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

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Introduction

Strategies to reestablish spring-run Chinook Salmon within the SJRRP Restoration Area 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). These efforts, and subsequent monitoring efforts, have provided evidence of adult spring-run salmon returning to the RA in 2017, 2019–22 (Hutcherson et al. 2020; Sutphin et al. 2019, Sutphin and Root 2020; 2021). 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 SJRRP 2018 Fisheries Framework). Trap and haul efforts will continue until in-river fish passage structures are constructed and volitional passage is achieved, and may also be necessary during Critical Years if fish passage structure prove ineffective during such conditions.

Methods

Study Area - The SJRRP RA extends upstream approximately 150 river miles (RM) from the Merced River confluence (Stanislaus County) to Friant Dam (Fresno County). The RA is sub-divided into five reaches. Adult salmon monitoring occurred at various locations in the most downstream reach (Reach 5 and 4B), and salmon were truck transported for release in the most upstream reach (Reach 1). Sampling was confined from the first in-river impediments to immigrating fish downstream to the confluence of the San Joaquin and Merced Rivers.

Sampling Methodology – Most commonly during adult salmon monitoring, fyke traps and nets are the capture gear employed. 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 holes in the cod end (and loss of samples). 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.

Figure 1.—Fykes trap at the Eastside Bypass location, Reach 4 of the San Joaquin River Restoration Area.

When river water levels are lower, a deep and narrow thalweg is not established, or site access is challenging fyke nets are commonly deployed. The nets are constructed of a 1.2 or 1.8 m square entry, followed by a series of three circular compartments, with 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 were extended bank to bank in a V-shaped pattern downstream and were used to guide upstream-moving fish into the net.

Figure 2.—Fyke net at the Hills Ferry Barrier location in Reach 5 of the San Joaquin River Restoration Area. Note opening(s) and v-shape of wing walls facing downstream.

Fish Processing, Transport, and Release - Adult salmon captured were transferred to a 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). Additionally, all salmon released to Reach 1 of the RA were externally marked with a set of uniquely identifiable Dart Tags (Hallprint Fish Tags; Hindmarsh Valley, South Australia) affixed below the dorsal fin (Figure 4). A subset of fish were 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). 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.

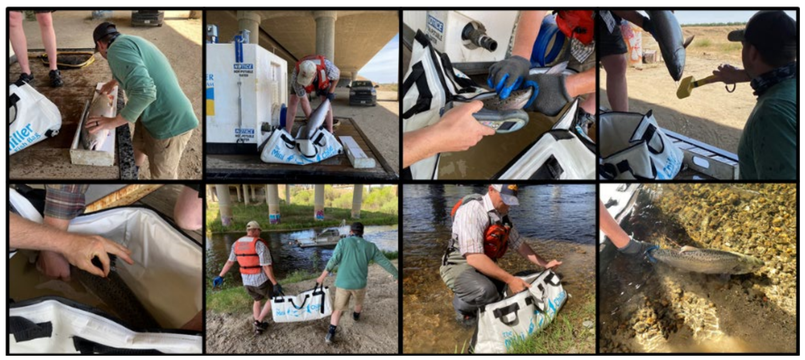

Figure 3.—Above images detail Adult Chinook Salmon (*Oncorhynchus tshawytscha*) post-transport processing. From top left to bottom right image: (1) salmon were removed from the haul tank and measured for fork and total length, (2) transferred to a fish bag filled with transport tank water, (3) checked for presence of adipose fin and PIT tag, (4) checked for presence of coded wire tag, (5) provided gastric implant of acoustic and PIT tags (not pictured) and an external dart tag, (6) provided water-to-water transfer to river in fish bag, and (7/8) removed from fish bag in river and permitted time to adjust to in-river conditions until they were able to swim away under their own volition.

Results and Discussion

Since inception, 184 adult spring-run Chinook Salmon have been captured (2019 = 23, 2020 = 57, 2021 = 93, 2022 = 11) and 152 have been released into Reach 1 of the RA (2019 = 20, 2020 = 48, 2021 = 74, 2022 = 10). Fish found as carcasses, or identified as a capture location mortality or transport mortality contributed to 6%, 5%, and 5% of the totals across all years of sampling, respectively. From the limited data collected thus far, temporal distribution of adult immigration based on fish captures indicates fish tend to enter the RA in early- to mid-April, peak mid-April through early-May, and cease by early-June. The end of the immigration period has also corresponded with elevated temperatures.

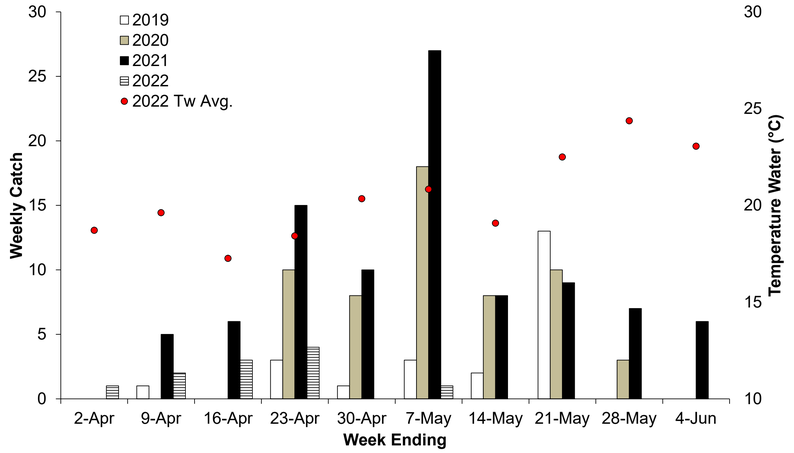

Figure 5.—Weekly capture of adult spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) during 2019, 2020, 2021, and 2022 monitoring efforts in the San Joaquin River Restoration Program's Restoration Area. Mean 2022 (red) weekly river temperature at the Stevinson gauging station (SJS, CDEC) is reported on the secondary y-axis.

All adult spring-run Chinook Salmon captured during described monitoring have been in the mainstem San Joaquin River. To date, monitoring effort have provided no evidence of adult spring-run Chinook Salmon straying into Mud or Salt Sloughs. The majority of individuals captured have been age-3 (90%), but age-2 (2%), and age-4 (8%) fish have been observed. The female to male ratio of fish identified to sex is 1.2:1. Captured adults have provided evidence that releasing fish as smolts or yearlings in the RA can be a successful strategies and result in adult returners. These efforts have also captured evidence of a single juvenile emigrating successfully from Reach 1 of the RA and returning as an age-3 adult.

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Literature Cited

Hutcherson, J., Z. Sutphin, P. Ferguson, M. Grill, J. C. Garza, and A. Clemento. 2020. *Juvenile spring-run Chinook Salmon production and emigration in the San Joaquin River Restoration Area. 2017–18 Monitoring and Analysis*. San Joaquin River Restoration Program.

Sutphin, Z. S. Durkacz, M. Grill, L. Smith, and P. Ferguson. 2019. 2019 Adult Spring-Run Chinook Salmon Monitoring, Trap and Haul, and Rescue Actions in the San Joaquin River Restoration Area. San Joaquin River Restoration Program Annual Technical Report ENV-2019-088. Bureau of Reclamation, Denver Technical Service Center, Colorado.

Sutphin, Z. and S. Root. 2020. 2020 Adult Spring-Run Chinook Salmon Monitoring and Trap and Haul in the San Joaquin River Restoration Area. San Joaquin River Restoration Program Annual Technical Report. Bureau of Reclamation, Denver Technical Service Center, Colorado.

Sutphin, Z. and S. Root. 2021. 2021 Adult Spring-Run Chinook Salmon Monitoring and Trap and Haul in the San Joaquin River Restoration Area. San Joaquin River Restoration Program Annual Technical Report. Bureau of Reclamation, Denver Technical Service Center, Colorado.

SJRRP. 2018. Fisheries Framework: Spring-run and Fall-run Chinook Salmon. http://www.restoresjr.net/?wpfb_dl=1055