Adult Spring-Run Chinook Salmon Monitoring and Trap and Haul in the San Joaquin River Restoration Area

2020 Monitoring and Analysis Report

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2020 Adult Spring-Run Chinook Salmon Monitoring and Trap and Haul in the San Joaquin River Restoration Area

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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 four individuals are qualified to review this work, and that they have peer reviewed this report.

Zachary Sutphin

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PI Signature

Contents

1.0 Introduction

1.1 Background

Historically, California's upper San Joaquin River (SJR) supported stable populations of spring-run Chinook Salmon (*Oncorhynchus tshawytscha;* Yoshiyama et al. 1998). Water management infrastructure erected on the SJR (i.e., Sack Dam, Mendota Dam, and Friant Dam) in support of expanding agricultural production in California's Central Valley blocked migrational pathways and access to suitable over summer holding and spawning habitat, which contributed to the extirpation of adult spring-run Chinook Salmon from the system (Moyle 2002). In response to the current state of Chinook Salmon, and other species in the upper SJR, a lawsuit was filed on the behalf of a coalition of environmental groups challenging the renewal of long-term water contracts. The 18-year lawsuit resulted in a settlement in which two primary goals were established: (1) to restore a naturally reproducing and self-sustaining population of Chinook Salmon as well as other fishes in the system (Restoration Goal), and (2) to reduce impacts on water supply to the contractors (Water Management Goal). The San Joaquin River Restoration Program (SJRRP) was established in an effort to achieve the goals of the settlement (http://www.restoresjr.net/) and is supported by collaborative groups of scientists and managers, from multiple state and federal implementing agencies. The SJRRP Fisheries Management Plan (SJRRP 2010) and Fisheries Framework (SJRRP 2018) define criteria for goals and objectives specific to re-establishing populations of Chinook Salmon in the SJRRP Restoration Area (RA; San Joaquin River from Merced River confluence to Friant Dam).

Strategies to reestablish spring-run Chinook Salmon within the SJRRP Restoration Area (as per SJRRP 2011) have included releases of translocated juvenile salmon sourced from Feather River as well as artificial propagation of spring-run Chinook Salmon produced from the Interim Salmon Conservation and Research Facility (SCARF), as permitted by the National Marine Fisheries Service (NMFS) under the authority of Section 10(a)(l)(A) of the Endangered Species Act of 1973. Releases of translocated juveniles occurred from 2014 through 2016, with the SJRRP relying solely on artificial propagation of spring-run Chinook Salmon as its primary strategy to reestablish juveniles since 2016. These efforts, and subsequent monitoring efforts, have provided evidence of adult spring-run salmon returning to the RA in 2017, 2019, and 2020 (Hutcherson et al. 2020; Sutphin et al. 2019). Until fish passage construction projects are complete, adult salmon returning to the RA will not have access to suitable holding and spawning habitat in the upper reaches of the RA during most water years. Therefore, enumerating, trapping, and truck-transporting adult salmon from the lower reaches to the upper reaches of the RA is necessary to permit evaluation of the majority of biological objectives for naturally returning salmonids established in the SJRRP Fisheries Framework (Table 7 in Fisheries Framework). Trap and haul efforts will continue until in-river fish passage structures are constructed, and volitional passage is achieved.

1.2 Objectives

The primary objective of this effort was to enumerate adult salmon in the RA, trap and haul the adults around in-river migration impediments and release them into upper reaches of the RA to support additional monitoring efforts (e.g., adult holding and spawning, fry emergence, and juvenile monitoring studies). This effort provides crude estimates of annual adult escapement, as well as immigration timing and factors effecting immigration. Capture, transport and release of naturally returning adult salmon into the upper reaches of the RA supports multiple efforts to quantify criteria specified in the Fisheries Framework, including, but not limited to: pre-spawn adult survival, adult holding and spawning habitat, female fecundity, egg survival to fry emergence, juvenile growth, survival rate, production, and diversity of juveniles exiting the RA (SJRRP 2017). Successful spawning and subsequent production of truck-transported individuals may help increase success of spring-run reintroduction if progeny are able to successfully emigrate and return as adults. In addition, coded wire tag, passive integrated transponder tag, and tissues collected for genetic analyses provide important information pertaining to age class, juvenile release date and release strategy, and familial genetics. Capture of adult spring-run salmon in the RA during their immigration period can expose fish to challenging environmental conditions, including, but not limited to, temperatures commonly exceeding thermal preference. Nonetheless, biologists working for the SJRRP will continue to evaluate salmon survival during these described processes and consider best scientific practices for fish handling and transport to maximize health and survival.

2.0 Materials and Methods

2.1 Study Area and Sampling Duration

Study Area– The SJRRP Restoration Area extends upstream approximately 150 river miles (RM) from the Merced River confluence (Stanislaus County) to Friant Dam (Fresno County; Figure 1). The Restoration Area is sub-divided into five reaches. Adult salmon monitoring occurred at various locations in the most downstream reaches (Reach 5 and 4B), and salmon were truck transported for release in the most upstream reach (Reach 1, Figure 1). Sampling was confined from the first in-river impediments to immigrating fish downstream to the confluence of the San Joaquin and Merced Rivers. In 2020, this was assumed to be the Eastside Bypass Control Structure (ESBP) downstream to the Merced River confluence. During 2020 adult salmon monitoring, traps were fished upstream of the Merced River confluence at the Hills Ferry Barrier, in Salt Slough, upstream of the Bear Creek confluence with the SJR at the Van Clief location, and downstream of the control structure in ESBP (Figure 1).

Sampling Duration – The first adult spring-run Chinook Salmon was captured and transported on April 16, 2020. Efforts continued daily through June 1, 2020, when sampling was suspended due to a combination of an extensive period without capturing salmon (9 days) and unsuitable river conditions for spring-run Chinook Salmon (i.e., low flows and elevated temperatures).

2.2 Sampling Equipment and Operation

Steel Fyke Trapping – When river conditions provide a narrowed and deep channel, steel fyke traps are the preferred sampling approach for capturing adult immigrating salmon in the RA. These traps can be maintained at elevated flows, provide a large area for captured fish to reside after capture, are less likely to contribute to fish entanglement, and are less prone to damage (and loss of samples) from debris and mammals. To adapt to varying site-specific depths, two different size fyke traps are used: 3.1 m diameter x 6.1 m long and 2.4 m diameter x 5.5 m length. Both styles are constructed primarily of chain link fence (5.1 cm mesh; Figure 2), and have a mouth opening (facing downstream) that constricts to a 0.9 m opening permitting fish to swim into the trap, while making it difficult to escape. Traps were deployed and retrieved from their sampling position in the river by a vehicle-mounted winch connected to a main line (0.64-cm steel cable) wrapped around the trap. This process was aided by additional safety guidelines (1.3-cm rope) wrapped around the front and back of the trap and controlled by individuals on the bank. During fish recovery, traps were rolled to a stable location, maintaining enough depth (> 0.3 m) to provide water for trapped fish. Swinging doors permit entrance into the traps to remove fish using large dip-nets. The fyke traps were generally fished continuously, and were checked, at a minimum, once daily.

Fyke Netting –The nets are constructed of a 1.2 or 1.8 m square entry, followed by a series of three circular compartments, with 2.4 cm square no. 252 knotless nylon mesh. A mesh-constructed partition separates three internal circular compartments that taper to a 25-cm opening, reducing the possibility of fish escaping the net after capture. Wing-walls (1.2 or 1.8 m high) were extended bank to bank in a v-shaped pattern downstream and were used to guide upstream-moving fish into the net (Figure 3). Fyke-nets were anchored with t-posts driven into the substrate. Nets were checked at least once daily for fish, net scour, and damage, were cleaned to prevent debris buildup, were reset and repaired, as necessary.

Marker buoys were placed up- and downstream of all in-river sampling equipment, and flashing amber lights were placed in close proximity to alert boaters of the presence of sampling gear. Water temperature (°C), dissolved oxygen (DO, mg/L) and turbidity (NTU) were measured at each site daily during sampling using a handheld multiparameter instrument. In addition, HOBO TidbiT temperature loggers (Onset; Bourne, MA) were installed at all sampling locations in early May to get a more precise estimate (temperature recorded in 30 min intervals) of site-specific thermal trends.

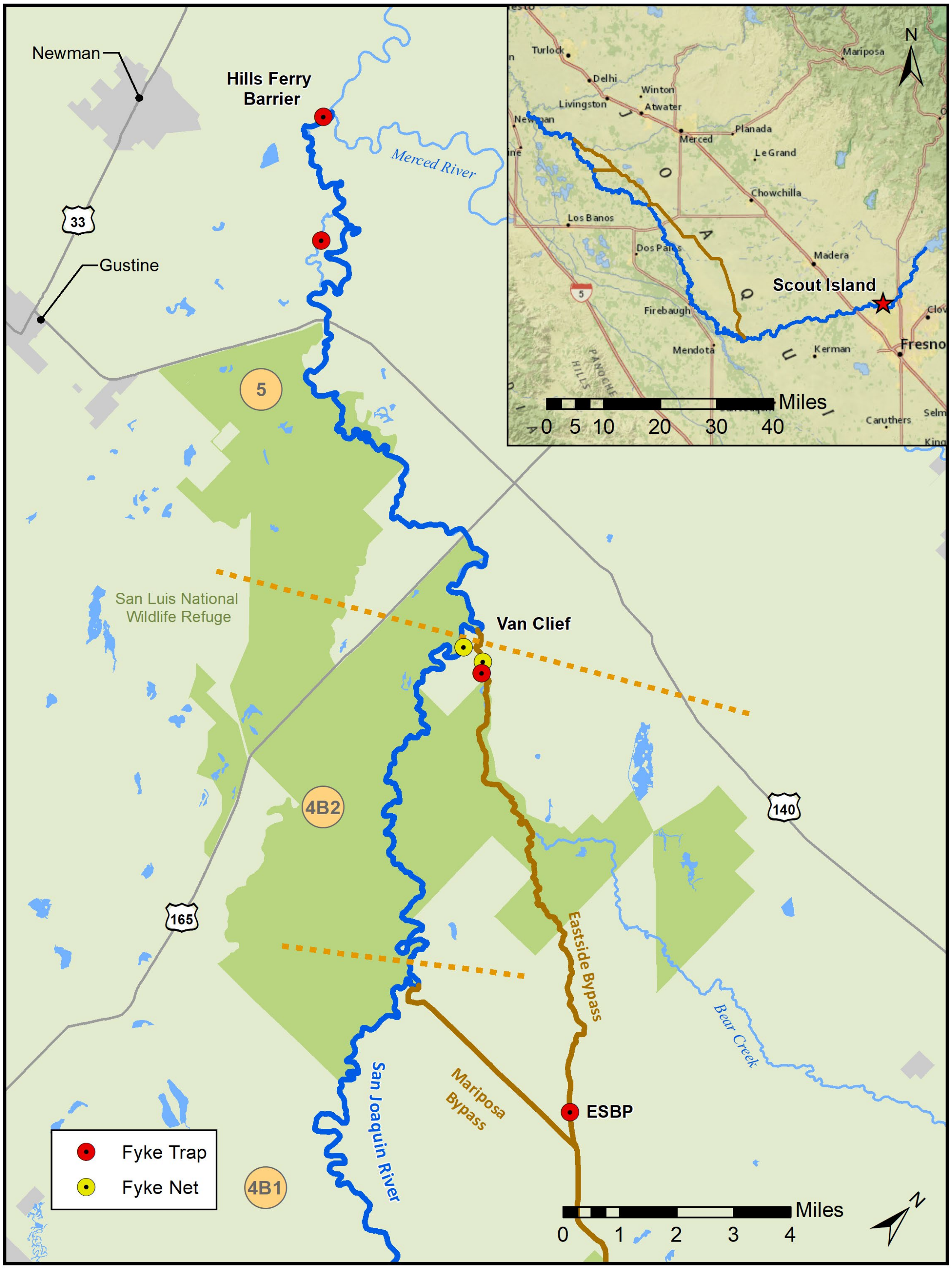

Figure 1.— Map of the San Joaquin River Restoration Program Restoration Area showing adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) monitoring locations in Reaches 4–5 and the primary release locations in Reach 1 (insert). Reaches are denoted in orange-yellow circles and defined by orange-yellow dotted lines.

Figure 2.— Steel fyke trap used to monitor for adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) in the San Joaquin River Restoration Program Restoration Area (Eastside Bypass trap location left image, Hills Ferry Barrier location right image).

Figure 3.— Mesh fyke net used to monitor for adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) at the Van Clief location in the San Joaquin River Restoration Program Restoration Area.

2.3 Fish Processing, Transport, and Release

Fish Processing – If Chinook Salmon were present in a sample, they were removed prior to any bycatch. Salmon were transferred; one at a time using plastic-coated dip nets, from the trap to a portable insulated Chiller Fish Bag™ (100(L)×40(H)×25(Base) cm) filled at least ½ full of water (river or transport water buffered to within ~4 degrees of on-site temperature). This method allowed fish to remain in water during processing to minimize handling stress. Adult salmon captured were transferred to the fish-haul tank and were processed post-transport at the release site. Salmon processing included collecting a fin-clip from the dorsal or caudal fin for DNA analysis, recording fork (FL) and total length (TL, mm), checking for presence/absence of adipose fin, passive integrated transponder (PIT) tag, and coded wire tag, and making notes on general condition (Figure 4). Identification of fish sex was not attempted released individuals because sexually dimorphic characteristics, observed in fall-run Chinook Salmon, were not distinct in captured spring-run Chinook Salmon. Additionally, all salmon released to Reach 1 of the RA were externally marked with a set of uniquely identifiable spaghetti tags (Hallprint Fish Tags; Hindmarsh Valley, South Australia) affixed below the dorsal fin (Figure 4), and intragastrically implanted with an acoustic transmitter (V9, 69 kHz transmitter; VEMCO, Bedford, Nova Scotia) and a 23-mm low frequency half-duplex PIT tag (LF HDX+ PIT tag; Oregon RFID, Portland, Oregon). A balling gun, coated in food-grade glycerin was used to place the acoustic transmitter and PIT tag in the salmon, and all tags were verified active prior to insertion (Figure 4). Acoustic and PIT tags were used to track and identify salmon in Reach 1 following their transport and release, supporting adult over-summer holding, survival, and spawning studies. Bycatch (all non-salmonids) were measured (TL, mm) and released upstream of the nets and traps to minimize likelihood of immediate recapture. Recovered salmon mortalities were processed, sexed, and transferred to a freezer and coded wire tags were recovered at a later date by California Department of Fish and Wildlife staff. Additional samples, including eye lenses, egg masses, and otoliths were recovered and frozen from some individuals for future analyses if deemed important.

Figure 4.— Adult Chinook Salmon (*Oncorhynchus tshawytscha*) were checked for presence/absence of coded wire tags using a T-Wand CWT detector (upper left image), provided an external tag (upper right image) and an internal acoustic transmitter and passive integrated transponder tag (lower left image), and measured for fork and total length (lower right image) prior to release.

Fish Transport - Following capture, spring-run Chinook Salmon were placed in a tank (1.9–3.0 m^3) for transport to Reach 1. Transport water was collected from facilities at Friant Dam, and was tempered to ~4°C below capture temperature using water from the capture location(s). For example, salmon captured in 21°C SJR water would be immediately transferred and transported in 17°C water. Salt was added to the transport tank at approximately 6–10 ppt to alleviate osmotic imbalance and stress-related effects. Oxygen was supplied via a compressed-gas cylinder and regulator in an effort to maintain dissolved oxygen levels ≥ 8 mg/L.

Multiple in-tank agitators were used to assist with oxygenation and water mixing, but primarily to promote degassing of carbon dioxide which can be harmful to fish at elevated levels (Westers 2001). Water quality (water temperature [°C], salinity [ppt], and dissolved oxygen [mg/L]) was collected with a handheld multiparameter instrument before loading fish and immediately prior to fish release. The tank was checked at least once during transport to ensure the oxygen and agitator systems were operational.

Fish Release – Prior to release, water temperature in the transport tank was tempered to within ~2°C of release site temperature using water from the release location at a rate not exceeding ~2°C/hour. On April 16, 2020, adult salmon were truck-transported and released at the Highway 99 location in Reach 1. However, given the thermal parameters for release (<19°C) selected by the SJRRP Fisheries Management Work Group, the release location was moved to Scout Island for the remainder of the season (Figure 1). After tempering, fish were processed (*see Fish Processing*), moved to the river in an insulated Chiller Fish Bag™ filled at least ½ full with transport tank water to minimize stress and atmospheric exposure, and permitted time to recover until they were able to swim away under their own volition (Figure 5).

Figure 5.— Adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) being released into Reach 1 of the San Joaquin River Restoration Program's Restoration Area.

3.0 Results and Discussion

Fifty-seven adult spring-run Chinook Salmon were captured during 2020 monitoring efforts, resulting in the second season of successfully trapping and hauling adult spring-run Chinook Salmon in the RA (23 adult spring-run salmon were captured in 2019; Figure 6). The 2020 water year was classified as "dry", considerably different than the "wet" 2019 year, indicating adult spring-run salmon successfully immigrated through the SJR and into the RA in less-than-optimal conditions. Based on initial fish capture, the beginning of immigration into the RA in both 2019 and 2020 occurred in early April (Figure 6). Unlike 2019, when it was likely adult salmon were still immigrating through the RA when sampling equipment was removed (Sutphin et al. 2019), weekly capture distribution and elevated late-season temperatures suggest the full immigration period was likely encompassed during 2020 activities. The most upstream fyke trap at ESBP span most of the river width (see Figure 2). Therefore, it is assumed the majority of salmon immigrating through Reach 4 of the RA towards the spawning reach are captured during conditions when flood releases are not being moved through the ESBP. Nonetheless, current adult escapement estimates are based solely on enumerating captured adults and gear efficiency estimates that would provide measurement error for such estimates are not currently incorporated in the study design.

Of the 57 adult salmon captured, 48 were tagged and released into Reach 1 of the RA. Adult salmon provided acoustic and PIT tags released into Reach 1 supported additional monitoring efforts necessary to track restoration efforts related to salmon population metrics defined in the SJRRP Fisheries Framework (SJRRP 2017). Eight salmon succumbed to mortality during truck-transport (Table 1). Three of these individuals were captured in the Van Clief fyke net (of the 12 captured at this location), and five of these mortalities were captured in an ESBP fyke trap (of the 45 captured at this location). In addition, a single mort was found impinged upstream of the wingwall at the Van Clief net on May 13, 2020. This individual appeared to have been dead for a period of time and apparently floated downstream into the net. No tissues were sampled from this individual due to its decayed condition. Percent of combined truck-transport induced and in-trap mortalities in 2020 (14%) were similar to 2019 (13%). With only two years of sampling, low sample sizes per year, and given these efforts are not designed to test what is affecting survivability, it is difficult to tease out contributing factors. However, mortality tended to occur throughout the sample season (see Table 1) and across both sites where fish were captured. Interestingly, similar capture and transport methods used to transport over 2,600 adult fall-run Chinook Salmon by the SJRRP between 2012 and 2016 resulted in lower mortality (0.3 – 7.0% across years; Root et al. 2017). Immigration timing of fall-run Chinook Salmon (fall through early-winter) exposes them to cooler river temperatures (Root et al. 2017). Therefore, it is assumed elevated water temperatures during spring-run Chinook Salmon capture and transport are likely affecting survival, and biologists working for the SJRRP should continue to explore ways to maximize survival of salmon exposed to suboptimal conditions.

Of the 56 tissue samples collected during 2020 adult trap and haul efforts, genetic analysis classified all individuals as spring-run fish: 50 were identified as SCARF fish and 6 were identified as Feather River Hatchery fish. In addition, 37 of these individuals were identified to sex. Twenty of these were female and the remaining 17 were genetically identified as male (1.2:1 female:male ratio). Interestingly, the sex ratio of naturally-returning adult salmon recovered during 2019 redd and carcass surveys in Reach 1 of the RA (2.4:1, n = 147, unpublished USFWS data) and during 2019 adult trap and haul efforts (2:1, n = 18) were skewed high towards females. Significant sex ratio imbalances can adversely affect genetic health of a population, particularly a smaller population in the infancy of being established (Frankham et al. 2002). This assessment is based on a small sample size and predominantly one year of returning adult salmon. Regardless, biologists working for the SJRRP should continue to quantify sex ratio, study the varying reasons gender imbalances may exist in salmon populations (Craig et al. 1996; Holtby and Healy 1990; Nagler et al. 2001), and consider mitigative measures if this trend persists.

Size distribution of captured adult salmon is reported in Figure 7. The combination of recovered CWT (n = 8 [from recovered mortalities]) and previously PIT tagged fish (n = 2) indicate 80% of adults (n = 8) were age-3 (brood year 2017) and 20% (n = 2) were age-4 (brood year 2016) returning adults, providing evidence for the second straight year (brood year 2015 and 2016 fish returned in 2019), of multiple spring-run Chinook Salmon cohorts returning to the RA in a single season. This is promising for re-establishing a population of spring-run Chinook Salmon in the RA, as one of the key characteristics of a healthy and complex salmon population is the annual return of multiple age classes (CRITFC 1995). Additionally, data recovered from CWT and PIT tags proved multiple juvenile releases strategies can be successful, as recovered adults were initially released on different occasions as both parr/smolts and larger yearlings. One of the returning adult salmon (CWT 06_14_38, brood year 2017) was identified as a fish released as a juvenile in Reach 1 of the RA, indicating the first recent evidence of a spring-run Chinook Salmon emigrating from the upper most reach of the RA, surviving to adulthood, and successfully returning as an adult.

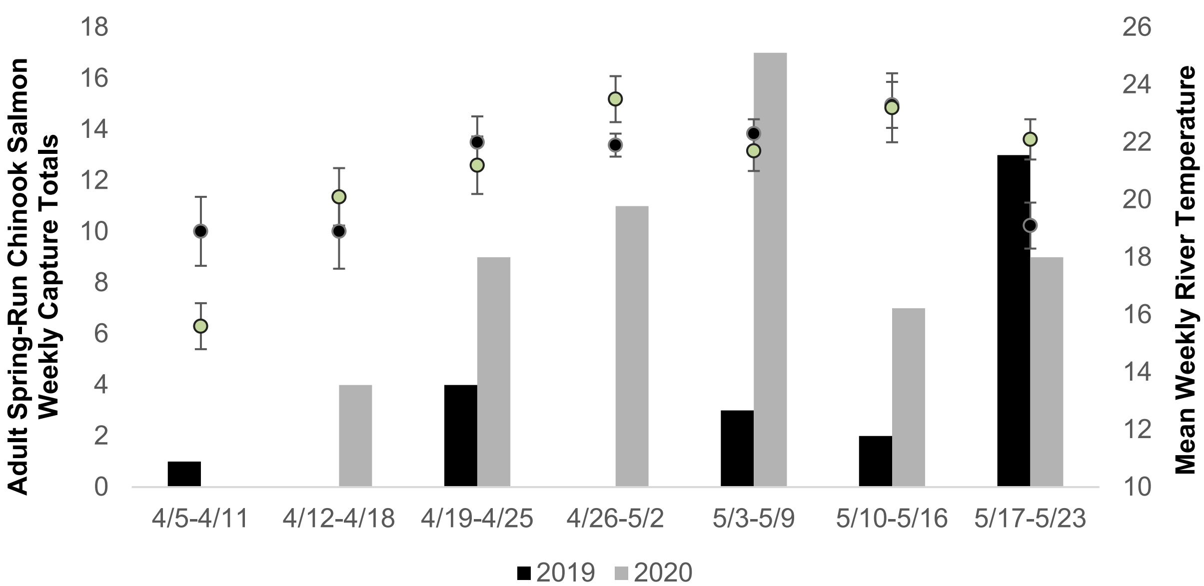

Figure 6.— Weekly capture of adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) during 2019 and 2020 monitoring efforts in the San Joaquin River Restoration Program's Restoration Area. Mean 2019 (dark grey) and 2020 (light grey) weekly river temperature (+/- 1 standard deviation) at the Stevinson gauging station (SJS, CDEC) is reported on the secondary y-axis.

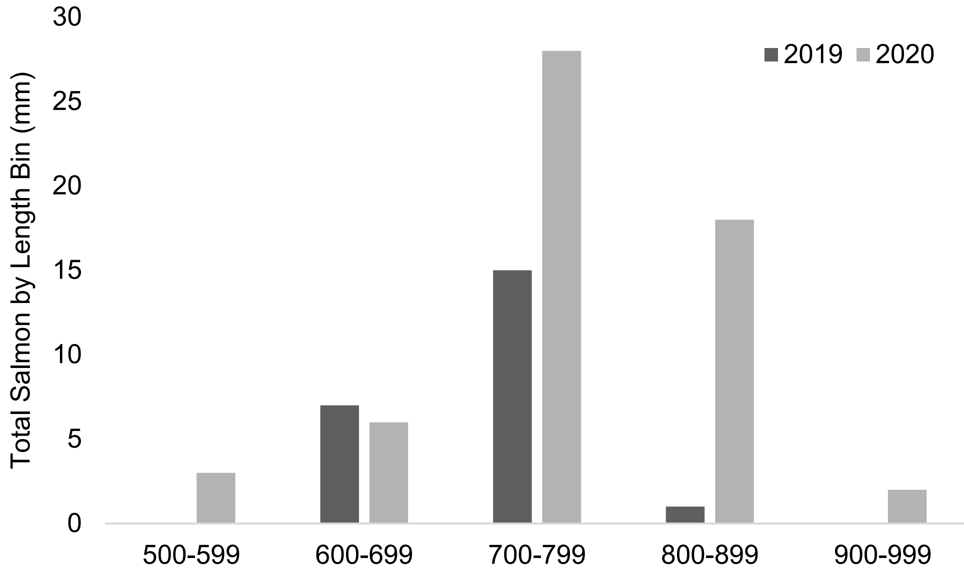

Figure 7.— Size distribution of adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) during 2019 and 2020 monitoring activities in the San Joaquin River Restoration Program's Restoration Area.

Similar, to 2019 adult spring-run monitoring and trap and haul efforts (Sutphin et al. 2019), water temperatures were above optimal for the majority of the salmon immigration period. Mean monthly water temperatures at most capture locations were within the critical range (17–20°C) for adult Chinook Salmon migration (EPA Region 10 2003, SJRRP 2017, Table 3). In general, the coolest water temperatures were observed at the most upstream sample site (ESBP), with the warmest temperatures and highest conductivity levels observed at the Mud Slough location (Table 3, Figure 8).

Beginning April 28, 2020 adult monitoring and trap and haul sample efforts were shifted from all described locations to fishing multiple traps at the ESBP and the Van Clief locations. This was done in an effort to expose captured salmon to the coolest river temperatures and minimize transportation duration, thereby minimizing duration of exposure to stressors. In addition, since these locations, primarily ESBP, contributed to the majority of adult salmon captured through 2019 and early-2020 sampling, it was assumed this effort would not significantly affect total capture of adult spring-run Chinook Salmon in the RA. A similar sampling approach, whereby efforts transition from being widely dispersed across multiple immigration routes, early in the season, to most upstream locations as temperatures warm, is recommended for future efforts. Early season efforts should be long enough, at least two weeks from first observed salmon, to determine the extent which alternate immigration pathways in the lower reaches of the RA (e.g., Mud Slough) are being used. Regardless of approach, trapping adult salmon in the lower reaches of the RA during the adult spring-run immigration period is likely to expose fish to elevated temperatures outside of optimal (optimal < 15°C, SJRRP 2017), and continued efforts should be evaluated to maximize health and survival. In addition, Biologists working for the SJRRP should seek to better understand how thermal conditions in the SJR may be impacting adult immigration, as temperatures observed during the current study often exceeded levels that reportedly contribute to cessation of immigration in adult spring-run Chinook Salmon (McCullough et al. 2001).

Across all sampling locations and methods, 564 non-salmonids (bycatch) were captured during adult spring-run monitoring and rescue efforts (Appendix A). Bycatch was dominated by non-native species, including Striped Bass (*Morone saxatilis*, n = 192), Common Carp (*Cyprinus carpio*, n = 110), Channel Catfish (*Ictalurus punctatus*, n = 86), and Black Crappie (*Pomoxis nigromaculatus*, n = 79). Native non-salmonids captured during this effort included Sacramento Sucker (*Catostomus occidentalis*, n = 11), Sacramento Blackfish (*Orthodon microlepidotus*, n = 1), Sacramento Splittail (*Pogonichthys macrolepidotus*, n = 1), and Sacramento Pikeminnow (*Ptychocheilus grandis*, n = 1).

Table 1.— Capture date, location and method, as well as other recorded characteristics for all spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) captured during 2020 adult spring-run Chinook Salmon monitoring and trap and haul. Salmon with ID SJRRP2020ADULT005 was captured and released alive, but later found in dead in a rotary screw trap at the Highway 99 location.

Sample ID	Date of Capture	Location	Method	FL (mm)	TL (mm)	Condition	Acoustic Tag ID	Floy Tag	Gastric PIT	Release Location
SJRRP2020ADULT001	4/16/2020	Eastside Bypass	Fyke Trap	785	840	Good	35108	0001/0002	180984134	HWY 99
SJRRP2020ADULT002	4/16/2020	Eastside Bypass	Fyke Trap	770	810	Poor	#N/A	0003/0004	180984133	HWY 99
SJRRP2020ADULT003	4/17/2020	Eastside Bypass	Fyke Trap	723	770	Good	10322	0005/0006	180984130	Scout Island
SJRRP2020ADULT004	4/18/2020	Eastside Bypass	Fyke Trap	770	826	Good	#N/A	0007/0008	180984132	Scout Island
SJRRP2020ADULT005	4/19/2020	Eastside Bypass	Fyke Trap	816	880	Mortality	10320	0009/0010	180984135	Scout Island
SJRRP2020ADULT006	4/20/2020	Eastside Bypass	Fyke Trap	758	792	Good	10321	0011/0012	180984137	Scout Island
SJRRP2020ADULT007	4/20/2020	Eastside Bypass	Fyke Trap	710	758	Good	10319	0013/0014	180984136	Scout Island
SJRRP2020ADULT008	4/21/2020	Van Clief	Fyke Net	636	688	Fair	10318	0015/0016	180984138	Scout Island
SJRRP2020ADULT009	4/21/2020	Eastside Bypass	Fyke Trap	737	782	Good	10317	0017/0018	180984139	Scout Island
SJRRP2020ADULT010	4/22/2020	Eastside Bypass	Fyke Trap	695	745	Fair	10316	0019/0020	180984140	Scout Island
SJRRP2020ADULT011	4/23/2020	Eastside Bypass	Fyke Trap	760	810	Good	10315	0021/0022	180984141	Scout Island
SJRRP2020ADULT012	4/24/2020	Van Clief	Fyke Net	793	850	Mortality	#N/A	23	#N/A	CDFW
SJRRP2020ADULT013	4/25/2020	Van Clief	Fyke Net	700	750	Good	10314	0024/0025	180984142	Scout Island
SJRRP2020ADULT014	4/26/2020	Eastside Bypass	Fyke Trap	595	640	Good	10313	0026/0027	180984143	Scout Island
SJRRP2020ADULT015	4/27/2020	Eastside Bypass	Fyke Trap	720	775	Good	10312	0028/0029	180984144	Scout Island
SJRRP2020ADULT016	4/27/2020	Van Clief	Fyke Net	630	675	Good	#N/A	0030/0031	180984145	Scout Island
SJRRP2020ADULT017	4/29/2020	Eastside Bypass	Fyke Trap	760	810	Good	10311	0032/0033	180984146	Scout Island
SJRRP2020ADULT018	4/29/2020	Eastside Bypass	Fyke Trap	715	765	Good	10310	0034/0035	180984147	Scout Island
SJRRP2020ADULT019	4/30/2020	Eastside Bypass	Fyke Trap	750	790	Good	10309	0036/0037	180984148	Scout Island
SJRRP2020ADULT020	5/1/2020	Eastside Bypass	Fyke Trap	735	775	Fair	10307	0038/0039	180984149	Scout Island
SJRRP2020ADULT021	5/2/2020	Eastside Bypass	Fyke Trap	707	765	Good	10308	0040/0041	180984150	Scout Island
SJRRP2020ADULT022	5/2/2020	Eastside Bypass	Fyke Trap	785	853	Good	10302	0042/0043	180984151	Scout Island
SJRRP2020ADULT023	5/2/2020	Eastside Bypass	Fyke Trap	580	625	Fair	10300	0044/0045	#N/A	Scout Island
SJRRP2020ADULT024	5/2/2020	Eastside Bypass	Fyke Trap	908	970	Good	10301	0046/0047	180984152	Scout Island
SJRRP2020ADULT025	5/3/2020	Eastside Bypass	Fyke Trap	780	825	Good	10303	1001/1002	180984153	Scout Island
SJRRP2020ADULT026	5/3/2020	Eastside Bypass	Fyke Trap	748	790	Good	10304	1003/1004	180984154	Scout Island
SJRRP2020ADULT027	5/4/2020	Eastside Bypass	Fyke Trap	690	745	Good	10305	1005/1006	180984155	Scout Island
SJRRP2020ADULT028	5/4/2020	Eastside Bypass	Fyke Trap	702	760	Good	10306	1007/1008	180984156	Scout Island
SJRRP2020ADULT029	5/4/2020	Eastside Bypass	Fyke Trap	790	853	Good	17954	1009/1010	180984157	Scout Island

Table 1 (Continued).— Capture date, location and method, as well as other recorded characteristics for all spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) captured during 2020 adult spring-run Chinook Salmon monitoring and trap and haul.

Sample ID	Date of Capture	Location	Method	FL (mm)	TL (mm)	Condition	Acoustic Tag ID	Floy Tag	Gastric PIT	Release Location
SJRRP2020ADULT030	5/4/2020	Eastside Bypass	Fyke Trap	785	835	Good	17955	1011/1012	180984158	Scout Island
SJRRP2020ADULT031	5/5/2020	Van Clief	Fyke Net	719	742	Good	17957	1013/1014	180984159	Scout Island
SJRRP2020ADULT032	5/5/2020	Eastside Bypass	Fyke Trap	665	712	Good	17958	1015/1016	180985012	Scout Island
SJRRP2020ADULT033	5/6/2020	ESBP Upstream	Fyke Trap	795	852	Good	17959	1017/1018	180985024	Scout Island
SJRRP2020ADULT034	5/6/2020	ESBP Upstream	Fyke Trap	605	648	Mortality	#N/A	#N/A	#N/A	CDFW
SJRRP2020ADULT035	5/6/2020	Van Clief	Fyke Net	682	731	Mortality	#N/A	#N/A	#N/A	CDFW
SJRRP2020ADULT036	5/6/2020	Van Clief	Fyke Net	734	762	Mortality	#N/A	#N/A	#N/A	CDFW
SJRRP2020ADULT037	5/7/2020	ESBP Downstream	Fyke Trap	740	805	Good	17960	1019/1020	180985011	Scout Island
SJRRP2020ADULT038	5/7/2020	ESBP Downstream	Fyke Trap	705	756	Mortality	#N/A	#N/A	#N/A	CDFW
SJRRP2020ADULT039	5/8/2020	ESBP Upstream	Fyke Trap	748	794	Good	17963	1023/1024	180985014	Scout Island
SJRRP2020ADULT040	5/8/2020	ESBP Downstream	Fyke Trap	849	909	Poor	#N/A	1025/1026	#N/A	Scout Island
SJRRP2020ADULT041	5/9/2020	ESBP Upstream	Fyke Trap	760	809	Good	17962	1027/1028	180985041	Scout Island
SJRRP2020ADULT042	5/12/2020	ESBP Upstream	Fyke Trap	676	732	Good	17961	1029/1030	180985040	Scout Island
SJRRP2020ADULT043	5/12/2020	ESBP Upstream	Fyke Trap	750	803	Mortality	#N/A	1031	#N/A	CDFW
SJRRP2020ADULT044	5/13/2020	Van Clief	Hand Net	683	730	Mortality	#N/A	#N/A	#N/A	#N/A
SJRRP2020ADULT045	5/14/2020	ESBP Upstream	Fyke Trap	473	502	Good	17956	1032/1033	#N/A	Scout Island
SJRRP2020ADULT046	5/16/2020	Van Clief	Fyke Net	730	779	Good	10320	1034/1035	180985028	Scout Island
SJRRP2020ADULT047	5/16/2020	ESBP Upstream	Fyke Trap	692	752	Good	17974	1036/1037	180985004	Scout Island
SJRRP2020ADULT048	5/16/2020	ESBP Downstream	Fyke Trap	660	708	Good	17972	1038/1039	180985043	Scout Island
SJRRP2020ADULT049	5/17/2020	Van Clief	Fyke Net	469	507	Good	17970	1040/1041	#N/A	Scout Island
SJRRP2020ADULT050	5/17/2020	Van Clief	Fyke Net	765	830	Good	17971	1042/1043	18098518	Scout Island
SJRRP2020ADULT051	5/17/2020	ESBP Upstream	Fyke Trap	730	760	Mortality	#N/A	1044	#N/A	CDFW
SJRRP2020ADULT052	5/17/2020	Van Clief	Fyke Net	558	592	Good	17973	1045/1046	#N/A	Scout Island
SJRRP2020ADULT053	5/18/2020	ESBP Upstream	Fyke Trap	595	625	Good	17969	1047/1048	#N/A	Scout Island
SJRRP2020ADULT054	5/19/2020	ESBP Upstream	Fyke Trap	705	759	Good	17968	1049/1050	180985005	Scout Island
SJRRP2020ADULT055	5/21/2020	ESBP Downstream	Fyke Trap	759	813	Mortality	#N/A	1051	#N/A	CDFW
SJRRP2020ADULT056	5/22/2020	ESBP Upstream	Fyke Trap	760	822	Good	17967	1052/1053	180985030	Scout Island
SJRRP2020ADULT057	5/23/2020	ESBP Upstream	Fyke Trap	740	796	Good	17964	1054/1055	180985003	Scout Island

Table 2.— Site-specific water quality (mean ± 1 standard deviation) during April and May 2020 adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) monitoring and trap and haul in the San Joaquin River (SJR).

Location	Month	Temp. (°C):	DO (mg/L):	Cond. (µS/cm):	Turb. (NTU):
Hills Ferry Barrier	April	20.2 ± 2.6	9.5 ± 1.1	1560.8 ± 410.4	102.7 ± 54.1
	May	NA	NA	NA	NA
Mud Slough	April	21.0 ± 2.5	9.9 ± 1.3	2965.5 ± 299.7	89.7 ± 47.0
	May	25.9	8.5	4225.0	NA
Van Clief (SJR)	April	20.6 ± 2.1	10.6 ± 1.8	1379.5 ± 128.5	43.4 ± 21.1
	May	23.0 ± 2.1	9.0 ± 2.0	1835.9 ± 234.1	NA
Van Clief (ESPB)	April	20.3 ± 2.2	9.3 ± 1.0	524.2 ± 130.4	93.2 ± 45.9
	May	22.2 ± 1.9	8.2 ± 0.6	492.6 ± 50.3	NA
Eastside Bypass (ESPB)	April	19.6 ± 2.3	9.1 ± 1.0	512.0 ± 53.0	90.5 ± 48.0
	May	21.2 ± 1.9	8.2 ± 0.4	428.5 ± 87.3	NA

Figure 8.— Water temperature at the most downstream (Hills Ferry Barrier, HFB) and upstream (Eastside Bypass, ESPB) sampling locations, as well as Mud Slough, during 2020 adult spring-run Chinook Salmon monitoring and trap and haul (SMN and EBM California Data Exchange Center Gauging Station Data, cdec.water.gov).

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5.0 Appendix

5.1 Appendix A— Summary of non-salmonids (bycatch)

Table A-1.— Bycatch totals for non-salmonids captured during 2020 adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) monitoring and trap and haul.

Species	April	May	Mean (± SD) Total Length (mm)
American Shad (*Alosa sapidissima*)	0	1	367
Black Crappie (*Pomoxis nigromaculatus*)	33	46	260 ± 35
Bullhead Spp. (*Ameiurus spp.*)	1	0	274
Channel Catfish (*Ictalurus punctatus*)	48	38	535 ± 109
Common Carp (*Cyprinus carpio*)	49	61	492 ± 148
Goldfish (*Carassius auratus*)	3	5	341 ± 40
Largemouth Bass (*Micropterus salmoides*)	29	13	409 ± 43
Redear Sunfish (*Lepomis microlophus*)	1	3	211 ± 13
Sacramento Blackfish (*Orthodon microlepidotus*)	1	0	400
Sacramento Pikeminnow (*Ptychocheilus grandis*)	0	1	565
Sacramento Splittail (*Pogonichthys macrolepidotus*)	0	1	174
Sacramento Sucker (*Catostomus occidentalis*)	3	8	383 ± 31
Spotted Bass (*Micropterus punctulatus*)	5	16	399 ± 62
Striped Bass (*Morone saxatilis*)	66	126	470 ± 96
Threadfin Shad (*Dorosoma petenense*)	2	0	137 ± 4
White Catfish (*Ameiurus catus*)	2	2	374 ± 31
Total	243	321	