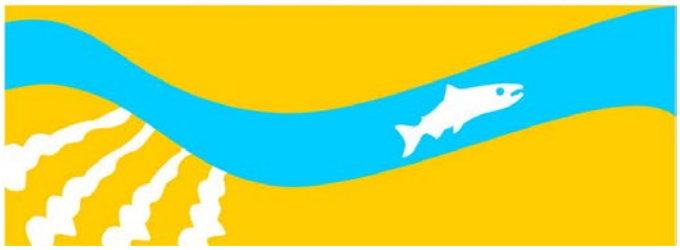
Study 29

Thermal Conditions in Riverine Pools

Public Draft
2013 Monitoring and Analysis Plan

SAN JOAQUIN RIVER
RESTORATION PROGRAM



September 2012

Thermal conditions in riverine pools from the Eastside Bypass/Reach 4 to Reach 5

INTRODUCTION

To assess the cold water thermal refugia habitat conditions in the San Joaquin River, fifteen pool-riffle sites are to be instrumented from July to August 2012. Thermal refugia provide the cold water habitat needed by salmonids when ambient water temperatures exceed their temperature tolerances. It is created when groundwater, hyporheic exchange, or a combination of both upwells cold water into the surface water. Upwelling flow forms cold water patches along the streambed and thermal stratification in riverine pools. The availability of thermal refugia in the San Joaquin River from the Eastside Bypass/Reach 4 to Reach 5 is not known. This study will be conducted to quantify the amount and quality of thermal refugia in fifteen different San Joaquin River pools from the Eastside Bypass/Reach 4 to Reach 5.

METHODS

Fifteen pool-riffle sites in the Eastside Bypass, Reach 4B2, and Reach 5 will be instrumented to evaluate thermal conditions in San Joaquin River pools. Potential sites will be selected by first analyzing San Joaquin River LIDAR and bathymetric data to identify pools. Fifteen pool-riffle sites to instrument will be selected from this list by conducting spot temperature measurements in each pool to identify ones with upwelling cold water along the riverbed.

At each of the fifteen pool-riffle sites, temperature, pressure, and conductivity sensors will be deployed for two weeks to a month to measure water temperature, hydraulic head gradients, and solution conductivity. Subsurface conditions will be measured by temperature, pressure, and conductivity sensors in the piezometers screened between 1 to 5 feet below the streambed. Water temperature data from piezometers will be used to determine the upwelling subsurface flow temperature and subsurface velocity. Hydraulic head data will indicate direction of subsurface flow. Conductivity data will help to determine the proportion of upwelling that is groundwater or hyporheic exchange. Surface water temperature conditions in pools will be measured by a set of three to ten temperature sensors positioned vertically in the water column. Surface water temperature sensors will be anchored either to one of the piezometers or to steel rebar located at the deepest part of the river pool. All sensors will take readings every 15 minutes for two weeks to one month at each site to quantify daily and weekly variations in the pool temperature profile.

ANTICIPATED RESULTS

The study will identify cold water thermal refugia characteristics in pools occurring in the San Joaquin River from the Eastside Bypass/Reach 4 through Reach 5. Subsurface data can be used to estimate upwelling conditions associated with thermally stratified pools and thermal refugia. Surface water temperature data can be used to calculate the degree of thermal stratification and depth of cold water in pools to estimate the quantity of thermal refugia for salmonids. Study results will inform future flow scheduling and salmon reintroduction strategies.

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