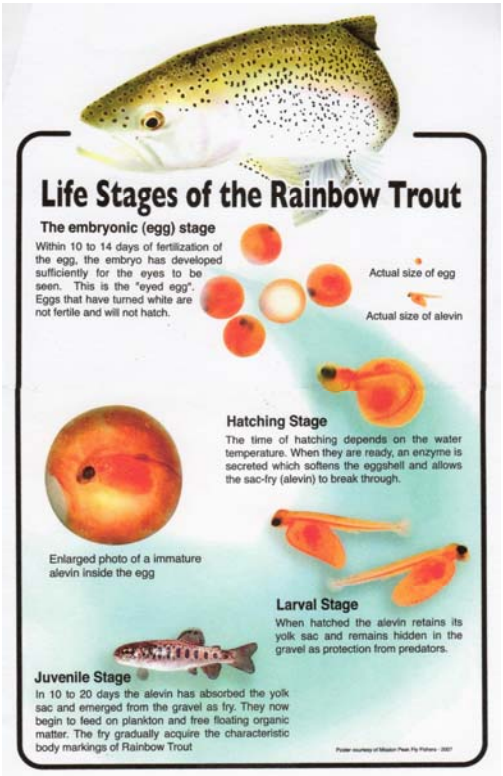
How Steelhead Use Habitat In the Alameda Creek Watershed

Recent storms once again are bringing adult steelhead trout into Alameda Creek, attempting to move upstream to spawn. But how will they use habitats within the watershed once they're restored?



Steelhead are essentially rainbow trout that live in streams for 1-2 years before turning into **smolts** and migrating out to sea. This life history, in which trout undergo the physiological changes that allow them to migrate between fresh and salt water, is called **anadromy.** Steelhead remain in the ocean for varying lengths of time, where they feed on fish, squid, and large crustaceans. After spending at least one year in the ocean (but usually 2 or 3) they return to their natal stream to spawn, using their strong homing sense to return to the same area in which they lived as fry. Unlike salmon, which spawn only once and then die, steelhead may repeat spawning 2-4 times, returning to the ocean in between.

Steelhead trout require distinct habitats for each stage of life. A healthy steelhead population in Alameda Creek will require attention to the entire watershed and each of these different types of habitat. The abundance of steelhead in a particular watershed is influenced by the quantity and quality of suitable habitat, food availability, and interactions with human activities and other species.

Steelhead that are ready to spawn enter Alameda Creek in the winter, typically from late December through March, depending on precipitation and flows. These spawning fish migrate upstream after a larger storm has passed and flows have peaked. Adult steelhead require high flows to migrate, with water at least 7 in (18 cm) deep. They have an amazing ability to leap, and can jump over barriers of up to 10 feet or more (3.4 m) if conditions are right. Like a high-jumper, steelhead need to get a moving start for their jumps and for them this means deep enough pools below any barrier and a concentrated water column .

Spawning habitat in Alameda Creek, Sunol Park

Steelhead spawn and rear in smaller headwater tributaries in upper portions of watersheds. In the Alameda Creek watershed these potential spawning grounds are in the tributaries of Niles

Canyon (particularly Stonybrook Creek along Palomares Road), in the upper mainstem of Alameda Creek (through Sunol and Ohlone Regional Wildernesses), and in the upper reaches of Arroyo Mocho. Adult fish are merely looking to migrate through lower Alameda Creek (the flood control channel), the Sunol Valley, and the Arroyos of the Tri-Valley area to get to suitable spawning grounds, without spending time in residence. Typically, steelhead do not feed when migrating upstream, yet the longer they remain in freshwater before returning to sea, the more likely they are to feed.

When they reach spawning grounds, females will build a series of small nests, called a **redd,** in the gravel of the stream-bottom, typically in loose gravels at the tail-end of pools. Females choose a redd site with gravel between "marble" and "fist" size. Redds are usually built in water depths up to 5 ft (1.5 m) and with low to moderate water velocities. Each spawning female will lay between 200 and 12,000 eggs in her redd. Once adult steelhead have spawned they may migrate back out to the Bay as Alameda Creek rises again in rain events.

Embryos incubate in the eggs for 18 to 80 days depending on water temperatures. Eggs hatch into an early and short life-stage where they're called **alevin**. These tiny fish carry yolk-sacs on their bellies that feed them and support their initial growth. During this time they remain in the protected gravels of their redd. High levels of sediment (>5% sand and silt) can reduce redd survival and emergence due to decreased dissolved oxygen concentrations available for the incubating eggs.

Young fish that emerge from the redd and are able to feed for themselves are called **fry**. Fry emerge from the redd from 2-6 weeks after hatching. Because steelhead spawning can occur over many months, the emergence of fry may also take place over months. The fry will swim to the surface to gulp air and seek food, feeding on microscopic organisms. Emerging fry also need cool waters and have difficulty getting oxygen from the water at temperatures above 70°F.

Above: Steelhead fry in Stonybrook Creek

Below: Rocky riffles in Sinbad Creek help oxygenate water. In-stream woody debris creates habitat complexity

Newly emerged steelhead school together and seek shallow waters along riffle margins or pool edges. Older juveniles maintain territories in faster and deeper locations in pool and

run habitats. They favor areas with cool, clear, fast-flowing riffles, ample riparian cover and undercut banks, and diverse and abundant invertebrate life. The size that the young fish can attain is dependent on environmental conditions and the quality of the habitat. Physical structures such as boulders, large woody debris, and undercut banks create a diversity of habit for steelhead. These in-stream structures provide substrate for algae to grow and for insects to attach - both critical to the steelhead food web. Root, wood and boulder structures give the young fish separation of territories, refuge during high flows, and cover from predators. Juveniles in their first year are preyed upon by older trout, sculpins (another native fish), egrets, herons, kingfishers, mergansers, common garter snakes, river otters and raccoons. Fry can also be impacted by degradation of habitat due to excessive sedimentation, water diversion and development. These factors reduce food abundance, pool depths and cover. Successful juveniles typically rear in streams for one to two years.

Below: Pools like these in Stonybrook Creek provide important refuge habitat during dry summers.

Rearing juvenile steelhead or spawning adults that become stranded in the creek system during the summer seek deep pools with cooler water at the bottom. Water in these pools is not stagnant but is replenished through groundwater often flowing just below the surface of seemingly dry creeks. This flow is important to replenish oxygen in the pools and in keeping them cool. Overhanging vegetation is also important to keep temperatures below lethal levels, and to maintain a healthy food web in the pool. When creek flows are low, young fish seeking refuge in pools are particularly vulnerable to pollution events.

Steelhead juveniles that leave the stream during higher spring flows emigrate to the estuaries at the creek mouth, where additional rearing takes place. Estuaries are tidal basins with inputs of fresh water, rich in food, enabling young to grow large quickly. They provide some protection from the harsh open water conditions of the open Bay. These juveniles primarily eat amphipods or caddisfly larvae. When connected to a healthy estuary a greater proportion of older juveniles live in the estuary than in the river. The estuaries of the Alameda Creek watershed are those between Coyote Hills and Eden Landing, and are fortunate to be part of a long-term effort to

Steelhead smolt

Tidal marsh provides important rearing habitat for smolts.

restore them from commercial salt ponds to tidal marsh (The South Bay Salt Ponds Restoration Project).

In general, larger smolts have a greater chance of survival to adulthood, and this time spent in estuaries is important to their long-term survival. An important future component of this project will be to provide a direct connection between Alameda Creek and restored salt marsh habitat.

The journey from egg to ocean steelhead is perilous - less than 3% of steelhead survive from egg to adulthood. Once in the ocean steelhead grow rapidly, feeding on the more abundant fish, squid, and crustaceans in the saltwater environment. When ready to reproduce, they will begin their own journey back to their home creeks to spawn and to contribute to the next generation of these amazing fish.

Restoration of a healthy steelhead population in Alameda Creek will require attention to the entire watershed to provide conditions that allow as many smolts as possible, each growing as large as possible, before entering San Francisco Bay. New flow releases (especially of colder water) from upstream dams will improve spawning and rearing success by increasing habitat abundance and quality. Migration barriers continue to be removed or modified to allow fish migration throughout the system. We must also continue to steward and improve habitat throughout the watershed so that trout have clean, cool water and a healthy food web at every stage in their life history.