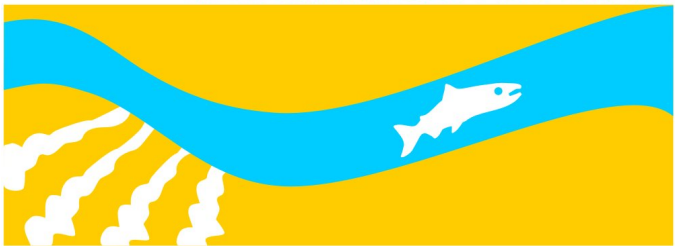
Adult Spring-Run Chinook Salmon Monitoring, Trap and Haul, and Rescue Actions in the San Joaquin River Restoration Area

2019 Monitoring and Analysis Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM



ENV-2019-088

2019 Adult Spring-Run Chinook Salmon Monitoring, Trap and Haul and Rescue Actions 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:

Name	Affiliation	Phone Number
Hilary Glenn	NMFS	916-930-3720
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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 proposal.

Zachary Sutphin

PI Signature

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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 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.

Strategies to reestablish spring-run Chinook Salmon within the SJRRP Restoration Area (RA; San Joaquin River from Merced River confluence to Friant Dam) 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. The SJRRP released approximately 60,114 (brood year 2013), 54,839 (brood year 2014), 104,880 (brood year 2015), and 89,150 (brood year 2016) fish into the lower reaches of the Restoration Area in 2014, 2015, 2016, and 2017 respectively. Releases in 2014 through 2016 were completed just upstream of the Merced River confluence, the most downstream section of the RA, and releases in 2017 were completed further upstream in the RA, in Eastside Bypass near Harmon Road. To determine the efficacy of these efforts, and to evaluate spawning and production of returning adults, the SJRRP conducts adult spring-run return monitoring annually. When adult spring-run are detected during monitoring, trap and haul protocols are triggered to transport adult salmon around instream migrational barriers for release and additional monitoring in rearing and spawning habitats. Trap and haul efforts will continue until in-river fish passage structures are constructed, and volitional passage is achieved.

1.2 Objectives

The objective of this effort was to identify returning adult spring-run Chinook Salmon through passive (i.e., Vaki Camera Monitoring) or active (i.e., fyke trapping or netting) monitoring in the lower reaches of the RA. Once detected, the objective was to quantify the number of 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).

The upper thermal threshold (22°C) limit in the SJRRP adult spring-run monitoring Section 10(a)(l)(A) permit was exceeded in late-April 2019, at which point sampling was suspended. Based on capture data, it was assumed there were still adult spring-run Chinook Salmon immigrating into the RA that would be stranded in locations with insufficient holding or spawning habitat.

On May 3, 2019 a formal letter was issued by the NMFS and supported by the SJRRP, pursuant to Section 4(d) of the ESA, specifically Limit Number 3 to the 4(d) Rule regarding Rescue and Salvage Actions. Limit Number 3 of the 4(d) Rule "relieves certain agencies and official personnel (or their designees) from the take prohibitions when they are acting to aid an injured or stranded fish…". Once this letter was issued, efforts to recover fish from inhospitable habitats for translocation to suitable habitats in upper reaches of the RA were continued. This action permitted the accumulation of information to improve capture, handling, transport and release protocols for adult spring-run salmon, allowing recovery of additional tissue samples and/or coded wire tags to determine fish origin, and provided the foundation for further monitoring efforts in upstream reaches of the RA.

2.0 Materials and Methods

2.1 Study Area and Sampling Duration

Study Area– Adult monitoring took place in the SJRRP Restoration Area, which ranges 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 by the first in-river impediments to immigrating fish downstream to the confluence of the San Joaquin and Merced Rivers. In 2019 this was assumed to be downstream of Sack Dam and Eastside Bypass Control Structure (ESBP).

Sampling Duration – The first adult spring-run Chinook Salmon detected in the RA was observed during the SJRRP Steelhead Monitoring Plan (SMP; December–April). For the sake of this effort, we will define the Adult Monitoring/Trap and Haul sample season from when the first adult spring-run Chinook Salmon was detected (April 9; during SMP) until completion of

sampling (May 21). Adult Monitoring/Trap and Haul was completed April 9–24, at which time water temperatures in Reach 5 exceeded upper thermal limits as defined in the SJRRP spring-run Chinook Salmon 10(a)(l)(A). Fish rescue and salvage under Limit No. 3 of the 4(d) Rule occurred from May 5 to May 21. Sampling ceased in late May as a result of flood flows which negated access to some sample sites and contributed to unsuitable conditions for monitoring at other sites.

2.2 Sampling Equipment and Operation

Elevated flows and excessive river depths during sampling negated the usefulness of some proposed sample techniques, including Vaki Riverwatcher fish monitoring, and, in most cases, four and six ft wide mesh fyke nets. As a result, larger steel fyke traps were the most commonly used tool for adult spring-run Chinook Salmon monitoring. During the fish rescue and salvage effort, spot checks by boat and vehicle were completed to identify carcasses or live fish at terminal ends of irrigation canals and ditches.

Steel Fyke Trapping – The fyke traps are approximately 6.1 m long and 3.1 m in diameter (diameter of the primary first open entrance to the trap mouth), and constructed primarily of chain link fence (5.1 cm mesh; Figure 2). The 3.1 m diameter mouth opening (facing downstream) is constricted to a 0.9 m opening permitting fish to swim into the trap, while making it difficult to escape. At each sample site, multiple (3-4) t-posts were driven into the embankment slope to facilitate anchoring, and retrieval of the fyke traps (see Figure 2). Traps were deployed and retrieved from their sampling position in the river by a hitch-mounted winch with a guideline connected to a main line (0.64-cm steel cable) wrapped around the trap. This process was aided by additional 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 location with water depth that allowed access, but maintained enough depth (> 0.3 m) to provide water for trapped fish. Three 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. During 2019 adult salmon monitoring, traps were fished upstream of the Merced River confluence at the Hills Ferry Barrier location, downstream of the Bear Creek confluence at the Van Clief location and downstream of the control structure in ESBP (Figure 1).

Fyke Netting – On occasion during 2019 sampling, water levels were low enough to permit the use of fyke nets. Fyke nets were deployed April 10–17 and May 11–14 downstream of Sack Dam and May 9 and 14 in Salt Slough near the San Luis National Wildlife Refuge (Figure 1). 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—this reduces the possibility of fish escaping the net after capture. Wing-walls (1.2 or 1.8 m high) extended in a v-shaped pattern downstream and were used to guide upstream-moving fish into the net (Figure 3). Fyke-nets were secured to 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, and were reset and repaired as necessary.

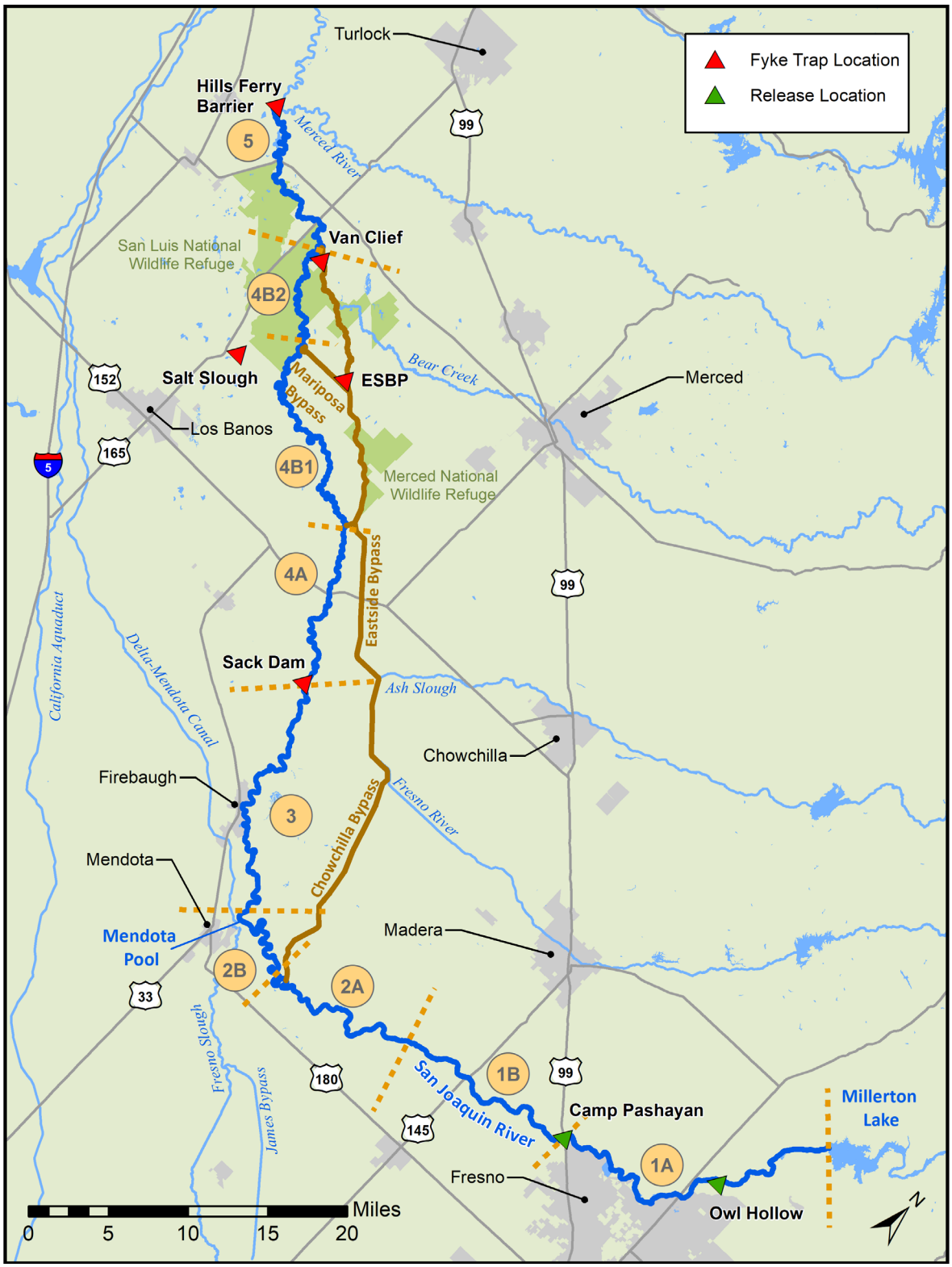

Figure 1.— Map of the San Joaquin River Restoration Program Restoration Area showing adult spring-run Chinook Salmon monitoring locations in Reaches 4-5 and release locations in Reach 1. Reaches are denoted in orange-yellow circles and defined by orange-yellow dotted lines.

Marker buoys were placed up- and downstream of all in-river fish 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, temperature loggers (HOBO) were installed at all sampling locations in early May to get a more precise estimate of site-specific thermal trends.

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).

Spot Checks and Carcass Recovery – Past sampling efforts indicated a portion adult fall-run Chinook Salmon immigrating into Reach 5 strayed into sloughs (Mud and Salt Slough) and ultimately accessed terminal ends of smaller irrigation ditches (Root et al. 2017). Assuming spring-run adults could potentially use the same routes, these locations were accessed by road and visually assessed for presence of adult salmon. These efforts occurred from May 6 to 14, 2019 in a general northwest direction, starting from Britto Road 1-4 (Appendix A). Sites were visually checked for indicators of salmon presence (e.g., surface disturbance, fish jumping at water outlets or weir boards) and when observed, staff entered the water with large dip nets to capture potential salmon. Positive identification of adult salmon at these locations would result in capture efforts using large handled dip nets (see Root et al. 2017 for further explanation of methodology). In addition, a carcass recovery effort was completed on May 6th in the first ~2–3 miles of the most downstream section of the RA. This included driving a boat upstream and looking for salmon carcasses in the river margins.

Figure 3.— Mesh fyke net erected downstream of the Sack Dam in the San Joaquin River Restoration Program Restoration Area to monitor for adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*).

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 plastic trough (66×43×25 cm) filled at least ½ full with river water. This method permitted minimal atmospheric exposure during transfer and processing. Adult salmon captured in April 2019 were immediately processed, then transferred to a fish-haul tank. Due to concerns with handling fish in warmer water temperatures, the protocol was amended in May 2019 to include immediately transferring captured salmon to the fish-haul tank and then completing processing 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, PIT tag, and coded wire tag, and making notes on general condition (Figure 4). Identification of fish sex was not attempted because sexually dimorphic characteristics observed in fall-run Chinook Salmon were not distinct in captured spring-run. Additionally, all salmon released to Reach 1 of the RA were externally marked with a set of uniquely identifiable spaghetti tags (Floy Tag and Mfg., Inc, Seattle, Washington) affixed below the dorsal fin (Figure 5), and intragastrically implanted with an acoustic transmitter (V9, 69 kHz transmitter; VEMCO, Bedford, Nova Scotia) and a 23-mm low frequency half-duplex passive integrated transponder (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 6). These tags will be used to track salmon and locate redds in Reach 1 following their

transport and release. 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 transferred to a freezer and coded wire tags were recovered from individuals at a later date.

Figure 4.— All captured adult Chinook Salmon (*Oncorhynchus tshawytscha*) were checked for presence/absence of coded wire tags using a T-Wand CWT detector prior to release.

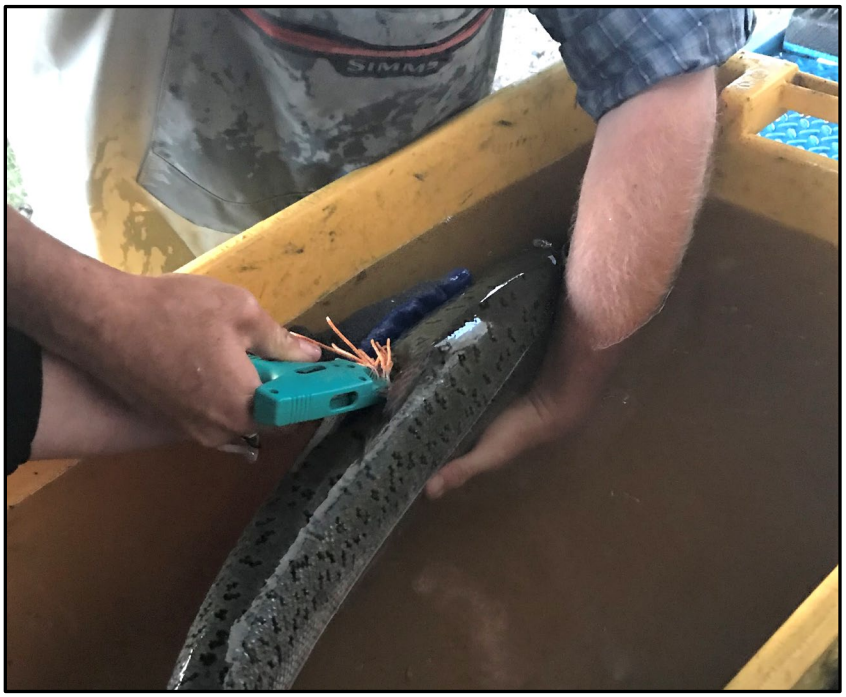

Figure 5.— All Chinook Salmon (*Oncorhynchus tshawytscha*) released into Reach 1 of the San Joaquin River Restoration Program's Restoration Area were provided two external spaghetti-type tags to promote post-release monitoring.

Figure 6.— Acoustic transmitter being intragastically implanted into an adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) prior to release in Reach 1 of the San Joaquin River Restoration Program's Restoration Area.

Fish Transport - Following capture, spring-run Chinook Salmon were placed in a tank (1900-3000 L) for transport to Reach 1. During efforts in April 2019, transport water was collected directly from the SJR near the collection sites to ensure minimal differences in water temperature and chemistry. This practice was established and adhered to during SJRRP fall-run Chinook Salmon trap and haul efforts (Root et al. 2017). Due to concerns with transporting fish in water temperatures near their upper thermal limits, fish transport practices were amended in May 2019. The updated protocol consisted of acquiring cooler Reach 1 water from facilities at Friant Dam then tempering transport temperatures 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. During efforts in April 2019, adult salmon were truck-transported and released at the Owl Hollow location in Reach 1. However, given the disparity between SJR temperatures at

Owl Hollow and capture/transport temperatures, tempering fish required an excessive amount of time during which fish were confined to the transport tank. In May 2019 the release site was shifted downstream to Camp Pashayan (see Figure 1), which exposed fish to slightly warmer temperatures upon release, but limited the time required to temper fish prior to release. After tempering, fish were processed (*see Fish Processing*), moved to the river in a portable plastic trough (66×43×25 cm) filled at least ½ full with river water, and permitted time to recover until they were able to swim away under their own volition.

Figure 7.— 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

Twenty-three adult spring-run Chinook Salmon were captured during 2019 monitoring and rescue efforts, providing the first evidence of adult spring-run salmon returning to the RA since inception of the SJRRP. Twenty of the captured fish were tagged and released into Reach 1 of the RA, one of which was later recovered as a mortality during rotary screw trap monitoring activities. This individual was initially captured downstream of Sack Dam, and was noted to be in poor condition at the time of capture. Three individuals succumbed to mortality during truck-transport (Table 1). All in-transport mortality was observed prior to changing transport tank water source and release location (Table 1 and Table 2). 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). Temperatures at some sites were in the reported lethal range; commonly surpassing 22°C and occasionally 26°C during fyke trapping (Figure 8), and exceeding 20°C during spot-checks (Salmon Hole [21.6°C], Delta Rd. East and West [20.3°C], and Britto 4 [20.1°C]). Future adult spring-run monitoring and trap and haul efforts will likely have to contend with difficulties associated with handling and transporting salmon at elevated temperatures. We recommend the continued practice and evaluation of immediately transferring and transporting fish in water with temperatures nearer their reported preferred range (SJRRP 2017) regardless of temperature at location of capture. We also recommend releasing fish at locations with river temperatures more similar to those fish are exposed to during transport in an effort to minimize time necessary for acclimation prior to release.

The majority of adult salmon (n = 22) were captured using a fyke trap at the ESBP location, and one individual was captured downstream of Sack Dam using a fyke net. This effort represents the first attempts to use the larger steel fyke traps in the SJRRP RA to sample for adult salmonids, and results suggest they are a useful tool and should be considered for future efforts. No salmon were captured or observed in Salt Slough, or while completing spot checks in irrigation ditches/canals. However, the presence of adult fall-run salmon during past sampling efforts warrants future monitoring at these locations. Carcass recovery efforts in Reach 5 were suspended after an ~3 mile boat survey indicated turbidity levels were too high to effectively spot carcasses. Interestingly, 57% of adult salmon (13 of 23 fish) were captured during the last five days of sampling, suggesting adult salmon were still likely immigrating into the system when sampling operations ceased. This is supported by continued capture of adult spring-run salmon immigrating through the San Joaquin River mid- to late-June downstream of the RA by FISHBIO during unrelated monitoring efforts (S.Ainsley pers. comm. 2019; Appendix B). Sampling ceased as a result of flood releases from Friant Dam, impacting site access and compromising some sampling locations. Future adult spring-run monitoring and trap and haul should continue through May, and then the need for continued efforts should be assessed on a weekly basis by scientists working for the SJRRP.

Across all sampling locations and methods, 704 non-salmonids (bycatch) were captured during adult spring-run monitoring and rescue efforts (Appendix C). Bycatch was dominated by non-native species, including Striped Bass (*Morone saxatilis*, n = 315), Common Carp (*Cyprinus carpio*, n = 146), and Channel Catfish (*Ictalurus punctatus*, n = 71). Native non-salmonids

captured during this effort included Sacramento Sucker (*Catostomus occidentalis*, n = 21) and Sacramento Pikeminnow (*Ptychocheilus grandis*, n = 2).

To promote transparency and create a permanent record of discussions and key decisions made during this historic event, meeting notes from an interagency committee developed to guide adult spring-run salmon rescue efforts are included in Appendix D.

Table 1.— Capture date, location and method, as well as other recorded characteristics for all spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) captured during 2019 adult spring-run Chinook Salmon monitoring and trap and haul. The salmon captured on 5/13/19 at Sack Dam is denoted with an asterix (*) as it was released alive, but found dead on 5/16/19.

Fish #	Capture Date	Capture Location	Capture Method	Fork Length (mm)	Total Length (mm)	Condition	CWT	Adipose	Release Location
1	4/9/2019	ESBP	Steel Fyke Trap	730	787	Good	Yes	No	Owl Hollow
2	4/19/2019	ESBP	Steel Fyke Trap	820	880	Good	Yes	No	Mort
3	4/19/2019	ESBP	Steel Fyke Trap	700	755	Good	Yes	No	Owl Hollow
4	4/23/2019	ESBP	Steel Fyke Trap	730	792	Moderate	Yes	No	Mort
5	4/24/2019	ESBP	Steel Fyke Trap	638	680	Good	Yes	No	Mort
6	5/5/2019	ESBP	Steel Fyke Trap	721	771	Good	Yes	No	Pashayan
7	5/5/2019	ESBP	Steel Fyke Trap	750	813	Good	Yes	No	Pashayan
8	5/7/2019	ESBP	Steel Fyke Trap	721	771	Good	UNK	No	Pashayan
9	5/13/2019	Sack Dam	Fyke Net	740	790	Poor	Yes	No	*Pashayan
10	5/14/2019	ESBP	Steel Fyke Trap	730	768	Poor	Yes	No	Pashayan
11	5/17/2019	ESBP	Steel Fyke Trap	735	767	Good	Yes	No	Pashayan
12	5/17/2019	ESBP	Steel Fyke Trap	621	668	Good	Yes	No	Pashayan
13	5/17/2019	ESBP	Steel Fyke Trap	680	728	Good	Yes	No	Pashayan
14	5/18/2019	ESBP	Steel Fyke Trap	720	778	Good	Yes	No	Pashayan
15	5/18/2019	ESBP	Steel Fyke Trap	630	675	Good	Yes	No	Pashayan
16	5/19/2019	ESBP	Steel Fyke Trap	680	725	Good	Yes	No	Pashayan
17	5/19/2019	ESBP	Steel Fyke Trap	695	750	Good	Yes	No	Pashayan
18	5/19/2019	ESBP	Steel Fyke Trap	740	785	Good	No	No	Pashayan
19	5/20/2019	ESBP	Steel Fyke Trap	740	795	Good	Yes	No	Pashayan
20	5/20/2019	ESBP	Steel Fyke Trap	702	758	Good	Yes	No	Pashayan
21	5/21/2019	ESBP	Steel Fyke Trap	675	732	Good	Yes	No	Pashayan
22	5/21/2019	ESBP	Steel Fyke Trap	735	794	Good	Yes	No	Pashayan
23	5/21/2019	ESBP	Steel Fyke Trap	755	819	Good	Yes	No	Pashayan

Table 2.— Pre, during, and post-release water quality conditions for all captured and truck-transported adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) during 2019 adult spring-run Chinook Salmon monitoring and trap and haul activities. Fish # corresponds to the same Fish # reported in Table 1.

Fish #	Capture Site Temperature (°C)	Capture Site Dissolved Oxygen (mg/L)	Pre-Transport Tank Temperature (°C)	Pre-Transport Tank Dissolved Oxygen (mg/L)	Post-Transport Tank Temperature (°C)	Post-Transport Tank Dissolved Oxygen (mg/L)	Release Site Temperature (°C)
1	20.3	9.8	20.3	9.8	20.3	9.8	13.2
2	21.4	8.1	N/A	N/A	N/A	N/A	N/A
3	21.4	8.1	21.4	8.1	22.8	8.3	12.1
4	21.2	9.9	20.9	9.2	21.6	9.5	12.3
5	21.4	7.9	21.5	9.6	22	14.7	N/A
6	22.9	9.3	18.1	13.7	18.3	14.7	16.4
7	22.9	9.3	18.1	13.7	18.3	14.7	16.4
8	21.8	8.7	18.4	9.1	18.8	8.7	16.8
9	20.6	9.1	15.9	10.6	16.3	10.5	16.3
10	23.1	7.7	18.9	9.8	18.9	13.5	17
11	20.7	8.6	15.1	10.9	15.2	12.5	13.6
12	20.7	8.6	15.1	10.9	15.2	12.5	13.6
13	20.7	8.6	15.1	10.9	15.2	12.5	13.6
14	19.7	8	15	11	15.2	16.9	12.8
15	19.7	8	15	11	15.2	16.9	12.8
16	18.5	9.2	17.8	15.1	17.7	13.5	12
17	18.5	9.2	17.8	15.1	17.7	13.5	12
18	18.5	9.2	17.8	15.1	17.7	13.5	12
19	18.7	8.9	14.4	10.7	14.8	10	13.1
20	18.7	8.9	14.4	10.7	14.8	10	13.1
21	17.5	8.9	14.2	16.2	14.4	9.3	14.2
22	17.5	8.9	14.2	16.2	14.4	9.3	14.2
23	17.5	8.9	14.2	16.2	14.4	9.3	14.2

Table 3.— Site-specific water quality (mean ± 1 standard deviation) during April and May 2019 adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) monitoring and trap and haul.

Location	Month	Temperature (°C)	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Turbidity (NTU)
Hills Ferry Barrier	April	18.3 ± 1.4	8.6 ± 1.5	1019.2 ± 306.1	46.0 ± 16.2
	May	19.3 ± 2.5	9.0 ± 0.6	721.7 ± 265.0	43.3 ± 14.6
Van Clief	April	18.7 ± 1.8	9.0 ± 1.3	363.0 ± 137.9	39.8 ± 12.3
	May	21.5 ± 5.7	8.7 ± 3.1	420.2 ± 147.7	96.7 ± 135.4
Sack Dam	April	16.9 ± 1.7	9.6 ± 0.3	169.3 ± 20.2	27.1 ± 2.5
	May	21.1 ± 1.2	9.1 ± 0.1	359.9 ± 24.7	34.2 ± 2.0
Eastside Bypass	April	19.0 ± 2.0	8.8 ± 0.7	200.5 ± 70.5	42.2 ± 21.0
	May	21.4 ± 1.6	8.5 ± 0.6	304.6 ± 45.7	67.4 ± 19.0
Salt Slough	May	20.6	10.6	NA	NA

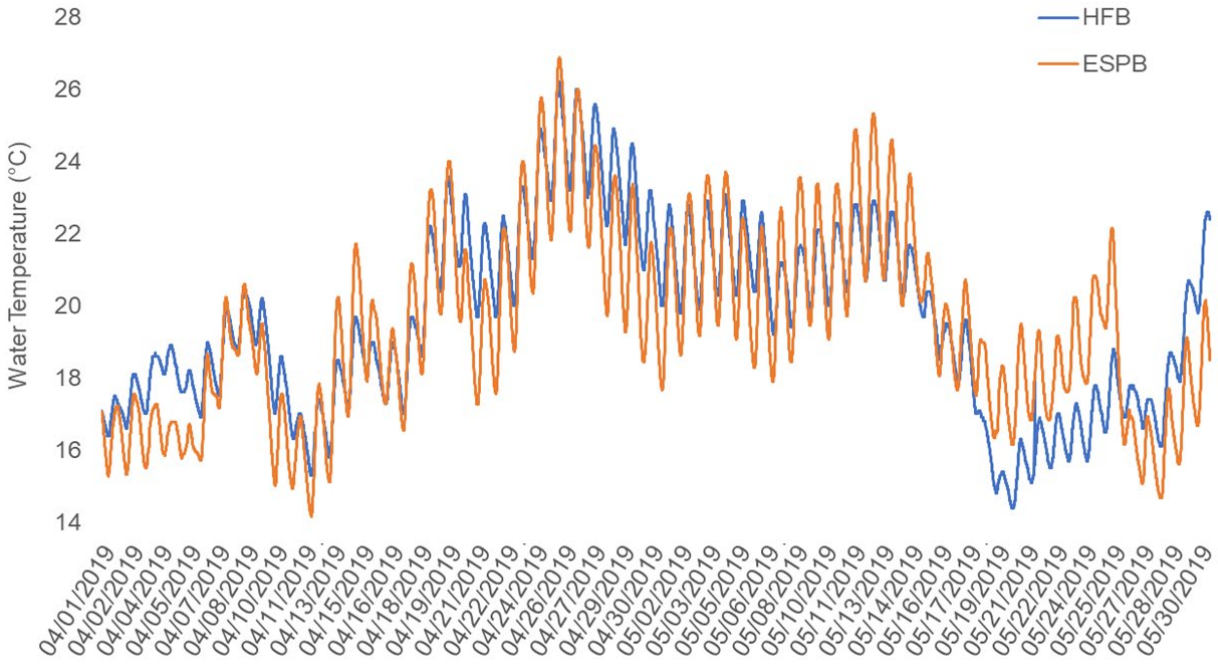

Figure 8.— Water temperature at the most downstream (Hills Ferry Barrier, HFB) and upstream (Eastside Bypass, ESPB) sampling locations during 2019 adult spring-run Chinook Salmon monitoring and trap and haul (SMN and EBM California Data Exchange Center Gauging Station Data, cdec.water.gov).

4.0 References

EPA (U.S. Environmental Protection Agency). 2003. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA 910-B-03-002. Region 10 Office of Water, Seattle, WA.

Root, R., Z. Sutphin, J.Hutcherson, C.Hueth, D.Portz, P.Ferguson, and M.Bigelow. 2017. Fall-run Chinook Salmon Trap and Haul 2012-2106. San Joaquin River Restoration Program Final Monitoring and Analysis report.

SJRRP 2017. Fisheries Framework: Spring-run and Fall-run Chinook Salmon. http://www.restoresjr.net/?wpfb_dl=1055

Westers, H. 2001. Production. Pages 31-90 in G.A. Wedemeyer, editor. Fish hatchery management, second edition. American Fisheries Society, Bethesda, Maryland.

Ainsley, S. 2019. San Joaquin River Bass and Catfish Population Study. Unpublished Data. FISHBIO, Oakdale, CA.

5.0 Appendix

5.1 **Appendix A**— Map of Adult Spring-Run Chinook Salmon (*Oncorhynchus tshawytscha*) spot-check locations in the San Joaquin River Restoration Program's Restoration Area.

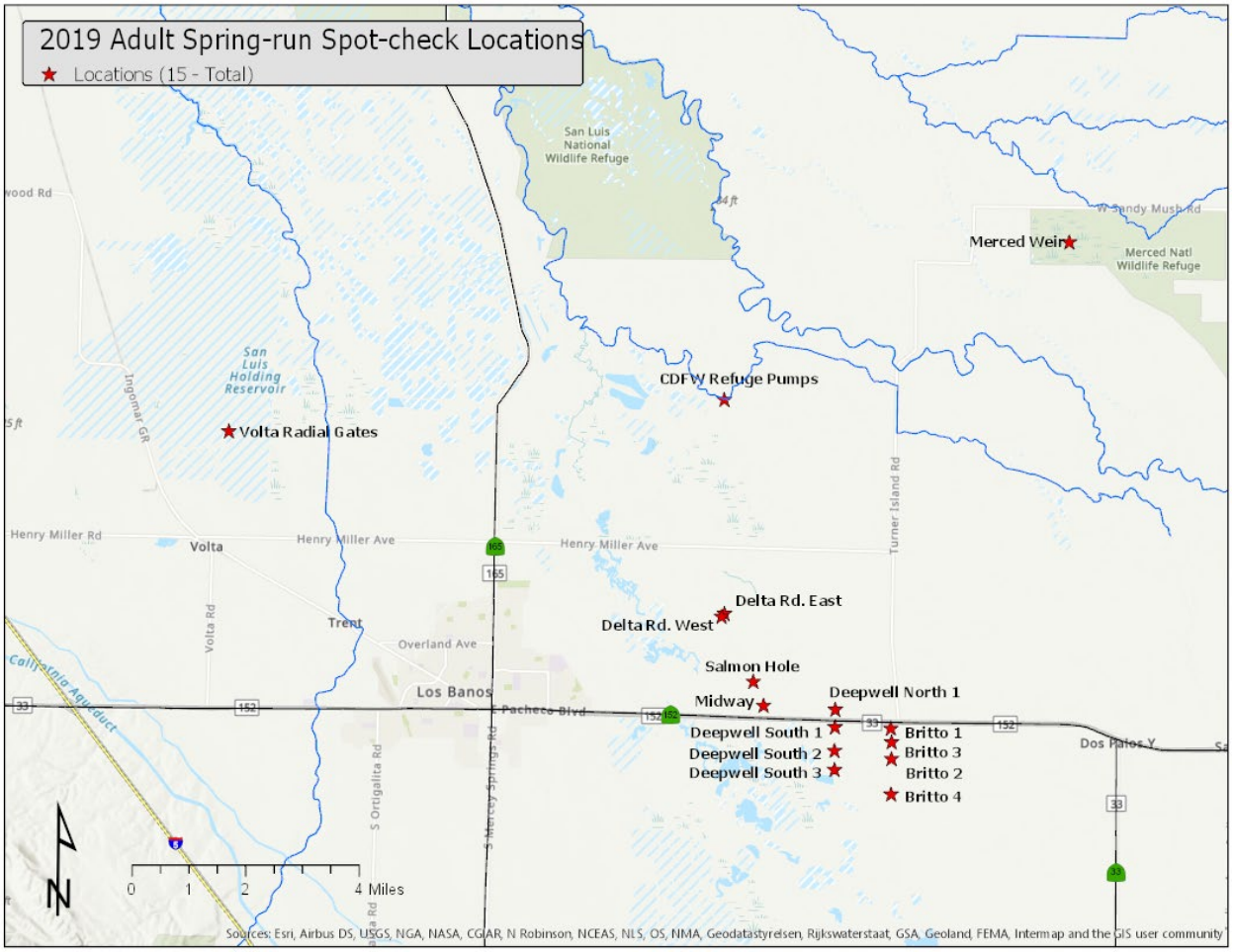

Figure 1A. — Map depicting locations where spot-checks occurred at end of slough and drainage locations during adult spring-run (ASR) Chinook Salmon (*Oncorhynchus tschawytscha*) rescue efforts. Locations were selected because adult fall-run Chinook Salmon were observed at the same locations in previous years.

5.2 **Appendix B**— Adult Spring-Run Chinook Salmon (*Oncorhynchus tshawytscha*) captured downstream of the San Joaquin River Restoration Program's Restoration Area.

Table 1B.— Incidental capture of adult Chinook Salmon in FISHBIO fyke traps on the San Joaquin River at Sturgeon Bend (RM 74; Lat: 37.6707; Long: -121.2464), Alegre (RM 65; Lat: 37.7092; Long: -121.2767), BCID (RM 63; Lat: 37.7284; Long: -121.2987) and Lathrop (RM 51; Lat: 37.8243; Long: -121.3143) between April 28 and June 26, 2019.

Location	Date	Fork Length (mm)	Total Length (mm)	Adipose Fin Clip?	Tissue Sample?
BCID	5/1/2019	-	-	yes	no
Alegre	5/3/2019	-	-	yes	no
Alegre	5/14/2019	-	-	yes	no
Lathrop	5/15/2019	-	-	yes	no
Sturgeon Bend	5/16/2019	-	-	yes	no
Alegre	5/17/2029	-	-	yes	no
BCID	5/30/2019	-	-	yes	no
BCID	5/31/2019	-	-	yes	no
BCID	6/10/2019	500	540	yes	yes
BCID	6/19/2019	560	605	yes	yes
Alegre	6/20/2019	830	860	no	yes

5.3 Appendix C— Summary of non-salmonids (bycatch)

Table 1C.— Bycatch totals for non-salmonids captured during 2019 adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) monitoring and trap and haul.

Species	April	May
Black Crappie (*Pomoxis nigromaculatus*)	21	26
Bluegill (*Lepomis macrochirus*)	1	1
Bullhead spp. (*Ameiurus spp*.)	0	6
Channel Catfish (*Ictalurus punctatus*)	20	51
Common Carp (*Cyprinus carpio*)	62	84
Goldfish (*Carassius auratus*)	5	0
Largemouth Bass (*Micropterus salmoides*)	13	17
Redear Sunfish (*Lepomis microlophus*)	0	17
Sacramento Pikeminnow (*Ptychocheilus grandis*)	2	0
Sacramento Sucker (*Catostomus occidentalis*)	5	16
Spotted Bass (*Micropterus punctulatus*)	5	4
Striped Bass (*Morone saxatilis*)	256	59
White Catfish (*Ameiurus catus*)	5	5
Total	400	286

5.4 **Appendix D**— San Joaquin River Restoration Program Fish Rescue Meeting Notes.

NEP Spring-run Chinook Rescue Discussion – 5/15/19

Participants:

- Hilary Glenn
- Donald Portz
- Erin Strange
- Lori Smith
- Towns Burgess
- Pat Ferguson
- Stephanie Durkacz
- Zach Sutphin
- Abbie Moyer
- Andreas Raisch

Meeting Notes:

- Ten fish have been caught so far!!!
- The last two fish were caught over the past two days:
    - One on May 13th at Sack Dam in a fyke net
    - One on May 14th just below the ESBP Control Structure in a fyke trap
    - Both swam away at Camp Pashayan location
    - Both were adipose fin clipped with coded wire tags
- Additional flows (1000 cfs) are being released from Friant
    - Considered restoration flows
        - Most will be recaptured in the Mendota Pool
    - This strategy will maintain minimum flow below Sack Dam
    - A Friant water user is willing to work with us to keep water below Sack Dam in the event of flood flows
        - If we do go into flood flows, some land owner is willing to do a cross valley swap out of the San Luis Reservoir
- Rescue
    - Don thinks Reclamation should continue rescue through Friday (at least)
    - CDFW staff is stretched thin and would like to prioritize San Mateo RST removal
        - Zak's needs to divert crew to help CDFW remove the RST at San Mateo on Thursday
    - What is the scientific benefit to put the nets back in for the possibility of catching one or two fish (especially if they are in poor condition)?
    - USFWS suggested decreasing efforts and keep traps in the two locations where the fish were found last (Sack Dam and ESBP Control Structure)

        - There is a storm settling over the valley today that could potentially reduce demand from water users and influence water temperatures, potentially cueing any remaining fish to move up stream.
        - Does the potential cost of looking for these fish outweigh the potential scientific benefit of recovering them?
- Group decided to:
    - Remove RSTs tomorrow and put the fyke traps back in on Friday to fish through Monday.
    - The group will meet again on Monday morning.

NEP Spring-run Chinook Rescue Discussion – 5/15/19

Participants:

- Hilary Glenn
- Donald Portz
- Lori Smith
- Baker Holden
- Lauren Yamne
- Rocky Montgomery
- Towns Burgess
- Pat Ferguson
- Stephanie Durkacz
- Zak Sutphin
- Abbie Moyer
- Andreas Raisch

Meeting Notes:

- Currently 3 fyke traps in the water: ESBP, Bear Creek (Van Clief Rd), Hills Ferry Barrier
    - 8 salmon were caught over the weekend at ESBP
    - All were released at Hwy 99
        - All were ad clipped and CWTed except for one
- The group decided to keep sampling for another week
    - Fyke traps will be out of the water on Wednesday due to a shift change.
    - **The group will meet again on Tuesday (Monday is a holiday)**
- What to do if flood flows begin before next Tuesday?
    - Current condition- no flood flows in the river, most of the current restoration flows are being recaptured in Mendota Pool
    - Reggie will put all of the flood flows down Reach 2B for capture at Mendota Pool until he begins to seep out the adjacent landowners. Then he will split the flows sending some down the Chowchilla and some into Reach 2B
        - In this scenario it is likely that flows will not be allowed past Sack Dam
            - Unless the Program staff can find a solution that all the water users can agree on
    - If flood flows begin in earnest Reggie wants his team to have unrestricted access to the levees meaning the fyke trap at the ESBP will need to be removed
        - As of now the other two fyke traps could stay in during flood flows
    - Potentially we could put a fyke net at Sack Dam if we have to take the fyke trap out at ESBP but most of the flow would be coming from the Chowchilla which will not be passable for adults (until very very high flows)
    - **This will be a day-to-day situation and Don or Towns will keep the group updated on the flows and actions associated with different flow scenarios**
- Acoustic Tags
    - There were only 10 V9 tags ordered for this year

        - Those have all been used and Zak has been using tags for the adult broodstock release for the returning adults
    - Both Zak and Pat have a few V13 tags left over from a few years ago but these tags might have lost some of their battery life and they are a little bigger
        - Originally roughly 400 days of battery, they lose 9ish days per year, they are 3 years old, so they probably have 379 days of battery life left (plenty)
    - The group agreed that it was more important to tag the returning adults than it was to tag the fish in the August release group because there are a limited amount of tags that Reclamation is allowed to purchase