



Steelhead Pre-screen Loss in Clifton Court Forebay

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Background

Clifton Court Forebay is operated as a regulating reservoir within the Sacramento-San Joaquin Delta to improve operations of the State Water Project's Banks Pumping Plant at the head of the California Aqueduct. Clifton Court Forebay is tidally filled and water is diverted from Old River into the forebay through the operation of five radial gates. When the radial gates are opened, fish are entrained in Clifton Court Forebay and must make a minimum 2.1 mile crossing of the forebay before reaching the John E. Skinner Fish Protection Facility. Losses of fish during movement from the radial gates to the fish protection facility, termed pre-screen loss, include predation by fish and birds. The NOAA Fisheries OCAP biological opinion (2004) required investigations to (1) quantify predation losses on juvenile steelhead within Clifton Court Forebay, and (2) identify potential management actions to reduce predation mortality of juvenile steelhead. The steelhead pre-screen loss investigation is a pre-condition to increasing State Water Project export rates to 8,500 cfs.

Objectives

DWR, together with USBR, DFG, and Hanson Environmental, has designed and initiated a three year experimental field investigation to:

- Evaluate predation losses of juvenile steelhead during passage through Clifton Court Forebay
- Evaluate behavior and movement patterns of adult striped bass which have been identified as the primary predatory fish species that would potentially prey on juvenile steelhead within Clifton Court Forebay
- Identify physical locations and environmental factors that contribute to increased vulnerability of juvenile steelhead to predation within the Clifton Court Forebay
- Develop quantitative estimates of pre-screen losses of juvenile steelhead within the forebay

Pilot Study Methods

A pilot study was conducted over two years, 2005 & 2006, in order to (1) test various assumptions inherent in the experimental design for quantifying pre-screen losses and (2) provide preliminary information on the behavior, spatial distribution, and residence time of juvenile steelhead within Clifton Court Forebay.

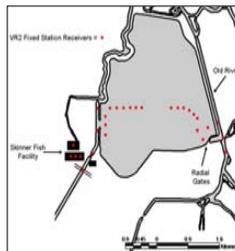
- In 2005 striped bass > 620 mm were captured, tagged externally with acoustic transmitters, and released into Clifton Court Forebay.
- In 2005 & 2006 juvenile steelhead were surgically implanted with 60 day acoustic transmitters and released immediately upstream of the radial gates.
- Striped bass and juvenile steelhead were detected using fixed station receivers and from a boat using a mobile receiver.



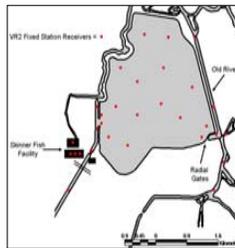
Striped bass captured and acoustic tagged in Clifton Court Forebay.



Surgical incision for tag implantation into juvenile steelhead abdominal cavity.



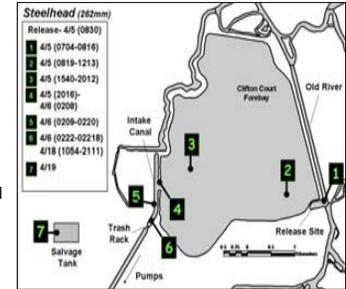
2005 fixed station receiver grid.



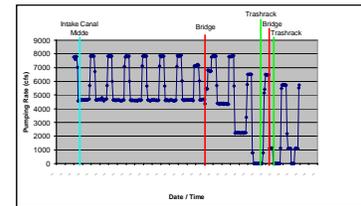
2006 - 2007 fixed station receiver grid.

2005 Pilot Study Results

- 13.5% of tagged juvenile steelhead entrained were subsequently detected in the fish facility holding tanks
- 13.5% of tagged juvenile steelhead entrained emigrated from Clifton Court Forebay during periods when the radial gates were open
- 67% of tagged juvenile steelhead entrained were last detected in Clifton Court Forebay
- 3% of tagged steelhead failed to be entrained
- 3% of tagged steelhead were never detected
- One tagged steelhead was detected downstream of the fish facility louvers multiple times and appeared to move upstream and downstream through the louvers in response to operational flow changes
- Tagged striped bass were detected throughout Clifton Court Forebay, but tended to concentrate in the area immediately downstream of the radial gates and within the intake canal
- Tagged striped bass were also observed to emigrate from Clifton Court Forebay during periods when the radial gates were open
- Recreational anglers harvested at least two of the acoustic tagged striped bass



Summary of a single juvenile steelhead's movement in 2005.



Summary of a single juvenile steelhead's movement through the fish facility louvers in 2005.

2007 Full-Scale Study In Progress

- The pilot study indicated that the methods and technologies tested are appropriate and can be utilized in the full-scale study to evaluate the pre-screen loss rate of juvenile steelhead.
- The pilot study effort also indicated that a high percentage of steelhead remain in Clifton Court Forebay longer than the battery life of the tagging technology utilized. To ascertain the fate of these fish, Passive Integrated Transponder (PIT) tagging technology is being used to allow for the quantification of pre-screen loss. PIT tags do not have batteries and therefore do not have the time constraints associated with battery life.
- Variables affecting fish behavior will be addressed by the acoustic tagging of striped bass and juvenile steelhead along with the collection of operational and conditions data within Clifton Court Forebay.
- Tagged juvenile steelhead releases began in January 2007 and will continue through April 2007.
- Point counts of piscivorous birds are being conducted to determine the abundance and location of avian species within Clifton Court Forebay that are capable of consuming juvenile steelhead.



2007 PIT tagging of juvenile steelhead.



PIT tag receiver system.