



Mill Creek Dam Fish Passage Project

Background

Mill Creek is a major tributary to the Russian River and harbors some of the best habitat for coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) in the watershed. Fish access to Mill Creek and its tributaries was severely impeded for many decades by a large flashboard dam, which the National Marine Fisheries Service identified as “the highest priority barrier within the Russian River [coho] population for remediation.” The dam blocked access to about 11.2 miles of habitat (62% of the anadromous stream) in the Mill Creek watershed. It was a complete barrier to upstream juvenile salmonid passage, and a partial barrier to upstream adult passage. It was a barrier for coho under most flow conditions.

The portions of Mill Creek above the dam offer some of the best rearing habitat in the Russian River watershed and consistently remain wet, whereas much of the reach below the dam goes dry during the summer months, especially during drought years.

Project Purpose

The purpose of the project was to remove the flashboard dam on lower Miller Creek near the confluence with Wallace Creek, and restore fish passage over and around the dam by constructing a roughened ramp and low-gradient side channel. The project was intended to improve passage conditions for coho and steelhead at various life stages and flows. A several partial barrier to fish passage, which consisted of a human-modified waterfall, was eliminated below the Mill Creek dam in 2012. Removal of the Mill Creek flashboard dam resulted in the elimination of all barriers in the water and reconnected access to habitat in Mill, Angel, Palmer, and Wallace creeks.

Project Effectiveness

Spawning coho salmon were observed above the former barrier in Mill Creek within weeks of modifying the barrier to allow upstream migration of adult fish. By December 14 of 2017, one redd was observed on Mill Creek. In 2017, there were extremely low water flows in the Russian River tributaries, which resulted in most fish being detected in the mainstem of the Russian River, or in Dry Creek.

Monitoring Purpose

To evaluate the success of the restoration project, a fish monitoring program was implemented to assess the effectiveness of removal of the flash board dam and the construction of a roughened ramp and low-gradient side channel. The primary components of the project validation monitoring included both physical and biological monitoring. The monitoring target was to document an increasing trend of salmonid use in both numbers of adults spawning and numbers of juvenile salmonids successfully rearing.

Monitoring Methods

Physical monitoring

The site was monitored by PCI two years post-construction to document stability and functioning. Longitudinal profiles were surveyed annually after each high flow season to document slopes and thalweg geometry. Repeat photography at set photo points visually documented any changes in

California Fish Passage Forum

Barrier Removal Effectiveness Monitoring

PROJECT AT-A-GLANCE

Project Title: Mill Creek Dam Fish Passage

Project Applicant: Trout Unlimited, Prunuske Chatham, Inc.

Partners: Prunuske Chatham, Inc., National Oceanic and Atmospheric Administration (NOAA), California Department of Fish and Wildlife (CDFW), private landowners

Project funding provided by: NOAA Restoration Center, Sonoma County Water Agency, CDFW

Groups Conducting Monitoring: UC Cooperative Extension, California Sea Grant

Project Location: Mill Creek is a major tributary to the Russian River in Healdsburg, Sonoma County, California

This project received Honorable Mention for the Distinguished Project Award at the 2017 International Conference on Engineering and Ecohydrology for Fish Passage by the American Society of Civil Engineers.



configuration or sediment distribution. An evaluation of actual fish passage conditions through the site was completed during one low fish passage flow and one high fish passage flow. Direct measurements of velocities and water depths at multiple locations throughout the engineered roughened channels were made.

Monitoring Methods

Physical monitoring

The site was monitored by PCI two years post-construction to document stability and functioning. Long profiles were surveyed annually after each high flow season to document slopes and thalweg geometry. Repeat photography at set photo points visually documented any changes in channel configuration or sediment distribution. An evaluation of actual fish passage conditions through the site was completed during one low fish passage flow and one high fish passage flow. Direct measurements of velocities and water depths at multiple locations throughout the engineered roughened channels were made.

Biological monitoring

Biological effectiveness was documented by UC cooperative Extension (UCCE) and California Sea Grant (CSG) as part of their ongoing monitoring for the Russian River Coho Salmon Captive Broodstock Program (RRCSCBP). Spawner surveys were conducted to document sightings of live fish, carcasses, and redds as adult coho return to the Russian River watershed to spawn during the winter months and were performed in accordance with CDFW protocols. Each study reach was surveyed at about two-week intervals, beginning once flows were sufficient to allow entrance of adult salmon into the tributaries. Surveys generally continued through the end of February for coho and mid-April for steelhead. Any live fish observed were identified to species, sex, and origin (wild or broodstock hatchery). Approximate fork length, fish condition, and location were also recorded. Photographs and video footage of spawning behavior were taken to help confirm sightings and identification, and all carcasses were scanned for presence of a coded wire tag (CWT), a PIT tag, an adipose clip, and other marks or tags. Carcass heads were removed and, if present, the CWT was retrieved to determine release year, season, and stocking stream. Otoliths were collected for future analysis of movement, growth and feeding patterns. A unique identifier tag was attached to all carcasses to estimate escapement and observer efficiency. Additional sampling from carcasses included scale sampling and fin clipping for genetic analysis. When a completed redd was observed, pot and tail spill measurements were taken. If a redd was constructed by an unknown species of salmonid, these metrics aid in species identification. Redd locations were flagged and mapped using a handheld GPS unit. On subsequent visits, redd age and condition were noted until the redd was no longer visible.

UCCE and CSG conducted pre- and post-project evaluation by continuing to conduct spawner surveys each winter and operating PIT tag antennae at sites downstream and upstream of the dam. In addition, snorkel surveys were conducted every summer on the entire length of Mill Creek to document the presence and distribution of juvenile salmonids and to confirm successful spawning the previous winter, informing the number and proportion of fish that make it upstream of the site each year. The broodstock program continued to release PIT-tagged juvenile coho into Mill Creek each year and operated stationary PIT tag detection systems throughout the watershed to track movement and survival patterns from the time coho were released until they returned as adults. Prior to release, about 20% of the program coho were weighed, measured, and PIT-tagged. Information about individual fish, including age, size at release, and release season were recorded along with each unique tag number. When a PIT-tagged fish swam through an antenna, a transceiver located on the stream bank recorded the unique tag number and the time that the fish passed through the antenna. Data collected at antennas placed above and below the dam site were used to estimate the number, proportion, and timing of adult coho that migrated upstream of the dam site.

Monitoring Results/Discussion

First documented coho salmon spawning in Mill Creek upstream of dam modification, December 2016:

<https://www.youtube.com/watch?v=JHubgnNYQLU>

In 2017, 17 coho salmon, nine steelhead trout, no Chinook salmon, and five unknown salmonid redds, for a total of 31 salmonid redds, were observed during spawner surveys in Mill Creek.

Coho salmon were evenly distributed throughout most of the mainstem of Mill Creek during broodstock monitoring in 2017. A total of 145 pools were snorkeled, and 48 young-of-year, 96 expanded young-of-year, 159 parr, and 318 expanded parr were documented (note: Expanded count is the observed count multiplied by a factor of two). Mill Creek parr counts likely included fish from a hatchery smolt release that occurred two days prior to snorkel counts.

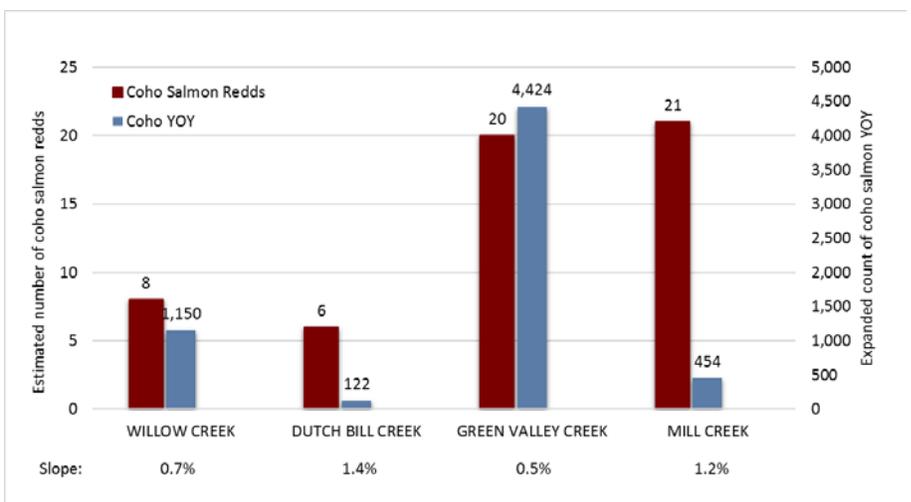


Figure X. Coho salmon redds observed in 2016–2017 spawner season along with coho young-of-year counts from 2017 snorkel surveys.



Map showing coho salmon redds in Mill Creek over the five winters prior to barrier remediation at the flashboard dam site. The vast majority of spawning activity occurred below the site, confirming the dam as a passage barrier to anadromous fish under most flow conditions. The reach of Mill downstream of the dam site dries extensively each summer, threatening rearing fish in most of that reach with almost certain mortality. Numerous adult coho were observed spawning upstream of the site in the winter of 2016/17—within weeks of the dam being remediated to allow full passage.

