Study 8

Egg Survival and Emergence in Reaches 1A and 1B of the San Joaquin River

Final
2014 Monitoring and Analysis Plan

November 2013

Fish Management Workgroup

Study Workplan

2013 Egg Survival and Emergence in Reaches 1a and 1b of the San Joaquin River

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Proposed Staff: Crystal Castle, Nathan Cullen, Jerrad Goodell (USFWS); Matt Bigelow, Patrick Ferguson (DFW).

County(ies) affected by Study: Fresno, Madera

I. Study Management

A. Study Description

1. History or Background

a. General project background discussion.

In 2011 and 2012 egg survival studies were conducted in Reach 1a in an effort to assess existing egg survival in existing spawning habitat in a longitudinal gradient from Friant Dam to Hwy 41. The egg survival information has been accompanied by sediment size class analysis, fine sediment accumulation, and hyporheic water quality measurements to evaluate how these variables impact survival estimates. This study was conducted using eyed eggs from the Feather River Fish Hatchery. In 2012, the SJRRP began a program to trap and haul adult Chinook salmon from above Hills Ferry Barrier near the Merced Confluence to Hwy 99 (Reach 1b) to assess spawning site selection, movement patterns, and to conduct streamside spawning studies. The 2013 egg survival and emergence study goal is to pair the trap and haul program to make more assessments based on natural spawning success in reaches 1a and 1b. It will provide the next step in gaining information in the survivability and condition of embryos developing in the available spawning habitat by utilizing both artificial egg placement, as well as capping naturally placed redds resulting from the adult transport study using fall run Chinook salmon trapped in Reach 5.

Fry emergence has successfully been studied in other rivers (citations). Egg survival estimates, as have been calculated in 2011 and 2012, only describe the first step in successful reproduction for salmonids in the San Joaquin River. Assessments of alevin emergence are also important. Egg survival studies in encapsulated artificial egg tubes cannot be used to evaluate the ability of alevin to escape the hyporheic environment and emerge successfully. Given the high sand content in the

system as noted in many of the background documents and ongoing studies, evaluating successful emergence is the next step in determining life cycle completion for the spawning/incubation/emergence life stages of salmon in the San Joaquin River.

In 2011 and 2012 we conducted egg survival studies along with sediment transport and physical habitat characterization using egg tubes and eyed eggs from a hatchery source. We have 2 years of data and would like to start investigating other limiting factors related to spawning habitat quality, so are recommending investigating emergence success, and condition/health at emergence of naturally spawned embryos as well as artificial placements.

Egg survival from 2011 experiments was variable both within and between sites. In 2011 survival ranged from 13%-50%. Highest average survival by site was at the uppermost site and lowest was in the middle of the study reach. . In 2012 survival was similar and ranged from 20-54%, with lowest and highest values at the same sites. The site with the highest survival also had the largest substrate composition, but substrate may be too large for salmon to mobilize during redd construction. The site with the lowest survival was also correlated with a high sand content. These data have helped clarify the role of fine sediment in egg survival, now the Service would like to expand that study to look at naturally placed redds, and how egg survival translates into alevin success.

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

The Spawning Gravel Suitability Small Interdisciplinary Group (SIG) has begun meeting and discussing high priority questions still unresolved pertaining to spawning gravel habitat in the Restoration Area. The SIG has identified 6 tasks necessary to complete a comprehensive evaluation of spawning habitat suitability. Item 6 on this list is to 'estimate suitability of egg incubation habitat. As spawning habitat characteristics are better defined, decisions on where to improve spawning habitat to get the most benefit will begin to be made. Evaluation of critical life stage success for salmon will be critical information to support these decisions

2. Site Description

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

Egg survival and emergence in both naturally produced redds and in artificial redds will be evaluated in the SJR from Friant Dam to Highway 145 crossing (Skaggs Bridge).

3. Study purpose

a. Statement of study goals.

The goal of this study is to Evaluate the survival to emergence, as well as the overall condition at and timing of emergence for alevins from naturally placed fall run Chinook salmon redds as well as artificial placements in the San Joaquin River as an element of the tasks identified by the Spawning Gravel Suitability SIG as important for describing the overall suitability of spawning gravel from Friant Dam to Skaggs Bridge.

b. List the objectives of the study

1. Develop empirical counts of emerging alevin from natural and artificial redds in the Restoration Area.

2. Develop emergence timing data and compare to known degree-day relationships for Chinook salmon

3. Asses condition of emerging alevins and compare among and across sites.

4. Relate emergence timing and condition to environmental parameters at each spawning area.

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

Habitat availability of high quality spawning habitat is in question due to the high levels of sand in the San Joaquin system, elevated water temperatures during the incubation period (spatially and temporally distributed throughout the spawning reach). The information from this study, paired with studies conducted by USBR and DWR on hyporheic water quality conditions, substrate composition, depth/velocity profiles and fine sediment accumulation will help determine the deficit of suitable spawning habitat and evaluate options for habitat restoration including gravel restoration projects, flow objectives to move fine sediment, cleansing existing gravels, etc.

B. Study Organization and Responsibilities

1. Person(s) responsible (names, title, phone numbers, addresses, e-mail) and role.

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Fish and Wildlife Service field crew will consist of one GS-7 Fish Biologist – Jerrad Goodell (field crew lead) and 2 GS-5 technicians: Nathan Cullen and Crystal Castle.

Participation by CDFW staff is also anticipated.

2. Chain of command (if appropriate).

Order listed above.

3. Collaborators (agencies, NGOs, academia, etc.) and contact persons:

collaboration with Ca. Dept. of Fish and Wildlife staff: Patrick Ferguson and Matt Bigelow field sampling and field crew coordination.

C. Study Design

1. List the specific research questions (state them clearly as a null or positive hypothesis) to be answered by this study, including methodology:

a. If the study includes sampling, describe the sampling design and measurement variables. Be specific: describe the sampling unit, independent variables, dependent variables, and tests or techniques to be used. Explain how bias will be avoided in selection of sampling units. For hypothesis tests, state the null hypothesis and alternative hypotheses.

This study is contingent on the fall trap and haul study also being submitted to the 2014 MAP process. This study incorporates results of the redd and carcass surveys to implement. Planned operations of the fall trap and haul study would put externally marked and tagged adult fall run Chinook salmon in the Restoration Area at Hwy 99 between October and December of 2013 (dependent on trapping success in Reach 5 during those dates).

Once redds are detected, their location will be marked with a GPS unit, and date of placement recorded. The daily water temperature data collected at or near each redd will be used to estimate an emergence timing based on Beachum and Murray (1990). Approximately 2 weeks prior to anticipated emergence the red will be capped with an emergence trap following the protocols in the Don Pedro Project Fisheries Study Report (TID/MID 1992). Concurrent to natural redd placement (if sufficient eggs from streamside spawning can be obtained +/- a 1 week period) an artificial redd will be constructed within the same general spawning area (e.g., gravel bed, riffle) as the natural redd. An emergence trap with an artificial incubation chamber will be installed in

the artificial redd following Bernier-Bourgault et al (2011), and an emergence date prediction will be made for that redd as well.

Emergence traps will immediately be monitored on a daily basis by both DFW staff and FWS staff on a rotating basis. As alevin emerge they will be counted (emergence/day), measured (total Length), weighed (+/- 0.01g) and a visual assessment of condition will be made (yolk-sac fry, button up fry, seamed fry) as well as any anomalies or obvious deformities will be noted (white spot disease, fungus, underdeveloped fins, etc.).

Not more than 10 paired emergence traps and artificial redds/traps will be placed between Friant and Skaggs Bridge. Total number will be dependent on redd placement timing, access to locations, availability of eggs for artificial redds. If no eggs are available for artificial redds, capping of natural redds will still occur.

Data will be summarized and trends in survival and healthy emergence will be correlated with environmental variables, and geographic location.

D. Study Resource Needs

Staff time –

Bioday rate (this rate includes salary, benefits, administrative costs, use of vehicles, gasoline, office materials, etc.; $750 day for technical)

	# of Days	people	Net Total
Field work - technicians	22	2	33,000
Field Crew Lead Time (0.20*FTE)			47,388
			80,388

TRAVEL	# of Days	people	hotel	m&ie	Net total
2 months of sampling 2 days per week	11	2	1892	2002	3,894

Total Study Budget: $84,282

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

E. Compliance Considerations

1. This study is currently covered under 5 year permits acquired for the original egg survival study in the 2011 MAP.

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?

All gear will be washed and dried before entering the study area, and only used for work in the San Joaquin River between washing and drying. Care will be taken not to use personal gear in watersheds that contain New Zealand Mud Snail, and care will be taken to make sure no vegetation is transported between the study area and duty station. The USFWS AFRP office has developed an ISRAP (invasive species risk assessment planning) protocol this activity. This is available upon request.

G. Due Dates and Products

1. **Describe the timeline for the study, with due dates for deliverables, including drafts.**

Sampling will be conducted based on predicted egg emergence dates calculated from redd placement based on degree days. Emergence traps will be monitored daily beginning prior to emergence through the end of emergence. Reports will be submitted to the mid-year and end of year ATR as appropriate.