Study 34

Juvenile Chinook Salmon Migration and Survival in Mendota Pool and Sack Dam

Final
2014 Monitoring and Analysis Plan

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San Joaquin River Restoration Program

2014 Monitoring and Analysis Plan

Juvenile Chinook Salmon Migration and Survival in Mendota Pool and Sack Dam

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Proposed Staff: 3 Reclamation staff

County(ies) affected by Study: Fresno, Madera, Merced

I. Study Management

A. Study Description

1. History or Background

a. General project background discussion.

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 CVP Friant Division Long-Term Contractors. After more than 18 years of litigation of this lawsuit, known as NRDC et al. v Kirk Rodgers, et al., a Settlement was reached. On September 13, 2006, the Settling Parties, including NRDC, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement, which was subsequently approved by the U.S. Eastern District Court of California on October 23, 2006. The Settlement establishes two primary goals: (1) Restoration Goal – To restore and maintain fish populations in "good condition" in the mainstem San Joaquin River 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 Goal – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.

Juvenile Chinook salmon (*Oncorhynchus tshawytscha*) emigrating from spawning and rearing habitat must negotiate two structures and the lacustrine habitats created by impounded water on the San Joaquin River. The Mendota Pool formed by Mendota Dam at the confluence of the San Joaquin River and Fresno Slough, and the effluent of the Delta-Mendota Canal is the most

upstream of the two structures. The pool acts as a water distribution center for irrigation diversions. Approximately twenty-two miles downstream is Sack Dam, which was created as a check structure and diversion for the Arroyo Canal. None of the diversions at these two sites are screened and do not meet National Marine Fisheries Service and California Department of Fish and Wildlife screening criteria for salmonids. High entrainment losses are anticipated at these diversions and excessive predation has been identified as a potential limiting factor for downstream migrating juvenile Chinook salmon at these locations. These locations are known to support high numbers of piscivores including largemouth bass (*Micropterus salmoides*), spotted bass (*Micropterus punctulatus*), Sacramento pikeminnow (*Ptychocheilus grandis*), striped bass (*Morone saxitalis*), white catfish (*Ameiurus catus*), and channel catfish (*Ictalurus punctatus*). Recent studies in the San Joaquin Basin have suggested that upwards of 93 percent of juvenile salmon on the Tuolumne River below Don Pedro Dam perish due to predation (FERC 2013). Despite these and other findings of predation studies in the Central Valley, factors influencing the survival of salmonids are still fairly uncertainty regarding the specific sources of mortality for juvenile salmonids throughout the Restoration Area. It is unknown whether survival is constant throughout this migration corridor or whether man-made structures or impoundments are contributing to species composition of predators thereby increasing losses. It is important to identify where losses occur and how operations at in-river structures can be altered to reduce impacts. Changes in water releases or dam passage may affect residence time in the pools and therefore vulnerability to predation. Understanding factors affecting survival of salmon is therefore critical to devising effective recovery strategies for these populations.

c. Why is the study necessary (context of settlement requirements, reintroduction efforts, interim flow information needs, etc.)?

The Restoration Goal for the San Joaquin River Restoration Program is "To restore and maintain fish populations in "good condition" in the mainstem San Joaquin River below Friant Dam to the confluence with the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish." (NRDC v Rodgers et al. 2006). In order to produce a self-sustaining population, juvenile salmon must be able to successfully navigate the gauntlet of predators, diversions, and pass both irrigation dams on the San Joaquin River to leave the Restoration Area and continue their trek to the Pacific Ocean. As juvenile salmon migrate down the complex network of mine pits, canals, and diversions, they are subject to regulated river-specific processes that affect their rate of migration, predator vulnerability, food opportunities, and, ultimately, survival. Understanding factors affecting survival of salmon is therefore critical to devising effective recovery strategies. In addition, these data can be used for further refinement of fish population models (e.g., Emigrating Salmonid Habitat Estimation [ESHE]).

2. **Site Description**

    a. **Location of the study (include maps, geographic data, etc.).**

This study will occur at the Mendota Pool upstream of Mendota Dam to San Manteo Avenue on the San Joaquin River , five major canals on the west side, and St. James Bypass to the south, near Mendota, California. The second location is Sack Dam at the diversion of the Arroyo Canal near Dos Palos, California.

3. **Study purpose**

    a. **Statement of study goals**

To determine the survival and movements of juvenile Chinook salmon above Mendota and Sack Dams to meet the Restoration Goal and to collect data to better inform management decisions on how to best operate fish passages and gate openings on the structures.

    b. **List the objectives of the study**

1. Determine survival rates through Mendota pool and above Sack Dam.
2. Determine movements and migration rates through Mendota pool and above Sack Dam.
3. Provide data to better support operation of release gates and fish passage at the Mendota and Sack Dams.
4. Gain information on entrainment of emigrating juvenile Chinook salmon into canals and diversions.

4. **What are the management or policy implications of the study?**

Understanding the emigration behavior and movements of juvenile Chinook salmon and the losses due to entrainment and predation are vital to restoring sustainable populations of Chinook salmon to the San Joaquin River. This information can be used to adaptively manage future efforts for a more effective implementation of the Restoration Goal. Information gained from this study may help to improve operations at the two dams and provide data that will help develop effective downstream fish passage.

B. Study Organization and Responsibilities

1. **Person(s) responsible.**

Don Portz: Project Manager and coordinator including budgeting, staffing, equipment ordering/preparation, study design and implementation, draft and final report preparation.

Charles Hueth: Field Team Leader including installation and maintenance of receivers, construction of PIT tag arrays, tagging fish, data downloads and management, assistance with PMT updates and report preparation.

C. Study Design

1. Describe the sampling design and measurement variables.

Telemetry and PIT tag Array Locations

Twelve telemetry stations using Vemco VR2W 180 kHz receivers will be strategically placed from San Mateo Avenue (fish release site) to below Mendota Dam in the San Joaquin River, St. James Bypass, and all adjoining canals and diversions to monitor movement and loss of tagged fish. In addition to the acoustic telemetry, a half-duplex PIT tag array will be constructed on the dam passage location to determine passage of PIT tagged individuals.

Five telemetry stations using Vemco VR2W 180 kHz receivers will be strategically placed above and below Sack dam and one in the Arroyo Canal to monitor movement and loss of tagged fish. Half-duplex PIT tag arrays will also be constructed on the dam passage and Arroyo Canal headworks to determine passage of PIT tagged individuals.

Experimental fish will be also be tracked using a VR100 mobile tracking unit to monitor Chinook movement and behavior during their outmigration within each of the study locations to provide a more refined search area.

Tagging and Releases

Juvenile Chinook salmon obtained from progeny of Trap and Haul Fall-run Chinook will be surgically tagged with a Vemco V5 coded acoustic transmitter or a 12 mm half-duplex PIT tag and released upstream of Mendota Pool at San Mateo Avenue. Fish will be released in 5 replicates of 100 acoustic and 400 PIT tagged fish performed once a week starting in late March or as soon as fish have reached adequate size for accommodating acoustic tags. Fish will be monitored at one location above the release site and eleven below.

Sack Dam fish releases will be similar to that of the Mendota Pool component of the study, however fewer fish are believed to be required due to lower predator densities, fewer diversion entrainment possibilities, and a confined river. Fish will be released in 5 replicates of 50 acoustic and 200 PIT tagged fish performed once a week starting in late March or as soon as fish have reached adequate size for accommodating acoustic tags. Fish will be released one mile upstream of Sack Dam and monitored at one location above the release site and 4 below.

2. **Describe the contingency plans to assure the question is resolved and uncertainties are addressed:**

Contingency planning will occur based on 1) changes in planned operations schedule, 2) issues with access, purchasing, equipment, staffing, etc. In the event that water will not be released below Sack Dam additional replicates will be performed using the acoustic tags from Sack Dam at Mendota Pool. If there is not continuous flow throughout the Restoration Area, a rotary screw trap or entrainment netting may be incorporated to collect fish below the study areas.

D. Study Resource Needs

1. Detailed budget	*Estimated Costs*
3 Reclamation fisheries biologists	$110,400
Data Analysis and Report)	$22, 800
Travel (airfare, lodging, per diem, truck, fuel, parking, etc.)	$58,220
Equipment and Supplies:	
VR2W 180 kHz receivers (18 x $1695)	$30,510
V5 coded transmitters (750 x $350)	$262,500
Software and Interface Hardware	$250
Tag Activators (2)	$500
Dummy Tags (20 x $25)	$500
Range test tag	$375
Anchors, rope, cable, misc.	$2,000
Surgical supplies	$1,500
RFID Receivers (4 x $1995)	$6,000
12 mm half-duplex PIT tags (3,000 x $2.70)	$8,100
PIT tag array supplies (wire, security box, solar panels, etc.)	$3,500
PIT tag injector supplies	$500
Grand Total	$513,355

E. Compliance Considerations

1. **Compliance considerations**

CatEx (NEPA), Nationwide 5 (ACOE), Section 7 (ESA compliance), CA collection permits, and other relevant permits will be obtained before starting this study.

F. Invasive Species: What measures will be taken to ensure field staff does not spread invasive plants or animals to new sites during the study?

HACCP plans were developed for this activity for aquatic nuisance species.

G. Due Dates and Products

1. **Describe the timeline for the study, with due dates for deliverables, including drafts (this should relate to section I.A.2.c).**

Final and Draft Reports submitted to the Annual Technical Report.