

Olema Creek

Olema Creek is the largest undammed tributary of Lagunitas Creek. The 15.9 km stream flows northwest through the Olema Valley, the land-ward expression of the San Andreas Fault Zone (SFZ). It's confluence with Lagunitas Creek lies at the head of the ecologically significant Tomales Bay. Acquisition of land in the Olema Valley by the National Park Service's Point Reyes National Seashore and Golden Gate National Recreation Area began in the early 1960s. Currently, both salmon and steelhead return to the Olema Creek watershed to spawn.

Impacts to Watershed

- Historic logging practices
- Historic channelization
- Past and present agricultural operations
- Management of Highway 1
- San Andreas Fault

CSRP Monitoring

- Spawner Surveys
- Juvenile surveys
- Hankin & Reeves population estimate
- Outmigrant trapping
- Water quality monitoring
- Stream flow and rainfall
- Habitat assessment

Restoration Objectives

- Restore fish passage to viable habitat
- Riparian protection through fencing and planting
- Habitat enhancement with woody debris

Pine Gulch Creek

Pine Gulch Creek flows 12.2 km in a southeasterly direction through the San Andreas Rift Zone and is the major source of freshwater inflow into Bolinas Lagoon, a high-value estuarine preserve. Approximately 65% of the watershed is located within NPS legislative boundaries, the remainder being under private ownership. Pine Gulch Creek historically supported a coho salmon population, however, coho are now believed to have been extirpated from the system with the last recorded observation being in 1979. Currently, steelhead trout populations are sustained within the drainage.

Impacts to Watershed

- Historic logging and agricultural operations
- Seasonal dams and water diversions
- Drought

CSRP Monitoring

- Spawner and juvenile surveys
- Spring smolt snorkel surveys
- Outmigrant trapping
- Streamflow and rainfall
- Habitat assessment

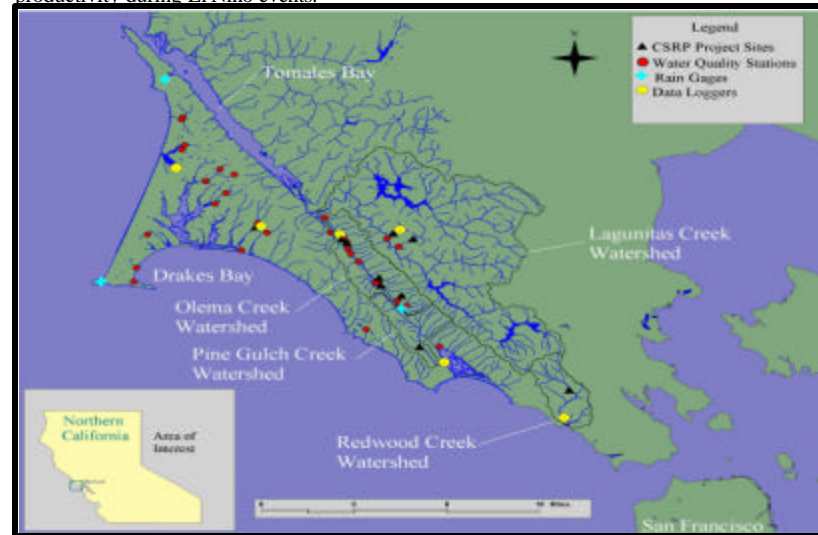
Restoration Objectives

- Sustainable water operations on private land
- Riparian protection and enhancement
- Fish passage
- Sediment source treatment and control

Project Overview

In 1997 the National Park Service (NPS) initiated a five-year Coho Salmon and Steelhead Trout Restoration Project (CSRP) to assess the habitat and condition of coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) populations within NPS managed watersheds. By evaluating existing salmon and steelhead resources, the CSRP intends to identify problems limiting to salmonid populations and opportunities to address those problems; develop and implement comprehensive restoration programs; and monitor the effectiveness of restoration efforts at Point Reyes National Seashore (PRNS), Muir Woods National Monument (MUWO), and the Golden Gate National Recreation Area (GGNRA).

Some of the factors contributing to the declines of salmonid fish runs within the parks include: dam construction and fragmentation of migration corridors; historical logging; agricultural practices associated with sediment delivery to the channel; removal of large woody debris and stream channel alteration; habitat alteration; loss of spawning and rearing habitat; water withdrawals, extreme hydrologic and climatic events; over-harvesting, and poor ocean productivity during El Niño events.



Cooperating Organizations

- California Department of Fish and Game
- County of Marin
- National Marine Fisheries Service
- National Fish and Wildlife Foundation
- Trout Unlimited
- Marin Municipal Water District
- Tomales Bay Association
- Pine Gulch Creek Association
- Bolinas School
- West Marin School
- Marin Community Foundation
- Jennifer Altman Foundation
- Mary Crocker Trust

Water Quality Monitoring

CSRP monitors water quality at several main stem and tributary sites within the Olema and Lagunitas Creek watersheds, and at several smaller coastal watersheds. Specific water quality parameters include:

- | | |
|---------------------------|--------------------------------|
| total coliform (MPN); | conductivity (uS/cm); |
| fecal coliform (MPN); | salinity (ppt); |
| nitrite (mg/L); | dissolved oxygen (mg/L); |
| nitrate (mg/L); | percent oxygen saturation; |
| unionized ammonia (mg/L); | total suspended solids (mg/L); |
| orthophosphorous (mg/L); | pH. |
| temperature | |

Lagunitas Creek

Lagunitas Creek and its tributaries support nearly 10% of the remaining wild coho salmon stock in the central California coast Evolutionarily Significant Unit (NMFS 1996b, NMFS 1996a). The watershed drains from the southeastern slopes of Mount Tamalpais, north to the head of Tomales Bay. The watershed is interrupted by four dams with storage in excess of 60,000 acre feet, which have altered both hydrology and the health of salmonid populations.

The CSRP is involved with restoration and monitoring efforts on Olema Creek, Cheda Creek, and Devil's Gulch, tributaries of Lagunitas Creek that have historically supported large runs of coho and steelhead trout.

Impacts to Watershed

- Historic logging and agricultural operations
- Dam construction
- Development

CSRP Monitoring on Olema Creek, Cheda Creek, & Devils Gulch

- Spawner surveys
- Juvenile surveys
- Hydrologic monitoring

Restoration Objectives

- Restore access to viable habitat
- Identify and control sediment sources
- Improve instream habitat through installation of woody debris structures
- Giacomini Wetland Restoration

Redwood Creek

Redwood Creek flows southwest 9.5 km from its headwaters on Mt. Tamalpais, through Muir Woods National Monument and Big Lagoon, and empties into the Pacific Ocean at Muir Beach. One of the highlights enjoyed by winter visitors to MUWO is the spectacle of spawning coho salmon in Redwood Creek. At one time, hundreds of coho salmon returned to spawn but now the run is greatly diminished.

CSRP Monitoring

- Annual spawner surveys
- Juvenile salmonid surveys
- Hydrologic monitoring
- Habitat assessment

Impacts to Watershed

- Historic logging in the watershed
- Historic dairy and agricultural operations in the lower sections
- Drought conditions and water withdrawal and
- Park management practices {i.e., removal of woody debris}

Restoration Objectives

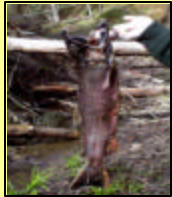
- Change woody debris management policy
- Remove or modify historic channel lining structures
- Riparian restoration in the lower section of the watershed
- Big Lagoon Restoration

CSRP Fisheries Monitoring

Outmigrant Trapping

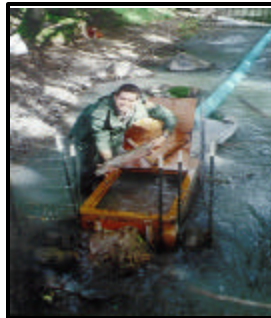
- Annually measure smolt yield between March and June using pipe style downstream traps;
- The traps are operated 24 hours per day, flow permitting, and are checked once daily;
- Pipe traps have been placed in Quarry Gulch, Giacomini Gulch, Bear Valley Creek, and BlueLine Creek (four tributaries of Olema Creek), and in the main stem of Pine Gulch Creek;
- Operation of the BlueLine Creek trap for four consecutive years has produced important information about salmonid productivity and use of monitored sub-watershed areas for spawning, rearing, and over-wintering.

Genetic Analysis and Aging



To further understand genetic identity and age classification tissue and scale samples are collected from:

- fresh adult carcasses during winter spawner/carcass surveys; and
- juvenile fish captured during population assessments.



Adult Spawner Counts

Surveys are conducted after storm events during the winter run (December – February), when hydrologic conditions and water clarity are at acceptable levels. CSRP currently conducts spawner surveys in Olema Creek, Redwood Creek, Pine Gulch Creek, their associated tributaries, and Cheda Creek. The following is the CSRP survey protocol:

- Live fish, carcasses, and redds are observed by staff and trained volunteers, who hike by foot along the stream bed;
- Length, sex, species, and age class of live fish are recorded in the field;
- Coho carcasses are measured, marked, and examined to determine success of egg and milt release;
- Length, width, and fish activity on redds is recorded.



Juvenile Salmonid Sampling

CSRP has established permanent index sections that contain a combination of habitat attributes characteristic of the stream reach as a whole. Currently, sampling takes place at eight different sections of Olema Creek, nine sections in Pine Gulch Creek, seven sections in Redwood Creek, and at fish passage restoration sites on BlueLine, Cheda Creek, and Muddy Hollow Creek.

- Use of a three-pass depletion sampling protocol to determine population estimates;
- Electrofishing surveys are conducted during the mid-summer months through the early fall;
- Use of low pulse DC frequencies, minimal effective voltages, and large diameter electrodes to mitigate stress related impacts of electrofishing;
- Snorkeling surveys have been conducted as an alternative sampling method, and to determine the most accurate method of sampling.



CSRP Restoration Activities

Fish Passage Construction

Annual fish migration routes have been negatively impacted by historic land use and road maintenance operations. Blockages, such as damaged culverts, impenetrable head-cuts, and inadequate road design physically restrict fish use of habitat suitable for spawning, summer rearing, and winter refugia. By creating fish passage structures, modifying culvert conditions (or removing culverts entirely), and stabilizing banks, CSRP can effectively return fish migration routes to their original condition.

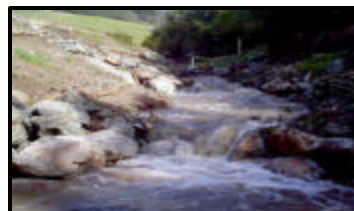


Blue Line Creek Fish Passage Project

Modification of the existing structure (culvert and receiving pool) to allow fish passage over a greater range of flow conditions; Completed in time for the 1999-2000 spawning season; Increase in the percentage of coho salmon observed above the BlueLine Creek culvert from 14% in the two seasons prior to construction to more than 70% in the last two years; Structure is used as summer rearing and spawning habitat.

Cheda Creek Bank Stabilization & Fish Passage

- Fish access had been restricted from the upper 2.5 miles of Cheda Creek, a tributary of Lagunitas Creek, by a seven foot eroding head-cut;
- Construction of a series of grade control boulder weirs, designed to allow returning adult coho and steelhead greater stream access, provide habitat for juveniles, and to stabilize the existing banks. The project was completed in the fall of 2000 by CSRP, in cooperation with the NMFS.



The Removal of the Muddy Hollow Culvert
- in the fall of 2000, CSRP staff removed an 80' culvert from Muddy Hollow Creek, and the Phillip Burton Wilderness Area (PRNS) to daylight the channel and enhance fish migration.

Riparian Exclusion Fencing

Riparian Fencing is an effective tool used to enhance and restore stream bank stability and riparian condition by excluding grazing livestock. The CSRP has combined exclusion fencing with riparian plantings and gully repair to jumpstart the recovery of the riparian corridor. Riparian fencing projects often involve providing alternative water and shade sources for affected livestock.



- Exclusion of more than 6 kilometers of stream from livestock access;
- Protection of a significant riparian corridor of BlueLine Creek and Cheda Creek;
- Fencing projects are combined with fish passage construction, sediment control, riparian revegetation, and enhanced fish monitoring.

Seasonal Grazing

- Implemented in areas where streams are intermittent;
- Seasonal grazing occurs when the stream is dry and wetland areas are less vulnerable to impacts associated with livestock. By removing cattle from these sensitive areas when conditions are wet, the Seashore may:
- better protect the assimilative capacity of the wetland;
- reduce damage to stream banks; and
- allow for the establishment of a healthier riparian vegetation complex.



The CSRP has successfully used volunteer groups including the Tomales Bay Association, Trout Unlimited, and Americorps to assist with fence construction.