Study 15

San Joaquin River PIT Tag Monitoring and Site-Specific Technology Development

Public Draft
2014 Monitoring and Analysis Plan

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San Joaquin River Restoration Program

2014 Monitoring and Analysis Plan

San Joaquin River PIT Tag Monitoring

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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 order to monitor the success of reintroduction, passive integrated transponder (PIT) tag arrays would be beneficial to study the downstream emigration, instream movement, and entrainment of hatchery-reared juvenile Chinook salmon. As well as the basin-wide escapement, entrainment, or straying of returning adults, which is important in determining survival estimates. The use of remote PIT tag detection will help monitor fish passively (i.e., dam passage, habitat use, entrainment, age, individual movements, behavior, life history parameters, and escapement) and PIT tag capture information can provide fish growth and abundance data. Advancements in RFID technology have allowed for smaller (i.e., 9 and 12mm) and superior tags for field detections. In 2013 PIT tag arrays were constructed to determine the migration rates, residence areas, and behavioral changes of juvenile Chinook salmon as related to Friant Dam flow pulses of varying magnitude in Reaches 1 and 2 of the Restoration Area. While 2013 was successful for monitoring instream juvenile Chinook migration, incorporating PIT tag arrays at in-river structures (i.e., dam and bypass passage) and developing designs that are effective, yet do not affect other river-users are important and need to be further developed. Continued efforts are needed to assess migration and survival over a variety of operations scenarios that include changing the migratory path of emigrating juvenile salmon by the use of managed flows, bypasses, or confining them to the river channel. PIT tags allow researchers to tag and monitor more and smaller fish because of their minimal cost and small size compared to other tracking methods (i.e., acoustic telemetry). Currently, we are safely tagging fish as small as 65 mm using the 12 mm half-duplex tag. Twelve

millimeter PIT tags are only a fraction of the cost of an acoustic tag. PIT tags cost $2.70 each as acoustic tags range over $350 each.

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

The San Joaquin River is highly regulated and water flow decisions may impact juvenile Chinook salmon downstream migration patterns. Data recorded from PIT tagged fish can be used to determine areas that contribute to mortality, residence areas, migration rate, and emigration routes through the Restoration Area under a variety of flow conditions. This information will be used to better inform management while making decisions regarding reintroduction timing and flows, and pathways through the system which provide the greatest chance for survival. These data will also be used to estimate reach specific and Restoration Area-wide juvenile Chinook survival rates providing more accurate information for the Emigrating Salmonid Habitat Estimation model to predict the number of juvenile production needed to meet the program population goals. This data can be used to gain a better understanding of the survival and migration paths of juvenile Chinook while adaptively managing future decisions toward reaching the Restoration Goal.

2. Site Description

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

The study will occur in all reaches of the Restoration Area with more emphasis on Reaches 1 and 2, Chowchilla Bifurcation structure, Mendota Dam fishway, and Sack Dam.

3. Study purpose

a. Statement of study goals

To provide mortality, migration rate, and emigration route choices through the Restoration Area and areas that fish hold under a variety of flow conditions and water year types. This information will be used to better inform management while making decisions regarding reintroduction timing and flows, and pathways through the system which provide the greatest chance for survival. In addition, better PIT tag array designs can further the detection technology and widen its use.

b. List the objectives of the study

1. Define juvenile Chinook movements, holding areas, and habitat uses throughout the Restoration area under different flow conditions.

2. Determine migration scenarios with the greatest survival for a variety of flow conditions and water year types.

3. Identify locations with high predation and fish losses.

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

PIT tag data and other telemetry data will be used to adaptively manage future Restoration efforts and actions regarding the volume of releases and routing of water through Restoration Reaches.

B. Study Organization and Responsibilities

1. Person(s) responsible.

Don Portz: Bureau of Reclamation, Fisheries and Wildlife Resources Group, Denver Federal Center, P.O. Box 25007, Denver, CO 80225-0007

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Reclamation project manager and coordinator. Responsibilities include: budgeting and staffing, equipment ordering/preparation, study design and implementation, PIT tag array construction, fish tagging, draft and final report preparation.

Michelle Workman: Project collaborator and coordinator of FWS assistance.

C. Study Design

1. Describe the sampling design and measurement variables.

Array Locations:

PIT tag arrays will be constructed at the same locations as in 2013 with the addition of one site near Highway 41 and potentially Mendota and Sack Dams. Data from 2013 suggests that fish resided for long time periods (50+ days) in Reach 1 between Owl Hollow and Scout Island, and further refined monitoring in this area may provide additional information about their rearing behavior. Locations may include: Lost Lake County Park, Owl Hollow, Highway 41, Scout Island, Lake Avenue, Chowchilla, San Mateo Avenue, Mendota Dam, and Sack Dam. Half-duplex detection arrays allow the use of larger antennas with smaller power requirement. The construction of antennas is much easier than that of full-duplex technology in that half-duplex arrays a less susceptible radio frequency interference which gives researchers the ability to construct site-specific antennas with ease and at a much cheaper cost than full-duplex arrays.

Monitoring at different river locations will allow an assessment of post-stocking survival and information on the fate of tracked specimens on spatial and temporal scale. Water flows and alternate pathways through the system may greatly affect survival. Movements can be correlated with temperature, flow, and other abiotic factors.

Fish Releases:

Three replicate fish releases of 1500+ fish below Friant Dam will be performed in March-April 2014. Stream-side spawned juvenile Chinook salmon progeny from the Trap and Haul Study will be inserted with a 12-mm half-duplex PIT tag. Fish will be provided 48 hours of recovery time after tagging and then released in the San Joaquin River below Friant Dam. Once juvenile Chinook salmon are released, the PIT tag arrays will be maintained for 10-12 weeks until water temperatures are too warm for smolt survival in downstream sections. We intend to maintain antennas past May in 2014 whereas in the past, antennas were removed prior to the fourth week of May. Fish were still being observed in the river when the PIT tag arrays were removed in 2013. As PIT tagged fish migrate through the river they pass antenna arrays where the code, date, and time of passage is detected by a receiver, recorded, and stored. The data is downloaded and can be compared with flow and temperature data to provide indications of fish activities in response to these variables.

Efficiency Tests:

Time and fish permitting we would like to conduct efficiency tests at each of the antenna sites to calculate a detection rate and efficiency for each antenna configuration for refinement of survival calculation and better PIT tag array designs.

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

Contingency planning will occur if changes arise regarding water availability and flow schedule alterations. Tagging will occur once fish reach at least 65 mm and in the event of slow growth, releases will have to be delayed.

D. Study Resource Needs

Detailed budget	*Estimated Costs*
Field testing:	
3 Reclamation fisheries biologists ($736/day/biologist)	
Installation of up to 8 field sites (3 weeks)	$46,368
Fish tagging (7.5 staff days per release)	$16,560
Monitoring / downloading data (20 staff days)	$14,720
Array Removal (one day per site)	$22,080
Field Equipment:	
12mm HDX PIT Tag (6,000@ $2.70)	$16,200
23mm HDX PIT Tag (100 @ $2.45)	$245
Antennae wire	$4,000
Bulk Twinax Cable for Antennas (1000 ft.)	$1,625
Flat plate array design and construction	$15,000
Antenna materials	$8,000
HDX PIT Readers (4)	$7,980
2 weeks data entry	
Data Analysis and Report writing (2 biologists, 4 weeks)	$29,440
Travel (airfare, lodging, per diem, truck, fuel, parking, etc.)	$48,456
Grand Total	$238,034

E. Compliance Considerations

1. Compliance considerations

A NOE (CEQA), CatEx (NEPA), Nationwide 5 (ACOE), NLAA, and Internal Section 7 FWS (ESA compliance), CA collection permits, and other relevant permits will be obtained before starting this study. A Special Use Permit (SUP) for access to the San Luis Refuge Complex will be requested three weeks prior to proposed access if access is needed.

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?

Permanent equipment is not shared among sites and hand tools are thoroughly dried between site installations.

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).

A Final Report will be submitted to the Annual Technical Report and project information will be shared on the Program's website. Presentations will be giving at the Fisheries Technical Feedback Group and other locations upon request.