Central Valley Steelhead Monitoring Plan for the San Joaquin River Restoration Area 2013–2023

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Introduction

Steelhead (*Oncorhynchus mykiss*) are the anadromous form (i.e., returning from sea to spawn in freshwater) of Rainbow Trout. Critical habitat for the Central Valley Steelhead (Steelhead) Distinct Population Segment extends downstream from the confluence of the San Joaquin River (SJR) and the Merced River, including primary SJR tributaries (Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced Rivers). Impassable barriers developed in the early-mid twentieth century contributed to SJR Basin steelhead population declines (McEwan 2001) and the extirpation of steelhead upstream of the SJR-Merced River confluence (i.e., the San Joaquin River Restoration Program [SJRRP] Restoration Area [RA]). Endangered Species Act consultation with the National Marine Fisheries Service mandates the Bureau of Reclamation to monitor for presence of Steelhead in the RA in lieu of full-scale consultation. Above average and spring interim flows can reconnect historically dry river sections that could attract adult Steelhead into the RA. Once in the RA, steelhead would not have access to spawning habitat due to several impassable barriers and could instead be attracted to return flows from irrigation sloughs. In 2011, the SJRRP Steelhead Monitoring Plan began to annually monitor for steelhead within the RA, and to relocate any captured individuals to suitable locations downstream of the RA.

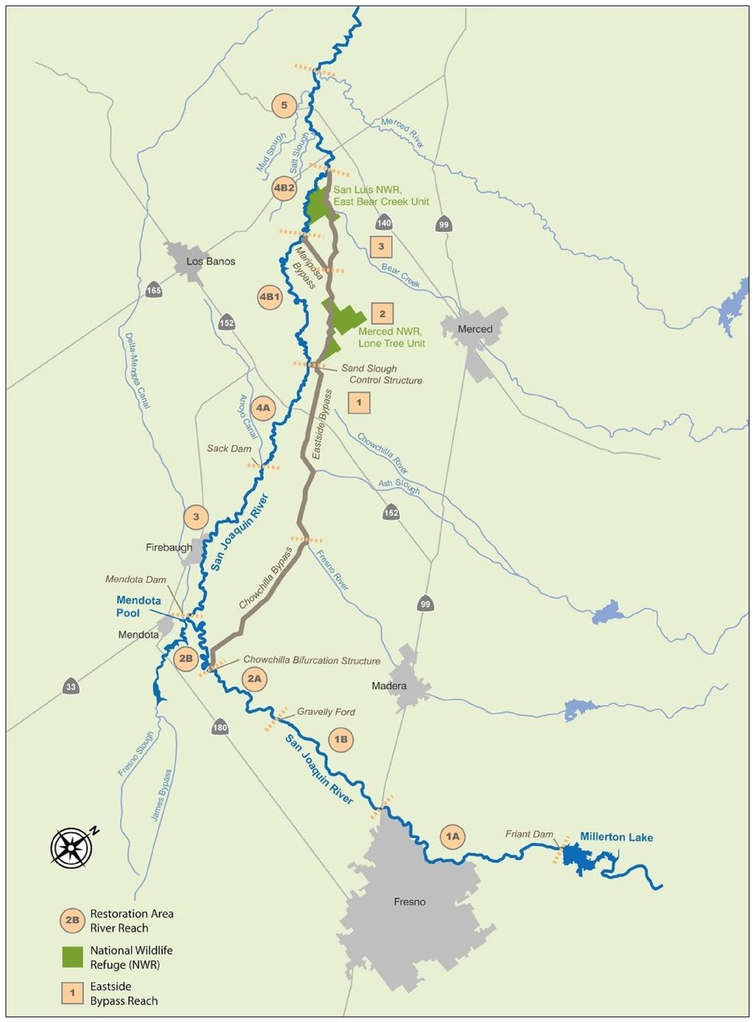

Figure 1.—General overview of the San Joaquin River Restoration Area (RA). Orange dotted lines delineate the distinct reaches of the San Joaquin River Restoration Area.

Methods

Study Area

The SJRRP RA is separated into five reaches that include the mainstem SJR from Friant Dam (Reach 1) downstream to Mendota Dam (Reach 3) and ending at the Merced River confluence (Reach 5; Figure 1). Steelhead monitoring is restricted to Reaches 3 thru 5 and includes adjoining tributaries (Mud Slough, Salt Slough, and Eastside Bypass) when connected.

Study Period

Steelhead Monitoring is completed annually from December–April, approximately two weeks each month, while adult steelhead are actively migrating to spawning grounds (McEwan 2001), and are most likely to be present in the RA. Analyzed data were collected between 2013 and 2023.

Sampling Methodology

Four techniques were employed to sample multiple habitat-types and locations:

Fyke Nets and Fyke Traps

Fyke nets and traps are passive fish sampling gear that use multiple compartments to trap adult fish.

The Fyke Net opening faces downstream and wing walls (the height of the net [4 or 6 ft]) extend towards shore in a v-shaped pattern, being held in place with t-posts (Figure 2). Wing walls can span most the river's width while leaving boat passage.

Fyke traps are made of wire mesh, larger (8 to 10 ft) and do not have wing walls so they can be fished at deeper depths and elevated flows. Traps were placed in riverine bottlenecks in a similar style to fyke nets (Figure 3).

Figure 2.—Fyke net at Salt Slough location, Reach 5 of the San Joaquin River Restoration Area. Note opening and v-shape of wing walls facing downstream.

Figure 3.—Fyke trap deployed in Eastside Bypass, Reach 4 of the San Joaquin River Restoration Area. Note downstream orientation of the trap opening and riverine bottleneck location.

Trammel Nets

Trammel nets consist of three parallel vertical layers of netting; the inner net has a small mesh size, while the outer nets have a large mesh size. As the fish swims through the outer mesh and into the smaller mesh, this creates a pocket which traps the fish.

Electrofishing

A Smith-Root 5.0 GPP raft-mounted electrofisher was used to actively cover larger stretches of the mainstem SJR. Settings were determined by water conductivity and adjusted to maximize capture efficiency while minimizing electrical exposure

Fish Handling and Relocation

Following capture, fish were identified to species, measured for length, and released (Figure 4). If steelhead were captured, these fish would have been processed (to include tissue collection, and PIT tag) and transported downstream to the SJR and Merced River confluence and released following appropriate transport protocol.

Results

Combined sampling methodologies encompassed approximately 85 river miles of the SJR and 28.3 river miles of adjacent tributaries, totaling approximately 113.3 river miles (Figure 1). **No CV steelhead have been detected since inception (2011).** Across all sampling methods, 34 species comprising a total of 7,992 fish were captured between 2013 and 2023 (Figure 5). Non-native fishes comprised 82.4 % (n=6,587) of the total. Common Carp (*Cyprinus carpio*), Striped Bass (*Morone saxatilis*), and Goldfish (*Carassius auratus*) were the most abundant species captured, constituting 43 % of all fish captured. Eleven native species were captured (17.6 % of total): Sacramento Sucker (*Catostomus occidentalis*, 9.7 %), Sacramento Splittail (*Pogonichthys macrolepidotus,* 4.8%), Sacramento Blackfish (*Orthodon microlepidotus,* 1.3%), Chinook Salmon (*Oncorhynchus tshawytscha*), Hitch (*Lavinia exilicauda*), Prickly Sculpin (*Cottus asper*), Sacramento Pikeminnow (*Ptychocheilus grandis*), Chum Salmon (*O. keta*), Green Sturgeon (*Acipenser medirostris*), White Sturgeon (*A. transmontanus*), and Rainbow trout (*O. mykiss*).

Discussion

Historically, the SJR RA was a migratory pathway for steelhead to reach spawning grounds; however, little detailed information on their distribution and abundance is available for these river reaches (McEwan 2001; Lindley et al. 2006). Much of the downstream habitat (Reaches 3–5) is unsuitable for rearing because of high summer water temperatures (Yoshiyama et al. 1996). However, as restoration efforts continue, increasing flows and the connection of upstream to downstream reaches in the RA may present the opportunity for Steelhead to move into the area and access suitable spawning habitat in upper reaches. As a result, and in compliance with the SJRRP ROD and BO, Reclamation will continue to monitor for their presence in the RA. Though this monitoring does not target non-salmonid species, bycatch data is valuable in providing information describing fish distributions, and presence absence data, in the RA. These data, combined with data from other monitoring programs, may provide an indication of SJRRP progress.

Figure 4.—Chinook Salmon, Sacramento Blackfish, Sacramento Splittail, and Striped Bass captured via electrofishing during steelhead monitoring efforts (left to right).

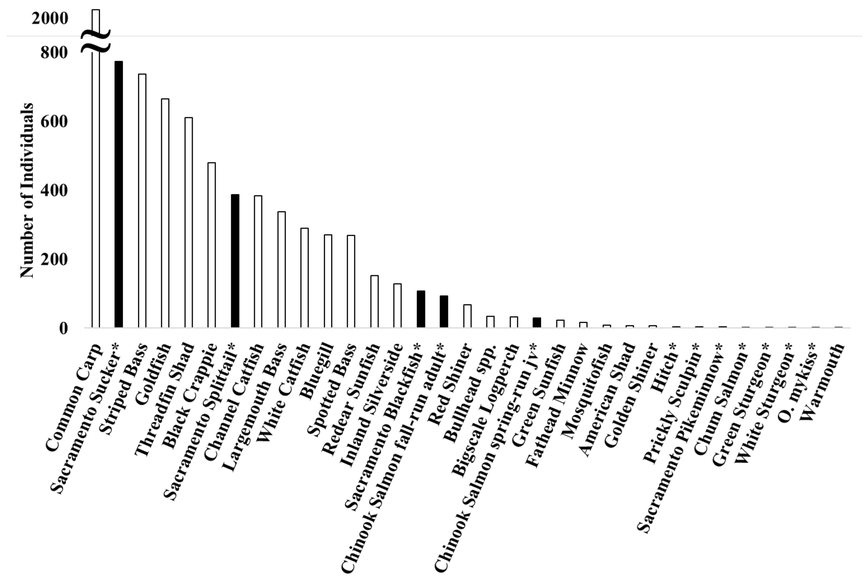

Figure 5. Fish captured (n = 7,992) during 2013-23 Steelhead Monitoring Plan in the San Joaquin River Restoration Area. No Central Valley steelhead were captured. Chinook Salmon separated by age class and run (adult/juvenile [jv] and spring/fall). * = Native species

Acknowledgements

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Literature Cited

Lindley, et al. 2006. *San Francisco Estuary and Watershed Science* 4(1): Article 2.

McEwan, D.R. 2001. *Fish Bulletin* 179.

Yoshiyama, et al. 1996. University of California, Center for Water and Wildlife Resources, Davis, CA, pp. 309–362.