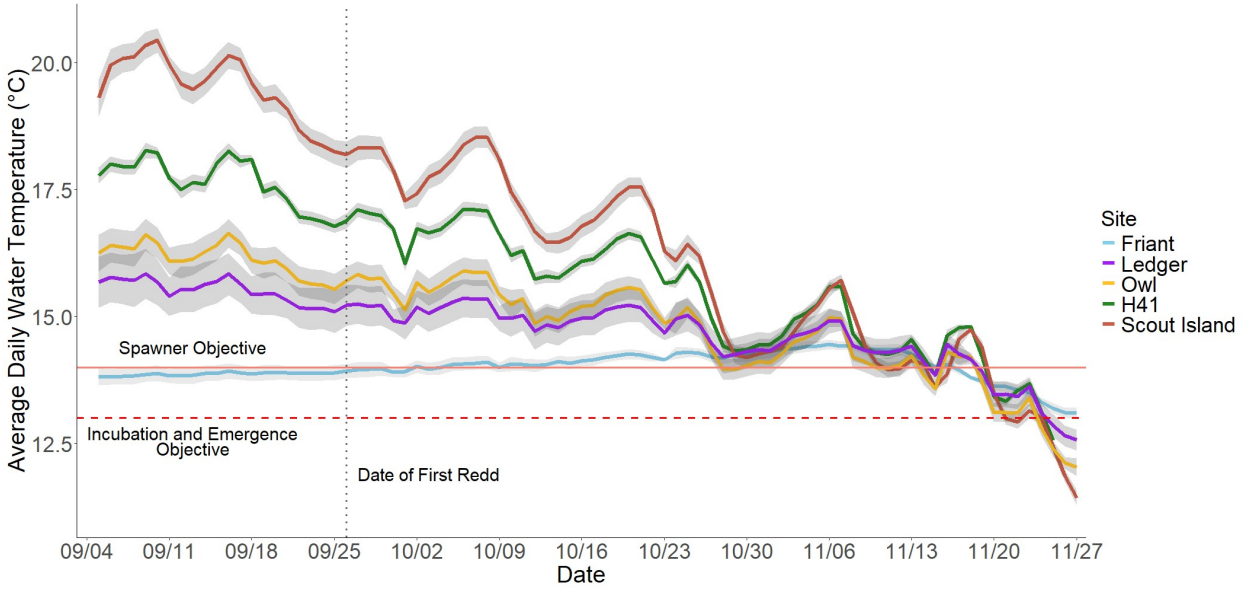

Figure 4. — Mean daily water temperatures (solid lines) and daily maximum and minimum temperatures (grey shading) at five locations in the survey area. Spawning and egg temperature objectives from FMP are noted with the horizontal solid and dashed lines. Date of first observed redd noted with a dotted vertical line (grey).

Mean river discharges (± SD) of 401.42 ±20.34 cfs (SJF) and 377.74 ± 43.41 cfs (H41) were calculated from gaging stations throughout the survey period. River discharge ranged from 337 to 442 cfs at the gage below Friant (SJF) and 274 to 478 cubic feet per second (cfs) at the Highway 41 gage (H41; Figure 5). Flows were highest in September and decreased over the survey period until a pulse in early November. Discharge at H41 was more variable and peaked twice, on approximately September 11 and November 7.

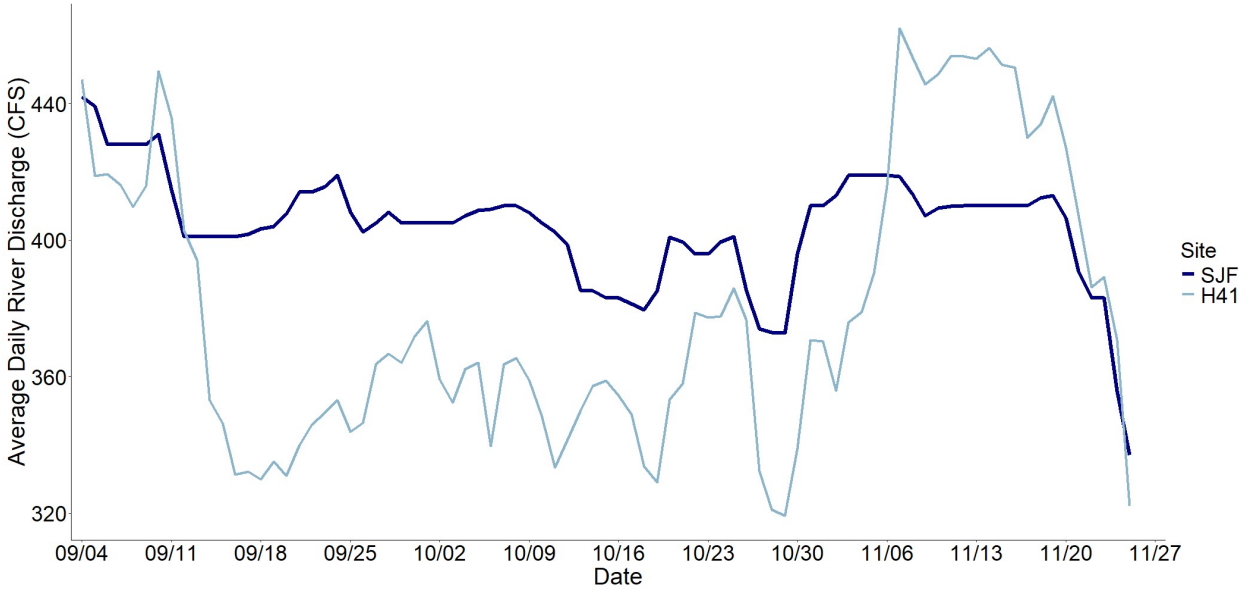

Figure 5. — River discharge (cfs) downloaded from the California Data Exchange Center, at the SJF (USGS) and H41 (Reclamation) gaging stations during the survey period in 2023.

Turbidity below Friant Dam steadily increased over the duration of the survey period with two large increases, which coincide with flow releases (Figure 6). A brief peak occurred in mid- to late-September (~14 Nephelometric Turbidity Units; NTUs). Following a steady increase through October and early November, turbidity rapidly declined again in mid-November. Additional turbidity data were collected to compare visual survey results across years.

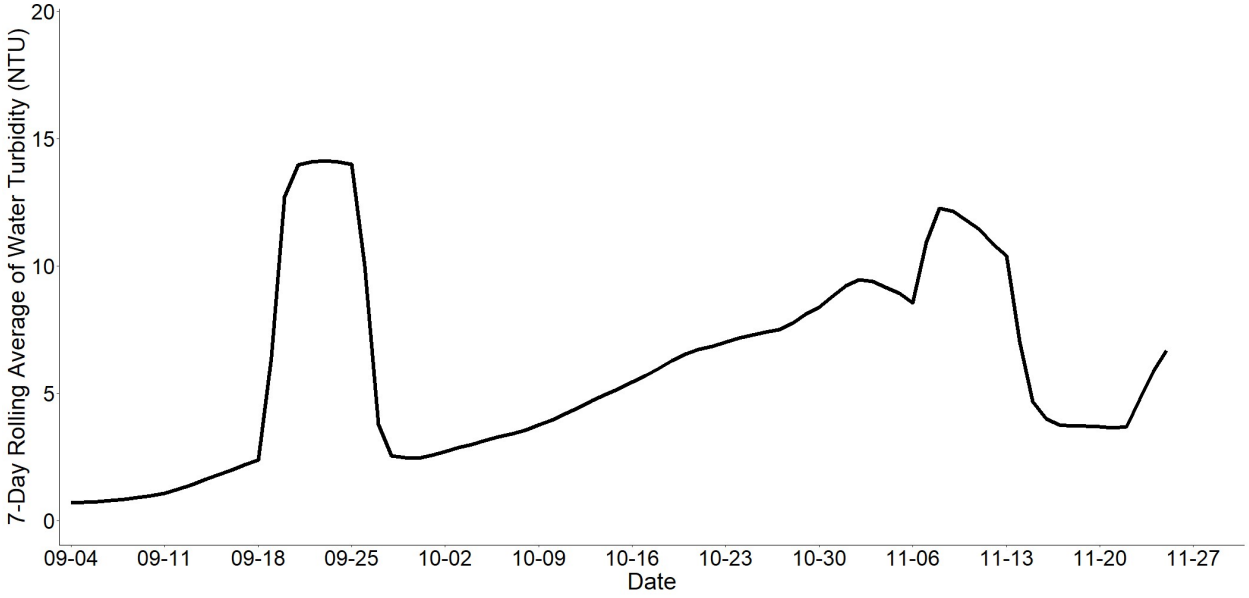

Figure 6. — Seven-day rolling average of turbidity (NTU) during the 2023 survey period obtained from CDEC at the FWQ gage.

2.2 Redd Surveys

Six redds were identified during the 2023 monitoring period: two between Friant Dam and Lost Lake, one between Owl Hollow and Highway 41, and three between Highway 41 and Scout Island (Figure 7). Spawning activity continued for three weeks following the first two redd detected on September 26, 2023. These two redds were located below Highway 41, near Scout Island. A single redd was detected the following week at the upper extent of the survey area, just below Friant Dam. The final three redds were detected on the final week but largely dispersed throughout the survey area; one just below Friant Dam, one about halfway through R1A, and one in the vicinity of Scout Island.

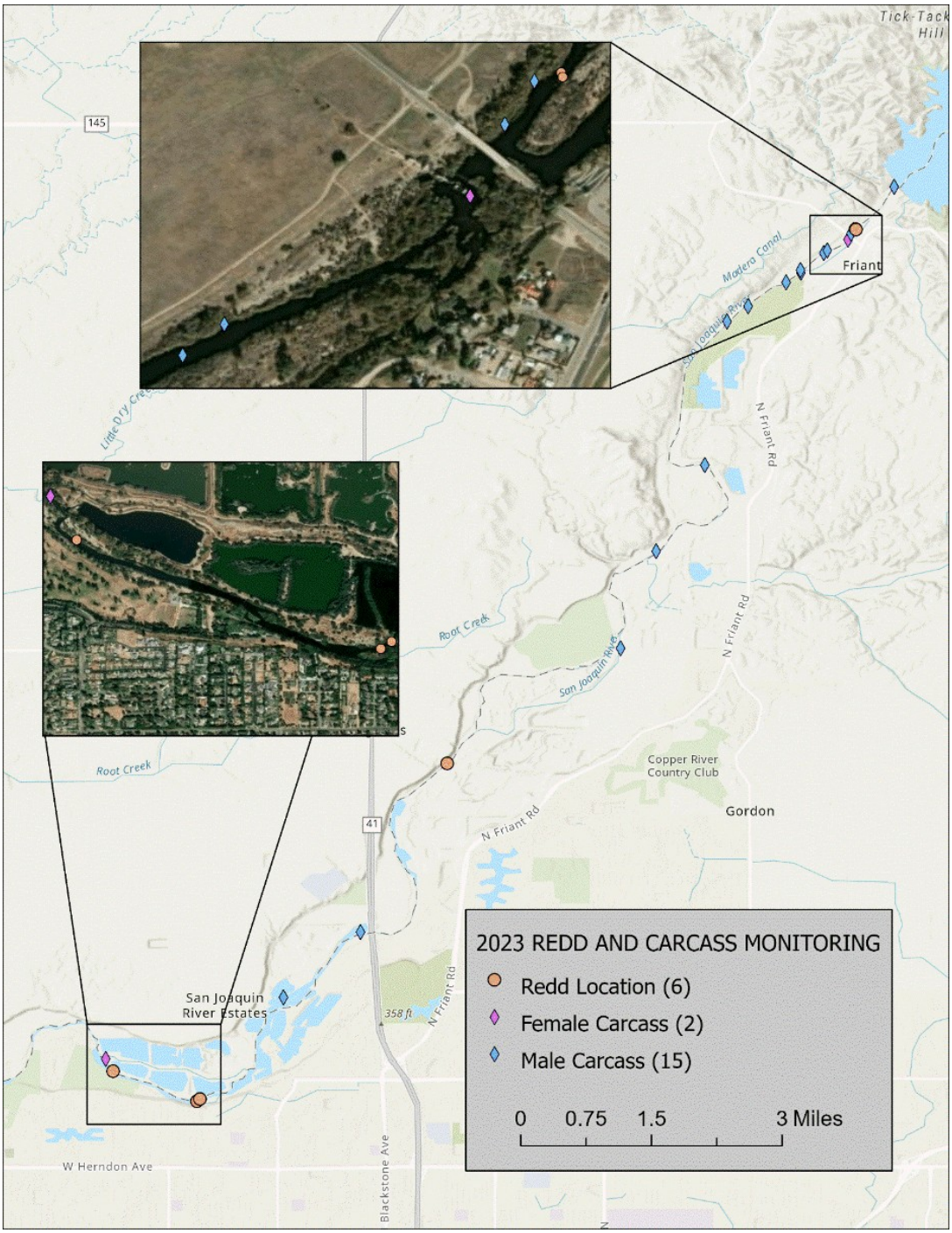

Figure 7. — Map detailing the location of redds (orange circle) and carcasses (diamonds). Female carcasses are represented in purple, and males are represented in blue.

Redds were split between main and side channels (Table 1). One redd (16.7%) was located within a run, two redds (33.3%) were located within glides, and the remaining three redds (50%) were located within riffles. Adult salmon were observed during monitoring at three out of six redds (Table 1). Two of the four test redds (TR002 and TR003) were changed to natural redds on the following week of marking a test redd.

Table 1. — Descriptions of natural and test redds encountered during the 2023 season in the Restoration Area.

ID	Week Discovered	Number of Fish Present	Channel	Habitat
NR001SR231002	7	1	Side	Glide
NR002SR230926	6	0	Main	Riffle
NR003SR230926	6	0	Main	Run
NR004SR231010	8	2	Side	Riffle
NR005SR231012	8	1	Side	Riffle
NR006SR231012	8	0	Main	Glide
TR001SR230830	2	0	Main	Glide
TR002SR230926	6	0	Main	Riffle
TR003SR230926	6	0	Main	Run
TR004SR231010	8	0	Side	Riffle

The 2023 spawning period, indicated via redd construction, spanned three weeks. The previous season, which had a similar start date, was one week shorter. (Table 2). The 2023 survey identified one more redd than the previous year; however, 2022 and 2023 recorded the lowest number of identified redds since 2016. The number of redds identified increased annually from 2016 (three redds), peaking in 2019 (209 redds), before declining continuously through 2022 (five redds).

Table 2. — Known numbers of Chinook Salmon released into Reach 1A, volitional passage availability, redd detection start and duration, and numbers of redds and carcasses detected from 2016 to 2023. Some data from 2016 to 2018 are missing.

Year		Broodstock		Trap and Haul			Survey Summaries			
Date	Water Year Type	F	M	F	M	Unk.	No. Redds	Date of First Redd	No. Weeks of Redd Detections	No. Carcasses
2016	Norm-dry	10	15	*NE*	*NE*	*NE*	3	26-Sep	Unk.	0
2017*	Wet	55	60	*NE*	*NE*	*NE*	13	14-Sep	Unk.	17
2018	Norm-dry	59	120	*NE*	*NE*	*NE*	42	19-Sep	Unk.	23
2019*	Wet	37	77	12	6	2	209	10-Sep	8	168
2020	Dry	136	148	16	16	16	73	9-Sep	12	48
2021	Crit-High	50	150	35	29	10	32	28-Sep	12	41
2022	Norm-Dry	14	60	4	6	0	5	26-Sep	4	8
2023*	Wet	35	195	*NE*	*NE*	*NE*	6	2-Oct	3	17

*Flood releases allowed for volitional returns
NE= No Effort

2.3 Carcass Surveys

A total of 17 SRCS carcasses were recovered. Three of which returned volitionally, with the

remaining 14 released as broodstock. Eleven carcasses were recovered between Friant Dam and Lost Lake, three between Lost Lake and Owl Hollow, and three between Highway 41 and Scout Island (Figure 7). Fifteen of the 17 recovered carcasses were males (88%). The two female carcasses were both found fully spawned downstream of redds. The mean FL of the two female carcasses was 572 mm and the mean POH was 460 mm. The male carcasses had a mean FL of 585 ± 61 mm and mean POH of 477 (± 53 mm).

Sixteen of the 17 carcasses (94%) recovered were adipose fin-clipped, 13 of the carcasses (77%) contained a PIT Tag, and three carcasses (17.6%) contained a CWT (Appendix B). The majority of the carcasses (70%, n= 12) were in early states of decay, either fresh or decayed firm. All carcasses, including the skeletal carcass, were determined to be hatchery releases due to the presence of an inserted tag or a clipped adipose fin. One individual was not tagged, but an adipose fin was absent, therefore the exact release and origin is unknown for this hatchery fish. Thirteen of the carcasses were identified as adult broodstock released in Reach 1 of the San Joaquin River Restoration Area. Adult trap and haul did not occur in 2023; however, three individuals, which were released as juveniles in Reach 5, returned volitionally due to high flows.

Carcass Mark-Recapture

Of the 17 carcasses recovered, 13 were tagged with an external jaw tag and released. Only 2 of the 13 carcasses (15%) were recaptured in subsequent surveys (Figure 8). The low capture and recapture rate of marked carcasses prevented the estimation of the total number of salmon available to spawn via the Cormack-Jolly-Seber model (escapement). The first recaptured carcass was marked on August 29, 2023, and recovered ~70 m downstream the following week. Similarly, the second recaptured carcass was marked on October 10, 2023, and recovered the following week ~25 m from of the mark location.

The overall male-to-female ratio of recovered carcasses was 7.5:1. Using a simple estimation based on the number of redds multiplied by the M:F ratio to estimate the number of males plus the number of redds, assuming one redd per female (Gallagher and Gallagher 2005), escapement is estimated to be 51 spawners in Reach 1A.

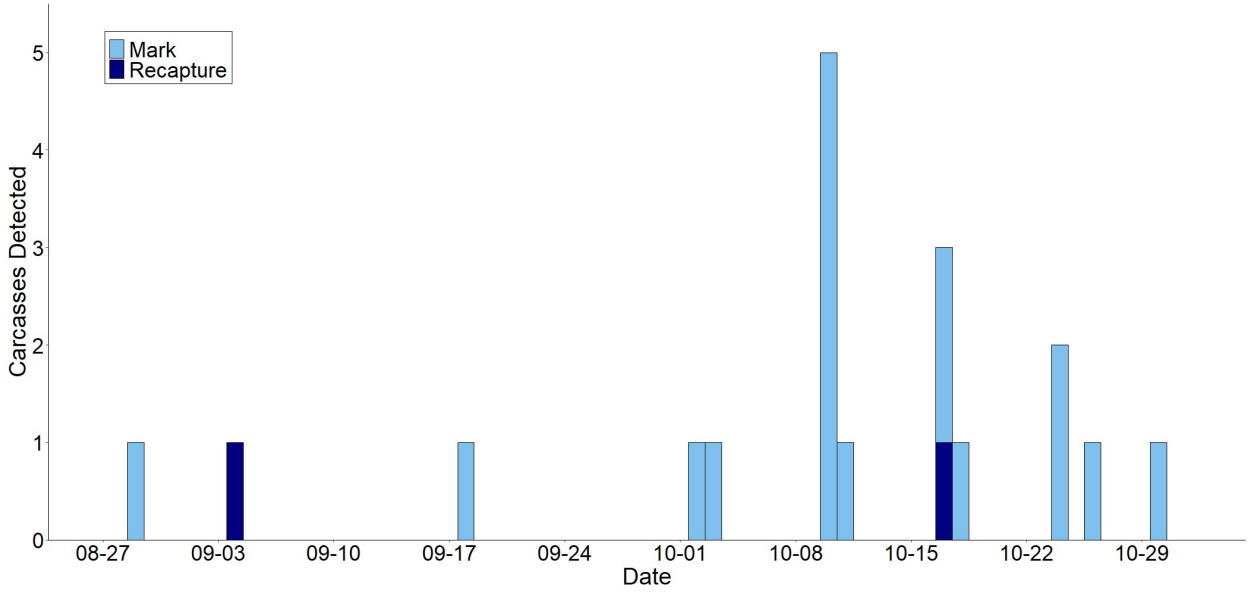

Figure 8. — The number of carcass detections (light blue) and recaptures (dark blue) each day in 2023.

3.0 Discussion

Spawning salmon in the Restoration Area are typically composed of released broodstock and trap and haul adults released into Reach 1; however, in 2023, flood releases prevented adult trap and haul effort, only allowing a known number of broodstock to be placed in R1A. However, due to the flood releases, volitional passage was possible. A mark-recapture effort was attempted in order to estimate the total number of volitionally returning adult salmon in R1A, and ultimately, the total number of individuals. Unfortunately, the planned use of the Cormack-Jolly-Seber model did not provide an estimate due to the low sample size of captures and recaptures. The other, simplified estimation technique used in other systems underestimated the number of spawners by one-third of the released broodstock alone and was therefore an unreliable estimate. Future efforts could still benefit from the modeling escapement, but the sample size should exceed 500 spawners (Bergmann and Nielson 2012), and individuals should be recaptured on more than one occasion (White and Burnham 1999) for the CJS model to more accurately predict escapement.

Based on previous surveys, the majority of redds were expected to be located near Friant Dam and dispersed along the river where habitat is available (Demarest et al. 2021); however, half of the redds in 2023 (n= 3) were located at the lower extent of the survey area, near Scout Island. While the thermal tolerance for egg incubation and spawning varies based on other environmental factors (Martin et al. 2016; McCullough et al. 2001), temperatures below 12.0°C are optimal for egg development (Richter et al. 2005); but all sites downstream of Friant Dam recorded temperatures remained well above the critical temperatures identified in the FMP (SJRRP 2010) for both spawners and egg development at Scout Island during for the duration of spawning activity. Managing Reach 1 water temperatures and flows as far downstream as Scout

Island, through Restoration Flows and cold-water pool releases may be necessary to maintain suitable spawning habitat supporting SRCS natural spawner abundance and juvenile production goals.

Initial redd construction occurred later in the year and continued for an ostensibly shorter period than previous monitoring seasons. Likewise, fewer redds were encountered during this monitoring season than any prior period. It is possible, however, that elevated turbidity levels impacted the ability to clearly detect redds, as evident by the two fresh, spawned female carcasses recorded in mid- to late-October. Superimposition was anticipated for 2023, as it has been shown to coincide with limited spawning habitat and high volitional return (Demarest et al. 2021) but was not noted for 2023.

Carcasses were first detected in late August, and recovered through October, which loosely corresponded with timing of redd construction; yet carcasses were largely discovered near the upper extent of Reach 1A, upstream from the majority of the redds. Male carcass discovery sites did not always correlate with the location of marked redds, however, the two recovered female carcasses were located near marked redds, as females tend to nest until senescence (Murdoch et. al. 2009). The abundance of males released as broodstock and limited females available to spawn (5.6M:1F) likely explains the disconnect between male carcass locations and redd location within the Restoration Area.

The low number of detected redds and recovered carcasses makes it difficult to discern SRCS 2023 spawning success alone but provided useful information to better understand spatial and temporal extent of adult SRCS in the Restoration Area and to address objectives outlined in the SJRRP Fisheries Framework (SJRRP 2010). The 2023 spring-run spawning season is the eighth consecutive season that redd and carcass surveys have been conducted that provide insight into the spatial and temporal patterns of SRCS in the SJR Restoration Area. One of the goals of the Settlement, to re-establish a population of SRCS to the previously extirpated area, has potential to be successful as evident by detected redds and spawned females over the previous eight years. While impassible barriers prevent volitions passage of SRCS during most years, passage may occur during wet years when flood flows permit passage around those structures via the Eastside Bypass. The presence volitionally returning adults during redd and carcass surveys when those conditions are present indicates the drive for SRCS to return to the Restoration Area. This highlights the importance of continuing to promote suitable spawning habitat and maintaining suitable conditions that will support successful spawning when impediments to passage are eventually removed.

The 2023 assessment of Central Valley SRCS spawning found that the recovery of carcasses and detections of redds were perceptibly low. There were likely many factors contributing to the low success rate such as high water temperatures influencing spawning activity, broodstock adult behavior, high turbidity biasing detection, low quantity of individuals in R1A, and intermittent suitable spawning habitat. Future restoration projects, surveys, and management plan adjustments can be made to improve the spawning habitat through maintaining colder temperatures through Scout Island and providing suitable gravel pads for spawning through gravel augmentation. As fish passage improves and the SRCS spawning populations increase, redd and carcass surveys will be crucial in determining the success of the SJRRP's reintroduction of spring-run Chinook Salmon.

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Appendix A

Table 1A. — Survey weeks, and dates, during 2023 redd and carcass surveys.

Week	Start Date	End Date
1	August 20	August 26
2	August 27	September 2
3	September 3	September 9
4	September 10	September 16
5	September 17	September 23
6	September 24	September 30
7	October 1	October 7
8	October 8	October 14
9	October 15	October 21
10	October 22	October 28
11	October 29	November 4
12	November 5	November 11
13	November 12	November 18
14	November 19	November 25

Appendix B

Table 1B. — PIT tag information and associated data for recovered carcasses.

ID	Date	Fork Length	Sex	Release	PIT Tag	CWT
NC001SR230829	8/29/2023	652	M	Yearling*	-	06.19.64
BC002SR230918	9/18/2023	454	M	Broodstock	3C8.0000A1BF82	-
BC003SR231002	10/2/2023	540	M	Broodstock	3C8.0000A9AFA1	-
BC004SR231003	10/3/2023	488	M	Broodstock	3C8.0000A1CF28	-
NC005SR231003	10/10/2023	880	M	Yearling**	3C8.0000A9D070	06.19.66
BC006SR231003	10/10/2023	642	M	Broodstock	3C8.0000A9C27D	-
BC007SR231003	10/10/2023	664	M	Broodstock	3C8.0000A9CC5D	-
BC008SR231003	10/10/2023	512	M	Broodstock	3C8.00009F01D4	-
BC009SR231010	10/10/2023	566	M	Broodstock	3C8.0000A1D638	-
BC010SR231011	10/11/2023	528	M	Broodstock	-	-
BC011SR231017	10/17/2023	598	M	Broodstock	3C8.0000A1B8DE	-
BC012SR231017	10/17/2023	622	M	Broodstock	3C8.0000A9AF99	-
NR013SR231018[X]	10/18/2023	684	F	Juvenile**	-	06.19.66
BC014SR231024	10/24/2023	460	F	Broodstock	-	-
BC015SR231024	10/24/2023	482	M	Broodstock	3C8.0000A1B876	-
BC016SR231026	10/26/2023	480	M	Broodstock	3C8.0000A9C9CE	-
BC017SR231030	10/30/2023	667	M	Broodstock	3C8.0000A9C5D7	-

*Released at Fremont Ford Bridge 2/28/2019

** Released at Fremont Ford Bridge 12/03/2020

[X]Should be NC, left as NR for consistency with stored sample.