Salmon Creek Water Conservation Program

Conservation Strategy No. 1: Streamflow Restoration for Salmonids

Coastal Conservancy



Overview

Streams, both large and small, touch the lives of every resident in a watershed. They provide water supply, flood capacity, aesthetic and recreation values, and fish and wildlife habitat. Within small coastal communities, streams provide critical habitat for populations of steelhead (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*).

Target community

Water purveyors, community groups and the resident and visitors to the watershed are the targets of this Strategy. Water purveyors, Chambers of Commerce, schools and community groups can play an important role in supporting native salmonid populations within their watershed by understanding the salmonid life cycle and making decisions about the how they do business with the fish in mind.

Young coho salmon.

Photo by Joe Pecharich.

Status within the Watershed

As in many California coastal communities, steelhead and coho salmon, collectively known as salmonids, were once abundant in Salmon Creek and its tributaries. Tales of their numbers, sizes, and favorite pools are still a vital part of local history. Now only a small population of steelhead continues to return each year, and the last naturally propagated coho was seen in 1996. Coho salmon were reintroduced into the watershed as part of the California Department of Fish and Game's annual coho broodstock program starting in 2008. Populations of steelhead and coho salmon have declined from historic levels for many reasons, including past and current water diversions, development, removal of large wood from creeks, and degradation of riparian areas. As a result, the species are now protected under the federal and state Endangered Species Acts.

Life History

Steelhead and coho salmon are anadromous fish; they are born and rear in freshwater streams, migrate to the ocean to grow and mature, and return to freshwater to reproduce. The life history of salmonids is relatively complex with some slight variation between species. Steelhead and coho salmon need a variety of habitats to support each stage of their development during the journey from egg to spawning adult. The diagram and text below outline the key stages and habitat requirements; a specific timeline for each species follows.

Spawning, Incubation, and Emergence

Each winter after the rains have returned, adult salmon begin to congregate at the mouth of the stream where they were born, guided by their keen sense of smell detecting small particles in the water. As they navigate upstream to select a suitable nesting site, they struggle against high winter flows and both man-made and natural obstacles. Once they reach their destination, the female selects a mate and begins **spawning. Redds** (salmon nests) are typically constructed at the head of riffles, where oxygenation of the developing eggs is key to development, in pea- to apple-sized gravels. Each salmon nest contains 300 to 1,200 eggs. Coho salmon die after spawning, whereas steelhead may spawn several times. The decaying fish provide nutrients to the stream and nourishment for a variety of species including their developing young.

Salmon eggs incubate in the gravels for several weeks - ideally in cool, well-oxygenated water free of excessive suspended particles. After hatching, small fish called **alevin** continue their development in the gravel, nourished by their attached yolk sac. Once the yolk sac is depleted, the young fish emerge from the gravels, typically in spring. These young fish that emerge from the gravel and begin rearing in freshwater are called **fry**.

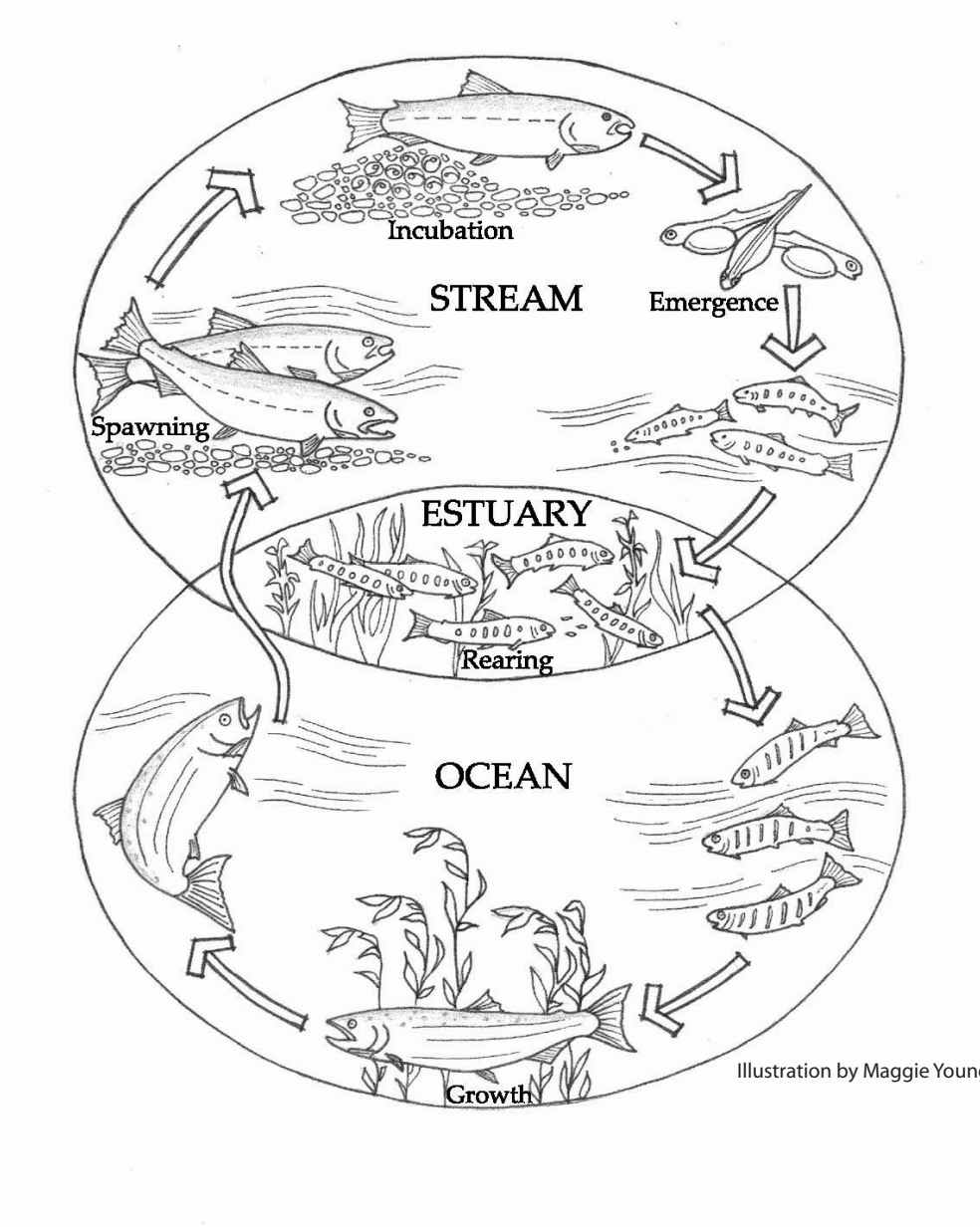


Illustration by Maggie Young

Habitat Elements Needed for Successful Spawning, Incubation, and Emergence

- High-quality, permeable gravels
- Sufficient riffles
- Passage to habitat
- Cool water temperatures
- High dissolved oxygen
- Minimal suspended sediment

Freshwater Rearing

Coho salmon typically spend a full year in freshwater, emerging from the gravels in spring and rearing there until the follow year. Steelhead may spend one to four years, typically two.

In **winter,** young, small fish are particularly vulnerable to high stream flows during storm events. They use the spaces between gravel particles and vegetation along stream banks for safety from winter storms and predators. As they gain strength and mobility, fry begin to seek out deeper, swifter water, yet they continue to need complex, low-velocity habitats throughout their rearing period.

During the **summer** rearing period, sufficient stream flows and optimal water quality conditions (cool water temperatures, well-oxygenated water, and clear conditions) continue to be critical for development. Low summer flows can reduce the availability of rearing habitat by creating isolated pools and increasing vulnerability to predators. Riparian cover is also important because it shades the stream channel, keeping water temperatures low.

Helpful Definitions

Redd – a salmon nest dug in the streambed where eggs are deposited.

Spawning – process of building a nest (redd) in gravel, mating, and laying eggs.

Alevin – salmonid larvae still in the gravel with their yolk sacs attached.

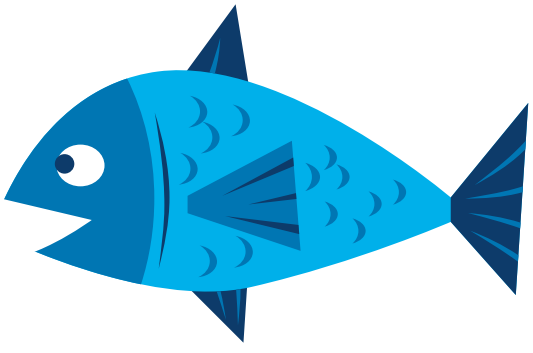
Fry – young salmon rearing in freshwater.

Smolt – a juvenile seaward-bound salmonid in the process of transition from fresh to saltwater.

Throughout the rearing period, salmonids need plenty of insects for food. Drifting terrestrial insects produced in the riparian canopy, aquatic invertebrates produced on the substrate, and leaf litter provide the bulk of their diet.

Habitat Elements Needed for Successful Rearing

- Low-velocity backwater areas (winter) and deep pools
- Shelter in the form of roots, large wood, vegetation, cobbles/boulders
- Vegetated stream margins
- Overhead shade and well-vegetated canopy
- Food supply
- Cool water temperatures
- High dissolved oxygen
- Minimal suspended sediment
- Sufficient flow (summer)



Estuary Rearing and Beyond

In the spring after completion of freshwater rearing, young salmonids begin to transition to life in the ocean. As they migrate downstream to the estuary, where fresh and saltwater mix, juvenile fish undergo a physiological process called **smoltification**, where their body makes adjustments to be able to survive in saltwater. Young fish may remain in the estuary for days or months as they adjust to the saltwater and grow. Salmon mature in the ocean in 1 to 4 years, depending on the species, before returning to their natal stream to begin the cycle all over again.

Habitat Elements Needed for Transition from Freshwater to Ocean

- Sufficient flow to allow safe passage
- Shelter in the form of roots, large wood, vegetation, cobbles/boulders
- Estuarine conditions that allow for adequate mixing of fresh and saltwater for gradual adjustment

Timeline of Salmonid Life History Stages within California Coastal Streams

(darker shading represents periods of peak activity; lighter shading represents less active periods)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Steelhead												
Upstream migration and spawning												
Egg incubation												
Fry emergence												
Rearing												
Smolt outmigration (1 to 4 years)												
Coho Salmon												
Upstream migration and spawning												
Egg incubation												
Fry emergence												
Rearing												
Smolt outmigration (typically 1+)												

Implementation

By implementing the following key conservation measures communities can help preserve riparian and aquatic habitat and ensure an adequate water supply for salmonids and other species:

- Protect and enhance riparian forests to provide shade, bank stability, and sources of large wood.
- Protect grasses and small shrubs along the riparian corridor to provide bank stability and pollutant filtration.
- Reduce the delivery of fine sediment from upland sources.
- Maintain and increase summer base flows to supply instream pools and the estuary with cool, oxygenated water.

Reduce overall water usage by practicing water conservation in homes, businesses and on community water systems

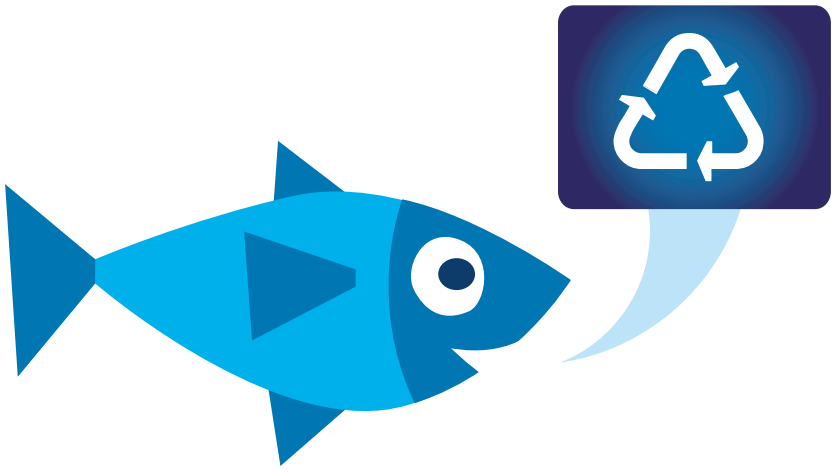
- Install water smart appliances and fixtures: washing machines, dishwashers, tankless or on-demand water heater, toilets, showerheads, and faucets.
- Check for water leaks and fix immediately.
- Use the Salmon Creek Water Conservation Program "Residential Self Survey Conservation Strategy" as a tool for identifying fixture efficiency and prioritizing which changes will make the biggest impact.
- Use the Salmon Creek Water Conservation Program "Conservation in the Hospitality Industry Conservation Strategy" to identify water saving opportunities in the food services, accommodations, recreation, and entertainment sectors.
- Install water efficient landscaping. Plant drought tolerant/low water use plants. Replace lawns with locally-adapted plants and mulch.
- Install efficient irrigation systems and program for effective watering.
- Use the Salmon Creek Water Conservation Program "Low Water Gardening Conservation Strategy" for a comprehensive approach to gardening and landscape management designed to preserve stream flow during the most critical times of the year.
- Install roofwater harvesting systems to capture winter runoff and reduce demand on the community water supply during critical periods.
- Use the Salmon Creek Water Conservation Program "Roofwater Harvesting Conservation Strategy" for a guide to using roofwater to offset summer dependence on local supply sources.
- Water purveyors, use the Salmon Creek Water Conservation Program "Managing Water Systems Conservation Strategy" for water system management practices designed to maintain stream flows and support water supply sustainability.

Reduce instream water diversions during critical low-flow summer rearing period

- Install roofwater harvesting and catchment tanks and agricultural storage ponds for alternative water supplies.
- Use the Salmon Creek Water Conservation Program "Roofwater Harvesting Conservation Strategy" for a guide to using roofwater to reduce diversions during critical periods.
- Implement water conservation practices (see above).

Protect the riparian corridor and improve stormwater retention and infiltration

- Fence riparian corridors from livestock during critical periods to protect water quality and plants.
- Improve and protect riparian cover by planting with native species and allow for adequate buffers.
- If you live on a creek, leave some fallen trees and small debris accumulations.
- Minimize impervious surfaces, such as paved driveways and patios.
- Refer to the Salmon Creek Water Conservation Program "Stormwater Management Conservation Strategy" for practices designed to decrease stormwater runoff and maximize on-site infiltration.



Tools

Salmonid Information

NOAA's National Marine Fisheries Service (NOAA Fisheries) Office of Protected Resources Federal regulatory overview and life history information for listed salmonids. http://www.nmfs.noaa.gov/pr/species/fish/

NOAA's National Marine Fisheries Service (NOAA Fisheries) Northwest and Southwest Regional Offices Local federal regulatory overview, life history information, and range maps for listed salmonids. http://swr.nmfs.noaa.gov/ and http://www.nwr.noaa.gov/

Russian River Coho Salmon Captive Broodstock Program Information on the coho salmon reintroductions in the Salmon Creek watershed and local fish identification guide and links. http://groups.ucanr.org/RRCSCBP/

The Russian River Interactive Information System Informative website with salmonid life history information and local references. http://www.russianriverwatershed.net/

Salmonid Restoration Federation Non-profit organization dedicated to the protection and restoration of California's salmonid populations and their habitat. Offers education services and useful resources on their website. http://www.calsalmon.org/

Water Conservation Tools

California's Water Conservation Resource - Save Our Water Offers water conservation background and tools.

http://www.saveourh2o.org/

Habitat Protection

Groundwork: A Handbook for Small-Scale Erosion Control in Coastal California - New 2nd Edition from the Marin Resource Conservation District and MCSTOPP. Got to resource for erosion control practices with an excellent references section for riparian protection and agricultural issues. http://www.mcstoppp.org/acrobat/Groundwork.pdf

Coastal Conservancy

This conservation strategy was produced by Jennifer Michaud, Prunuske Chatham, Inc., for the Salmon Creek Water Conservation Program (SCWCP). The SCWCP is a multi-year, multi-stakeholder effort focused on developing alternative water supply solutions that support human needs while protecting and restoring instream flows for fish and wildlife.